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CENOZOIC AND CRETACEOUS ICHTHYOLITHS FROM THE TOFINO BASIN AND WESTERN VANCOUVER ISLAND, BRITISH COLUMBIA, CANADA

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ABSTRACT

Cenozoic and Cretaceous Tofino Basin ichthyoliths (microscopic fish teeth and dermal denticles) from six offshore Shell Canada exploration wells (Apollo J-14, Zeus D-14, Zeus I-65, Prometheus H-68, Cygnet J-100, and Pluto I-87), one core, and several outcrops along the West Coast of Vancouver Island are described and illustrated. These include 99 different kinds of ichthyoliths, of which 17 are new. Comparisons are made to ichthyoliths previously known from temporally well-constrained deep-sea cores and are correlated with Cenozoic North American foraminifer zones. Ichthyoliths that indicate stratigraphic intervals are identified and illustrated for future stratigraphic correlation and interpretation of basin sedimentary processes.

Some elasmobranch ichthyoliths are identified belonging to the families Lamnidae, Scyliorhinidae, and Rajidae and Superorder Squalomorphii. However, most of the ichthyoliths are not identified using binomial systematics. Instead, seven groups of Tofino Basin ichthyoliths are defined (elasmobranch teeth, elasmobranch dermal denticles, triangular teeth with canals, triangular flanged teeth, triangular flexed teeth, cone teeth, and other ichthyoliths) and a coded utilitarian ichthyolith identification system is used, modified, and digitized to include new Tofino Basin subtypes. By using this coded system, important characteristics of Tofino Basin ichthyoliths are determined, an identification code is generated, and a link is made to a systematic page that includes the description and illustration of each species, form, or subtype. The versatility of electronic publishing allows for immediate linkages.

Tofino Basin ichthyoliths changed from the Oligocene to the Pleistocene, likely in response to shifting environments following regional tectonic activity and an overall global climate cooling trend. Cretaceous/early Paleogene ichthyoliths are chiefly elasmobranch teeth and dermal denticles, whereas late Eocene and Oligocene forms are dominated by canal and flexed teeth, followed by Miocene and Pliocene actinopterygian (teleost) cone teeth.

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INTRODUCTION

This paper is a first major study and catalogue of Eocene to Pliocene ichthyoliths from marine strata of the Tofino Basin, located onshore and offshore of the west coast of Vancouver Island, British Columbia. In addition, Cretaceous ichthyoliths occur at certain intervals. Ninety-nine species, forms, or subtypes are described and illustrated. This work expands ichthyolith studies from the large atlas of Holocene coastal British Columbia fishes and fish scales by Patterson et al. 2002 to include fossil teeth and dermal denticles from older strata. Only one previous study on fossil fishes from this region by Waldman 1971 identified six elasmobranch teeth from two families, the Hexanchidae and Orthacodontidae. These ichthyoliths were deposited in upper Eocene/lower Oligocene strata.

Helms and Riedel 1971 and Doyle et al. 1974 initially demonstrated that ichthyoliths in pelagic sediments can be used for biostratigraphic correlation. Their research emphasized that the resistant skeletal chemistry (calcium phosphate) of ichthyoliths resulted in their preservation, commonly where other microfossil groups were not preserved. Through the 1980s and 1990s the utility of ichthyoliths and stratigraphic correlation was further demonstrated in DSDP and ODP deep-sea cores and expanded to other sedimentary environments and ages including the Mesozoic and Paleozoic in addition to the original Cenozoic faunas (e.g., Table 1, Appendix 1). Joint studies with other fossil groups (e.g., nannofossils, foraminifers, radiolarians, conodonts) have resulted in further biostratigraphic correlation and paleoenvironment interpretation.

The nature of the fishes that provided microscopic disarticulated skeletal debris, teeth, scales, and dermal denticles in sediments commonly cannot be determined, nor can Linnean binomens be applied. This initial problem in identifying and naming ichthyoliths was overcome by developing and modifying a coded utilitarian ichthyolith identifica-

Table 1. Papers on ichthyoliths that use the Coded Utilitarian Ichthyolith Identification System (CUIIS). Numbers 1 to 32 indicate references footnoted in Appendix 1.

Footnote #	Year	Primary Author	CUIIS page reference	Paper Reference
1	1971	Helms	n/a	Helms, P.B. and Riedel, W.R. 1971. Skeletal debris of fishes. In Winterer, E.L., Riedel, W.R., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 7(part 2):1709-1720."
2	1974	Doyle	827-834	Doyle, P.S., Kennedy, G.G., and Riedel, W.R. 1974. Stratignathy. In Davies, T.A., Luyendyk, B.P., et al. (eds), *Initial Reports of the Deep Sea Drilling Project,* 26:825-905.
3	1975	Dengler	n/a	Dengler, A.T., Doyle, P.S. and Riedel, W.R. 1975. Ichthyoliths in some samples from the Philippine Sea, Deep Sea Drilling Project Leg 31. In Karig, D.E., Ingle, J.C., Jr., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 31:821-833.
4	1975	Dunsworth	855-856	Dunsworth, M.J., Doyle, P.S., and Riedel, W.R. 1975. Ichthyoliths from some NW Pacific sediments, DSDP Leg 32. In Larson, R., Moberly, R., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 32:853-863.
5	1976	Ramsey	130	Ramsey, C.A., Doyle, P.S. and Riedel, W.R. 1976. Ichthyoliths in Late Mesozoic pelagic sediments, mainly from Italy. *Micropaleontology,* 22(2):129-142.

Table 1 (continued).

Footnote #	Year	Primary Author	CUIIS page reference	Paper Reference
6	1977	Edgerton	n/a	Edgerton, C.C., Doyle, P.S. and Riedel, W.R. 1977. Ichthyolith age determinations of otherwise unfossiliferous Deep Sea Drilling Project cores. *Micropaleontology*, 23(2):194-205.
7	1978	Doyle	743-747	Doyle, P.S., Dunsworth, M.J. and Riedel, W.R. 1978. Ichthyoliths from some southeast Atlantic sediments, DSDP Leg 40. In Bolli, H.M., Ryan, W.B.F., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 40:743-759.
8	1979	Doyle	5-27	Doyle, P.S. and Riedel, W.R. 1979a. Ichthyoliths: present status of taxonomy and stratigraphy of microscopic fish skeletal debris. *SIO Reference Series,* No. 79-16, Scripps Institution of Oceanography, University of California, 231 p.
9	1979	Tway	152-159	Tway, L.E. 1979. A coded system for utilizing ichthyoliths of any age. *Micropaleontology*, 25(2):151-159.
10	1979	Doyle	n/a	Doyle, P.S. and Riedel, W.R. 1979b. Cretaceous to Neogene ichthyoliths in a giant piston core from the central North Pacific. *Micropaleontology*, 25(4):337-364.
11	1980	Kozarek	872	Kozarek, R.J. and Orr, W.N. 1980. Ichthyoliths, Deep Sea Drilling Project Legs 51 through 53. In Flower, M.F.J., Salisbury, M., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 51, 52, 53:857-895. Canadian Field-Naturalist, 54 (6):79-82.
12	1980	Doyle	n/a	Doyle, P.S. and Riedel, W.R. 1980. Ichthyoliths from Site 436, Northwest Pacific, Leg 56, Deep Sea Drilling Project. In E. Honza, et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 56:887-893.
13	1981	Doyle	n/a	Doyle, P.S., and Riedel, W.R. 1981. Ichthyoliths at site 464 in the northwest Pacific, Deep Sea Drilling Project Leg 62. In Theide, J., Vallier, T.L., et al. (eds), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 62:491-494.
14	1981	Kaneps	n/a	Kaneps, A.G., Doyle, P.S. and Riedel, W.R. 1981. Further ichthyolith age determinations of otherwise unfossiliferous deep sea cores. *Micropaleontology,* 27(3):317-331.
15	1982	Tway	n/a	Tway, L.E. and Zidek, J. 1982. Catalog of Late Pennsylvanian ichthyoliths. Part I. *Journal of Vertebrate Paleontology,* 2(3):328-361.
16	1983	Tway	n/a	Tway, L.E. and Zidek, J. 1983. Catalog of Late Pennsylvanian ichthyoliths. Part II. *Journal of Vertebrate Paleontology,* 2(4):414-438.
17	1984	Gottfried	75	Gottfried, M.D., Doyle, P.S., and Riedel, W.R. 1984a. Advances in ichthyolith stratigraphy of the Pacific Neogene and Oligocene. *Micropaleontology,* 30(1):71-85.
18	1984	Gottfried	n/a	Gottfried, M.D., Doyle, P.S., and Riedel, W.R. 1984b. Stratigraphic interpretations of pelagic sequences revised on the basis of ichthyoliths. *Micropaleontology*, 30(4):426-444.
19	1984	Tway	188-198	Tway, L.E. 1984. A coded utilitarian system for identifying Paleozoic ichthyoliths. *Journal of Vertebrate Paleontology,* 3(4):187-199.
20	1985	Doyle	n/a	Doyle, P.S. and Riedel, W.R. 1985a. Cenozoic and Late Cretaceous ichthyoliths, p. 965-995, 1032. In Bolli, H.M., Saunders, J.B., and Perch-Nielsen K. (eds.), *Plankton Stratigraphy,* Cambridge University Press.

Table 1 (continued).

Footnote #	Year	Primary Author	CUIIS page reference	Paper Reference
21	1985	Doyle	356-357	Doyle, P.S. and Riedel, W.R. 1985b. Ichthyolith biostratigraphy of western North Pacific pelagic clays, Deep Sea Drilling Project Leg 86. In Heath, G.R., Burckle, L.H., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 86:349-366.
22	1985	Tway	295-297	Tway, L.E., Doyle, P.S. and Riedel, W.R. 1985. Correlation of dated and undated Pacific samples based on ichthyoliths and clustering techniques. *Micropaleontology*, 31(4):295-319.
23	1986	Gebhardt	65-66	Gebhardt, U. 1986. Ichthyolithen aus dem Stefan C (Oberkarbon) der Saalesenke (DDR). *Freibergen Forschungshefte,* C410:65-76.
24	1987	Winfrey	456-457	Winfrey, E.C., Doyle, P.S. and Riedel, W.R. 1987. Preliminary ichthyolith biostratigraphy, Southwest Pacific, Deep Sea Drilling Project Leg 91. In Menard, H.W., Natland, J., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 91:447-468.
25	1987	Hart	n/a	Hart, M.B. and Mountain, G.S. 1987. Ichthyolith evidence for the age of reflector A^u, Deep Sea Drilling Project Site 603. In van Hinte, J.E., Wise, S.W., Jr., et al. (eds.), *Initial Reports of the Deep Sea Drilling Project,* Washington (U.S. Government Printing Office), 93:739-750.
26	1988	Doyle	n/a	Doyle, P.S. 1988. Remarks on Cretaceous-Tertiary ichthyolith stratigraphy in the Atlantic, Ocean Drilling Program Leg 103. In Boillot, G., Winterer, E.L., et al. (eds.), *Proceedings of the Ocean Drilling Program, Scientific Results,* 103:445-458.
27	1991	Gupta	126-127	Gupta, S.M. 1991. New ichthyoliths from ferromanganese crusts and nodules from the Central Indian Ocean basin. *Micropaleontology*, 37:(2):125-147.
28	1993	Firth	n/a	Firth, J.V., and Jull, D.M. 1993. Ichthyolith biostratigraphy of Deep-sea clays from the southwestern Hawaiian Arch. In Wilkens, R.H., Firth, J., Bender, J., et al. (eds), *Proceedings of the Ocean Drilling Program, Scientific Results,* 136:27-43.
29	1993	Johns	577-605	Johns, M.J. 1993. Taxonomy and biostratigraphy of Middle and Upper Triassic ichthyoliths from northeastern British Columbia. *Unpublished Master of Science Thesis,* University of Victoria, British Columbia, Canada, 752 p., 45 pls.
30	1996	Johns	338-341; 342-343	Johns, M.J. Diagnostic pedicle features of Middle and Late Triassic elasmobranch scales from northeastern British Columbia, Canada. *Micropaleontology*, v. 42, no. 4, p. 335-350.
31	1997	Johns	28-29; 141-152	Johns, M.J., Barnes, C.R., and Orchard, M.J. 1997. Taxonomy and biostratigraphy of Middle and Late Triassic elasmobranch ichthyoliths from northeastern British Columbia. *Geological Survey of Canada, Bulletin 502,* 235 p.
32	2005	Johns		Johns, M.J., Barnes, C.R., and Narayan, Y.R. 2005. Catalogue of Cenozoic and Cretacous ichthyoliths from the Tofino Basin and western Vancouver Island, British Columbia, Canada. *Palaeontolgia Electronica.*

tion system (CUIIS) (Doyle et al. 1974, 1978; Dunsworth et al. 1975; Ramsey et al. 1976; Doyle and Riedel 1979a, b, 1985a, b; Tway 1979 and 1984; Kozarek and Orr 1980; Kaneps et al. 1981; Gottfried et al. 1984a, b; Tway et al. 1985; Winfrey et al. 1987; Gupta 1991; Gebhard 1986; and Johns et al. 1997) (Table 1, Appendix 1). The system includes important ichthyolith morphologic characters in a key-like identification system, applies a code that organizes characteristics, and provides a mechanism to generate specimen descriptions. Descriptions of new ichthyoliths in this study follow the format (in part) of traditional systematics and use (in part) relevant CUIIS terms and characters

important for identification. In addition to the code, a colloquial name is assigned to each subtype to assist in discussions and other situations where long name-descriptions would be inconvenient. Procedures for using the code and ichthyolith terms are discussed in Doyle et al. 1974 and Doyle and Riedel 1979a and 1985b and are applied to the modified version and parts of the coded system included in this catalogue (Table 1, Appendix 1).

This publication provides an opportunity (1) to test an electronic version of part of the coded utilitarian ichthyolith identification system that is relevant to the Tofino Basin specimens; and (2) to unify binomial and utilitarian systematics by bringing together on one or a few pages: the illustration, CUIIS code, description, remarks, and occurrences for each taxon (subtype, form, or species). The catalogue allows the reader or user to organize taxa electronically for improved comparative research.

Results from Tofino Basin ichthyolith studies are published in three parts. Ichthyolith taxonomy, illustrations, CUIIS (Appendix 1), and catalogue are included herein. Biostratigraphic results are discussed by Johns et al., in press. A synthesis of the geologic evolution of the Tofino Basin, including wider integrated biostratigraphic, stratigraphic, and foraminifer strontium isotope results, will be discussed in a forthcoming manuscript, currently under consideration for publication in the *Bulletin of Canaadian Petroleum Geology*. The main purpose of the ichthyolith research is to expand biostratigraphic and facies studies in British Columbia to include marine Eocene to Pliocene faunas from the west coast of Vancouver Island and the offshore Tofino Basin. Ichthyolith results are correlated to foraminifer zonations by Cameron 1980, Narayan 2003 and Narayan et al., 2005, and other biostratigraphies. Micropaleontological results will contribute initial information for basin modeling and assessment of oil and gas potential in the Tofino and Queen Charlotte basins that is important for development of government policies before commencement of future exploration activities.

METHODS

Samples and Locations

The sample database includes surface samples from outcrops on the west coast of Vancouver Island, British Columbia (Nootka Sound area, 92E), one Geological Survey of Canada (GSC) vibrocore from offshore Flores Island (END-76B-6), and sample cuttings from six Shell Canada wells in the offshore Tofino Basin (Figure 1). About 1,025 Cenozoic surface samples are included from the Hesquiat Peninsula, Nootka Island, Flores Island, and Tatchu Point. They were collected from 1969 to 1974 by B.E.B. Cameron (GSC, retired) and processed for foraminifer studies. The samples are mainly from shale, siltstone, and mudstone lithologies, however, some are from sandstone and conglomerate.

Six Shell Canada Limited wildcat exploratory wells were drilled from 1967 to 1969 in the offshore Tofino Basin: Prometheus H-68 (7,662 ft; 2,335 m), Pluto I-87 (12,225 ft; 3,726 m), Zeus I-65 (9,981 ft; 3,078 m), Zeus D-14 (7,984 ft; 2,433 m), Apollo J-14 (10,170 ft; 3,100 m), and Cygnet J-100 (8,072 ft; 2,460 m) (Figure 1). Reports on each of the wells (including sidewall core and cuttings lithological descriptions, hydrocarbon mud analyses, well logs, microfossil reports, and other data) were released by Shell Canada and are available for viewing at the British Columbia Ministry of Energy, Mines, and Petroleum Resources, Victoria. Shouldice 1971 compiled and interpreted geophysical, geological, and paleontological data and correlated Tofino Basin Shell Canada well units. In this study, over 2,145 subsamples were taken from drill cuttings and processed for microfossil recovery. Sidewall core subsamples were not located.

One vibrocore, END-76B-6, was taken by the GSC from offshore Flores Island at a water depth of about 135 m. Excellent specimens of *angled cone and bulbous base* ichthyoliths were found in some of the subsamples and used to illustrate a new ichthyolith subtype.

Subsamples of a minimum 200 grams each from the outcrops and up to 200 grams each from the Shell Canada wells were processed in the 1970s at the GSC, Sidney, using Quaternary O (a strong soap solution that disaggregates mudstones), oscillation, washing, sieving, and other techniques. Residues were dried and microfossils extracted and mounted onto cardboard slides for three-dimensional viewing and identification. The samples were originally mainly picked for foraminifers. Other microfossils were picked to give a representation of the different fossil groups present. Recently, additional outcrop materials from five samples at ichthyolith-rich levels in the Oligocene were reprocessed and picked resulting in twice the number of ichthyoliths. The remainders of the outcrop sample residues were not repicked because of the low numbers of ichthyoliths originally recovered. Over 1,100 of the 1,407 subsample residues from the Zeus D-14, Prometheus H-68, Pluto I-87, Cygnet J-100, and Apollo J-14 wells were repicked for ichthyoliths at regular intervals to obtain a better representation of the faunas. Approximately double the original number of specimens were recovered. The 745 subsamples from the Zeus I-65 well were

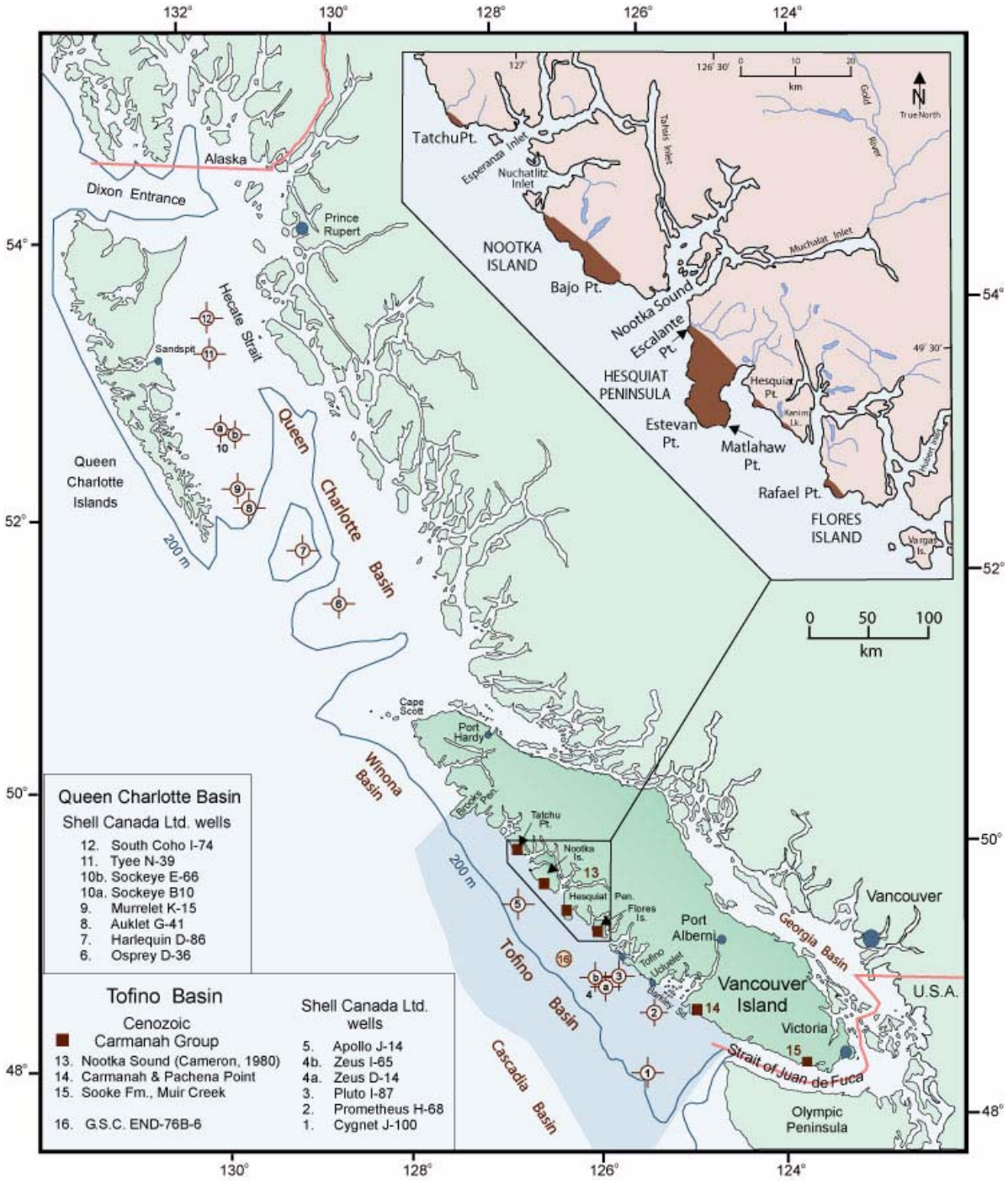

Figure 1. Location of the Tofino Basin, western Vancouver Island Cenozoic Carmanah Group strata and offshore Shell Canada wells.

not repicked because of the low ichthyolith recovery from the first picks. Samples, fossils, field notebooks, and stratigraphic data are archived at the Geological Survey of Canada, Sidney, BC.

Additional previously processed and picked ichthyolith materials were reviewed from Cretaceous Queen Charlotte Group (Queen Charlotte Islands) and Nanaimo Group (Vancouver Island) strata to identify transported or reworked older materials in the Tofino Basin. The database includes ichthyoliths from 200 to 300 Cretaceous samples from the Queen Charlotte Group, and 33 samples from the Upper Cretaceous Nanaimo Group. The samples were originally collected for foraminifer studies. Most are from shale, and some are from sandstones.

Ichthyolith Identification

To accomplish identification of the majority of ichthyoliths in this study, taxa from all 31 of the known CUIIS Cenozoic and Mesozoic papers (e.g., Table 1, Appendix 1) were digitally scanned and organized into a catalogue that included each ichthyolith type and subtype. Similarly, an updated version of the coded identification system was compiled, based on previous reported revisions. A digitized version of the CUIIS relevant to Tofino Basin taxa was prepared in Microsoft Word. Modifications to CUIIS were added to accommodate the new Tofino Basin subtypes.

The process of ichthyolith identification involved using the CUIIS because Tofino Basin ichthyoliths are similarly disarticulated and most only could be identified using the System. Tofino Basin specimens were compared using the code, descriptions, and illustrations of known subtypes. In some cases, a subtype differed slightly from a previously identified and described ichthyolith but also had many similarities to the subtype. To acknowledge this similarity, “cf.” is used ahead of the colloquial name and differences and similarities to the original identified subtype are compared and discussed in the systematics “Remarks” section. Any new subtype is designated with a code and assigned a new colloquial name. If five or more specimens are available, new characters are described and specimens illustrated. In many cases, ichthyoliths are quite rare in samples (diluted by high sedimentation rates, small samples sizes, or other causes). Rare new ichthyoliths (less than five specimens/subtypes) are identified using the CUIIS but a colloquial name is not assigned and a detailed description not completed. Important characteristics of previously identified deep-sea ichthyoliths also found in Tofino Basin strata are discussed in “Remarks.”

Some Tofino Basin ichthyoliths (elasmobranch teeth) can be identified to family and some to genus. The classification system outlined in Cappetta 1987 is followed. If a species is uncertain, then an informal designation of sp. A, sp. B, etc. is applied. To maintain consistency, the CUIIS code is provided for each species.

Systematics

Grouping certain types of Tofino Basin ichthyoliths assisted with the identification process. The groupings are maintained in the catalogue systematics section and Table 2 and include: 1) elasmobranch teeth [ET]; 2) elasmobranch dermal denticles [EDD]; 3) triangular teeth with canals [canals]; 4) triangular flanged teeth [flange]; 5) triangular flexed teeth [flex]; 6) cone teeth [cone]; and 7) other Tofino Basin ichthyoliths [odds]. These groups have not been tested with faunas from other regions or ages and therefore may be only significant in the Tofino Basin region.

Each group has a header page/pages where group characteristics are briefly outlined and figures illustrating ichthyolith terms are included. A list of the identified, illustrated, and/or described taxa within the group is provided. Within each group and when binomial systematics are not used, the taxa are organized in sequence according to the CUIIS code.

A taxon page contains several components.

- Binomial systematics are provided when identification is possible (e.g., some elasmobranch teeth).
- The CUIIS code is provided for all taxa. Links back to the CUIIS key can be made by choosing the appendix listed below the code. To return back to the taxon from the key, “back” can be selectred or its group name can be chosen from the Appendix (list) or the navigation bar at left.
- **Characters:** include a descriptive format and diagnostic characteristics of a new subtype or species. Readers can refer to the CUIIS code and key for other characters (Appendix 1).
- **Remarks:** include comments about the Tofino Basin subtype and comparisons to other similar taxa or subtypes.
- **Occurrence:** includes the number of specimens identified, section location or Shell Canada well, ichthyolith provisional zone or interval, and stratigraphic interval.
- Digital microscopic, photographic, or scanned images were imported into Adobe Photoshop or Corel Draw. Specimen backgrounds and brightness/contrast levels may have been altered to improve specimen imagery.
- Figure numbers are in three parts (e.g., 10.1.1). The first number assigned (10.) is unique to the taxon page. The second number (10.1.) is assigned to the first specimen illustrated (e.g., 2 would be the second specimen). The third number (10.1.1.) is the first illustrated view of specimen one (e.g., with 10.1.2. for the second view of that specimen).
- Figure captions include the 3-part figure number, comments on the illustration, a GSC number for each different specimen illustrated, and a scale bar for measurement (# mm = millimeter).

Table 2. Part A. See oversized file at end of document.

Viewing and Imaging

All archived and identified ichthyoliths are mounted with water-soluble glue on cardboard slides and can be viewed in three dimensions. Most images of ichthyoliths were captured either using a binocular microscope, transmitted light, and digital camera or a Hitachi S-3500N scanning electron microscope at the University of Victoria. Specimens for transmitted light image capture were mounted in a drop of water on a glass slide. SEM specimens were mounted on carbon tape on aluminum stubs and sputter coated with gold. Some images were captured using an HP ScanJet ADF scanner. Larger ichthyoliths were digitally photographed. Digital images may have the background of the specimen altered or the brightness/contrast levels adjusted to enhance imagery. All illustrated specimens are assigned a GSC type number and archived at the GSC, Ottawa (National Type Collections).

Biostratigraphy

Provisional Tofino Basin ichthyolith zones and intervals are provided (Figure 2.1, Table 2, Appendix 2, and the systematics "Occurrences" sections). Formal definition of ichthyolith zones and intervals are in Johns et al. (in press). Ichthyolith zones and intervals are determined by: 1) correlation of ichthyolith ranges and occurrences with foraminifer zones in the Hesquiat and Escalante Formations established by Cameron (1980) and a Tofino Basin foraminifer zonation developed by Narayan et al. (2005) which were compared to other foraminifer zones in the Pacific Northwest and Arctic; 2) correlation with strontium isotope ages at certain levels in the Shell Canada wells (Narayan 2003); and 3) comparison to deep-sea core ichthyoliths (age control from correlation to nannofossil, radiolarian, and other fossil zones assigned in deep-sea cores) mainly summarized by Doyle and Riedel 1979a and the many original publications (e.g., Table 1, Appendix 1).

An "ichthyolith zone" is determined by in situ taxa occurrences and range tops. Ichthyolith range-tops are noted: 1) during the Oligocene; 2) near the Oligocene/Miocene boundary, 3) during the lower and middle Miocene; and 4) at two levels in the Pliocene (Figure 2.1-2.2). An "ichthyolith interval" is defined on the occurrence of one or more transported/reworked ichthyoliths that were deposited by certain geological processes resulting in a specific Tofino Basin geological structure or feature. Within each ichthyolith interval, the taxa are distinct, were deposited in a specific stratigraphic interval (Figure 2.1-2.2), and can be used to interpret the potential scale, source(s) and cause(s) of the sediment transport/reworking and/or other geological processes.

Database

A PDF version of the ichthyolith database (Appendix 2) contains a list of each ichthyolith identified (colloquial or other name and abbreviated code); sample location, position and GSC locality number; provisional ichthyolith zone or interval, stratigraphic intervals according to various reports; GSC specimen type number, and PE figure number.

TOFINO BASIN ICHTHYOLITH ABUNDANCE, DISTRIBUTION, AND DIVERSITY

Approximately 35% (241) of the ichthyoliths came from 52 of the 1,025 outcrop samples, 59% (404) from 300 of the 2,152 Shell Canada well samples, and 6% (42) from five samples in the END-76B-6 core. A total of 687 specimens representing 99 different species, subtypes, or forms of ichthyoliths were recovered from approximately 11% (357 of 3,184) of the outcrop and offshore Tofino Basin samples. Tofino Basin upper Eocene-Pliocene ichthyoliths are typically in situ and diverse but few in finer grained (e.g., shale) bathyal environment strata. In three coarse-grained outcrop samples (BC-74 spot checks 7, 8, and 15) ichthyoliths were common (103 specimens), diverse (e.g., 6 Squalomorphii forms, 11 named ichthyolith subtypes, and 16 different rare-coded, undescribed, or unidentified ichthyoliths), and represent (in part) reworked Upper Cretaceous/lower Cenozoic ichthyoliths that were transported from structural highs and deposited in upper Eocene and lower Oligocene structural lows (bathyal environments, Narayan et al., 2005).

Most of the Tofino Basin ichthyoliths (45%) are cone teeth (actinopterigians, probably teleosts) and elasmobranch teeth and dermal denticles (31%). Teeth with canals, flanged or flexed teeth, and other ichthyoliths are 13%, 8%, and 3% (the affinity of these ichthyoliths is unknown). Elasmobranch teeth and dermal denticles, teeth with canals, and flexed teeth (90%) were commonly deposited in Oligocene and upper Eocene strata, whereas cone teeth (88%) were mainly deposited in Miocene and Pliocene strata.

Upper Eocene outcrop surface samples from the Hesquiat Formation and some samples near the base of the Pluto I-87 well contain rare ichthyoliths. The reason for this paucity is not well understood but the distal bathyal environment indicated by foraminifers in fine-grained shale samples (Cameron 1980) may not have been a suitable environment for many fishes. Also during the Eocene, tectonism, accretion, faulting and uplift contributed to much of the British Columbia coastal and inland topographic relief (e.g., Mathews 1991; Hyndman et al. 1990 and 1994; Hyndman 1995). Both distal and proximal Tofino Basin environments are indicated during the middle to upper Eocene and Oligocene. A tectonically active margin is further indicated with an unconformity above lower Eocene volcanic rocks in the Zeus D-14 and Prometheus H-68 Shell Canada wells (Shouldice 1971), in faulted (slickensided) upper Eocene and Oligocene strata in the basal Pluto I-87 well (e.g., Shell Canada report 1967). Cameron (1980) interpreted rapid facies changes and reworked older macro- and micro-faunas within the Escalante and Hesquiat formations.

Ichthyoliths in distal Tofino Basin sediments continued to be rare into the lower Oligocene until near the boundary of the *Turrilina alsatica* and *Bulimina* cf. *alsatica* foraminifer zones by Cameron 1980. At this level in the Hesquiat Formation and in the Pluto I-87 subsurface samples, faunas indicate a more proximal environment, and strata are coarser grained, contain shell and wood fragments, and locally disturbed. Ichthyoliths in these samples are common and diverse. Some of these ichthyoliths may have been concentrated in the sediments through a winnowing effect under turbid conditions (Cameron 1980), through transport and into graded beds, or by reworking. The ichthyoliths are dominated by potentially reworked Cretaceous to middle Eocene elasmobranch teeth (e.g., Superorder Squalomorphii forms) and dermal denticles (e.g., *pointed and skirted* Doyle et al. 1978; *kite-shaped longitudinal line* Doyle et al. 1974; *three peaks forked median ridge* new subtype; and several rare elasmobranch dermal denticles).

Ichthyoliths interpreted to be approximately in situ in the upper Eocene and Oligocene Tofino Basin strata are *short side peaks differentiated margin*, Doyle et al. 1974, triangular teeth with canals (*angled cone and basal canals*, *flanged triangle with canals*, *centrally inflated triangle with canals* – three new subtypes) *triangle one canal above* Doyle et al. 1974); triangular flanged teeth (*triangle double flex* Doyle et al. 1974; *wide triangle double flex* Gupta 1991); and one cone tooth new subtype, *dome-top triangle bowed inline.*

In upper Oligocene and lower Miocene intervals (possibly middle Miocene) a transitional ichthyolith fauna is observed in the Pluto I-87 well and in the Zeus D-14 and Prometheus H-68 wells just above the Eocene volcanic rocks and an unconformable surface. This transitional fauna contains: 1) Oligocene ichthyoliths observed in the Pluto I-87 well and the marine Hesquiat Formation; 2) cf. *triangle curved margin ends* Doyle and Riedel 1985 and *curved triangle striated inline* new subtype; and 3) a variety of other new "cone tooth" ichthyoliths which occur later in the Miocene. Further upsection, cone teeth are the dominant forms. These cone teeth include subtypes similar to *narrow curved triangle* Doyle et al. 1974; *short triangle stepped margin* Doyle et al. 1974; *triangle small top* Ramsey et al. 1976; and 11 new cone tooth subtypes (Table 2) dominated by *angled cone and bulbous base*, *curved triangle parallel-sided inline*, *curved triangle wide inline*, *narrow tall triangle inflated inline apex, narrow tall triangle cone inline,* and *narrow tall triangle irregular threaded inline*. These changes in faunas are significant in the Tofino Basin region because they mark the replacement of teeth with canals and many elasmobranch dermal denticles and teeth (flattened teeth with a cutting edge) by actinopterygians - mainly teleosts (with cone teeth that do not have a cutting edge and are circular in cross-section). The faunal change corresponds to an apparent lower Miocene transgression in this region (Shouldice 1971) that is indicated by fine-grained deeper water bathyal sediments and foraminifers (Narayan et al., 2005) observed at certain intervals in the Shell Canada Zeus D-14, Prometheus H-68, Apollo J-14, and Pluto I-87 wells. Also, pollen data from northwestern Canada and Alaska (White et al. 1997) show a warmer early to middle Miocene climate that peaked at 15 Ma followed by temperature declines before the onset of the Pliocene-Pleistocene glaciations.

In the upper Miocene and Pliocene, earlier common and diverse Miocene cone tooth ichthyoliths show a decrease in diversity and abundance. New cone tooth subtypes appear (e.g. *shadowed curved blunt triangle* and *shadowed high inline cone*) and a form similar to the deep-sea core subtype *long triangle stepped margin* Doyle et al. 1974. Only rare ichthyoliths are recovered from sediments above the upper Pliocene, an interval when glacial cooling (Fulton 1984; Clague 1991; Mathews 1991; White et al. 1997) would have significantly effected the environment in this region.

In summary, these patterns of ichthyolith occurrence correspond to regional tectonic activity in the Tofino Basin (e.g., Hyndman et al. 1990 and

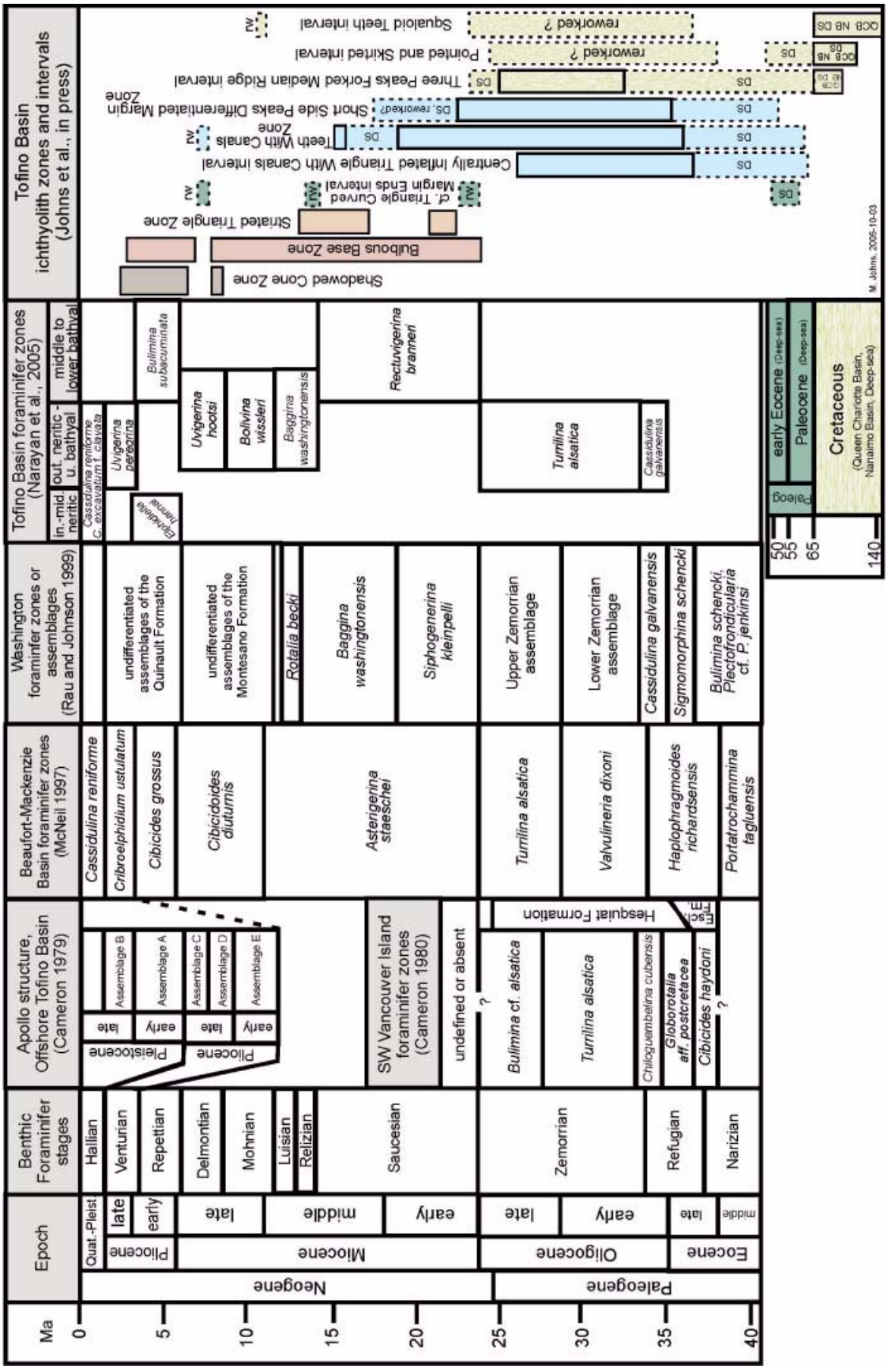

Figure 2.1. Correlation of Pacific Northwest and Arctic foraminifer and provisional ichthyolith zones (in part modified from Cameron 1979, 1980; McNeill 1997; Rau and Johnson 1999; Narayan et al., 2005).

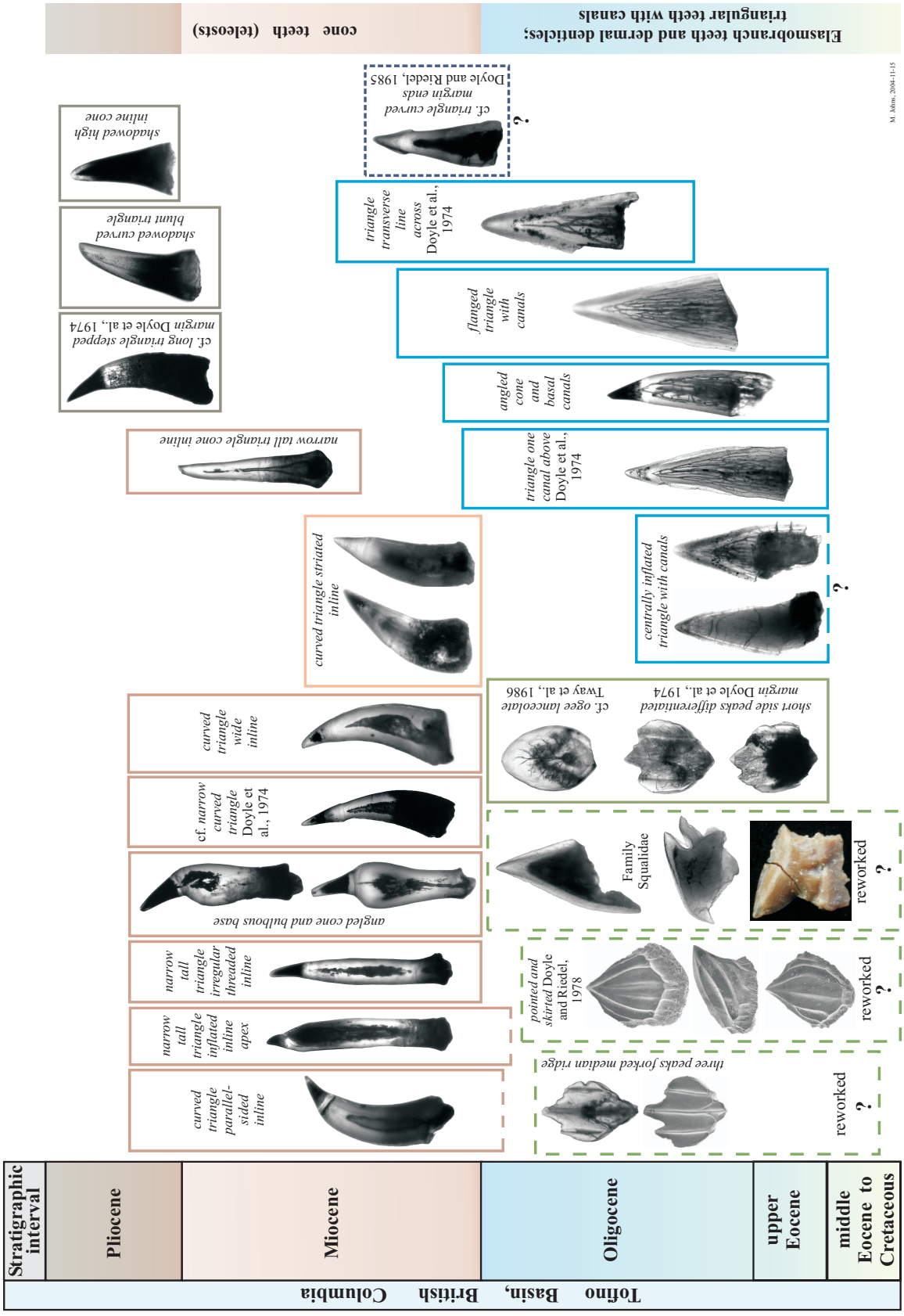

Figure 2.2. Characteristic Tofino Basin ichthyoliths that distinguish stratigraphic intervals (upper Eocene to Pliocene).

1994; Hyndman 1995; Yorath et al. 1999), apparent higher sea levels in the late Eocene/early Oligocene, early to middle Miocene, and early Pliocene indicated by deeper water bathyal environments (Narayan et al., 2005), and a climate cooling trend from the Oligocene through the Pleistocene (e.g., Clague 1991; Zachos et al., 1994, 1996, 1997; Hilary et al., 2000); Prothero 2003.

COMPARISON OF TOFINO BASIN AND DEEP-SEA ICHTHYOLITHS

Several ichthyolith subtypes and similar (cf.) subtypes from both the Tofino Basin and deep-sea cores have overlapping occurrences. They fit into intervals spanning the Cretaceous to lower Paleogene, the Eocene to lower Miocene (Table 3), and the upper Oligocene to Pliocene (Table 4).

Eight ichthyolith subtypes have a deep-sea core and Tofino Basin overlap occurrence in the Oligocene (Table 3). Most range from the Paleocene/lower Eocene to the lower Miocene. The top of the ranges of *kite-shaped longitudinal line* Doyle et al. 1974 and *triangle transverse line across* Doyle et al., 1974 occur in the Oligocene. Most of the eight subtypes are interpreted to have been deposited approximately in situ within bathyal environment strata.

Kite-shaped longitudinal line and *pointed and skirted* Doyle et al. 1978 are common in Upper Cretaceous deep-sea cores. Tofino Basin Superorder Squalomorphii (squaloid) forms and *pointed and skirted* Doyle et al. 1978 are common to abundant, reworked, and deposited in Oligocene strata. In the deep-sea cores, squaloid-like forms are present (e.g., *curved fibrous triangle* Tway et al. 1985 and *fibrous triangle convex margins* Tway et al. 1985). *Pointed and skirted* are rare in deep-sea Oligocene strata. This difference in ichthyolith distribution and abundance could indicate that the Tofino Basin has a proximal and more favourable environment for these fishes. However, more likely, the sedimentary conditions and active tectonic environment of the Tofino Basin resulted in concentration of older ichthyoliths or mixed faunas into younger sediments. Cameron 1980 commented that the Hesquiat Formation Oligocene *Turrilina alsatica* and *Bulimina* cf. *alsatica* foraminifer zones contain a large number of reworked older (Cretaceous and Jurassic) foraminifer species.

Five ichthyolith subtypes have a deep-sea core and Tofino Basin overlap occurrence in the upper Oligocene through Pliocene (Table 4). *Narrow curved triangle* Doyle et al. 1974 is an indicator of the upper Oligocene and lower Miocene in deep-sea strata and is in agreement with a similar subtype cf. *narrow curved triangle* occurring in upper Oligocene to middle Miocene fine-grained deeper water slope to bathyal strata above the Eocene volcanics of the Zeus D-14 (4620-7600 ft) and Prometheus H-68 (5550-60 ft) wells. Although rare in the Tofino Basin Cygnet J-100, Apollo J-14, and Prometheus H-68 wells, cf. *long triangle stepped margin* Doyle et al. 1974 shows a similar occurrence to *long triangle stepped margin* Doyle et al. 1974 found in upper Miocene and Pliocene deep-sea strata.

New Tofino Basin Subtypes

Sixteen new Tofino Basin subtypes are described and illustrated in this catalogue. Most of these new subtypes are cone teeth (11 subtypes) and triangular teeth with canals (3 subtypes). There is one triangular flanged tooth and one elasmobranch dermal denticle new subtype. The majority of the new cone tooth subtypes and specimens are mainly in Miocene Shell Canada well sample intervals. Only one new cone tooth subtype (*dome-top triangle bowed inline*) is from marine outcrop samples on the Hesquiat Peninsula (upper Eocene-Oligocene). The three new teeth with canals subtypes are in upper Eocene and Oligocene intervals, two are triangular with flanged margins and one is a curved triangular cone tooth. The new elasmobranch dermal denticle subtype (*three peaks forked median ridge*) occurs in Oligocene strata (possibly reworked from the Cretaceous through Eocene), and *triangle chisel-top* is a rare but distinctive Miocene ichthyolith that occurs in the Shell Canada well samples.

Ichthyolith Associations

Ichthyoliths near the boundary of the *Turrilina alsatica* and *Bulimina* cf. *alsatica* foraminifer zones (Cameron 1980) are common in three samples (BC-74 spot checks 7, 8, and 15) and fewer numbers in other stratigraphically close samples. While their concentrated occurrence in these samples may have resulted in a turbidite or lag deposit, it may also represent faunas that associated together or were even represented by the same species (e.g., elasmobranchs/sharks can have several different types of teeth and dermal denticles on the same fish).

Most of the Superorder Squalomorphii teeth (~60 specimens) occur at this level and forms share many similar characteristics such as overall shape, inline type, a broad lateral flanged occlusal crest/margin, and the outline texture. All are tooth fragments. Teeth with a lobed tooth base and one long flanged convex tooth margin that basally curves inwards to a point are probably of the Fam-

ily Squalidae. Specimens that do not have the above features and instead have shorter flanged margins where one or both may basally curve upwards (to form part of the next tooth file of a set) are probably of the Family Hexanchidae.

Also occurring in these samples is *centrally inflated triangle with canals* new subtype (37 specimens). It shares many of the Tofino Basin Squalomorphii tooth features but has inline canals and generally is not as robust. Elasmobranch dermal denticles *pointed and skirted* Doyle et al. 1978 (26 specimens), *kite-shaped longitudinal line* Doyle et al. 1974 (17 specimens), and *three peaks forked median ridge* new subtype (10 specimens) also commonly occur at this level. These dermal denticles, especially *pointed and skirted*, show many similarities in shape, pedicle, and crown ridges to dermal denticles of *Centrophorus granulosus* (Bloch and Schneider 1801) (e.g., Reif 1985, Plate 5), a Holocene deep water gulper shark of the Family Squalidae known from the Mediterranean. The relationship of this Holocene shark to the older ichthyoliths from the Tofino Basin cannot be determined from this study but dermal denticle morphological characteristics do suggest some Tofino Basin faunal representatives from the Family Squalidae.

Angled cone and bulbous base, a distinctive new subtype, occurs in many of the Shell Canada well Miocene and Pliocene samples. Its bulbous and elongate character may indicate a pharyngeal tooth form. The co-occurring new subtype *narrow tall triangle inflated inline apex* and *narrow tall triangle irregular threaded inline* are closest in overall shape and type of inline to *angled cone and bulbous base,* mainly differ by being narrower and taller and having a less bulbous tooth base, and may indicate species heterodonty. Other co-occurring subtypes such as cf*. narrow curved triangle* Doyle et al. 1974, and *curved triangle parallel-sided inline* and *curved triangle wide inline* (new subtypes) are common, and probably represent different faunas sharing a similar environment as *angled cone and bulbous base*.

SYSTEMATIC DESCRIPTIONS

Most of the Tofino Basin ichthyoliths in this study are identified using the Coded Utilitarian Ichthyolith Identification System (CUIIS) initially developed by Doyle et al. 1974 and later modified by several others (Table 1, Appendix 1). The CUIIS code is provided for all illustrated specimens in this catalogue. Also provided are subtype character descriptions (for non-rare subtypes), remarks, and occurrence information.

Some Tofino Basin ichthyoliths are identified to family or genus. The systematics used in Cappetta 1987 are followed. Form A, B, C, etc. or sp. A, B, C, etc. are applied to specimens where the genus or species is uncertain. When only the CUIIS is used, then taxa are organized in code sequential order.

Based on one or more common morphological similarities, Tofino Basin ichthyoliths are grouped and organized. Each category includes an introduction on the group and figures illustrating ichthyolith terminology.

Tofino Basin Ichthyolith Groups:

- Elasmobranch teeth
- Elasmobranch dermal denticles
- Triangular teeth with canals
- Triangular flanged teeth
- Triangular flexed teeth
- Cone teeth
- Other Tofino Basin ichthyoliths (oddities)

This catalogue does not contain all possible representatives of Tofino Basin ichthyolith taxa but represents those recovered from the Cenozoic samples processed and specimens reviewed in this study. All described ichthyoliths are known only from isolated teeth and scales.

Elasmobranch Teeth

Tofino Basin elasmobranch teeth are characterized by a prominent principal cusp and a base (or root) positioned approximately central under the base of the tooth crown. The tooth crown of all the Tofino Basin elasmobranchs has a flanged occlusal crest or cutting edge and is either inclined lingually or compressed labio-lingually (e.g., many of the Superorder Squalomorphii sharks). Examples of tooth forms and terminologies (Figure 3) include *Raja* sp. (Figure 3.1 and Figure 3.2), a form similar to *Isurolamna* (Figure 3.3), and Family Squalidae (Figure 3.4 and Figure 3.5).

Determining the type of tooth base (root) and its vascularization are important to complete identification. Figures 3.6 to Figure 3.12 show examples of tooth vascularization. When the tooth base was absent, identification (using binomial systematics) was limited (e.g., only to the Superorder Squalomorphii level) or not possible.

Systematics and list of elasmobranch teeth (following Cappetta 1987):

Phylum Chordata

Class Chondrichthyes Huxley, 1880
Subclass Elasmobranchii Bonaparte, 1838
Cohort Euselachii Hay, 1902
Subcohort Neoselachi Compagno, 1977

Table 3. Eocene to lower Miocene Tofino Basin ichthyoliths also occurring in deep-sea strata (cores). An interpretation (based on lithologies and faunas) of approximate in situ Tofino Basin ichthyolith / sediment deposition or transport / reworking is indicated.

Ichthyolith subtype	Ichthyolith subtype deep-sea strata occurrence	Overlap occurrence	Tofino Basin ichthyolith occurrence and deposition	Mo. spec.
triangle transverse line across Doyle et al., 1974	upper Paleocene to lower Miocene	Oligocene, lower Miocene	mainly Oligocene; possibly lower Miocene; ~ in situ	7
cf. *rhombus kite* Gupta, 1991	Eocene to Oligocene	Oligocene	Oligocene; in situ	1
ogee lanceolate Tway et al., 1985	Eocene to middle Miocene	Oligocene	Oligocene; in situ	3
triangle one canal above Doyle et al., 1974	Eocene to middle Miocene	upper Eocene, Oligocene	upper Eocene and Oligocene; possibly lower Miocene; in situ	5
triangle double flex Dunsworth et al., 1975	middle Eocene to middle Miocene	upper Eocene, Oligocene	upper Eocene and Oligocene; possibly lower-middle Miocene; ~ in situ	4
short side peaks differentiated margin Doyle et al., 1974	upper Eocene to middle Miocene	upper Eocene, Oligocene	upper Eocene and Oligocene; in situ	7
kite-shaped longitudinal line Doyle et al., 1974	Maastrichtian to Oligocene	Upper Cretaceous to Oligocene	lithologies indicate common reworked Cretaceous-Paleogene materials	13
pointed and skirted Doyle et al., 1978	Cretaceous to lower Eocene; rare (reworked?): middle Eocene to lower Pliocene	Cretaceous to lower Eocene	lithologies indicate common reworked Cretaceous-Paleogene materials	42

Table 4. Upper Oligocene to Pliocene Tofino Basin ichthyoliths also occurring in deep-sea strata (cores). In-situ Tofino Basin ichthyolith / sediment deposition (minimal or no reworking) is indicated for these subtypes.

Subtype	Deep-sea core occurrence	Overlap occurrence	Tofino Basin occurrence	No. spec.
cf. *narrow curved triangle* Doyle et al., 1974	upper Oligocene to lower Miocene; rare above	upper Oligocene to lower Miocene; rare above	Oligocene/ Miocene boundary and Miocene	24
cf. *short triangle stepped margin* Doyle et al., 1974	Olig./ Mioc. boundary to Quaternary	Olig./ Mioc. boundary and Miocene	Olig./ Mioc. boundary and Miocene	6
cf. *triangle small top* Ramsey et al., 1976	Cretaceous to Quaternary	upper Oligocene and Miocene	upper Oligocene and Miocene	3
cf. *small triangle long striations* Dunsworth et al., 1975	Olig./ Mioc. boundary to Quaternary	Miocene; pos. lower Pliocene	Miocene; pos. lower Pliocene	2
cf. *long triangle stepped margin* Doyle et al., 1974	upper Miocene to Recent	upper Miocene and Pliocene	upper Miocene and Pliocene	5

Superorder Squalomorphii Compagno, 1973
Order Squaliformes Goodrich, 1909

Family Squalidae Bonaparte, 1834
Family Squalidae indet. Forms A, B, C, D, and E
Family Squalidae indet., Form A
Family Squalidae indet., Form B
Family Squalidae indet., Form C
Family Squalidae indet., Form D
Family Squalidae indet., Form E

Order Hexanchiformes Buen, 1926
Suborder Hexanchoidei Garman, 1913
Family Hexanchidae Gray, 1851 or Family Heptranchidae Barnard, 1925
Suborder Hexanchoidei indet., Forms A, B, and C
Suborder Hexanchoidei indet., Form A
Suborder Hexanchoidei indet., Form B
Suborder Hexanchoidei indet., Form C

Superorder Galeomorphii Compagno, 1973
Order Lamniformes Berg, 1958
Family Lamnidae Muller and Henle, 1938
?Isurolamna sp. A

Order Carcharhiniformes Compagno, 1973
Family Scyliorhinidae Gill, 1862
Family Scyliorhinidae indet., Form A

Superorder Batomorphii Cappetta, 1980
Order Rajiformes Berg, 1940
Suborder Rajoidei Garman, 1913
Family Rajidae Bonaparte, 1831
Raja sp. A

Unidentified elasmobranch teeth, Forms A, B, C, D, and E

Unidentified elasmobranch tooth, Form A

Unidentified elasmobranch tooth, Form B

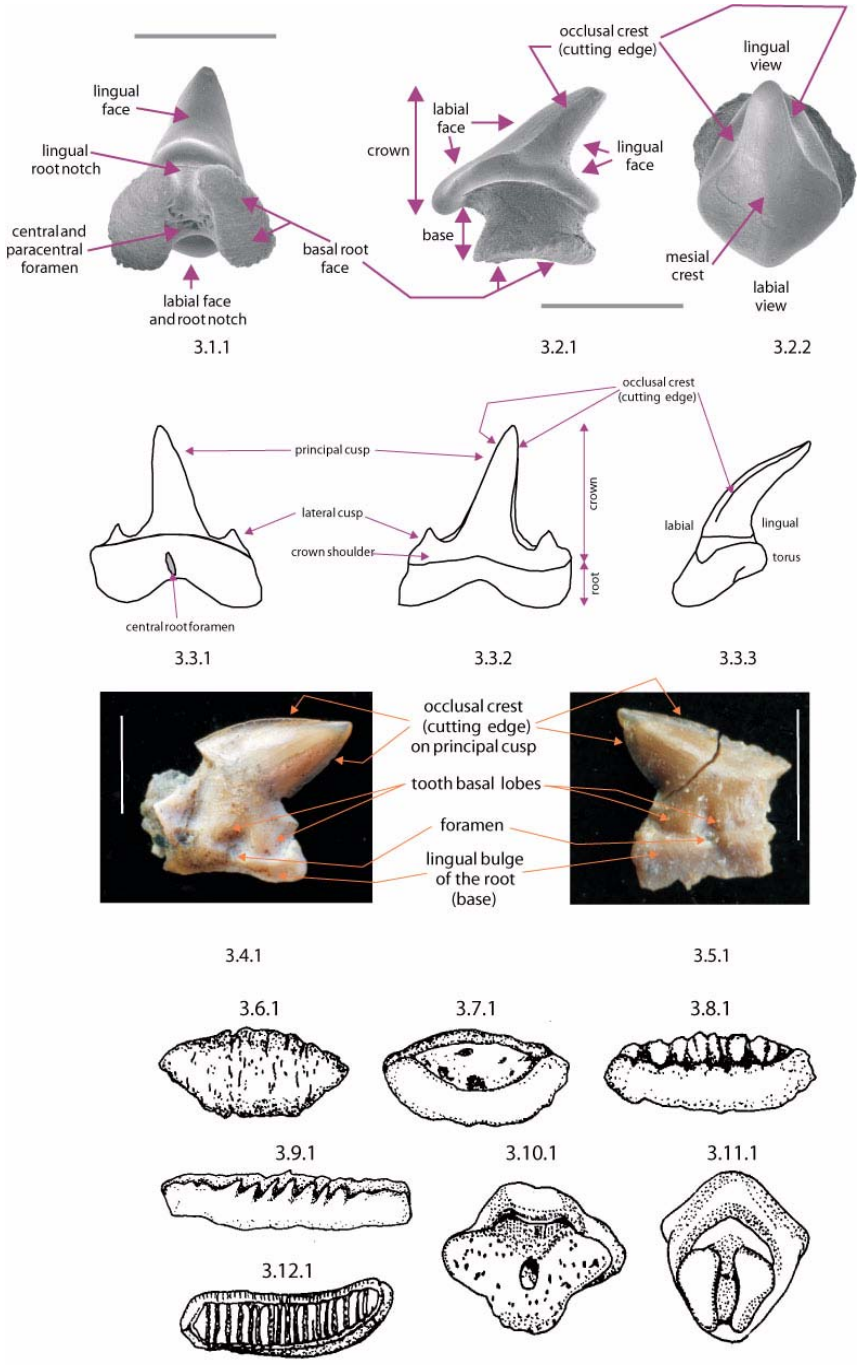

Figure 3. Elasmobranch tooth terms. **3.1** and **3.2.** Example and terms of Tofino Basin *Raja* sp. teeth. **3.1.1.** Subcrown/subroot view, GSC 124516; **3.2.1.** Profile view and **3.2.2.** Occlusal view, GSC 124517. Scale bar = 2.0 mm. **3.3.** Terms for a hypothetical elasmobranch tooth similar to *Isurolamna* and other Tofino Basin specimens. **3.3.1.** Lingual and basal view; **3.3.2.** Labial view; and **3.3.3.** Profile view. **3.4** and **3.5.** Example and terms of Tofino Basin Family Squalidae teeth. **3.4.1** and **3.5.1**. Lingual views; GSC 124521 and 124522; scale bar = 2.0 mm. **3.6** to **3.12.** Stages of elasmobranch root vascularization. **3.6.1.** Anaulacorhize stage; **3.7.1.** Anaulacorhize stage with a concave lower labial root face; **3.8.1** and **3.9.1** Pseudo-polyaulacorhize/anaulacorhize stage; **3.10.1.** Hemiaulacorhize stage; **3.11.1** Holaulacrohize stage; and **3.12.1.** Polyaulacorhize stage. (**3.6.1** and **3.10.1** to **3.12.1** modified from Cappetta 1987 (fig. 21), and **3.7.1** to **3.9.1** modified from Johns et al. 1997). This figure set also is reproduced with the permission of the Minister of Public Works and Government Services Canada, 2004, and courtesy of Natural Resources Canada, Geological Survey of Canada.

Unidentified elasmobranch tooth, Form C

Unidentified elasmobranch tooth, Form D

Unidentified elasmobranch tooth, Form E

Superorder Squalomorphii Compagno, 1973
Order Squaliformes Goodrich, 1909
Family Squalidae Bonaparte, 1834
Family Squalidae indet., Forms A, B, C, D, and E

Remarks: Tofino Basin Squalidae teeth are moderately robust, commonly compressed labio-lingually, slightly convex centrally (not flattened), and asymmetric. Each margin has a well-developed occlusal flange or cutting edge that may be serrated. One margin is longer than the other and convexly curved where it thins to a point basally. The cusp is broad, triangular, commonly angled (some may be more upright), and has apical shadow. The inline is opaque and a similar shape to the outline, is greater than one half to three-quarters the tooth height but does not reach the cusp apex; and has a rounded arc-like apex with approximately vertical striations between the inline and outline apices. The tooth outline is weakly textured with common, short, and irregular striations and may have basal vertical cracks. The base of the tooth is lobed, rarely preserved whole, and basally commonly breaks irregularly. The tooth base (root) is rarely preserved intact.

Greatest variations in the teeth (Forms A to E) include the type of margins, inline striations, cusp curvature and symmetry, and presence (or not) of a distal heel and base with central foramen on the lingual face. Many of the teeth occur together in the same samples suggesting that some may be the same species and that tooth heterodonty may be present.

Distinct characters of the Tofino Basin Squalidae teeth are the apron and lobed tooth base. Elasmobranch teeth from the Family Squalidae, Subfamily Squalinae, have a flanged primary cusp and a tooth apron and base usually with one lobe. Tooth base aprons with more than one lobe are known in Early Miocene to Recent Squalinae genera *Etmopterus* Rafinesque, 1810 and *Squaliolus* Smith and Radcliff 1912 (see Cappetta 1987, p. 52-64) but these do not resemble the shorter apron and multi-lobe arrangement of the Tofino Basin specimens.

Two deep-sea subtypes, *curved fibrous triangle* and *fibrous triangle convex margins* both Tway et al. 1985 have margins, a fibrous outline texture, and outline shape that is similar to the Tofino Basin Squalidae forms. Also, many of the Tofino Basin specimens similarly break irregularly at the tooth base region. The two deep-sea “fibrous” subtypes are known to range in samples from the middle Eocene to the lower Miocene. The Tofino Basin specimens differ by showing better development of the apron and have a tooth base characteristic of Squalidae.

Squalidae teeth almost identical to Tofino Basin specimens are observed in Cretaceous samples from the Queen Charlotte Islands and the Upper Cretaceous Nanaimo Group, Vancouver Island, and Gulf Islands. Reworked Cretaceous to middle Eocene ichthyoliths in the Tofino Basin are indicated following significant regional tectonic activity and a prominent unconformity that occurred during the interval. The occurrences of west coast Squalidae multi-lobate tooth aprons suggest that this feature was present in Cretaceous forms.

Most Holocene Squalinae are bathyal except for a few species of *Squalus* that live on the continental shelf (Cappetta 1987, p. 53).

Family Squalidae indet., Form A
Figure 4

a9/b8±12/c(12,13)+19/d14+19/e1/
f(4a+b)+9+11+14/g7+8/h3/i3,4/j3,4,10/k5,8,9/m0/
n≥1/p0/q1,9,10/r1,2/s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric, compressed labio-lingually, with a primary cusp, distal heel, basal region with a shallow three or greater lobed apron, and one (possibly more) foramen on lingual face of base (root) between basal crown lobes. Tooth primary cusp with both margins convex, one margin basally convex and significantly longer; and a broad flanged lateral occlusal crest where basally on the long margin it thins to a point and curves inwards; apex with lateral and apical shadow; inline apical striations short. Basal labial crown face and base (root) fragmented or not preserved.

Remarks: These teeth are distinctive by having both margins convex and one convex margin that is longer and thins to a point basally. Also, the three or greater lobed basal apron is characteristic as are the one or more foramen on the base between the lobes.

Occurrence: 2 approximately complete specimens, 5 other specimens, 9+ basal fragments; 12+ Form A or B fragments; Hesquiat Peninsula (Oligocene) and one small specimen from offshore Shell Canada well Zeus D-14 (in Miocene sediments that are probably reworked); Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

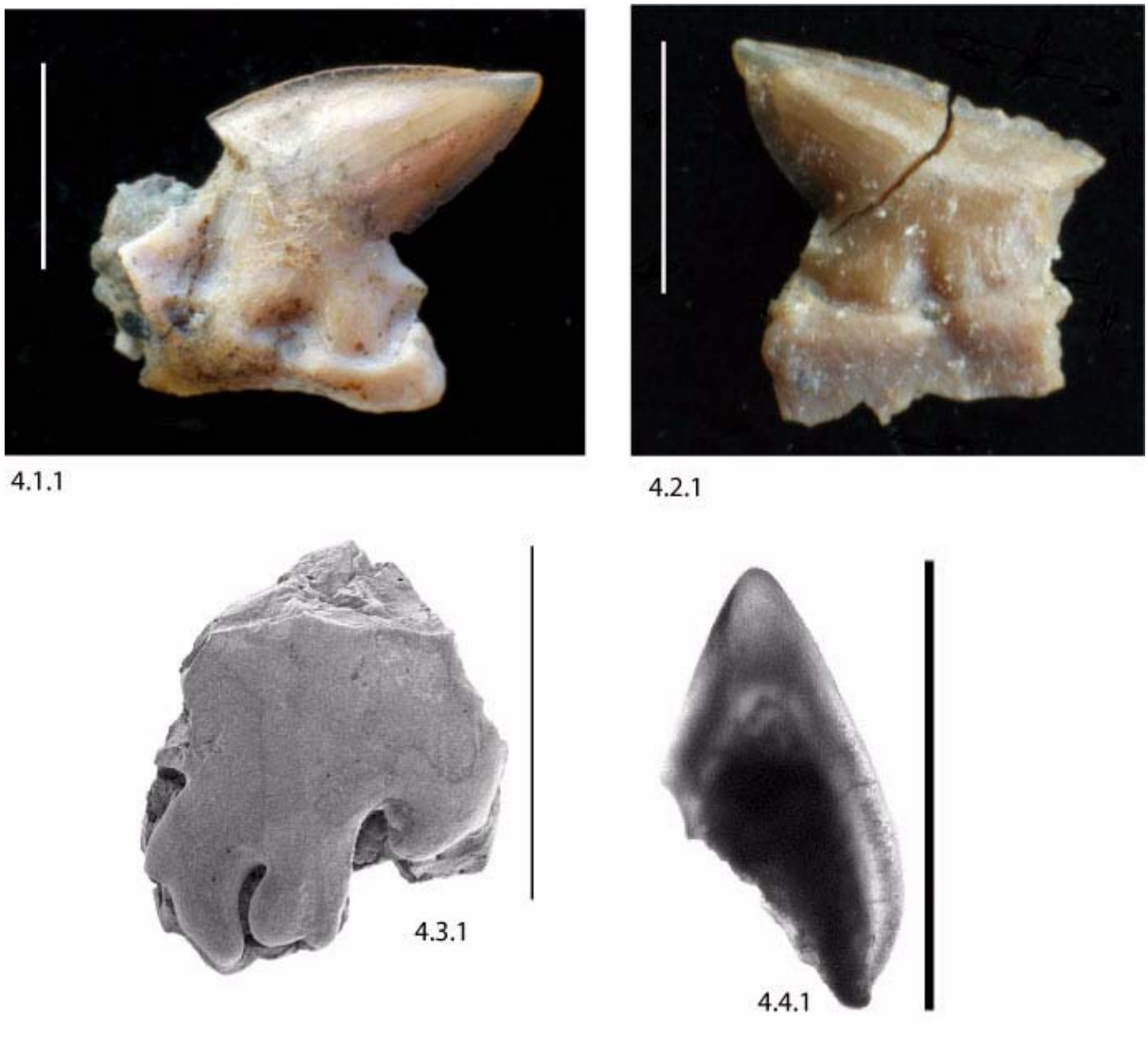

Figure 4. Family Squalidae indet., Form A. **4.1.1** and **4.2.1.** Lingual views showing the primary cusp and lobed apron of two almost intact teeth; GSC 124521 and 124522; scale bar = 2.0 mm. **4.3.1.** Lobes on tooth apron; SEM image; GSC 124523; scale bar = 2.0 mm. **4.4.1** Showing inline, outline flanged occlusal crest and convex margins, longest margin basally convex and curved inwards to a point; GSC 124524; scale bar = 0.4 mm.

Family Squalidae indet., Form B
Figure 5

a9/b8±12/c12+19/d19/e1/f(4a+b)+9+11+14/g7+8/h3/i4/j2,6/k5,8,9/m0/n≥1/p0/q9,10/r1,2/s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric; flanged occlusal crest on one margin convex (especially basally) and may slightly widen centrally and narrow to a point basally, and on second margin straight or slightly concave; first margin longer than second; apical inline striations restricted to lower half.

Remarks: Form B only differs from Family Squalidae indet., Form A by having a straight or slightly concave second margin.

Occurrence: 2 specimens; Hesquiat Peninsula and Flores Island; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

Family Squalidae indet., Form C
Figure 6

a9/b8±12/c14+19/d±13+19/e1/f(4a+b)+9+(11,12)+14/g7+8/h3/i2,3,9/j2,3,4,9/k5,8,9/m0/n≥1/p0/q9,10/r1/s1,2/t4/z0

Appendix 1.6.1

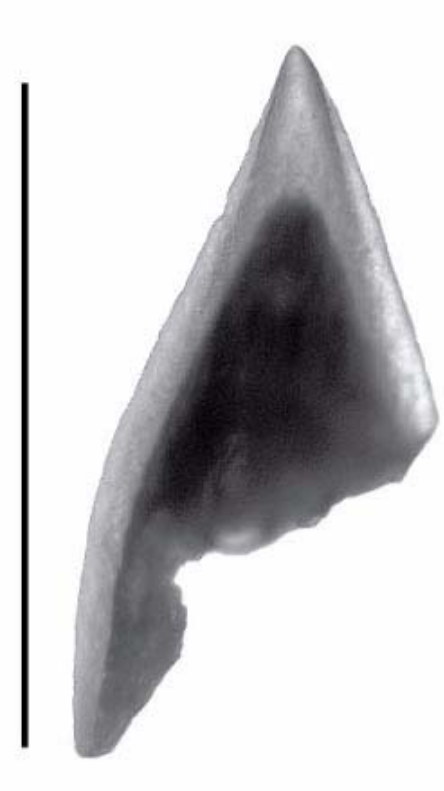

Figure 5. Family Squalidae indet., Form B. **5.1.1.** GSC 124525; scale bar = 1.0 mm.

Characters: Tooth asymmetric; with a primary cusp and part of distal heel; angle between distal heel and primary cusp narrow (approximately 20-30˚) and V-shaped. Primary cusp first margin straight to slightly convex and basally angled to form the V-shape; other margin straight to slightly convex apically and distinctively basally convex where flanged margin thins to a point. Cusp striations may extend from inline apex into upper half but not to outline.

Figure 6. Family Squalidae indet., Form C. **6.1.1.** GSC 124534; scale bar = 0.5 mm.

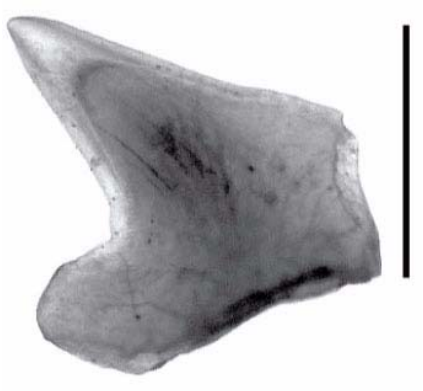

Figure 7. Family Squalidae indet., Form D. **7.1.1.** GSC 124533; scale bar = 0.5 mm

Occurrence: 4 specimens; Hesquiat Peninsula and offshore well Shell-Anglo Pluto I-87; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited Oligocene strata.

Family Squalidae indet., Form D
Figure 7

a9/b8+11±12/c14+19/d19/e1/f(4a+b)+9+11+14/ g7+8/h3/i2,9/j2,4,9/k5,8,9/m0/n≥0.8/p0/q9,10/r1/ s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric; with a primary cusp and part of distal heel; angle between heel and primary cusp moderately broad (approximately 90˚) and U-shaped. Primary cusp first margin straight to slightly sigmoid and basally angled to form the U-shape; other margin approximately straight to slightly basally convex where basal flanged margin thins. Cusp striations may extend from inline apex into upper half but not to outline.

Occurrence: 2 specimens; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

Family Squalidae indet., Form E
Figure 8

a9/b8±12/c(12,13)+(16, 17)+19/d(1,16,17)+19/e1/ f(4a+b)+9+11+14/g7+8/h3/i4/j2,3/k5,8,9/ m0/n≥1/ p0/q9,10/r1,2/s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric; with one or both margins serrated/crenulated; flanged occlusal crest on one margin slightly sigmoid to convex (especially basally), widens centrally and narrows to a point basally, and on second margin much shorter and straight or evenly convex; striations

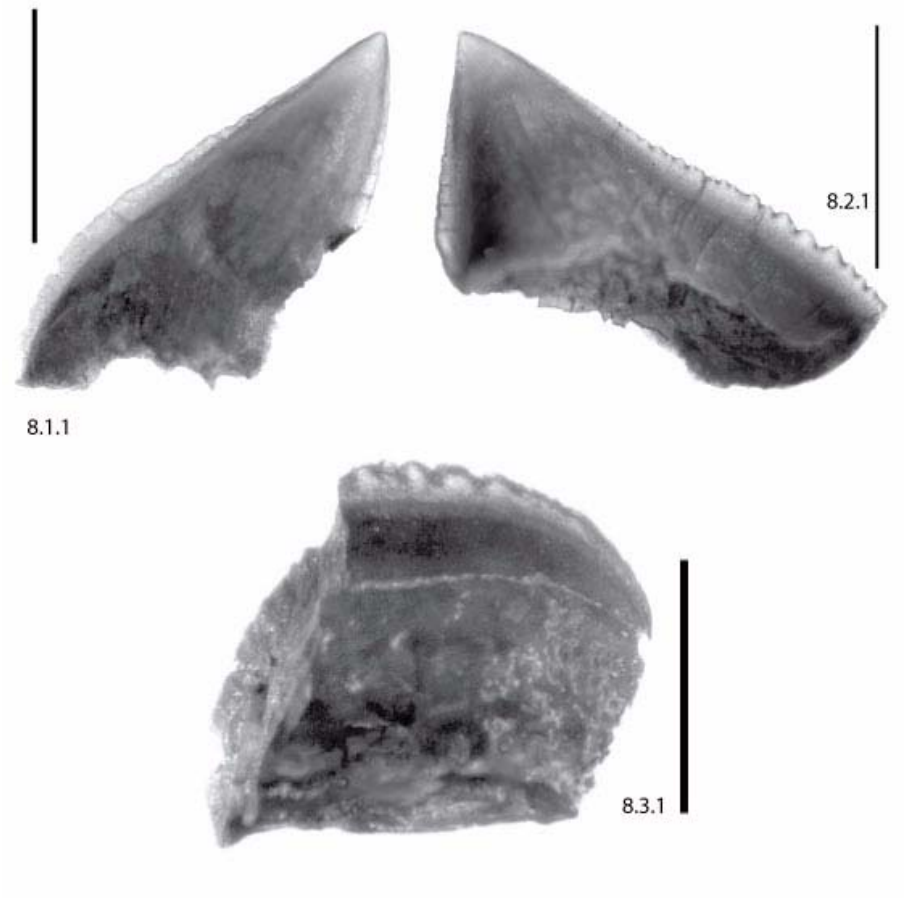

Figure 8. Family Squalidae indet., Form E. **8.1.1, 8.2.1,** and **8.3.1.** Showing variations in the serrated margin and the flanged occlusal crest that thins to a point basally; GSC 124530, 124531, and 124532; scale bar = 1.0 mm.

between apical inline and outline restricted to lower half.

Remarks: The flanged convex margin that curves inwards to a point basally, makes this Form E similar to Family Squalidae indet., Forms A and Family Squalidae indet., B and differs by having a serrated margin.

Occurrence: 5 specimens, 2 questionable specimens; 3 serrated margin fragments; Hesquiat Peninsula and offshore wells Shell-Anglo Harlequin D-86 and Pluto I-87; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into upper Eocene to lower Miocene strata.

Order Hexanchiformes Buen, 1926
Suborder Hexanchoidei Garman, 1913
Family Hexanchidae Gray, 1851 or Family Heptranchidae Barnard, 1925
Suborder Hexanchoidei indet., Forms A, B, and C

Remarks: Tofino Basin Family Squalidae and Hexanchoidei teeth are similarly moderately robust, compressed labio-lingually with a slightly convex central region, and have well- developed occlusal flanged margins or cutting edges. Tofino Basin Hexanchoidei teeth differ by having one crown margin that is convex with a distinct basal angled termination of the flanged occlusal crest that pinches inward and then may slightly curve upwards (slightly hooked). The other flanged margin is concave or straight and basally terminates with a straight across to irregular break. Margins are commonly of a similar length. The tooth crown commonly irregularly breaks basally without preservation of the root/base.

Suborder Hexanchoidei indet., Form A
Figure 9

a9/b8±12/c14+19/d19/e1/f(4a+b)+9+(11,12)+14/g7+8/h1,3,4,5/i3,9/j6,7,8/k5,8,9/m0/n~≥1/p0/q9,10/r1/s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth moderately robust, asymmetric and curved; with one margin evenly convex to

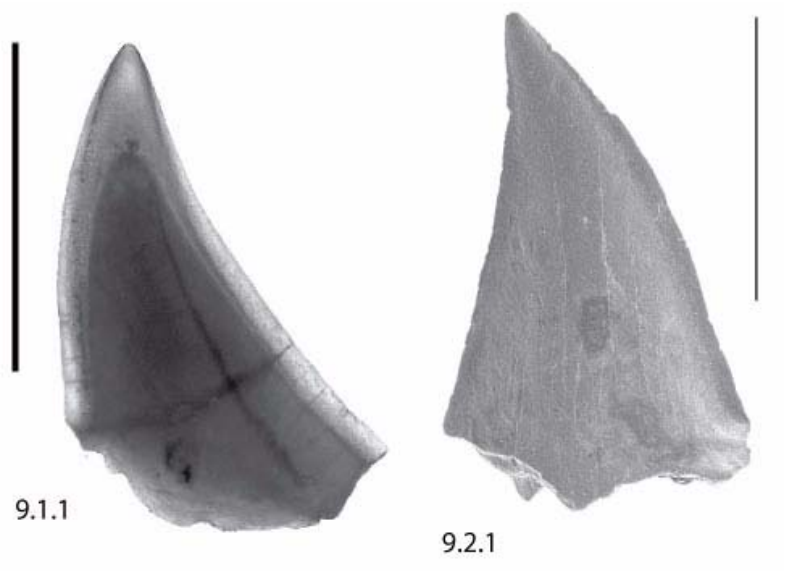

Figure 9. Suborder Hexanchoidei indet., Form A. **9.1.1** and **9.2.1.** Transmitted light and SEM images showing convex and concave flanged margins and a similar shape of the inline to the outline; GSC 124526 and 124527; scale bar = 1.0 mm.

sigmoid and slightly hooked and thinner at base; other margin variably concave and usually longer; both margins with prominent flanged occlusal crest or cutting edge; striations between apical inline and outline may extend into upper half; height to width ≥1; apex moderately acute (not acute, not rounded).

Remarks: A pronounced concave margin is distinct to this form.

Occurrence: 7 specimens; Hesquiat Peninsula and Flores Island; and offshore well Shell-Anglo Pluto I-87; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into upper Eocene to Oligocene strata.

Suborder Hexanchoidei indet., Form B
Figure 10

a9/b8±12/c13±14+19/d19/e1/f(4a+b)+9+12+14/g7+8/h1,5,4,3/i2,4/j2,6/k5,8,9/m0/n~≥0.7/p0/q9,10/r1,2/s3/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric, robust, centrally and basally moderately inflated; apex blunt to rounded; striations between apical inline and outline may extend from the crown base into upper three quarters with some almost to outline apex; flanged margins of similar lengths and widen basally. One margin straight to convex except at

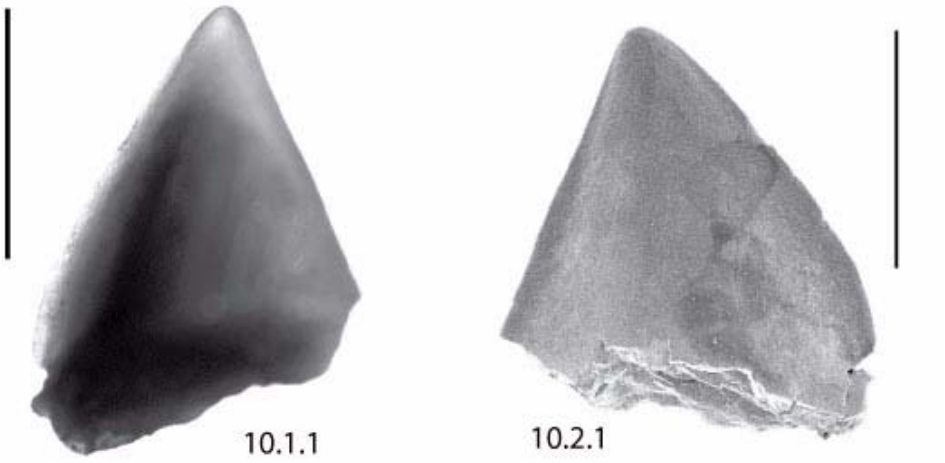

Figure 10. Suborder Hexanchoidei indet., Form B. **10.1.1** and **10.1.2.** Transmitted light and SEM images showing margins and inline; GSC 124528; scale bar = 1.0 mm.

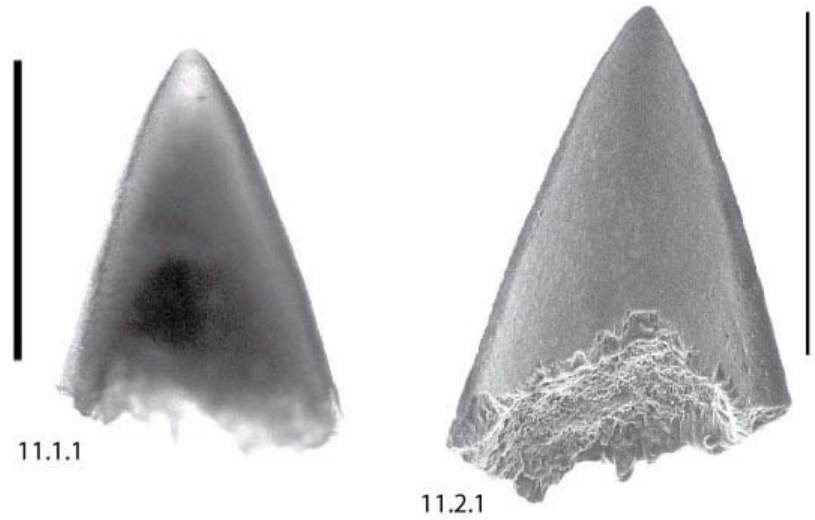

Figure 11. Suborder Hexanchoidei indet., Form C. **11.1.1** and **11.1.2.** Transmitted light and SEM images showing margins and inline; GSC 124529; scale bar = 0.5 mm.

most basal region where it abruptly curves inward (at about 135˚) to a point at inline; other margin straight or equally concave and basally breaks straight across at about 90˚; height approximately equals width.

Remarks: This robust tooth has margins commonly of the same length with one straight to basally convex and the other straight to slightly concave. Form B differs from Suborder Hexanchoidei indet., Form A by having a rounded apex, being shorter with width approximately equal to height, and by not having one concave flanged margin.

Occurrence: 16 specimens; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

Suborder Hexanchoidei indet., Form C
Figure 11

a9/b8±12/c19/d19/e1/f(4a+b)+9+(12,13)+14/g7±8/h1,5/i2,3/j2,3/k5,8/m0/n≥1/p0/q9,10/r1/s1,2/t4/z0

Appendix 1.6.1

Characters: Tooth approximately symmetric; inflated centrally and basally; flanged occlusal crest not as developed (thin apically and slightly widens basally); both margins slightly evenly convex or straight; about same length striations between apical inline and outline extend into upper half and possibly upper quarter; apex sharp to slightly rounded.

Occurrence: 1 specimen; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

Superorder Galeomorphii Compagno, 1973
Order Lamniformes Berg, 1958
Family Lamnidae Muller and Henle, 1838
Isurolamna Cappetta, 1976
?Isurolamna sp. A
Figure 12

a9/b8/c19/d19/e1/f1/g7/h0/i9/j9/k1/m0/n>1.2/p0/q0/r0,1/s0/t4/z1,2

Appendix 1.6.1

Characters: Tooth triangular; enameloid smooth; about 2 cm high and 1 cm wide; sigmoidal in mesial view and lingually angled at about 40-50˚; with a flattened labial face and an inflated cambered lingual face; occlusal crest or cutting edge closest to labial face and does not quite reach crown base (Figure 5.1.2); basal labial face flares and follows the root slightly beyond cutting edge terminus. Root with prominent lingual protuberance and an elliptical foramen that extends centrally down across lingual root face to root subsurface where opening is largest; lingual face approximately vertical, rounded basally, and evenly convex-curved laterally; labial face vertical and centrally concave.

Remarks: Cappetta (1987, p. 95-96) describes both *Isurolamna* Cappetta, 1976 and *Isurus* Rafinesque, 1810. *Isurolamna* is favoured because the lingual root face is significantly protruding and has an elliptical central foramen that extends to the base surface. Crown lateral cusplets may or may not be present in this genus and could not be

Figure 12. *?Isurolamna* sp. A. **12.1.1.** Lingual view of the tooth crown and a central foramen in the tooth base; **12.1.2.** and **12.1.3.** Profile views showing the inflated nature of the tooth lingual face and flattened non-inflated labial face; **12.1.4.** Labial view; GSC 124520; scale bar = 10.0 mm.

observed because the tooth/root is broken at both lateral margins. The identification is questionable because of the fragmentary condition of the specimen.

Isurolamna is known in the upper Paleocene-lower Eocene and *Isurus* in the upper Paleocene-Recent (Cappetta 1987).

Occurrence: 1 specimen; Rafael Point, Flores Island; upper Eocene to lower Oligocene.

Order Carcharhiniformes Compagno, 1973
Family Scyliorhinidae Gill, 1862
Family Scyliorhinidae indet., Form A
Figure 13

a9/b2+8+12/c19/d19/e1/f1/g6+7+8/h0/i6,7/j6,7/k0,1/m0/n0,~1/p0/q0/r0/s3/t4/z0

Appendix 1.6.1

Characters: Tooth crown lingually inclined; lingually curved and more basally convex. Tooth base missing. Crown with single cusp; margins

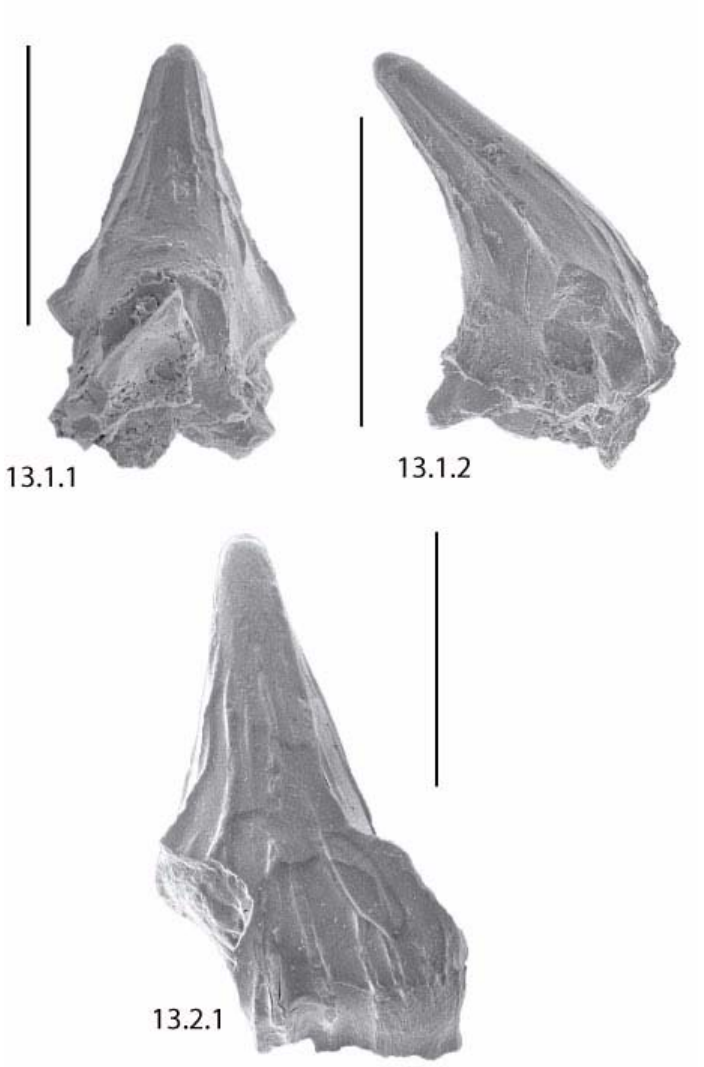

Figure 13. Family Scyliorhinidae indet., Form A. **13.1.1, 13.1.2** and **13.2.1**. Lingual, profile and labial views; GSC 124544 and 124545; scale bar = 0.5 mm.

slightly flare basally and laterally; lingual and labial faces with multiple long lines/ridges that bifurcate basally especially on labial face; lingual face slightly inflated basally; occlusal crest present at both margins; apex rounded.

Remarks: Tooth crown prominent lines/ridges, tall principal cusp that broadens basally, inflated lingual face that arches basally, and a labial face that overhangs the root/base (Figure 13.1.2) characterize many teeth of the Scyliorhinidae. The identification is indeterminate because of incomplete specimens, unknown cusplets, and the missing root/base.

Occurrence: 2 specimens, 1 fragment; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

Superorder Batomorphii Cappetta, 1980
Order Rajiformes Berg, 1940
Suborder Rajoidei Garman, 1913
Family Rajidae Bonaparte, 1831
Raja Linnaeus, 1758
Raja sp. A
Figure 14

a4/b6+8/c2/d2+8/e1/f0/g1,2/h1/i1,2/j2+(11,12)/k1/l3/m0/n1

Appendix 1.4.1

Characters: Crown with one rounded apex and flattened apical surface; occlusal crest terminates on upper surface of a rounded and inflated labial rim; inline similar shape to outline with abundant long striations that radiate from it. Crown longer than wide (immature specimens may be wider than long) and with prominent rounded basal rim that

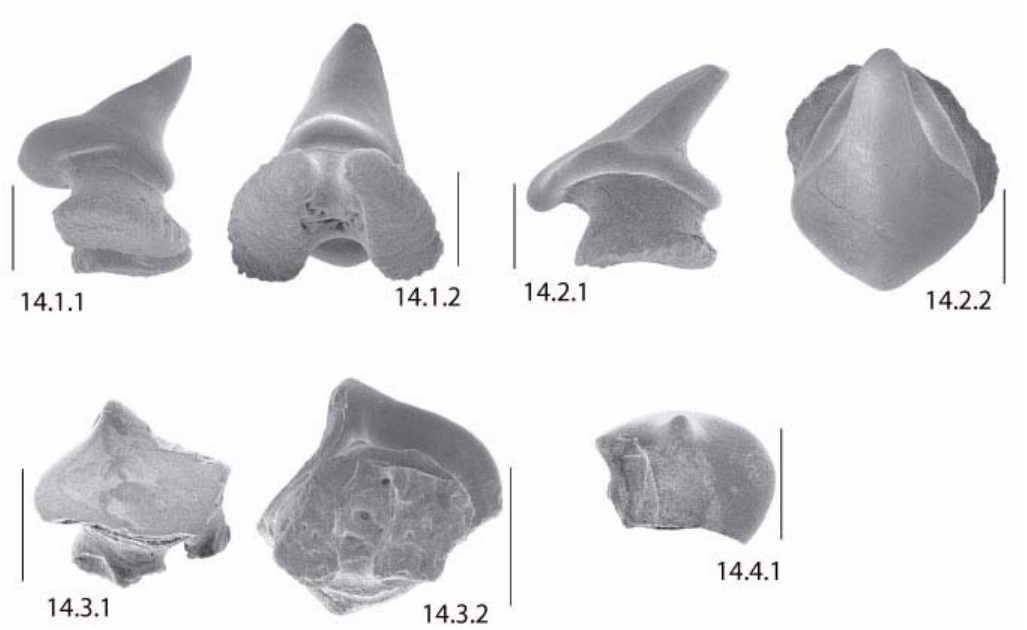

Figure 14. *Raja* sp. A. **14.1.1** and **14.1.2.** Profile and subsurface views; GSC 124516; scale bar = 1.0 mm. **14.2.1** and **14.2.2.** Profile and apical views; GSC 124517, scale bar = 1.0 mm; **14.3.1** and **14.3.2.** Apical and subsurface views; GSC 124518; scale bar = 0.5 mm; **14.4.1.** Apical view of ?*Raja* sp.; GSC 124519; scale bar = 0.5 mm.

overhangs the root base (especially labially) and curves under to subcrown collar and crown/root junction. Root base prominently flares basally; base wider than crown mesiodistally; labial face slightly higher than lingual face; and with distinct central, basal, lingual, rounded notch and prominent rounded and arched labial notch. Holaulacorhize root vascularization; root base with two separate kidney-shaped lobes each with flat surface and one or more foramina in central basal concavity.

Remarks: Probable juvenile or immature teeth with a less developed crown cusp or peak are shown in Figure 14.3.1 and Figure 14.4.1.

Occurrence: 3 specimens and 1 questionable specimen; offshore wells Shell-Anglo Zeus I-65 and Apollo J-14; offshore core END-76B-6E; Shadowed Cone ichthyolith Zone; upper Miocene and Pliocene.

Unidentified elasmobranch teeth Forms A, B, C, D, and E

Some elasmobranch teeth were not completely identified because they were rare and without a tooth base or root. Observing the character of the tooth base/root is required to complete identification to genus or species. Preliminary identifications (including illustration, brief description, and utilitarian code identification) are provided for five elasmobranch teeth (Forms A to E) with distinctive crowns. Future studies hopefully will result in the location of complete specimens so that comparative identifications can be made.

Unidentified elasmobranch tooth, Form A Figure 15

a9/b2+8+12/c19/d19/e1/f(4a+b)+9+(12,13)+14/
g4+7+8/h1,2,4,5/i3,9/j6,7/k5,8,9/m0/n0,≥1/p0/
q9,10/r1/s1/t4/z0

Appendix 1.6.1

Characters: Tooth asymmetric and curved; with one margin concave and longer than slightly convex second margin; striations between apical inline and outline may extend into upper half; both lingual and labial surfaces with ridges that are basally prominent, greater in number, and basally bifurcate; one face has the most ridges that extend from crown base to about three quarters height of tooth but not to occlusal crest, may be discontinuous and irregular.

Remarks: The missing tooth base prevents specimen identification.

Occurrence: 1 specimen; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

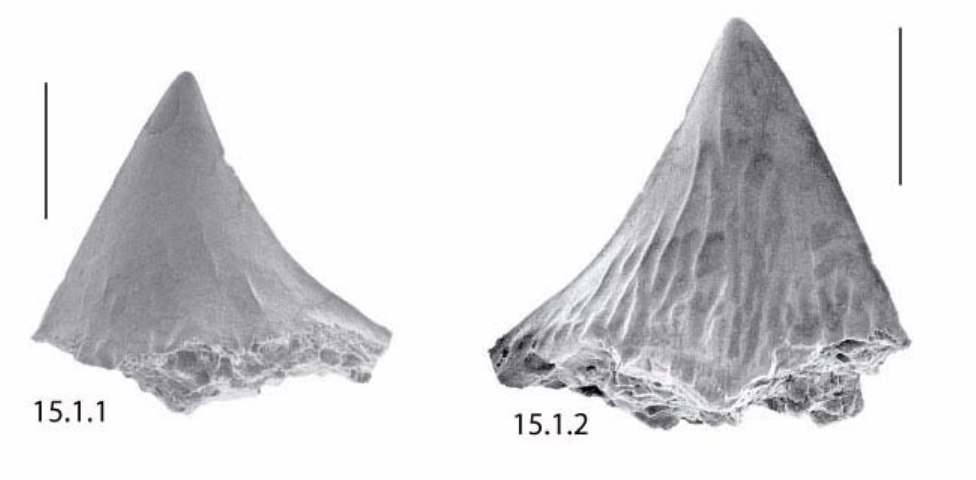

Figure 15. Unidentified elasmobranch tooth, Form A. **15.1.1** and **15.1.2.** Showing differences in the number and placement of ridges on two different crown faces. GSC 124535; scale bar = 1.0 mm.

Unidentified elasmobranch tooth, Form B
Figure 16

a9/b8/c19+20/d19+20/e1/f(4a+b)+9+(11,12)+14/
g7/h1,5/i6,7,8,9/j6,7,8,9/k8/m0.05-0.35/n1.2-2.0/
p0/q9,10/r1/s3/t4/z0

Appendix 1.6.1

Characters: Tooth labio-lingual curvature convex/concave; height to width ratio >1.5; one margin concave to sigmoid; other margin concave, slightly sigmoid, or slightly convex; most curvature basal where flanged occlusal crest margins widen and flare outwards; striations between apical inline and outline; asymmetric and acute laterally in cross-section; apex rounded.

Remarks: These unidentified elasmobranch teeth differ from Family Squalidae indet., Form C by being narrower and by having both basal occlusal crest margins that flare outwards (forming concave basal margins), and do not thin to a point basally, and do not curve inwards basally and lingually. These specimens differ from the Family Squalidae forms by not having a textured outline with common, short, and irregular striations, and by having both basal margins that flare outwards.

Occurrence: 4 specimens and 1 fragment; Hesquiat Peninsula; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into upper Eocene to Oligocene strata.

Unidentified elasmobranch tooth, Form C
Figure 17

a9/b8±12/c13+19/d13+19/e1/
f(4a+b)+9+(12,13)+14/g7+8/h1,5/i9,10/j9,10/k8,9/
m0/n>1.5-3/p0/q9/r1/s3/t4/z0

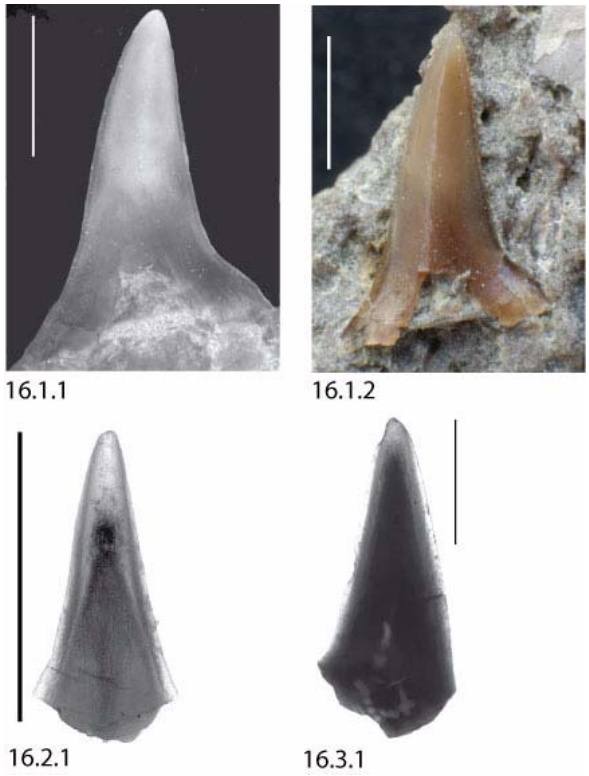

Figure 16. Unidentified elasmobranch tooth, Form B. **16.1.1** and **16.1.2.** Showing a large tooth (>4 mm) in disturbed bioclastic matrix; GSC 124536, scale bar = 2.0 mm. **16.2.1.** Showing concave margins and striations between the inline and outline; GSC 124537, scale bar = 0.4 mm. **16.3.1.** Showing a high inline with striations between the inline and outline; GSC 124538, scale bar = 1.0 mm.

Appendix 1.6.1

Characters: Tooth labio-lingual curvature sigmoid/reverse sigmoid; height to width ratio >1.5; lingual face more inflated and rounded (especially at

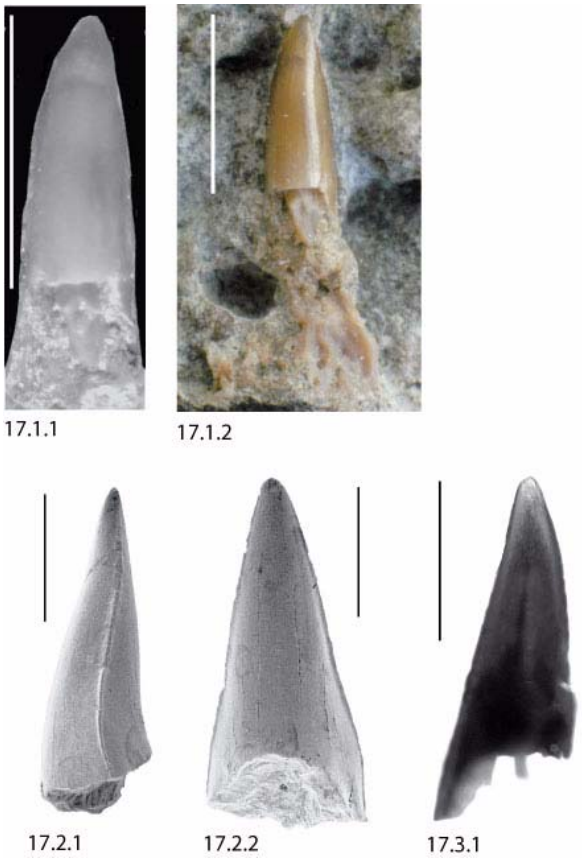

Figure 17. Unidentified elasmobranch tooth, Form C. **17.1.1** and **17.1.2**. Showing a large tooth (~2 mm) in disturbed bioclastic matrix; GSC 124539, scale bar = 2.0 mm. **17.2.1** and **17.2.2** Profile and lingual views showing margin sigmoid curvature; GSC 124540; scale bar = 1.0 mm. **17.3.1**. Showing inline with a similar shape to outline and striations between the inline and outline; GSC 124541, scale bar = 1.0 mm.

base) than flatter labial face; margins sigmoid or reverse sigmoid; flanged occlusal crest on both margins and thin to a point both apically and basally (widest centrally) and basally curve inwards lingually; thick and common long apical striations fill much of area between inline and outline; asymmetric and acute laterally in cross-section; apex rounded; outline with faint irregular ridges/lines.

Remarks: These teeth have a similar outline texture, shape of the inline, and striations between the inline apex and outline as many of the Family Squalidae teeth. They differ by not being compressed labio-lingually, by having basal lingual curvature, and by being more upright.

Occurrence: 5 specimens; Hesquiat Peninsula and Nootka Island; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into Oligocene strata.

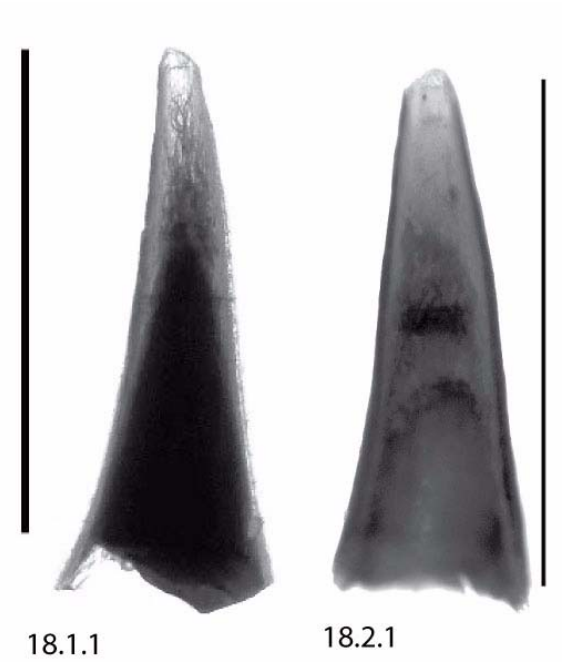

Figure 18. Unidentified elasmobranch tooth, Form D. **18.1.1** and **18.2.1**. Showing small variations in tooth inline and striations between the inline and outline; GSC 124542 and 124543; scale bar = 0.9 and 0.8 mm.

Unidentified elasmobranch tooth, Form D
Figure 18

a9/b8±12/c19/d19/e1/f±(4a+b)+9+(11,12)+14/g7±8/h1,5,4/i2,6,9/j2,6,9/k8,9/m0/n>2/p0/q9,10/r1/s0,1,2/t4/z0

Appendix 1.6.1

Characters: Tooth labio-lingual curvature sigmoid/reverse sigmoid; height to width ratio >2; lingual face more inflated and rounded (especially at base) than flatter labial face; margins concave, sigmoid, or straight with thin flanged occlusal crest; common apical striations between inline and outline; asymmetric and acute laterally in cross-section; outline may have faint irregular ridges/lines.

Remarks: These teeth have a similar shape to unidentified elasmobranch tooth, Form C but are smaller, thinner, and not as robust. The tooth apex is commonly damaged but is probably acute because the tooth is tall and narrow.

Occurrence: 4 specimens; Hesquiat Peninsula and Nootka Island; Squaloid Teeth ichthyolith interval; Cretaceous to middle Eocene, reworked and deposited into upper Eocene to Oligocene strata.

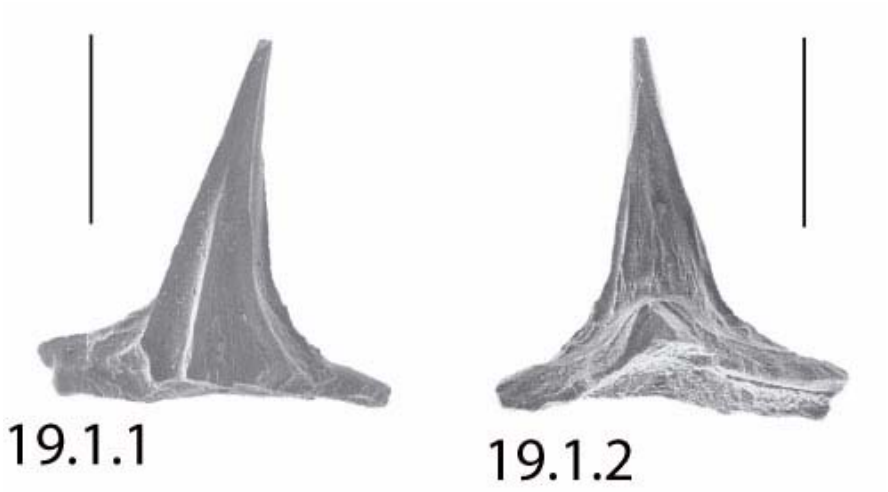

Figure 19. Unidentified elasmobranch tooth, Form E. **19.1.1** and **19.1.2.** Labial and lingual views; GSC 124546; scale bar = 0.2 mm.

Unidentified elasmobranch tooth, Form E
Figure 19

a9/b2+8+12/c19+20/d19+20/e1/f1/g6+7+8/h1,5/i7/j7/k0,1/m0/n~1/p0/q0/r0/s2/t4/z0,1

Appendix 1.6.1

Characters: Small triangular tooth (<0.4 mm), with base missing. Tooth crown flared and extended laterally; with single cusp and acute apex; labial face with central ridge and occlusal crest at both margins; lingual face with ridges/lines, more common basally and may bifurcate basally; lingual face base with protrusion.

Occurrence: 1 specimen, offshore well Shell-Anglo Prometheus H-68; Bulbous Base ichthyolith Zone; Miocene.

Elasmobranch Dermal Denticles

Class Chondrichthyes Huxley, 1880
Subclass Elasmobranchii Bonaparte, 1838

Tofino Basin elasmobranch dermal denticles have a lustrous crown that sits on a pedicle or base. The shape (e.g., lanceolate, rhomboid, circular, etc.) of the dermal denticle crown, its ornamentation (e.g., lines, ridges platforms, furrows, etc.), and the type of pedicle (e.g., Johns et al. 1997) are important characteristics to complete identification (Figure 20). Elasmobranch dermal denticles are commonly smaller than elasmobranch teeth and not as robust. Dermal denticles are commonly inclined anterior to posterior with the attachment of the pedicle positioned near the anterior margin leaving a significant region of the posterior subcrown that is unoccupied by the pedicle. Some dermal denticles have the pedicle positioned directly under the crown but the pedicle is distinctly smaller than the crown and the crown is usually horizontal (flat-topped), dome-shaped, or lobed. Elasmobranch teeth have a tooth base that is almost always directly below the crown base and occupies most of the subcrown surface.

List of elasmobranch dermal denticles identified:

short side peaks differentiated margin Doyle et al. 1974

three peaks forked median ridge new subtype

cf. *rhombus kite* Gupta 1981

kite-shaped longitudinal line Doyle et al. 1974

cf. *kite-shaped longitudinal line* Doyle et al. 1974

pointed and skirted Doyle et al. 1978

cf. *pointed and skirted* Doyle et al. 1978

cf. *ogee lanceolate* Tway et al. 1985

Undescribed elasmobranch dermal denticle, Form A

Undescribed elasmobranch dermal denticle, Form B

Undescribed elasmobranch dermal denticle, Form C

Undescribed elasmobranch dermal denticle, Form D

Undescribed elasmobranch dermal denticle, Form E

Undescribed elasmobranch dermal denticle, Form F

Undescribed elasmobranch dermal denticle, Form G

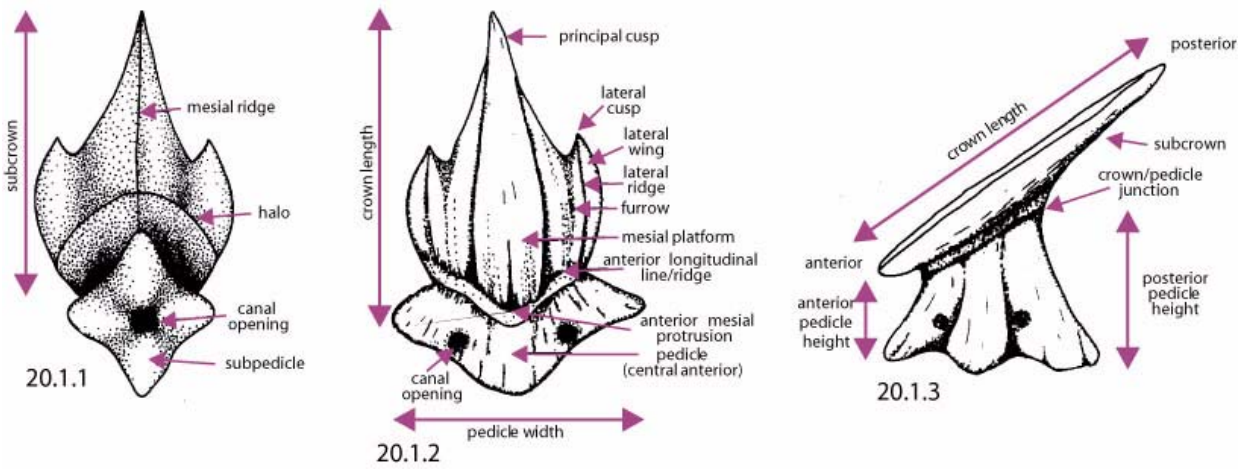

Figure 20. Elasmobranch dermal denticle terms (modified from Johns et al. 1997 and reproduced with the permission of the Minister of Public Works and Government Services Canada, 2004, and courtesy of Natural Resources Canada, Geological Survey of Canada). **20.1.1**. Subcrown and subpedicle view; **20.1.2.** Anterior and upper view of crown and pedicle; **20.1.3.** Profile view.

Undescribed elasmobranch dermal denticle, Form H

Undescribed elasmobranch dermal denticle, Form I

Undescribed elasmobranch dermal denticle, Form J

Undescribed elasmobranch dermal denticle, Form K

short side peaks differentiated margin
Doyle et al. 1974, p. 836
Figure 21

a2/b2±6/c3/d1,2/e1/f1,2/g1/h2,3/i2,10/j3-5/k0/l0/m1,2,5/n2+11/p0/q0/r0/s1

Appendix 1.3.1

Remarks: Tofino Basin specimens have a crown outline that is lanceolate-shaped, symmetric, approximately flat, and length greater than width but less than two times width. The posterior margin has three peaks with the median peak not greater than three times height of lateral peaks and depressions between peaks are U-shaped. The anterior margin is undulating with a short V-shaped mesial protrusion and a thin longitudinal line may be at the margin edge. The upper crown surface has three to five similarly raised ridges that extend from the anterior margin to posterior margin. The single mesial ridge is longer than lateral ridges. The subcrown may have faint vertical lines and the pedicle is missing.

The Tofino Basin specimens differ from *short side peaks differentiated margin* by not having a mesial ridge that is significantly more raised and differentiated from the lateral ridges and by having a median peak that is less than three times the height of the lateral peaks. *Short side peaks differentiated margin* ranges from upper Eocene to upper Oligocene (Doyle et al. 1974, p. 836).

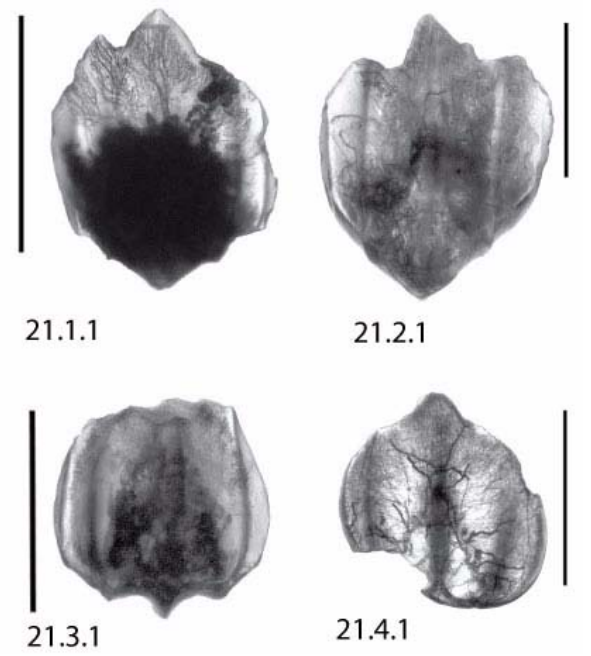

Figure 21. *short side peaks differentiated margin* Doyle et al. 1974. **21.1.1** and **21.2.1.** Upper crown (transmitted light) view; GSC 124547and 124548; scale bar = 0.5 mm. **21.3.1** and **21.4.1.** ?*short side peaks differentiated margin.* **21.3.1.** Specimen with damaged anterior margin but showing three crown ridges and a small anterior mesial protrusion; GSC 124549, scale bar = 0.3 mm. **21.4.1.** Showing minor lateral cusp development; GSC 124550, scale bar = 0.5 mm.

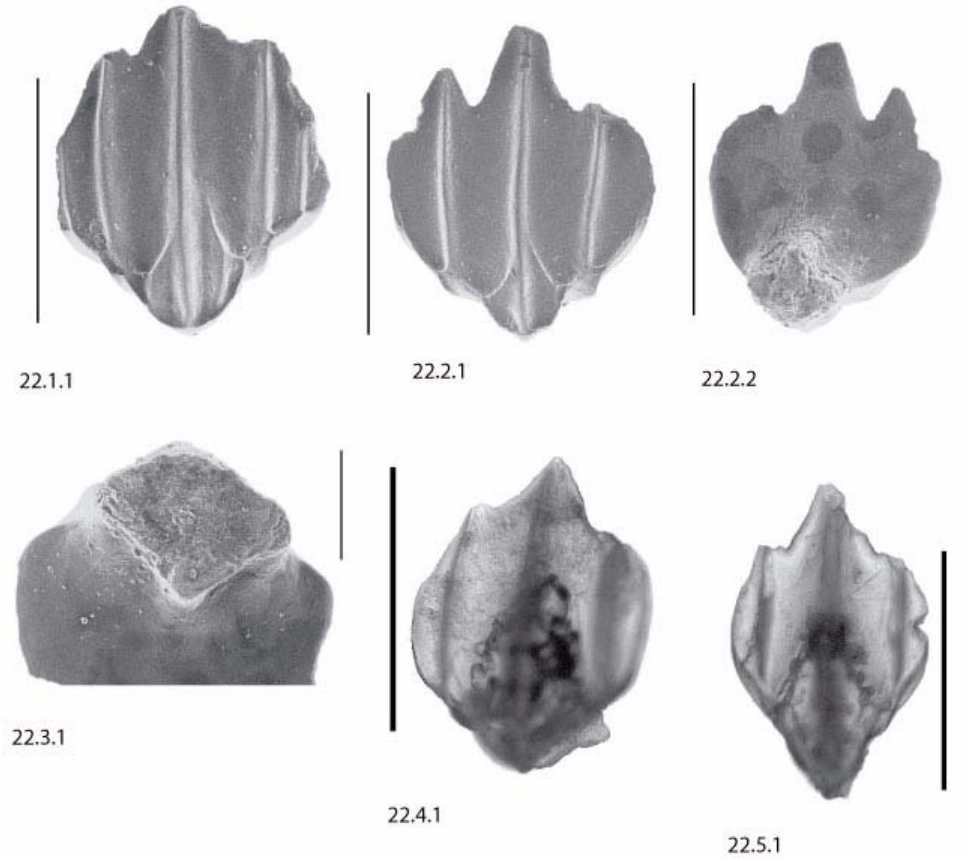

Figure 22. *three peaks forked median ridge* new subtype. **22.1.1** and **22.2.1.** Upper crown (SEM) images showing arrangement of ridges, anterior mesial protrusion, and dentate posterior margin; GSC 124551 and 124552; scale bar = 0.5 mm. **22.2.2** and **22.3.1.** Subcrown and subpedicle views (SEM images); GSC 124552 and 124553; scale bar = 0.5 mm and 0.2 mm. **22.4.1.** and **22.5.1.** Transmitted light images; GSC 124554 and 124555, scale bar = 0.4 mm.

Questionable specimens of *short side peaks differentiated margin* have a damaged or not well-developed posterior dentate margin.

Occurrence: 3 specimens, 5 questionable specimens; Hesquiat Peninsula, Flores Island, and offshore well Shell-Anglo Pluto I-87; Short Side Peaks Differentiated Margin ichthyolith Zone; upper Eocene to middle Miocene.

three peaks forked median ridge new subtype
Figure 22

a2/b2+6±12/c3/d1/e1/f1,2/g1/h1,2,3/i2+11+14/j3-5/k0,5,10/l3/m1/n11+15/p3/q0,1/r0,1/s1

Appendix 1.3.1

Characters: Crown outline lanceolate to polygonal-shaped; longer than wide; with three peaks on dentate margin and U-shaped depressions between peaks; median peak 2-3 times as long as lateral peaks; anterior longitudinal ridge runs approximately parallel to undulating anterior margin (opposite dentate margin); ridges approximately parallel, long (extend from anterior longitudinal ridge to dentate margin), and commonly three (occasionally 4 or 5); median ridge forks near anterior margin with two ridges departing near same spot on median ridge, each extending to anterior longitudinal ridge at a position between median and lateral ridge, and each (plus anterior longitudinal ridge) form a small mesial anterior protrusion; addition short forking may occur near anterior longitudinal line; not curved from side-to-side but equally undulating; anterior margin prominently overhangs crown/pedicle junction. Subcrown unornamented. Pedicle tetrahedroid; smaller than crown; commonly not well preserved; positioned near anterior margin; base surface flat with tetrapetaloid to rounded-rhombic margins; vascularisation hemiaulacorhize.

Remarks: *Three peaks forked median ridge* is distinct and mainly differs from *short side peaks differentiated margin* and *three similar peaks* Doyle et al. 1974 by having an anterior-forked median ridge and its associated anterior mesial protrusion.

Occurrence: 4 specimens, 6 probable fragments, 1 slightly modified specimen similar to this subtype;

Figure 23.1.1. cf. *rhombus kite* Gupta 1991. View of upper crown (SEM image); GSC 124556; scale bar = 0.5 mm.

near Matlahaw Point on Hesquiat Peninsula, and Rafael Point on Flores Island; offshore well Shell-Anglo Pluto I-87; Three Peaks Forked Median Ridge ichthyolith interval; common in Oligocene, ?reworked from Cretaceous to Eocene strata.

cf. *rhombus kite*
Gupta 1991, p.127
Figure 23

a3/b2±12/c3/d5+6/e1/f1/g1+2/h3/i1.3-1.5/j3

Appendix 1.4.1

Characters: Crown outline rhomboid-shaped; longer than wide (ratio 1.3-1.5:1); with prominent (very raised) median ridge line that bifurcates near the margin opposite the acute prominence; median and two other ridges converge at apex of acute prominence and at other end each contacts one crown basal corner; margin opposite acute prominence rounded, moderately narrow and extended, and with concave sides; acute prominence fairly erect at about 80-85°, margins slightly sigmoidal, height similar to crown width; basal margins continuous and smooth; subsurface outline approximately rhomboid; pedicle absent.

Remarks: The biggest similarities to *rhombus kite* are the high mesial ridge and a rhombus outline. The Hesquiat Peninsula specimen differs by having two additional ridges that radiate from the acute prominence – each to an outer margin; a ridge line that bifurcates near the margin opposite the acute prominence, sinuous margins on the acute prominence; and concave margins opposite the acute prominence. *Rhombus kite* is believed to occur in the Paleogene (Gupta 1991).

Occurrence: 1 specimen; Estevan Point, Hesquiat Peninsula; deposited in Oligocene strata, probably reworked from older strata.

kite-shaped longitudinal line
Doyle et al. 1974, p. 844
Figure 24

a4/b2±6/c3/d2+3/e2/f3/g1+2/h1,2,3/i1-2/j3

Appendix 1.4.1

Remarks: Tofino Basin specimens have a crown: outline that is kite-shaped, longer than or about equally as long as wide (ratio 1-2:1), and with one median ridge that is more raised near the margin opposite the acute prominence that may curve downwards (Figure 24.3.2). Crown lateral ridges are absent or short near the margins. The crown margins opposite the acute prominence have concave sides, and a rounded moderately narrow and extended protrusion. Acute prominence margins are concave to slightly sigmoidal with a thin transparent flange-like extension. All margins are continuous and smooth. A thin longitudinal line may be present along the margin opposite the acute prominence. The crown subsurface has a mesial ridge (Figure 24.1.2). The pedicle is commonly missing or broken and when present, is short truncate and wider than crown on margins opposite the acute prominence. The anterior crown/pedicle junction is located at the anterior crown edge and the posterior junction at centre or posterior of centre. The pedicle base is concave, approximately rhomboid-shaped, may have anterior bulge (Figure 24.2.1), and margins may be undulating.

Lanceolate median line Winfrey et al. 1987 has one mesial ridge like these Hesquiat Peninsula specimens but was not chosen because it is lanceolate-shaped and does not have four distinct sides. *Kite-shaped longitudinal line* ranges from the Maestrichtian through the Oligocene (Doyle and Riedel 1979a, p. 43).

Occurrence: 11 specimens, 2 questionable fragments; near Matlahaw Point, Hesquiat Peninsula; Three Peaks Forked Median Ridge ichthyolith interval; Oligocene; ?reworked from Eocene through Cretaceous strata.

cf. *kite-shaped longitudinal line* Doyle et al. 1974, p. 844
Figure 25

a4/b2±6/c3/d3/e1,2/f3/g1+4/h1/i1-1.5/j3,4

Appendix 1.4.1

Characters: Crown outline kite-shaped; longer than or about equally as long as wide (ratio 1-

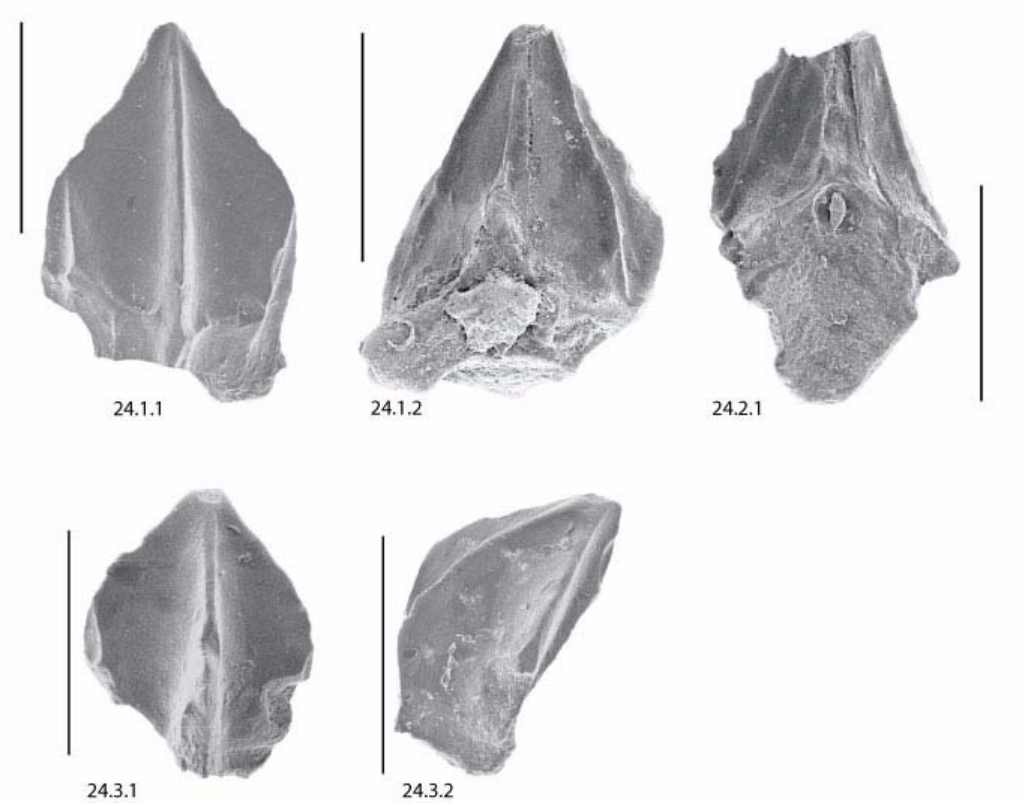

Figure 24. *kite-shaped longitudinal line* Doyle et al. 1974. 24.1.1, 24.1.2, and 24.2.1. (GSC 124557) Crown and sub-crown views and subpedicle view (GSC 124558); scale bar = 0.5 mm. 24.3.1 and 24.3.2. Crown and profile views; GSC 124559, scale bar = 0.5 mm.

1.5:1); with one median ridge that is more raised near margin opposite acute prominence and may curve downwards, and two long additional lateral ridges; margins opposite acute prominence with straight or undulating sides and a short V-shaped protrusion; acute prominence margins straight to slightly convex with thin transparent flange-like extension on both margins that is continuous and smooth; longitudinal line along margin opposite acute prominence; subsurface with mesial ridge. Pedicle short truncate and wider than crown on margins opposite acute prominence; anterior crown/pedicle junction located at anterior crown edge and posterior junction at centre or posterior of centre; base concave, rounded to tetrapetaloid, and margins may be undulating.

Remarks: The specimens differ from *plain and lined lanceolate* Doyle et al. 1978 by having acute prominence margins that are straight to slightly convex and four margins that are approximately distinct. These specimens differ from *kite-shaped longitudinal line* by having three long crown ridges, straight to slightly convex acute prominence margins, a less pronounced anterior protrusion, and margins opposite the acute prominence that are straight to undulating.

Occurrence: 4 specimens; near Matlahaw Point, Hesquiat Peninsula; Three Peaks Forked Median Ridge ichthyolith interval; Oligocene, ?reworked from Cretaceous to Eocene strata.

pointed and skirted Doyle et al. 1978, p. 747 Figure 26

a4/b2±6±12/c2,4/d4±(7,8)+10±13/e3/f3,4/g1/h1,2/i1,2/j(4,5,6)+11+13/k0,1,2,4±8/l1,2/m0,9/n0,3,4

Appendix 1.4.1

Remarks: Tofino Basin specimens are about equally long as wide or slightly longer and have a crown outline that is rhomboid to lanceolate-shaped, a posterior margin with one short acute or obtuse apex, and an irregular to undulating anterior margin without a mesial protrusion that may slightly overhang the pedicle or slope directly down to the pedicle. The crown has 3-6 long and prominent ridges and furrows which converge at the posterior margin near the acute prominence and may bifurcate near anterior margins especially when the crown has a steeper or more erect inclination (Forms C, D, and E). The crown mesial platform is lanceolate-shaped, extends anterior to posterior, commonly broad, centrally highest, and not well

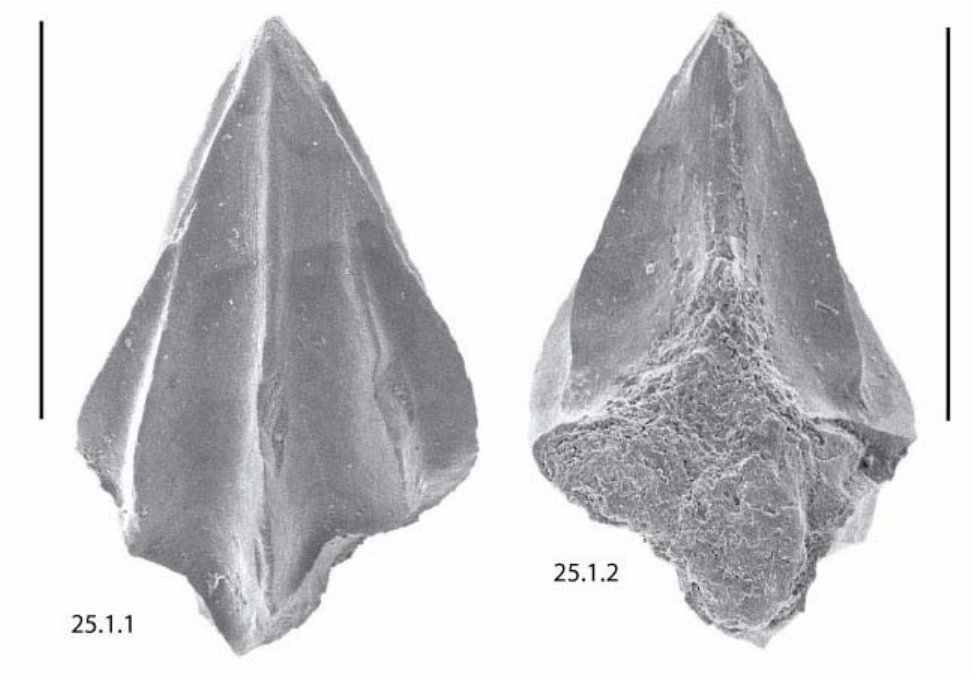

Figure 25. cf. *kite-shaped longitudinal line* Doyle et al. 1974. 25.1.1 and 25.1.2. Crown and subcrown views; GSC 124560; scale bar = 0.5 mm.

developed (ridge height and furrow depth similar). Two crown wings are lower in height than, on each side of, and positioned mainly at anterior end of the mesial platform. Most of the subcrown surface is occupied by the pedicle with only a small amount of subapical region exposed. The pedicle is anterior, wider than the crown and short truncate. The crown looks skirted or fringed. Vascularisation is anaulacorhize or indeterminate with the subsurface convex or convex with an anterior bulge. The anterior crown/pedicle junction is located at the anterior crown edge and posterior junction at centre or posterior of centre.

Pointed and skirted is distinctive by having a short and broad pedicle (especially at anterior) making it look skirted. It occurs in the Campanian through lower Eocene and rarely in the later Cenozoic (Doyle and Riedel 1979a, p. 38).

Pointed and skirted dermal denticles show many similarities (shape, ridges, and pedicle) to *Centrophorus granulosus* (Bloch and Schneider 1801), an extant gulper shark of the Family Squalidae that is common to deep waters (100-1200 m) in the Mediterranean (Reif 1985, plate 5). These dermal denticles occur in many but not all of the same samples as the Superorder Squalimorphii teeth. A number of other variable characteristics (Table 5) are observed in the Tofino Basin specimens. In the future, these may be useful for subdivision of the subtype.

Occurrence: 42 specimens; Nootka Island, several locations on the Hesquiat Peninsula, and offshore well Shell-Anglo Pluto I-87; Pointed and Skirted ichthyolith interval; Upper Cretaceous to lower Eocene, reworked and deposited into upper Eocene and Oligocene strata.

cf. *pointed and skirted* Doyle et al. 1978, p. 747 Figure 27

a4/b2+6/c2/d4+8+10/e1,3/f4/g1,2/h2/i1/j(5,9)+11+13/k1,8/l2/m9/n3,4?

Appendix 1.4.1

Characters: Crown outline lanceolate to rectangular or pentagonal; longer than wide; with low inclination to almost horizontal; posterior margin with one short acute or obtuse apex; anterior margin rounded to truncated, overhangs pedicle, and without mesial protrusion. Mesial platform broad (occupies most of crown) and long (extends anterior to posterior), approximately lanceolate to pentagonal shaped, height not well developed (ridge height and furrow depth similar), may have short or long approximately parallel lines and ridges. Two narrow crown wings lower in height than and on each side of mesial platform, terminate before posterior apex. Most of subcrown surface occupied by pedicle with only a small

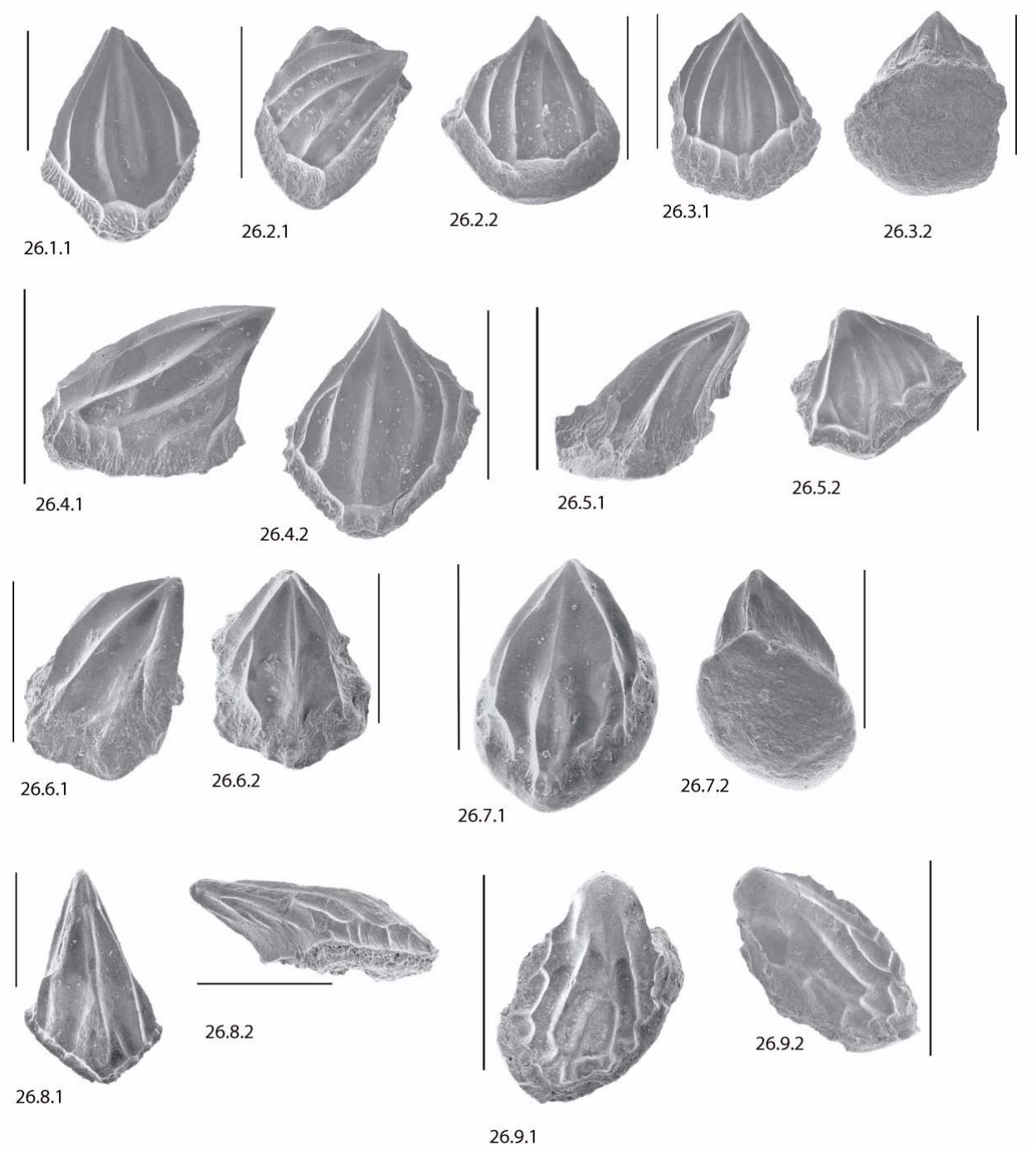

Figure 26. *pointed and skirted* Doyle et al. 1978. **26.1.1.** Form A, crown view, GSC 124561, scale bar = 0.2 mm. **26.2.1** and **26.2.2.** Form B, profile and crown views, GSC 124562, scale bar = 0.5 mm. **26.3.1** and **26.3.2.** Form B, crown and subcrown/subpedicle views; GSC 124563, scale bar = 0.5 mm. **26.4.1** and **26.4.2.** Form C, profile and crown views, GSC 124564, scale bar = 0.5 mm. **26.5.1** and **26.5.2.** Form C (slightly more erect), profile and crown views, GSC 124565, scale bar = 0.4 mm. **26.6.1** and **26.6.2.** Form D, profile and crown views, GSC 124566, scale bar = 0.5 mm. **26.7.1** and **26.7.2.** Form D, crown and subcrown/subpedicle views, GSC 124567, scale bar = 0.5 mm. **26.8.1** and **26.8.2.** Form D, crown and profile views showing greater development of the posterior apex, GSC 124568, scale bar = 0.5 mm. **26.9.1** and **26.9.2.** Form E, crown and profile views, GSC 124569, scale bar = 1.0 mm.

Table 5. Characteristics of pointed and skirted Forms A, B, C, D, and E.

Characteristic	Form A	Form B	Form C	Form D	Form E
pedicle margin	slightly scalloped	slightly scalloped to undulating	scalloped with small nodes	smooth to undulating	smooth to undulating
pedicle base	convex	convex with anterior bulge	convex with anterior bulge	convex with anterior bulge	convex with anterior bulge
crown inclination (anterior to posterior)	approx. flat	<20º	>30º < 80º	>30º < 80º	>30º < 80º
crown curvature (anterior to posterior)	none	none to slightly convex	slightly convex	none to slightly convex	anterior convex
crown curvature (side to side)	slightly convex	slightly convex	convex	convex	convex
crown anterior longitudinal line/ridge	present	weakly to moderately scalloped	prominently scalloped	thin or absent	scalloped
crown anterior overhang	some	some	some to slight	none or slight	slight
mesial platform ridges	converge posteriorly	converge posteriorly	converge posteriorly, may fork anteriorly	converge posteriorly, may fork anteriorly	converge posteriorly, fork anteriorly
subcrown mesial ridge	short	present	may be present	present	present
stratigraphic interval	upper Eocene	upper Eocene and Oligocene	Oligocene	upper Eocene and Oligocene	lower Oligocene
no. specimens	1	22 + 3?	5	10 + 1?	1

amount of subapical region exposed. Pedicle similar to *pointed and skirted*; at anterior is wider than crown and short truncate, crown looks skirted or fringed; vascularisation anaulacorhize or indeterminate; subsurface convex; anterior crown/pedicle junction located at anterior crown edge and posterior junction at posterior of centre.

Remarks: These specimens differ from *pointed and skirted* Doyle et al. 1978 by having a low inclined to almost horizontal crown that has a lanceolate to rectangular/pentagonal shape, the ridges/lines are less developed and commonly shorter, and the mesial platform is broader.

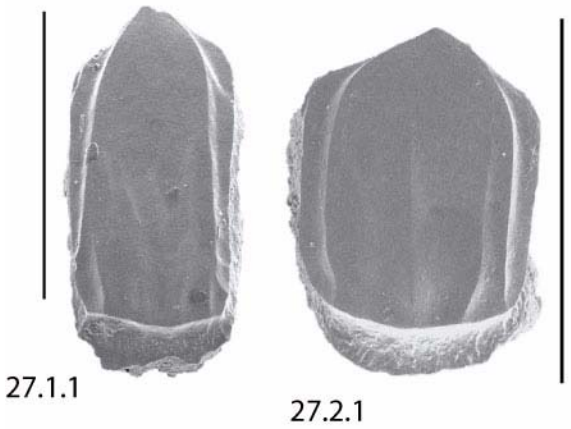

Figure 27. cf. *pointed and skirted* Doyle et al. 1978 **27.1.1.** Crown view showing an elongated lanceolate-pentagonal shape, GSC 124570, scale bar = 0.5 mm. **27.2.1.** Crown view of a less elongated specimen, GSC 124571, scale bar = 0.5 mm.

Occurrence: 2 specimens Hesquiat Peninsula, and offshore well Shell-Anglo Prometheus H-68; Pointed and Skirted ichthyolith interval, Upper Cretaceous to lower Eocene, reworked and deposited into Oligocene and lower Miocene strata.

cf. *ogee lanceolate* Tway et al. 1985, p. 302
Figure 28

a4,6/b1/c2/d1/e0/f3,4/g3/h1/i1/j1/k1/l3/m0,1/n0,1

Appendix 1.4.1

Characters: Crown outline lanceolate-shaped; longer than wide (height/width >1 and <3); with no surface ornament (smooth); upper surface flat; all margins rounded, convex, and continuous; subcrown unornamented. Within crown branching dendritic lines radiate from crown/pedicle junction. Pedicle short and significantly smaller than crown; positioned under crown anteriorly but not at anterior margin; possibly tetrahedroid; outline circular to rhombic; subsurface flat.

Remarks: The Tofino Basin specimens are similar to *ogee lanceolate* Tway et al. 1985 by having dendritic lines and differ by not having concave posterior margins and an acute posterior prominence. *Ogee lanceolate* is known to range in the lower Eocene to the middle Miocene.

Occurrence: 1 specimen, 2 fragments; offshore well Shell-Anglo Pluto I-87; Short Side Peaks Differentiated Margin ichthyolith Zone; Oligocene.

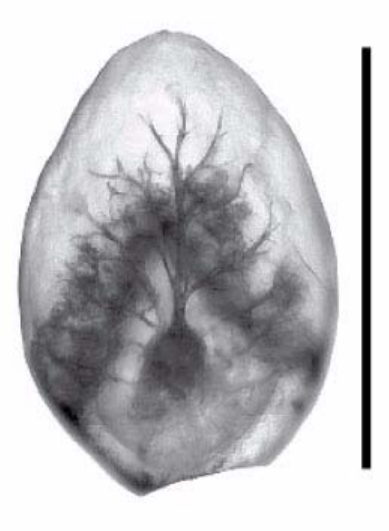

Figure 28. cf. *ogee lanceolate* Tway et al. 1985. **28.1.1.** Transmitted light view of crown; GSC 124572; scale bar = 0.3 mm.

Undescribed elasmobranch dermal denticles Forms A, B, C, D, E, F, G, H, I, J, and K

Some elasmobranch dermal denticles were rare but distinctive. Preliminary identifications of 11 elasmobranch dermal denticles (Forms A to K) include the CUIIS code, a brief description in the "remarks" section, and illustration(s). Future studies hopefully will result in the location of additional specimens so that comparative identifications can be made.

Undescribed elasmobranch dermal denticle, Form A
Figure 29

a2/b±2+10/c>2/d1.0-1.5/e1/f1-3/g1/h1/i2+15/j0-3/k0/l0,3/m0,4/n1/p3

Appendix 1.3.1

Remarks: Form A is lanceolate-shaped and approximately horizontal (low inclined), with a central circular depression, a convex-rounded anterior margin, and a dentate posterior margin with > 2 cusps.

Occurrence: 4 specimens; Hesquiat Peninsula and offshore wells Shell-Anglo Prometheus H-68 and Pluto I-87; Oligocene and lower Miocene.

Undescribed elasmobranch dermal denticle or tooth, Form B
Figure 30

a3,4/b2/c2/d4+10/e2,3/f0/g0/h2/i1/j2+11/k3/l0/m0/n0

Appendix 1.4.1

or

a11/b2/c2/d0/e1/f3/g1/h2/i4+8/j4

Appendix 1.7.1

Remarks: Form B is approximately lanceolate-shaped with a single mesial ridge that is highest at anterior margin and a V-shaped mesial protrusion at anterior margin. One lateral ridge is located on each side of a mesial ridge. Crown with one posterior apex or cusp and poor development of low and abraded lateral cusps. Subcrown with two

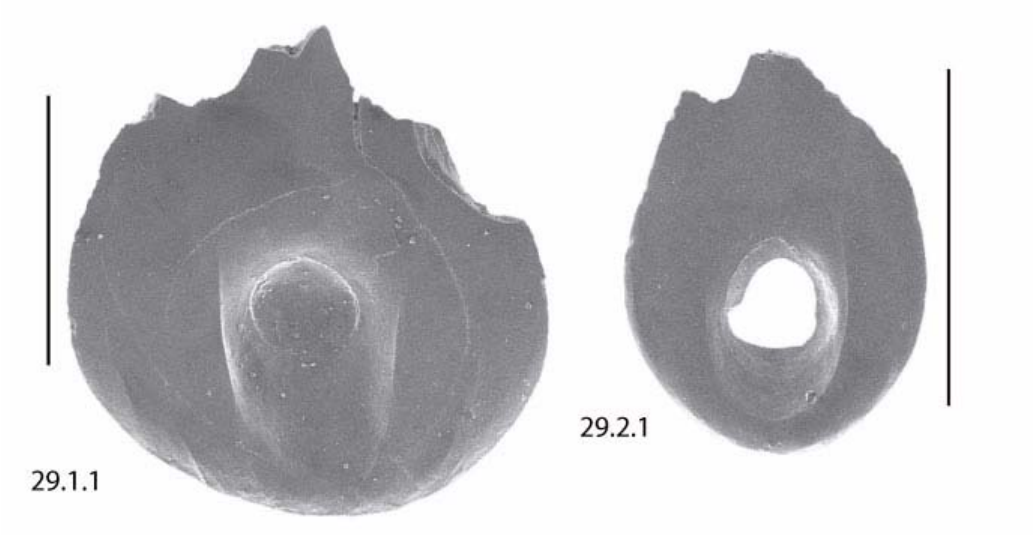

Figure 29. Undescribed elasmobranch dermal denticle, Form A. **29.1.1** and **29.2.1.** Crown views, GSC 124573 and 124574, scale bar = 0.5 mm.

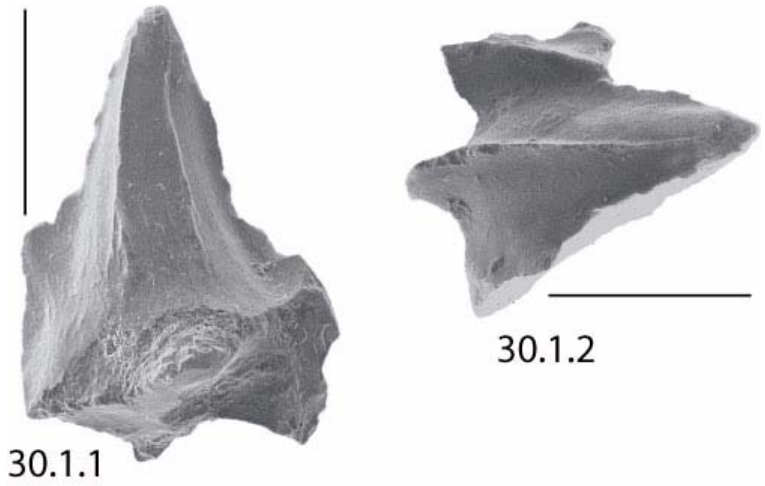

Figure 30. Undescribed elasmobranch dermal denticle or tooth, Form B. **30.1.1** and **30.1.2.** Subcrown and crown views, GSC 124575, scale bar = 0.2 mm.

long ridges/lines on a moderately broadly inflated central region. Base or pedicle is missing.

This specimen differs from *kite-shaped longitudinal line* Doyle et al. 1974 by having lateral cusps with some development and two ridges/lines on the inflated mesial region of the subcrown surface.

Occurrence: 1 specimen; offshore well Shell-Anglo Cygnet J-100; Bulbous Base ichthyolith Zone, lower Pliocene.

Undescribed elasmobranch dermal denticle, Form C
Figure 31

a4/b1,2/c2/d1,4/e1,3/f0/g0/h0,1/i1/j6+12+13/k1/l2/m0/n0

Appendix 1.4.1

Remarks: Form C is asymmetric lanceolate-shaped with rounded and convex margins, a shallow rounded anterior protrusion, and 1 to 3 very short approximately parallel lines on the anterior margin. Much of the upper crown is unornamented and the subcrown has one mesial ridge. Pedicle damaged.

Occurrence: 1 specimen; offshore well Shell-Anglo Prometheus H-68; Oligocene.

Undescribed elasmobranch dermal denticle, Form D
Figure 32

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j(1,2)+11/k1/l2/m0/n0

Appendix 1.4.1

Remarks: Form D is lanceolate-shaped with a single posterior apex and concave sides. Anterior margins are convex and undulating without an anterior longitudinal line/ridge. Crown has one long mesial ridge and one long lateral ridge on each side. Subcrown unornamented. Pedicle damaged.

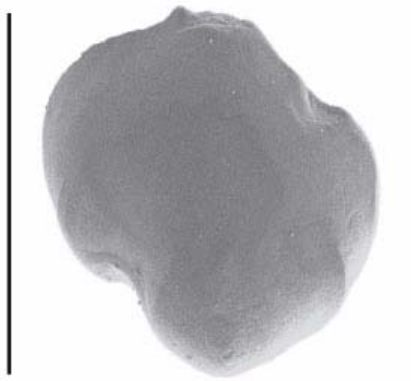

Figure 31. Undescribed elasmobranch dermal denticle, Form C. **31.1.1.** Crown view, GSC 124576, scale bar = 0.5 mm.

Form D differs from *plain and lined lanceolate* Doyle et al. 1978 by having an undulating anterior margin.

Occurrence: 2 specimens; Hesquiat Peninsula; Oligocene, possibly reworked from older strata.

Undescribed elasmobranch dermal denticle, Form E
Figure 33

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j1+12/k1/l2/m0/n0

Appendix 1.4.1

Remarks: Form E is lanceolate-shaped with a single convex-sided posterior apex. The anterior margins are convex and undulating without an anterior longitudinal line/ridge. The crown has four

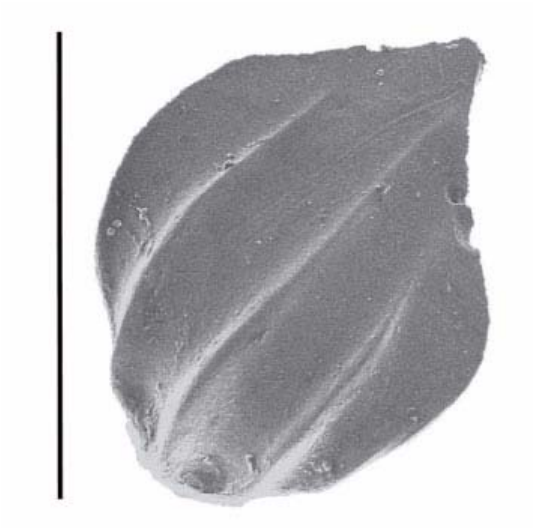

Figure 32. Undescribed elasmobranch dermal denticle, Form D. **32.1.1.** Crown view, GSC 124577, scale bar = 0.5 mm.

moderately short ridges (about one half length of crown) at anterior margin where the central two ridges form a short and not well-developed mesial platform. The subcrown is unornamented. The pedicle occupies much of the subcrown surface, is tetrahedroid, and the outline is rhomboid or tetrapetaloid.

Form E mainly differs from Form D by having four moderately short ridges (instead of 3 long) and convex posterior margins.

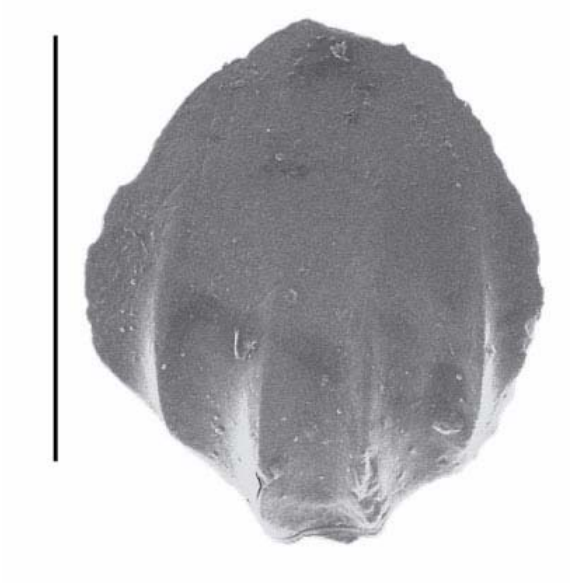

Figure 33. Undescribed elasmobranch dermal denticle, Form E. **33.1.1** Crown view, GSC 124578, scale bar = 0.5 mm.

Figure 34. Undescribed elasmobranch dermal denticle, Form F. **34.1.1.** Crown view, GSC 124579, scale bar = 0.5 mm.

Occurrence: 1 specimen; Hesquiat Peninsula; Oligocene, possibly reworked from Cretaceous to Eocene strata.

Undescribed elasmobranch dermal denticle, Form F
Figure 34

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j6+12+13/k2/l3/m0/n0

Appendix 1.4.1

Remarks: Form F is lanceolate-shaped with convex posterior margins and one apex. Anterior margins are undulating with short approximately parallel ridges/lines and a prominent anterior longitudinal ridge. The crown is convex both from anterior to posterior and from side-to-side (laterally). The central part of the crown is shiny and unornamented. The pedicle and subcrown are damaged.

Occurrence: 1 specimen; Hesquiat Peninsula; Oligocene, possibly reworked from Cretaceous to Eocene strata.

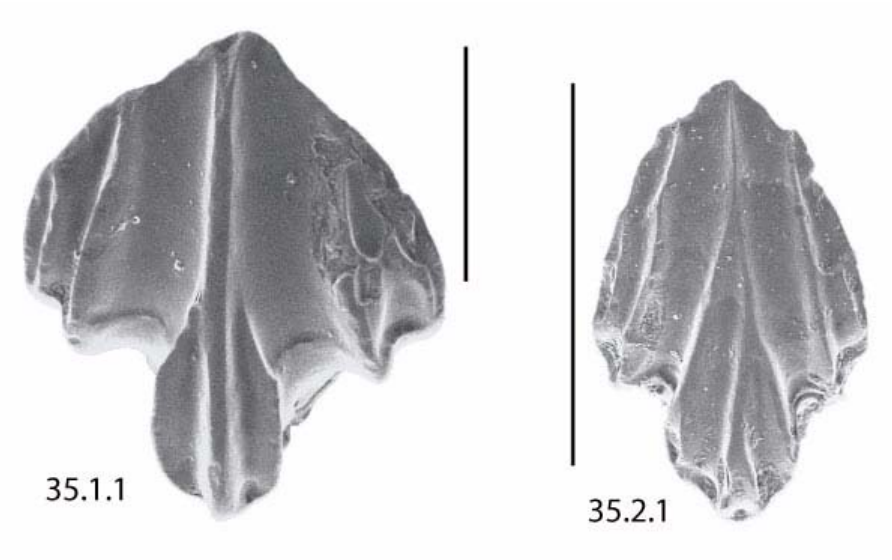

Figure 35. Undescribed elasmobranch dermal denticle, Form G. **35.1.1.** Crown view showing the mesial ridge with two ridge branches that form a prominent mesial protrusion, GSC 124580, scale bar = 0.2 mm. **35.2.1.** Crown view showing a mesial ridge with three ridge branches that form a prominent mesial protrusion, GSC 124581, scale bar = 0.5 mm.

Undescribed elasmobranch dermal denticle, Form G
Figure 35

a4/b2+6±12/c2/d4+8+10+13/e3/f8/g3/h1,2/i1/j5+11+15/k2/l3/m1/n1

Appendix 1.4.1

Remarks: Form G is lanceolate-shaped with a long and prominent mesial ridge with 2-3 anterior ridges that branch to form a prominent anterior platform and mesial protrusion. One deep furrow and two long lateral ridges are present on each side of the mesial ridge/platform. The posterior margin has a single apex with approximately convex sides. The anterior margin is undulating and has a prominent longitudinal ridge. The subcrown has a mesial line/ridge. The pedicle is tetrahedroid with a tetrapetaloid outline.

Occurrence: 2 specimens; offshore well Shell-Anglo Pluto I-87; upper Eocene to Oligocene; possibly reworked from older strata.

Figure 36. Undescribed elasmobranch dermal denticle, Form H. **36.1.1.** Crown view, GSC 124582, scale bar = 0.2 mm.

Undescribed elasmobranch dermal denticle, Form H
Figure 36

a4/b(2,7)+6/c2/d(2,4)+8+10/e0,2/f3,4/g2,3/h1/i1,4/j2+11/k2/l1/m9/n2

Appendix 1.4.1

Remarks: Form H is elongate-lanceolate shaped and inclined (about 45˚) with an irregularly undulating anterior margin, a single rounded posterior apex with concave to sigmoidal sides, and a single upper crown mesial ridge. The pedicle is short with a concave subsurface.

Occurrence: 1 specimen; offshore well Shell-Anglo Pluto I-87; upper Oligocene and lower Miocene; possibly reworked from older strata.

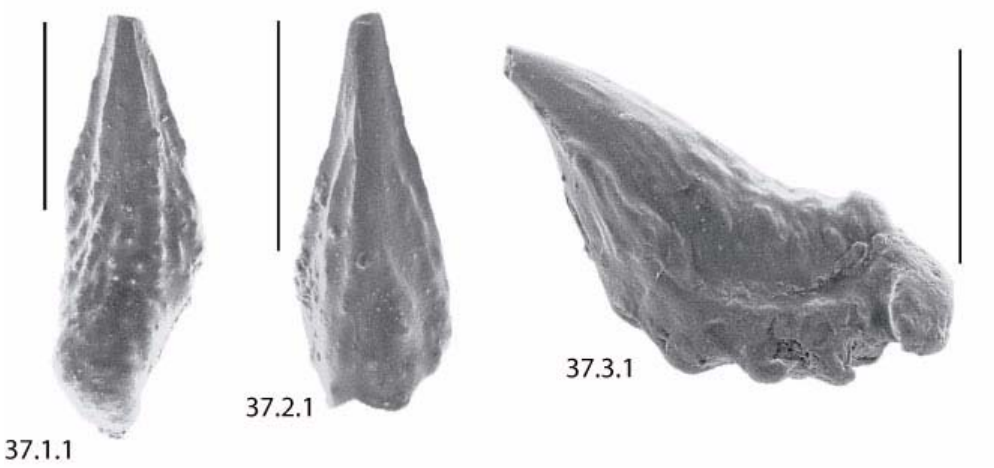

Figure 37. Undescribed elasmobranch dermal denticle or possible tooth, Form I**. 37.1.1** and **37.2.1.** Crown views, GSC 124583 and 124584. **37.3.1.** Profile view, GSC 124585, scale bar = 0.2 mm.

Undescribed elasmobranch dermal denticle or possible tooth, Form I
Figure 37

a4/b2+10/c2/d4+10+14/e3/f0/g2/h1/i1,4/j4+11+13/k4,5/l1,2/m0,2/n0

Appendix 1.4.1

Remarks: Form I is small (<0.5mm) and distinct elongate-lanceolate shaped with crown ridges, lines, and small rounded nodes. In profile view, the crown is sigmoidal, inclined at about 45˚, and has minor or no overhang of the base at the anterior margin. The base is irregular and occupies much of the subcrown surface.

Occurrence: 3 specimens; offshore well Shell-Anglo Zeus D-14; upper Oligocene or lower Miocene, possibly reworked from older strata.

Undescribed elasmobranch dermal denticle, Form J
Figure 38

a4/b2+13/c2/d4+12/e3,4/f0/g0/h1/i1/j0/k1/l1/m0/n0

Appendix 1.4.1

Remarks: Form J is approximately pentahedral-shaped and moderately erect (inclined at about 50-60˚). The crown posterior apex is rounded and blunt with concave sides, and the apical and posterior surfaces have a scalloped texture. The anterior crown has two parallel ridges that form a moderately broad mesial platform that extends about halfway up the crown. One to two other ridges are short. The anterior margin is truncated. The subcrown is concave and unornamented. The pedicle is missing.

Figure 38. Undescribed elasmobranch dermal denticle, Form J. **38.1.1.** Crown view, GSC 124709, scale bar = 0.5 mm.

Form J was the only Tofino Basin ichthyolith with a scalloped texture on the crown. This texture is common to Recent shark (elasmobranch) dermal denticles of the Order Carcharhiniformes and some of its families including Scyliorhinidae, Triakidae, Carcharhinidae, and Sphyrnidae. Dermal denticles of some of the species of these sharks are illustrated in Reif (1985) but the scalloped pattern does not match that seen in Form J.

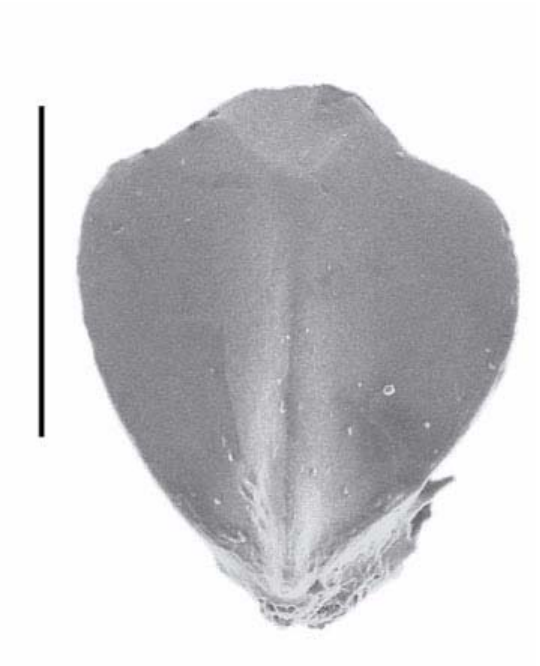

Figure 39. Undescribed elasmobranch dermal denticle, Form K. **39.1.1.** Crown view, GSC 124586, scale bar = 0.2 mm.

Occurrence: 1 specimen; offshore well Shell-Anglo Zeus D-14; upper Eocene/Oligocene or lower Miocene.

Undescribed elasmobranch dermal denticle, Form K
Figure 39

a4/b6+7/c2/d2+8/e1/f8/g3/h1/i1,2/j2+11/k1,2/l3/m1/n1

Appendix 1.4.1

Remarks: Form K is lanceolate to rhomboid-shaped, with a single mesial ridge that is highest at the anterior margin and a rounded to V-shaped anterior margin with convex sides. The primary posterior apex or cusp is damaged. Subsidiary cusps are possibly present with poor development on a rounded lateral margin. The subcrown is unornamented and concave. The pedicle is small and positioned at the anterior.

Form K differs from *kite-shaped longitudinal line* Doyle et al. 1974 by having convex instead of concave anterior margins and by not having a subcrown mesial ridge.

Occurrence: 2 specimens; offshore well Shell-Anglo Pluto I-87; upper Oligocene; possibly reworked from older strata.

Triangular Teeth with Canals

Tofino Basin teeth with inline canals are triangular-shaped and all but one subtype (*angled cone and basal canals* new subtype) have a flanged occlusal crest (Figure 40.1). The branching inline canals are distinctive for this group and are in the tooth base and crown (Figure 40).

List of identified triangular teeth with inline canals:

angled cone and basal canals new subtype

centrally inflated triangle with canals new subtype

triangle one canal above Doyle et al. 1974

cf. *triangle transverse line across* Doyle et al. 1974

triangle transverse line across Doyle et al. 1974

flanged triangle with canals new subtype

angled cone and basal canals new subtype
Figure 41

a9/b1,5/c11,12/d20/e1,2/f1±4a+b/g1/h0,4,5/i2,3,4,9/j2,6,7,9/k1/m0/n>1.5/p0,>1.5/q0,9,10/r0,1/s1,2/t2/z0,2/cc1/dd1/ee2/ff1/gg1,4/hh0,1-4/jj2,3/kk2,4/mm0,1-3/nn0,0.3-1.0

Appendix 1.6.1

Characters: Tooth triangular with no occlusal crest; apically inclined (angled in apical region with one concave and one convex margin); circular cross-section; may have thin transverse line separating cap and base; may be slightly stepped. Cap smooth; commonly with pointed apex and apical shadow; margins straight, or slightly concave, convex, or sigmoid; height to width ratio 1-2:1. Tooth base with prominent branching canals throughout and may extend into basal most region of cap; outline weakly stippled; height to width ratio 1-4:1; basally breaks irregularly.

Remarks: This subtype is distinct because it has branching canals, a circular cross-section, no flanged occlusal crest, and is apically curved (convex-concave).

Occurrence: 6 specimens, 7 tooth base fragments, 2 questionable tooth caps; Flores Island, Hesquiat Peninsula, and offshore wells Shell-Anglo Apollo J-14, Pluto I-87, Prometheus H-68, and Zeus D-14; Teeth with canals ichthyolith Zone; upper Eocene and Oligocene, reworked into lower and middle Miocene.

centrally inflated triangle with canals new subtype
Figure 42

a9/b5+8/c19±(11,12,13)/d19±(11,12,13)/e2/f4a+b/g7±8/h0,1,2,3,4,5/i2,3,4,5/j2,3,4,5/k8±(12,14)/m0.04-0.35/n≤2/p0/q0,3,4,5,9,10/r0,1/s1,3/t4/z10,11/cc5/dd5/ee2/ff0/gg6±8/hh0-1.3/jj2/kk2/mm0.44/nn0.3

Appendix 1.6.1

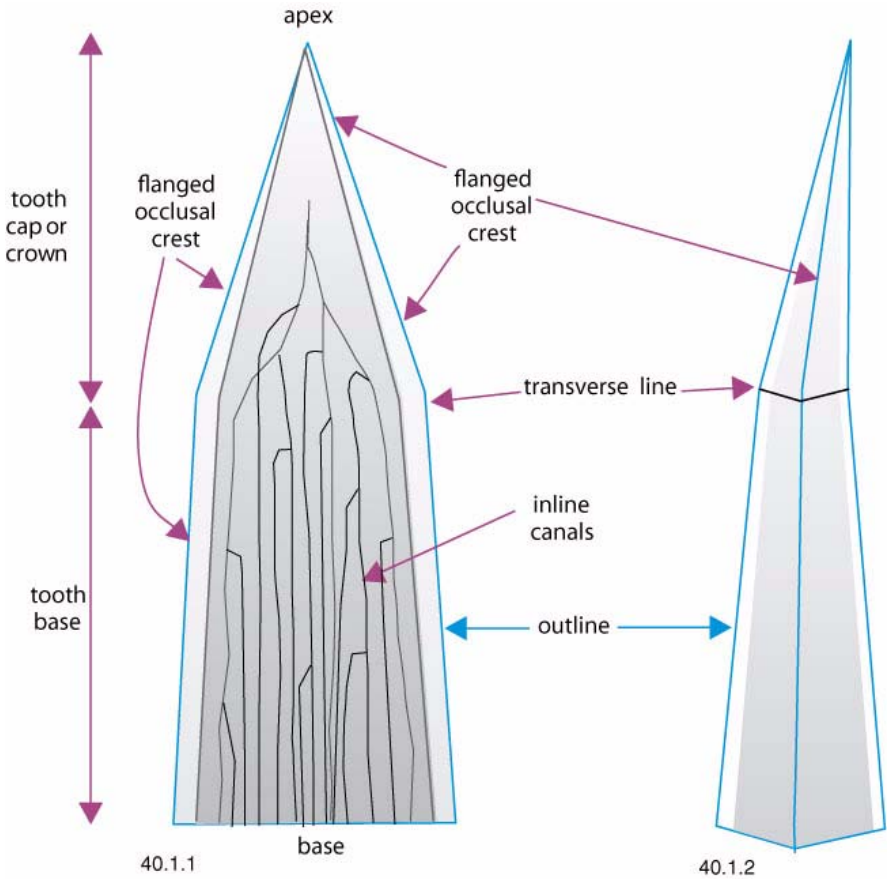

Figure 40. Schematic and terms of triangular teeth with canals. **40.1.1.** Inline branching canals are prominent in the tooth base and may extend into the tooth crown. **40.1.2.** Profile view.

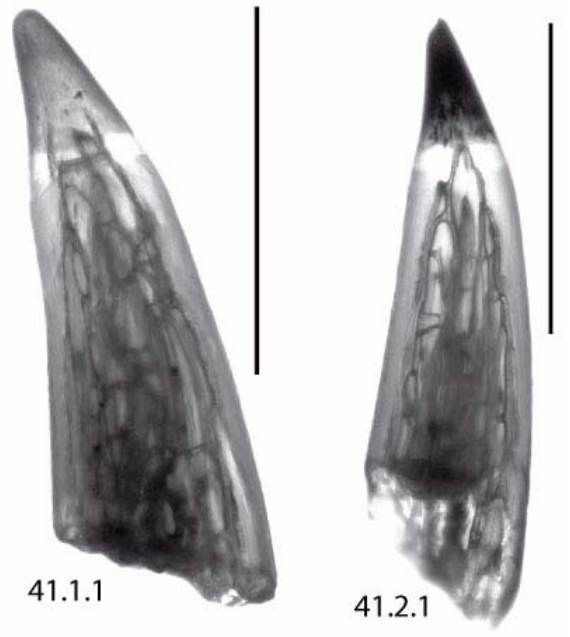

Figure 41. *angled cone and basal canals* new subtype. **41.1.1** and **41.2.1.** Showing apical shadow in the tooth cap and branching canals in the base, GSC 124587 and 124588, scale bar = 0.5 mm.

Characters: Tooth triangular and moderately robust; with a prominently flanged occlusal crest; symmetric-elliptical and acute laterally in cross-section; inflated basally and centrally; both margins approximately straight near apex, commonly with a simple shallow convex-outward flanged margin curvature at level of inline transverse line apex; and straight below this curvature. Inline translucent to almost opaque; contains branching canals above and below transverse line; similar shape to outline but does not approach outline basally; apex approximately three quarters tooth height but not to tooth outline apex, may terminate in a thread-canal or be acute to acuminate; base breaks irregularly. Transverse line flexed; centrally above base of flanged margins where it traverses approximately straight across; near flanged margins it commonly steeply drops basally and then cuts across each flanged margin. Tooth with lateral and apical shadows between apical inline and outline; apex blunt to rounded; basal flanged margins extend below transverse line apex and variable lengths. Tooth crown above transverse line commonly taller than wide (height to width ratio≤2:1).

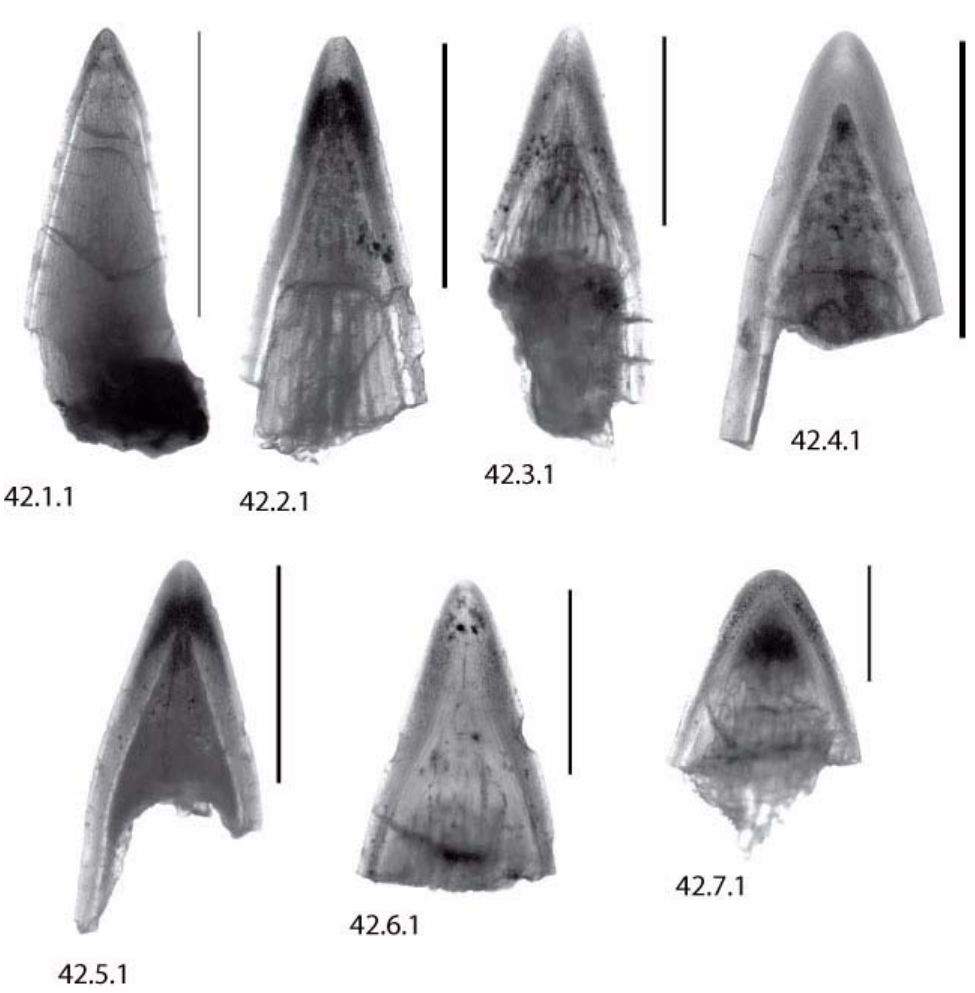

Figure 42. *centrally inflated triangle with canals* new subtype. **42.1.1.** Tooth crown with very long flanged occlusal crest margins that extend well below the apex of the transverse line, GSC 124589, scale bar = 2.0 mm. **42.2.1, 42.3.1,** and **42.4.1.** Show the inline canals and the slight convex-outward bulge of the flanged occlusal crest margin at the level of the transverse line, GSC 124590 to 124592; scale bar = 0.5 mm. **42.5.1.** An almost opaque inline has a similar shape to the outline and the tooth crown has apical and lateral shadow, GSC 124593, scale bar = 0.5 mm. **42.6.1.** Shows an apical thread canal, GSC 124594, scale bar = 0.5 mm. **42.7.1.** Shows a broad tooth crown (height approximately equals width) with canals, apical shadow, and a rounded/blunt apex, GSC 124595, scale bar = 0.5 mm.

Remarks: The Tofino Basin specimens differ from *triangle with canals* Doyle et al. 1974 by having: a flexed transverse line, convex outward curvature of the flanged margin near the apex of the transverse line in many specimens, an acute to thread-like inline apex in several specimens; and an inline base that is not greater than two times the width of the transverse line (inline base commonly narrower and less basally flaring than *triangle with canals*). *Triangle transverse line across* Doyle et al. 1974 has fewer inline canals, a greater tooth crown height to width ratio (above transverse line), and has a transparent inline region. The inline of *centrally inflated triangle with canals* is translucent to opaque and is a similar shape to the outline.

The Tofino Basin specimens have similar margins to *narrow triangle straight inbase* and *wide triangle straight inbase* both Doyle et al. 1974 but these forms do not have inline canals (see emend. Doyle and Riedel 1979a, p. 87 and 91). *Centrally inflated triangle with canals* differs from *flanged triangle with canals* new subtype by having 1) an inline that is a similar shape to the outline and not transparent, 2) a greater number of canals that are denser, 3) a greater inflated tooth central and basal region, and 4) a transverse line.

Occurrence: 38 specimens, 1 fragment, and 11+ base fragments; Hesquiat Peninsula and offshore well Shell-Anglo Pluto I-87; Centrally Inflated Triangle With Canals ichthyolith interval; upper Eocene and Oligocene, ?middle to ?lower Eocene.

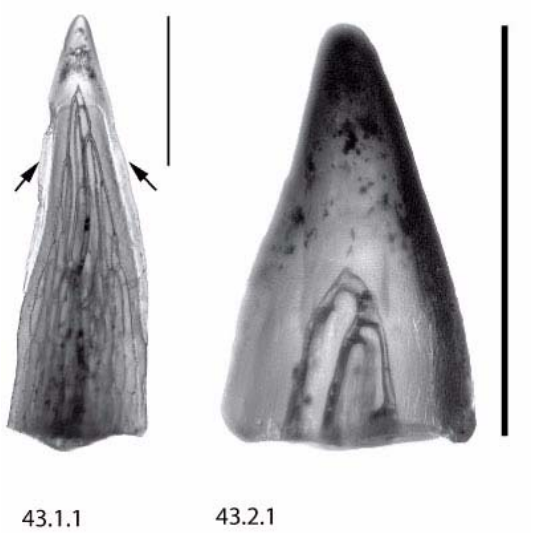

Figure 43. *triangle one canal above* Doyle et al. 1974 and Doyle and Riedel 1979. **43.1.1.** Tooth crown and base showing branching canals and long flanged occlusal crest margins that extend well below the apex of the transverse line; GSC 124596. **43.2.1.** Tooth crown showing two canal branches and apical and lateral shadow, GSC 124597. Scale bar = 0.4 mm.

triangle one canal above Doyle et al. 1974, p. 848; and Doyle and Riedel 1979a p. 193
Figure 43

a9/b5+8/c13+19/d13+19/e2/f4a±b/g7/h0/i2,4/j2,4/k1/m0/n>1<2/p0/q0/r0/s1/t4/z7,11,12/cc5/dd5/ee2/ff1/gg4+6/hh2.0-2.5/jj3,6/kk5,6/mm2.0-2.5/nn<0.3

Appendix 1.6.1

Remarks: Tofino Basin teeth are triangular and slightly curved (convex/concave) with a complex-curved to flexed-curved transverse line and multiple branching canals that are prominent in the tooth base and one or two above the transverse line. The inline is transparent between canals. The tooth is elliptical and acute laterally in cross-section with a more prominently flanged crest on the tooth base than cap (above transverse line). The tooth cap has apical and may have lateral shadow, and the apex is rounded and neither blunt or sharp. Tooth margins are straight or basally convex. The tooth height to width ratio above the transverse line is >1<2:1. The tooth base is tall (height to width ratio 2-3:1), slightly widens basally with an irregular break, and one margin is convex or reverse sigmoid.

The Tofino Basin specimens may have one or two canals above the transverse line and have a distinctive transparent inline between the prominent branching canals. *Triangle one canal above* is known to range from the lower Eocene through the middle Miocene (Doyle and Riedel 1979a, p. 192).

Occurrence: 5 specimens; Flores Island and offshore well Shell-Anglo Pluto I-78; Teeth with canals ichthyolith Zone; upper Eocene and Oligocene, reworked into the lower to middle Miocene.

cf. *triangle transverse line across* Doyle et al. 1974, p. 848; emend. Doyle and Riedel 1979a, p. 109
Figure 44

a9/b5+8/c13+19/d13+19/e2/f(4a+b)±(8,22)/g7/h0,1,5/i2,4/j2,4/k1,12/m0,0.02-0.4/n1.9-2.5/p0/q0,6,7/r0,3,4/s1,3/t4/z4,7

Appendix 1.6.1

Remarks: These specimens differ from *triangle transverse line across* Doyle et al. 1974 by having a curved transverse line and flanged margins that are basally convex and curve inwards at the same level to a point. Also, 3 specimens (e.g., Figures 44.2.1, 44.3.1) have inline striations that radiate from the canal region.

The curved and flexed transverse line has been previously described and illustrated in *triangle transverse line across* but both these transverse lines are distinctive in the Tofino Basin specimens and therefore have been separated.

Occurrence: 4 specimens; offshore wells Shell-Anglo Pluto I-87 and Prometheus H-68; Teeth with canals ichthyolith Zone; Oligocene, reworked into the lower Miocene.

triangle transverse line across Doyle et al. 1974, p. 848; emend. Doyle and Riedel 1979a, p. 109
Figure 45

a9/b5+8/c19/d19/e2/f4a+b/g7/h0,1,4,5/i2/j2/k1,12/m0,0.02-0.4/n1.9-2.5/p0/q0,3,6/r0,1,3,4/s1,3/t4/z4,10,11

Appendix 1.6.1

Remarks: Tofino Basin teeth are triangular, taller than wide (height to width ratio 1.9-2.5:1), widen basally, and elliptical and acute laterally in cross-section. The apex is rounded (not acute or blunt), and lateral shadow may be present. The inline contains branching canals that form a single thread apical canal that commonly extends into the upper two-thirds to three-quarters of the tooth crown. The region between branching canals is transparent. The transverse line is flexed and terminates about equally at both tooth margins. Crown margins are straight, both with flanged occlusal crest and may be pointed basally or break straight across.

The Shell-Anglo specimens are noted for the high (in upper crown two-thirds to three-quarters) apical

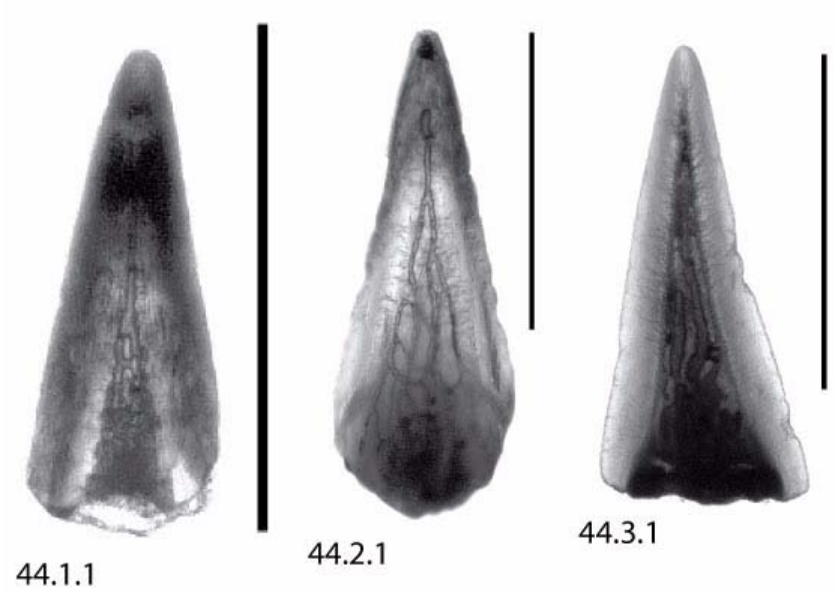

Figure 44. cf. *triangle transverse line across* Doyle et al. 1974 emend. Doyle and Riedel 1979. Showing variations of the inline canals and the transverse line. **44.1.1** Scale bar = 0.4 mm, GSC 124598. **44.2.1** and **44.3.1**. Crown with inline striations radiating from the canal region, GSC 124599 and 124600, scale bar = 0.5 mm.

thread canal and the presence of other basally branching canals. A similar subtype, *triangle curved base* Doyle et al. 1978 was not chosen because the branching canals do not extend beyond one half the tooth height. *Triangle transverse line across* occurs in the upper Paleocene through lower Miocene (Doyle and Riedel 1979a, p. 108).

Occurrence: 7 specimens; Hesquiat Peninsula and offshore wells Shell-Anglo Pluto I-87 and Zeus D-14; Teeth with canals ichthyolith Zone; Oligocene, reworked into the lower Miocene.

flanged triangle with canals new subtype
Figure 46

a9/b8/c19/d19/e2/f1,(4a±b)/g7/h0,1,4,5/i2,3,5/
j2,3,5,6/k1,8/m0.1-0.5/n>1.5/p0/q9,10/r1/s1,3/t4/z0

Appendix 1.6.1

Characters: Tooth triangular; taller than wide (height to width ratio >1.5:1); inline consists of prominent branching canals that form a single canal apically but do not extend to outline apex; inline transparent between canals; transverse line absent; base breaks irregularly; apex neither blunt or sharp; apical and lateral shadow may be present. Tooth widens basally; flattened apically and slightly more inflated basally and centrally; elliptical and acute laterally in cross- section; margins straight or slightly curved (convex/ concave) and with prominent (non-crenulated) occlusal crest lateral flanges. In profile view, tooth thin and shows convex/concave curvature.

Remarks: *Flanged triangle with canals* differs from *triangle one canal above* Doyle et al. 1974 (p. 848) by not having a transverse line and the tooth widens basally not forming a shaft-like base. *Flanged triangle with canals* differs from *triangle with canals* Doyle et al. 1974 (p. 848) by not having a transverse line within the outline, by having a transparent inline between the canals where the canals appear to float within the tooth, and the teeth generally have a greater height to width ratio.

Sixteen base fragments of either *flanged triangle with canals* or *triangle one canal above* were found in samples from the Pluto I-87 well and near the base of the Zeus D-14 Shell-Anglo well.

Occurrence: 11 specimens; Flores Island, offshore wells Shell-Anglo Pluto I-87 and Prometheus H-68, and offshore core END-76B-5; Teeth with canals ichthyolith Zone; upper Eocene and Oligocene, reworked into the lower Miocene.

Triangular Flanged Teeth

Tofino Basin flanged teeth are triangular-shaped and have a cutting edge (occlusal crest) that traverses the apex and tooth crown margins and may traverse the tooth base margins (Figure 47). At the tooth margins, the occlusal crest may be broad or flanged. Important characteristics of the occlusal crest or flange include thickness api-

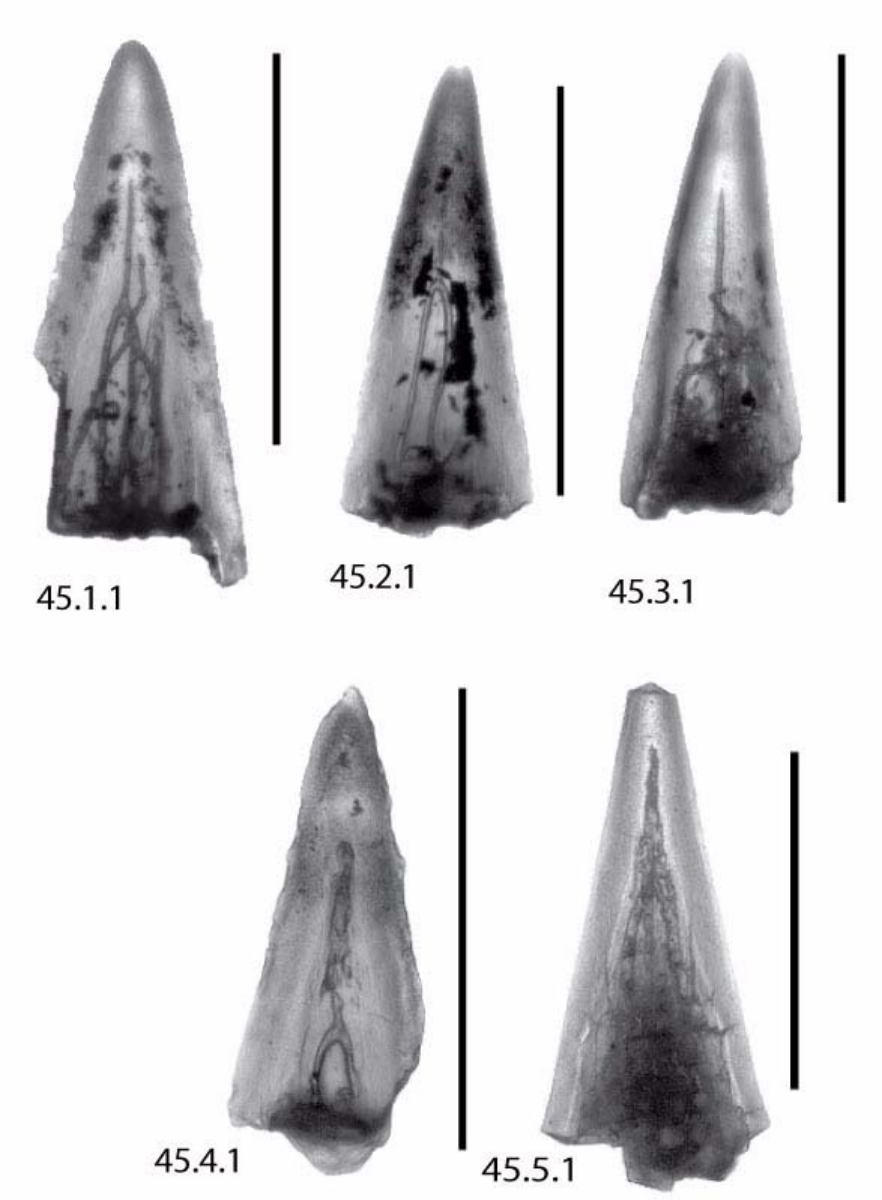

Figure 45. *triangle transverse line across* Doyle et al. 1974, emend. Doyle and Riedel 1979. Showing variations of the inline canals, GSC 124601 to 124605. **45.1.1** and **45.5.1**. Scale bar = 0.5 mm. **45.2.1** to **45.4.1.** Scale bar = 0.4 mm.

cally and basally, curvature, and termination at the transverse line or the base of the tooth.

Flanged teeth with canals are included in the triangular teeth with inline canals group.

Damaged flanged teeth (8 specimens) were mainly from the Pluto I-87 well and the base of the Zeus D-14 well (Oligocene or upper Eocene). They could be specimens of *triangle double flex*, *centrally inflated triangle with canals*, or *narrow triangle straight inbase*.

List of identified triangular flanged teeth:

triangle chisel-top new subtype
cf. *triangle notched corner* Doyle et al. 1974
beveled triangle high inline Doyle et al. 1978
cf. *triangle bowed inline* Ramsey et al. 1976 emend. Doyle and Riedel 1979a
triangle modified margin ends Doyle and Riedel 1985b
cf. *simple triangle* Winfrey et al. 1987
cf. *triangle curved margin ends* Doyle and Riedel 1985b
narrow triangle straight inbase Doyle et al. 1974
triangle sigmoid rough Ramsey et al. 1976
cf. *wide triangle* Dunsworth et al. 1975
cf. *straight triangle keeled edges* Ramsey et al. 1976
cf. *wide crescent* Doyle et al. 1978

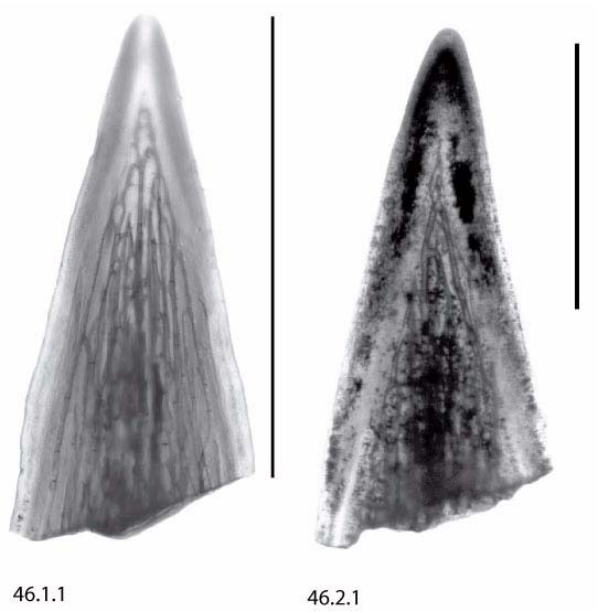

Figure 46. *flanged triangle with canals* new subtype. **46.1.1.** Showing canals, flanged occlusal crest margins, and a base that breaks irregularly, GSC 124606, scale bar = 2.0 mm. **46.2.1.** Showing canals and apical and lateral shadow, GSC 124607, scale bar = 0.5 mm.

Undescribed triangular flanged tooth:

undescribed triangular flanged tooth, Form A

***triangle chisel-top* new subtype**
Figure 48

a9/b1/c1/d1/e1/f4a±8/g1/h1,5/i5,9,10/j2,5,9,10/k1,8/m0.09-0.5/n≤2/p0/q2,9/r1/s4/t3/z0

Appendix 1.6.1

Characters: Tooth asymmetric and rounded, approximately triangular; with a chisel-top apex and an inflated wedge-shaped to irregular base; height/width ≤2. Margins variable; in one view: one margin apically convex and other margin approximately straight; in another view both margins convex to sigmoid. Inline narrow cone-shaped in one view, in other view funnel-shaped; shape generally similar to outline. Apical region shadowed and may have striations.

Remarks: This tooth is distinctive with its odd chisel-shaped apex, inflated wedge-shaped base, and prominent inline.

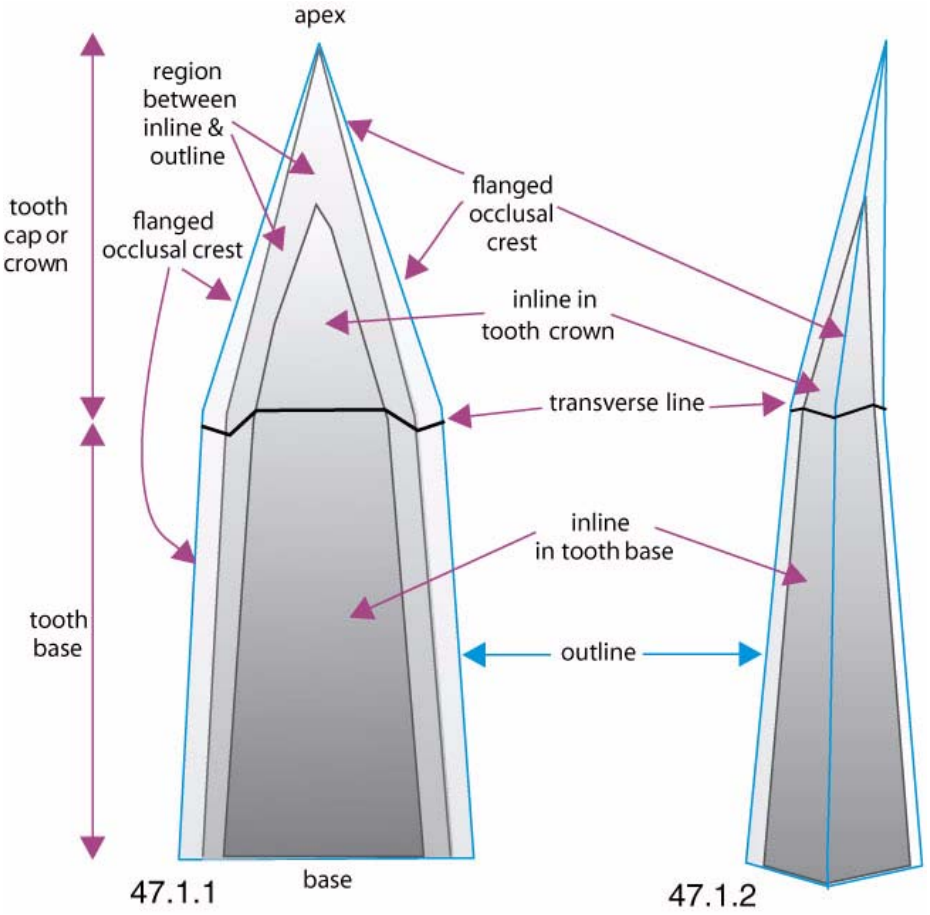

Figure 47. Schematic and terms of triangular shaped flanged teeth**. 47.1.1** Flanged margins form a tooth cutting edge, are prominent on the tooth crown, and may extend down the tooth base. **47.1.2.** Profile view.

Figure 48. *triangle chisel-top* new subtype. **48.1.1** and **48.2.1.** Crown apex and base, GSC 124608 and 124609. **48.2.2.** Profile view, GSC 124608. Scale bar = 0.2 mm.

Occurrence: 3 specimens, 1 fragment, 5 questionable specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Prometheus H-68, and Zeus D-14; Bulbous Base ichthyolith Zone; Miocene and lower Pliocene, possibly upper Oligocene.

cf. *triangle notched corner* Doyle et al. 1974, p. 847
Figure 49

a9/b5+8/c(9,13)+19/d(9,13)+19/e1/f(9,10)+12+(14,15)/g7/h1,5/i3,4/j6,10/k5,7/m0.85-0.9/n>2/p0/q0,2,6/r0,1,4/s1/t4/z0,7,11

Appendix 1.6.1

Characters: Tooth triangular with prominent flanged occlusal crest margins; both basal margins modified by shallow simple angle that curves inwards, otherwise one margin convex and other concave; inline low arc or narrow (not near outline); with long (greater than three-quarters tooth height) striations between inline and outline, some may radiate laterally; may have apical and lateral shadow; elliptical and acute laterally in cross-section; apex rounded (not sharp or blunt); height to width ratio >2:1. Tooth base slightly flared and in cross-section (including view of each simple angled margin) looks puckered-lip-like; transverse line curved over inline and complex at margins.

Remarks: The Shell-Anglo specimen mainly differs from *triangle notched corner* Doyle et al. 1974 by having one convex and one concave margin (instead of both straight). *Triangle notched corner* differs from *beveled triangle high inline*

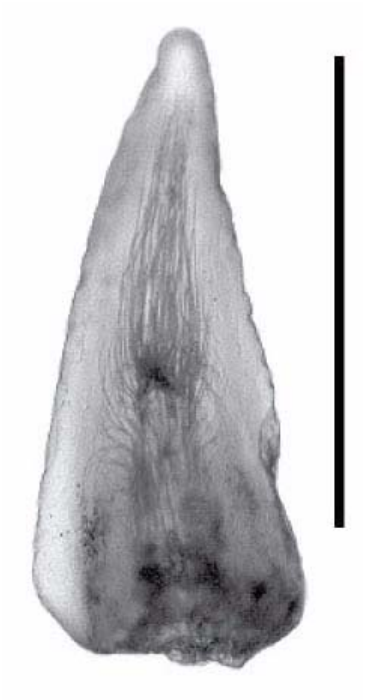

Figure 49. cf. *triangle notched corner* Doyle et al. 1974. **49.1.1.** Crown with long striations between the inline and outline, and flanged margins that curve inwards basally; GSC 124610; scale bar = 0.4 mm.

Doyle et al. 1978 by having striations between the inline and outline and by not having a high inline that has a similar shape to the outline. *Triangle notched corner* is known to range from the lower Eocene to approximately the Oligocene/Miocene boundary (Doyle and Riedel 1979a, p. 152).

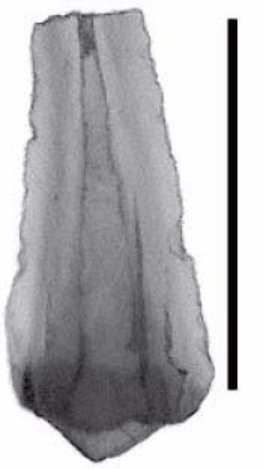

Figure 50. *beveled triangle high inline* Doyle et al. 1978. **50.1.1.** View of crown, modified basal margins, and narrow and tall inline; GSC 124611; scale bar = 0.5 mm.

Occurrence: 1 specimen; offshore well Shell-Anglo Apollo J-14; Bulbous Base ichthyolith Zone; middle to upper Miocene.

***beveled triangle high inline* Doyle et al. 1978, p. 749**
Figure 50

a9/b5+8/c13+19/d13+19/e1/f1,4a/g7/h1,5/i2/j2/k7,8±12/m0/n0,>2/p0,>2/q1,2/r1,4/s0/t4/z0

Appendix 1.6.1

Remarks: This Tofino Basin tooth is triangular with prominent flanged occlusal crest margins. Both basal margins are modified by a shallow simple angle (otherwise margins are approximately straight). The inline is narrow (not near the outline), a similar shape to the outline but attenuate apically and slightly widens basally with lateral shadow. The tooth is elliptical, acute laterally in cross-section, and has a height to width ratio >2:1. The apex is missing. The tooth base is slightly flared and in cross-section (including view of each simple angled margin) looks puckered-lip-like. The transverse line is complexly curved.

The Shell-Anglo specimen differs by potentially having a higher height to width ratio that is >2.1. *Beveled triangle high inline* is known to range from the Lower Paleocene through the lower Eocene and one specimen in the Campanian (Doyle and Riedel 1979a, p. 156).

Occurrence: 1 specimen; offshore well Shell-Anglo Pluto I-87; Oligocene.

cf. *triangle bowed inline* Ramsey et al. 1976, p. 130; emend. Doyle and Riedel 1979a, p. 115
Figure 51

a9/b5+8/c±13+19/d±13+19/e1/f4a+b/g7/h0,1,5/i1,4,5,10/j1,4,5,10/k3/m0.2-0.4/n1.4-2.0/ p0/q0,2/r0,1/s3/t4/z0,2

Appendix 1.6.1

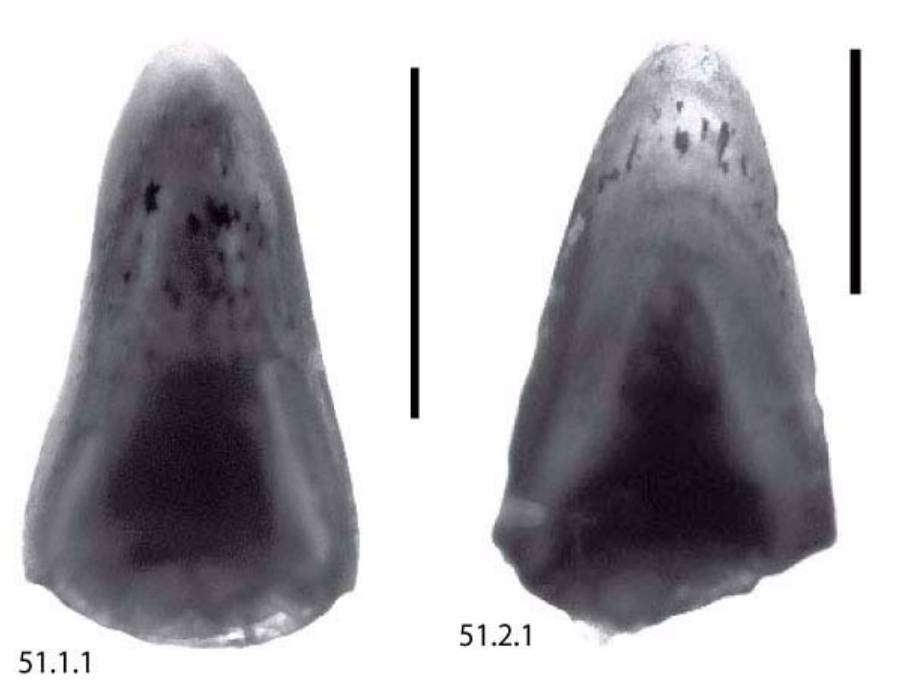

Figure 51. cf. *triangle bowed inline* Ramsey et al. 1976 emend. Doyle and Riedel 1979. **51.1.1** and **51.2.1.** Views of tooth crown, inline, and margins; GSC 124612 and 124613; scale bar = 0.5 mm.

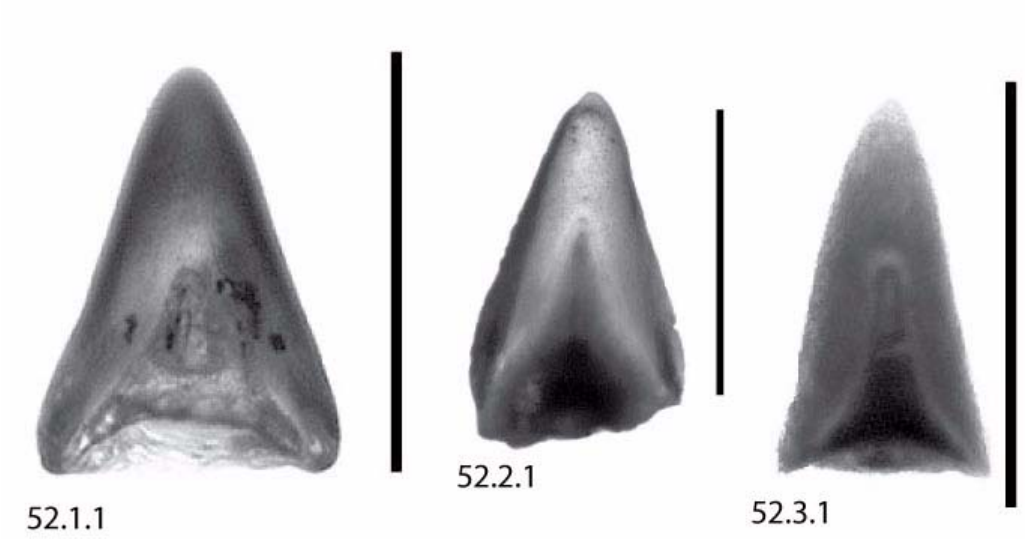

Figure 52. *triangle modified margin ends* Doyle and Riedel 1985. **52.1.1, 52.2.1,** and **52.3.1.** Showing the margin ends that terminate in a point and variations in the shape of the bowed-in inline; GSC 124614 to 124616; scale bar = 0.4 mm.

Characters: Tooth triangular and moderately robust; taller than wide (ratio: 1.4-2.0:1); inflated basally and centrally; inline similar to outline, moderately high, widens basally and apically, and centrally is bowed inwards; prominent apical and lateral shadow; margins sinuous and curve inwards apically and basally; asymmetric-elliptical and acute laterally in cross-section; occlusal crest flange moderately thin and basally and apically thins; apex broadly blunt; inline and tooth base break approximately straight across.

Remarks: The Hesquiat Peninsula specimens differ from *triangle bowed inline* by having an occlusal crest flange or ridge that slightly curves-in basally, and the teeth are asymmetric-elliptical and acute laterally in cross-section. Having a broadly blunt apex and being inflated centrally and basally makes these specimens distinctive and different from *triangle modified margin ends* Doyle and Riedel 1985b.

Occurrence: 2 specimens; Hesquiat Peninsula; upper Eocene.

triangle modified margin ends
Doyle and Riedel 1985b, p. 358
Figure 52

a9/b5+8/c13+19/d13+19/e1/f4a+b/g7/h0,1,5/i2,4/j2,4/k3/m0.4-0.7/n1.2-2.0/ p0/q0,6,7/r0,3/s1,3/t4/z4

Appendix 1.6.1

Remarks: Tofino Basin teeth are triangular, cone-like (inflated basally), and with one or both margins concave or straight and slightly basally convex. The crown margins have a flanged occlusal crest, which terminates equally at a point basally. The inline and transverse line are shallowly curved. The tooth is elliptical and acute laterally in cross-section with a height to width ratio 1.2-2.0:1. The apical region is shadowed and the apex rounded (not sharp or blunt). The inline is one-half to two-thirds the tooth height, bowed-in, and approximately a similar shape to the outline.

Triangle modified margin ends differs from *simple triangle* Winfrey et al. 1987 by having 1) a higher inline that is bowed-in and not arcuate; 2) slightly curved and pointed margins ends; and 3) a shallowly curved inline/transverse line. It mainly differs from *triangle curved margin ends* Doyle and Riedel 1985b by not having distinct curved margin ends and a lower inline. *Triangle modified margin ends* occurs in the lower Paleocene (Doyle and Riedel 1985b, p. 358).

Occurrence: 3 specimens; offshore wells Shell-Anglo Apollo J-14, Zeus D-14, and Zeus I-65; deposited in a turbidite, or near and unconformable surface in Miocene strata; probably reworked from older Cenozoic strata.

cf. *simple triangle* Winfrey et al. 1987, p. 459
Figure 53

a9/b5+8/c±13+19/d±13+19/e1/f4a+b/g7/h0,1,5/i2,4/j2,4/k5/m0.65-0.85/n<2/ p0/q0,2,6,7/r0,1/s1,3,4/t2,4/z2,4/cc1/dd1/ee1/ff0/gg4/hh1.0-1.5/jj2/kk2/mm1/nn1

Appendix 1.6.1

Characters: Tooth triangular to almost conical; inflated basally; with a thin flanged occlusal crest

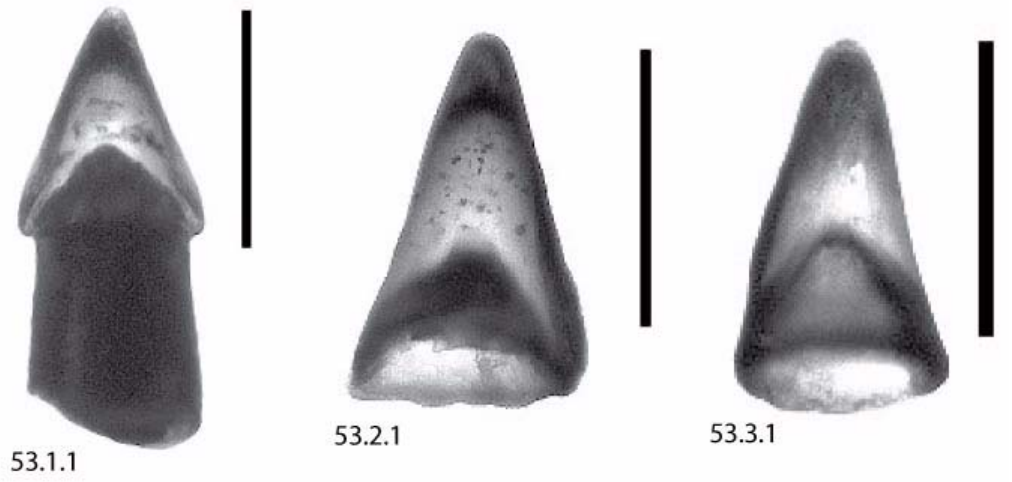

Figure 53. cf. *simple triangle* Winfrey, Doyle and Riedel 1987. **53.1.1.** Tooth crown and base, GSC 124617. **53.2.1** and **53.3.1.** Tooth crown showing arc-shaped inline, apical shadow, and a straight-across transverse line at the base of the crown, GSC 124618 and 124619. Scale bar = 0.2 mm.

and straight across transverse line; margins straight to slightly convex basally; inline arc-shaped and about one-third (or <one-half) tooth height; cross-section circular to slightly acute laterally; apex acute to rounded and with shadow; height to width ratio 1-2:1.

Remarks: The Shell-Anglo specimens differ from *simple triangle* by having a straight across transverse line in most specimens, an inflated cap base, and a greater height to width ratio in some specimens. *Simple triangle* mainly differs from *triangle curved margin ends* Doyle and Riedel 1985b by having a shorter inline that is arc-shaped and not having distinctly curved margin ends. The earliest occurrence of *simple triangle* is in Cretaceous or older strata (Winfrey et al. 1987).

Occurrence: 6 specimens; offshore wells Shell-Anglo Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D-14; long ranging, Oligocene to Pliocene.

cf. *triangle curved margin ends*
Doyle and Riedel 1985b, p. 359
Figure 54

a9/b5+8/c13+19/d13+19/e1/f4a+b/g7/h0,1,5/i4/j4/k0/m0/n1-1.5/p0/q0,7,8/r0,3,4/s1/t2,4/ z4,7,11/cc1/dd1/ee1/ff1/gg3+4/hh2-3/jj3/kk4/mm1.5-3.0/nn0.2-0.5

Appendix 1.6.1

Characters: Tooth triangular with flanged occlusal crest margins that basally curve to a point at about same level; and a curved, complexly curved, or flexed transverse line. Tooth cap shadowed; elliptical and acute laterally in cross-section; height to width ratio 1.0-1.5:1; apex rounded (not sharp or blunt); outline smooth; inline absent or not close to outline. Tooth base with parallel sided inline that terminates before transverse line; one margin concave, other margin convex; outline stippled, weakly striated and/or basally irregularly striated; without occlusal crest; circular in cross-section; widens basally.

Remarks: The Shell-Anglo well specimens differ from *triangle curved margin ends* Doyle and Riedel 1985b by not having an inline in the tooth cap and by having a distinctly curved tooth base with a parallel-sided inline or inline not close to the outline. *Triangle curved margin ends* occurs in the upper Paleocene through lower Eocene (Doyle and Riedel 1985b). A similar undescribed form found in the lower Eocene is illustrated in Plate 4, Figure 9 (Doyle et al. 1974). Other similar subtypes *triangle pointed end margins* Doyle et al. 1974 and *triangle transverse line across* Doyle et al. 1974 differ by having a tooth cap inline that extends into the upper tooth half. *Triangle curved margin ends* differs from *narrow curved triangle* Doyle et al. 1974 and *curved triangle parallel sided inline* new subtype and *curved triangle wide inline* new subtype by having a tooth cap flanged occlusal crest.

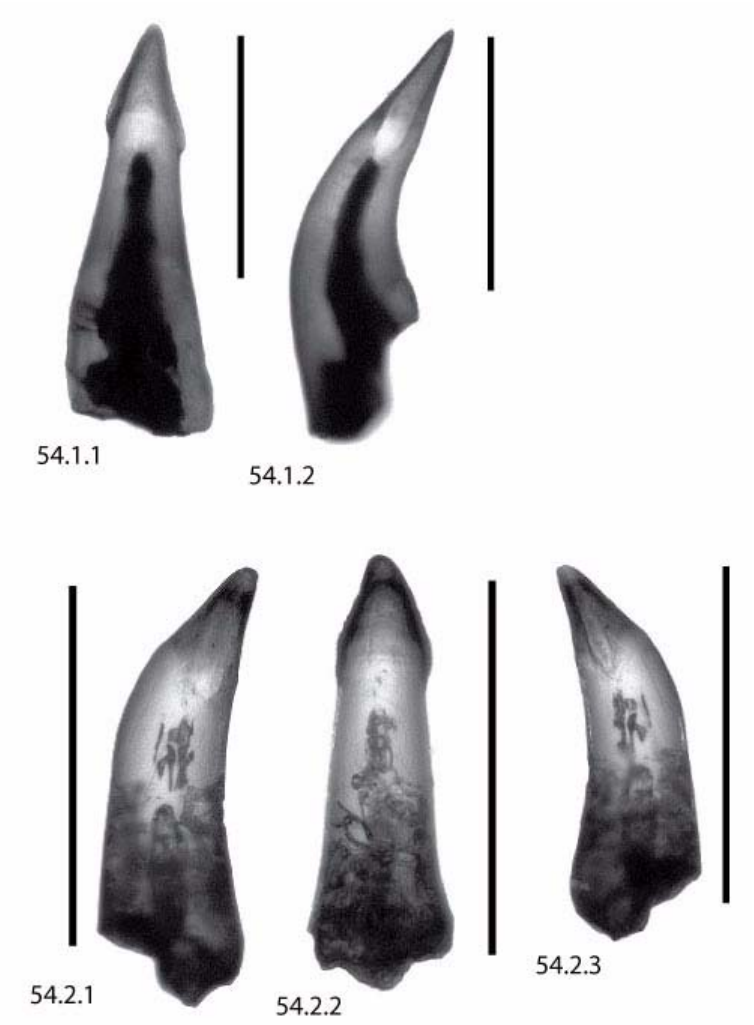

Figure 54. cf. *triangle curved margin ends* Doyle and Riedel 1985. **54.1.1** and **54.1.2.** Showing tooth crown with curved margin ends and a tooth base with an almost parallel inline or inline that is not close to the outline; GSC 124620. **54.2.1** to **54.2.3.** Showing a similar crown with curved margin ends and a tooth base with a parallel inline and various irregular inline structures; GSC 124621. Scale bar = 0.5 mm.

Occurrence: 5 specimens; offshore wells Shell-Anglo Apollo J-14, Pluto I-87 and Zeus D-14; cf. Triangle Curved Margin Ends interval; lower and middle Miocene, ?Eocene-?Paleocene.

narrow triangle straight inbase Doyle et al. 1974, p. 846; Doyle and Riedel 1979a, p. 87 Figure 55

a9/b5+8/c13+19/d19/e1/f4a+b/g7/h0,4/i4/j2,6/k8,14/m0.3-0.6/n>1.5/p0/q0,3,4/r0,1/s1/t4/z10,11

Appendix 1.6.1

Remarks: Tofino Basin teeth are triangular, taller than wide (height to width ratio >1.5), symmetric-elliptical and acute laterally in cross-section, and basally and centrally inflated. The transverse line is flexed (centrally straight across and above margin ends, flexed at margins). Margins have a flanged occlusal crest of variable lengths (not equal in length) that are slightly basally convex or straight. The inline is similar to the outline, without canals, and high up in the tooth but not to the outline apex. The inline apex may be acuminate. The inline slightly widens basally but is not close to the outline. The crown apex is rounded (neither sharp nor blunt) and may have apical and lateral shadow.

The Tofino Basin specimens differ slightly from *narrow triangle straight inbase* by having one margin with slight convex basal curvature. The flexed transverse line is illustrated but not described in Doyle et al. 1974. *Narrow triangle straight inbase* differs from *wide triangle straight inbase* Doyle et al. 1974 by having a height to width ratio (from outline apex to inline base highest

Figure 55. *narrow triangle straight inbase* Doyle, Kennedy, and Riedel1974. **55.1.1** and **55.2.1.** Showing a crown basal convex flanged margin that is longer than the other margin that is straight, GSC 124622 and 124623, scale bar = 0.3 mm.

level) > 1.5:1. *Narrow triangle straight inbase* mainly differs from *narrow triangle double flex* Gupta 1991 by not having equal length flexed margins that terminate slightly below the inline base. *Narrow triangle straight inbase* occurs in the late Paleocene through Quaternary (Doyle and Riedel 1979a, p. 86).

Occurrence: 3 specimens, 1 questionable specimen; Hesquiat Peninsula, Nootka Island, and offshore well Shell-Anglo Zeus D-14; upper Eocene to lower; reworked in lower to middle Miocene.

triangle sigmoid rough Ramsey et al. 1976, p. 132
Figure 56

a9/b±5+8/c19/d19/e1/f(4a+b)+9+12+14/g (4,6)+7/ h0/i9/j10/k7+8/m0/n>2/p0/q0,2,10/ r0,1/s1,2/t4/z2

Appendix 1.6.1

Remarks: These BC offshore teeth are triangular, sigmoidal, taller than wide (height to width ratio >2:1), and asymmetric and acute laterally in cross-section. The tooth base is slightly flared and basally inflated more on one side than the other. The tooth crown has a thin sigmoidal flanged occlusal crest, one margin sigmoid-shaped, other margin reverse sigmoid, a base with a straight across transverse line (or breaks irregularly), and shadow that darkens most of the tooth interior. The inline is narrow and parallel sided with common striations in the apical region, which do not extend to the outline apex. The tooth apex is approximately sharp to slightly rounded. The tooth outline has common vertical ridges or lines (some basally bifurcating) on the basal one-half of the labial face.

The Shell-Anglo specimens differ from *triangle sigmoid rough* by having outline basal vertical ridges/lines and possibly having a parallel-sided inline. *Triangle sigmoid rough* occurs in the Upper Jurassic through Eocene and is rare in the Oligocene (Doyle and Riedel 1979a, p. 142).

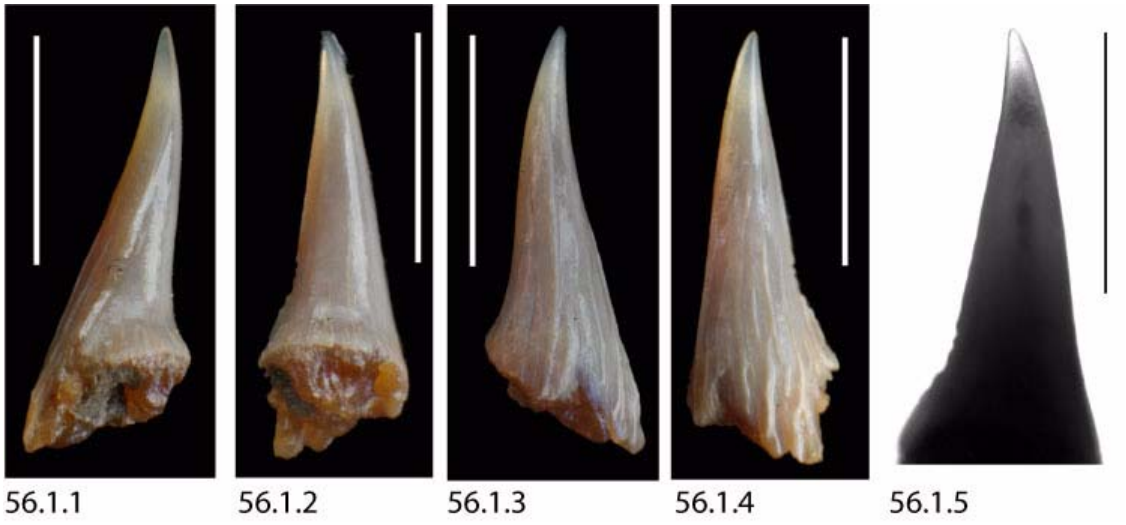

Figure 56. *triangle sigmoid rough* Ramsey et al. 1976. **56.1.1** to **56.1.4.** Profile/lingual, lingual, profile, and labial views showing tooth occlusal crest, sigmoidal curvature, and labial face ridges/lines. **56.1.5.** Showing a parallel-sided inline and apical striations (transmitted light image), scale bar = 2.0 mm. GSC 124624.

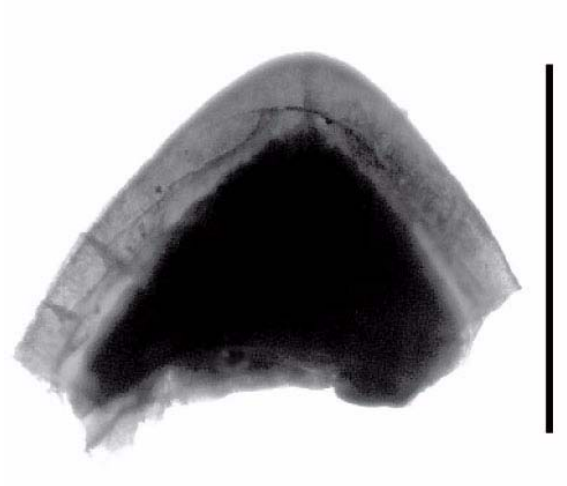

Figure 57. cf. *wide triangle* Dunsworth et al. 1975. **57.1.1.** Note the wide crown, rounded apex, and high inline; GSC 124625; scale bar = 0.5 mm.

Occurrence: 1 specimen, 1 questionable fragment; offshore wells Shell-Anglo Pluto I-87 and Murrelet K-15; Oligocene/upper Eocene.

cf. *wide triangle* Dunsworth et al. 1975, p. 857; Doyle and Riedel 1979a, p. 78-79
Figure 57

a9/b5+8±(10,12)/c19/d19/e1/f(4a±b)±8±22/ g3+7+8/h0,1,3,5/i3,4/j3,4/k5,8/m<0.3/n0.4-1.4/ p0/ q0,6,7/r0,1/s3/t4/z0,4,5,7,8,9,10,11

Appendix 1.6.1

Characters: Tooth triangular and almost opaque; about as tall as wide or slightly taller; with flanged occlusal crest; margins both evenly convex or basally convex and may terminate at different levels; inline base or transverse line an inverted U-shape (convex-up) and may be beveled; inline an arc or similar shape to outline, high in tooth; area between inline and outline very shadowed and may contain striations; apex rounded; elliptical and acute laterally in cross-section; outline pitted texture or with irregular short striations.

Remarks: The Tofino Basin specimens differ from *wide triangle* by having a textured outline and some specimens with a height to width ratio >1. *Wide triangle* ranges from the lower Eocene through lower Miocene with rare specimens in the Paleocene, upper Miocene, and Pliocene (Doyle and Riedel 1979a, p. 78).

Occurrence: 5 specimens; Hesquiat Peninsula, Nootka Island, and offshore wells Shell-Anglo Cygnet J-100 and Zeus D-14; long ranging, Oligocene through Pliocene.

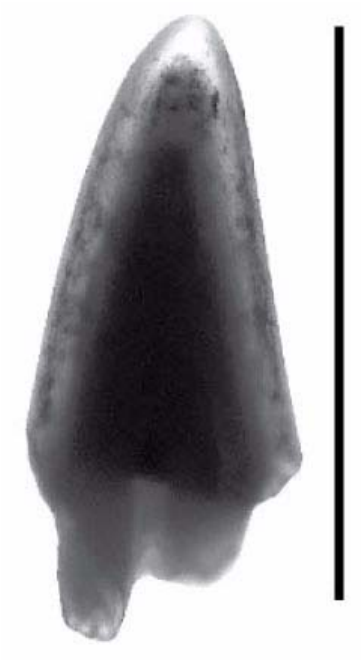

Figure 58. cf. *straight triangle keeled edges* Ramsey et al. 1976. **58.1.1.** Showing tooth crown, high inline with similar shape to outline, and irregular break of the crown base; GSC 124626; scale bar = 0.5 mm.

cf. *straight triangle keeled edges* Ramsey et al. 1976, p. 131
Figure 58

a9/b8/c13+19/d13+19/e1/f(4a+b)+8,(9+13+22)/g7/ h0/i3,4/j2/k8/m0.8/n>1.5/p0/q10/r1/s3/t4/z0

Appendix 1.6.1

Characters: Tooth triangular; with flanged occlusal crest; one margin convex; other margin approximately straight; apex blunt; base breaks irregularly; inline similar shape to outline; striations between inline and outline; height to width ratio >1.5:1; elliptical and acute laterally in cross-section.

Remarks: The Shell-Anglo specimens are almost opaque where inline, striations, and shadow darken the interior. This specimen differs from *straight triangle keeled edges* by having one convex margin and a height to width ratio greater than 1.5:1. *Straight triangle keeled edges* is known to occur from Upper Jurassic through Miocene (Doyle and Riedel 1979a, p. 118).

Occurrence: 2 specimens; offshore wells Shell-Anglo Cygnet J-100 and Zeus I-65; Oligocene and Pliocene.

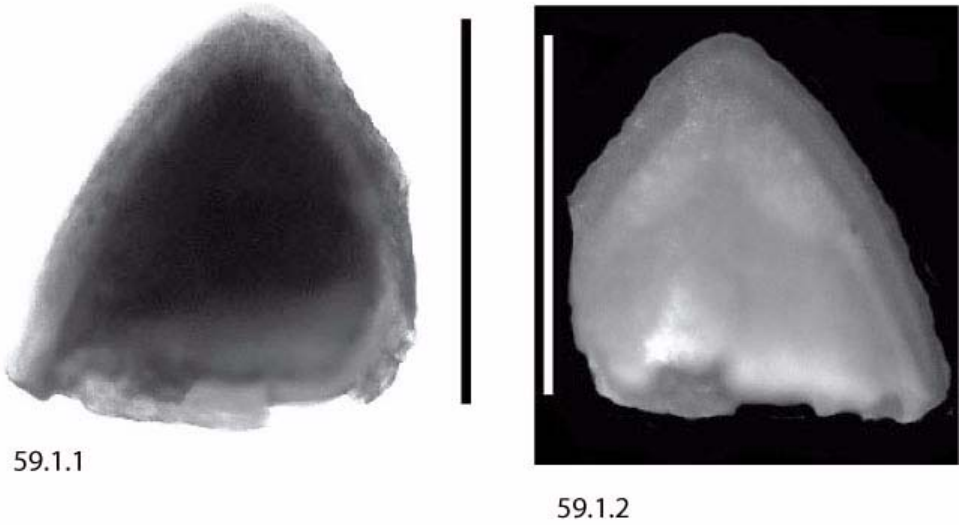

Figure 59. cf. *wide crescent* Doyle et al. 1978. **59.1.1** and **59.1.2.** Transmitted and reflected light views of the crown; GSC 124627; scale bar = 0.5 mm.

cf. *wide crescent* Doyle et al. 1978, p. 749
Figure 59

a9/b8±(10,12)/c19/d19/e1/f4a+b/g3+7/h3/i3,4/j2,3/k8/m0.15-0.25/n≤1/p0/q9/r1/s3/t4/z0

Appendix 1.6.1

Characters: Tooth triangular; short (width≥height); apex blunt or rounded; one margin convex or basally convex and other margin straight to slightly convex; inline similar to outline; possible second similar-shaped inline below primary inline; prominent lateral shadow thins basally on margin-one; with occlusal crest ridge; symmetric-elliptical and acute laterally in cross-section; basally inflated; basal inline breaks irregularly; outline surface weakly stippled or textured.

Remarks: The Hesquiat Peninsula specimen differs from *wide crescent* by not having basal margins at a similar level and by having a base that breaks irregularly. *Wide crescent* ranges from the Campanian to lower Paleocene with rare specimens in the lower and middle Eocene and upper Miocene (Doyle and Riedel 1979a, p. 140).

Occurrence: 1 specimen; Leclair Point, Hesquiat Peninsula; upper Eocene/lower Oligocene.

Undescribed triangular flanged tooth, Form A
Figure 60

a9/b7+8/c19/d19/e1/f0/g5+7/h1,5/i2/j2/k1/m0.33/n2.9/p0/q0,6,9/r0,1/s1/t4/z0,11

Appendix 1.6.1

Remarks: This tooth has flanged occlusal crest/margins, one mesial line/ridge about two-thirds the height of the tooth from the base, straight margins, and a height to width of approximately 3:1.

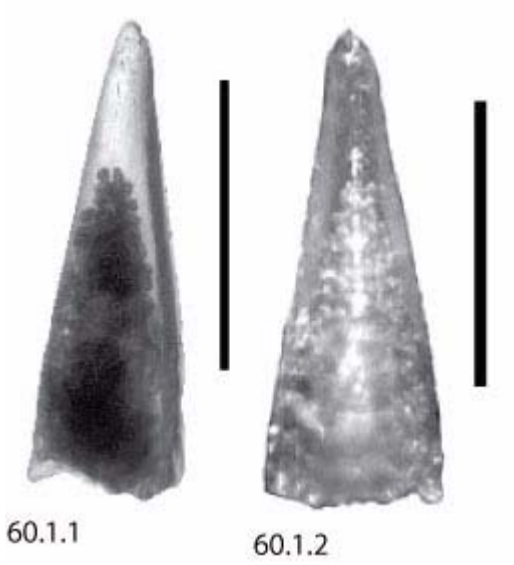

Figure 60. Undescribed triangular flanged tooth, Form A. **60.1.1** and **60.1.2.** Transmitted light images showing tooth margins and mesial line/ridge (highlighted in white); GSC 124628; scale bar = 0.2 mm.

Occurrence: 1 specimen; offshore well Shell-Anglo Pluto I-87; Oligocene.

Triangular Flexed Teeth

Triangular flexed and flanged teeth have a prominent angular flexure of one or both margins (Figure 61). The width of the flexure is at least 0.2 the length of the maximum tooth width. Like Tofino Basin triangular flanged teeth, triangular flexed teeth have a cutting edge (occlusal crest) that

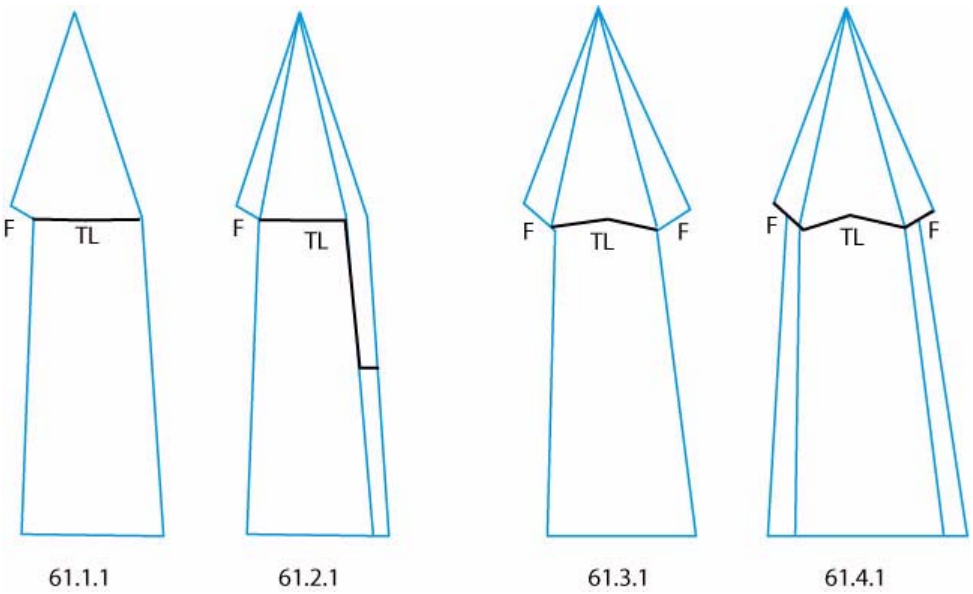

Figure 61. Schematic of flexed and double flexed teeth showing examples of the transverse line, otherwise terms are the same as flanged teeth. **61.1.1** and **61.2.1** flexed teeth; **61.3.1** and **61.4.1** double flexed. Flexure (F) and Transverse Line (TL).

traverses the apex and tooth crown margins and may traverse the tooth base margins (Figure 47). At the tooth margins, the occlusal crest may be broad or flanged.

Damaged (unidentified) flanged teeth (8 specimens) were mainly from the Pluto I-87 well and the base of the Zeus D-14 well (upper Eocene/Oligocene or lower Miocene). They could be specimens of triangle double flex Dunsworth et al. 1975, centrally inflated triangle with canals new subtype, or narrow triangle straight inbase Doyle et al. 1974.

List of identified triangular flexed teeth:

cf. *flexed triangle asymmetric* Doyle and Riedel 1985b

wide triangle double flex Gupta 1991

triangle double flex Dunsworth et al. 1975; emend. Doyle and Riedel 1979a

cf. *flexed triangle asymmetric*
Doyle and Riedel 1985b, p. 357-358
Figure 62

a8/b5+8/c1,2/d1,2/e120-150˚/f25-30˚/g1,2/h1,2/i2

Appendix 1.5.1

Characters: Tooth triangular; one margin longer than other; margins both with prominent flexure; flexure closer to apex with greatest angle (about 150˚) and gently rounded; flexure closest to base angled (120-130˚); inline base or inline transverse line shallowly curved, concave-down, and at or below flexure bases; inline apex high in apical region and shape similar to outline; apical angle 25-35˚; taller than wide, height to width ratio about 2:1; slightly asymmetric-elliptical (one face slightly flatter) and acute laterally in cross-section; slightly inflated basally; margins straight with occlusal lateral flanges.

Figure 62. cf. *flexed triangle asymmetric* Doyle and Riedel 1985. **62.1.1.** Shows crown asymmetric flexure of the flanged margins; GSC 124629, scale bar = 0.5 mm.

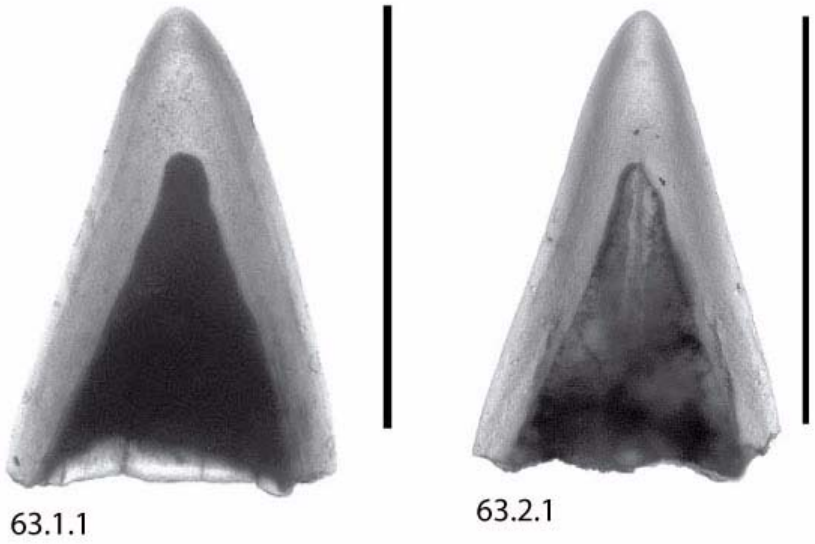

Figure 63. *wide triangle double flex* Gupta 1991. **63.1.1** and **63.2.1.** Showing double-flexed margins and a crown height to width ratio ≤1.5:1; GSC 124630 and 124631; scale bar = 0.4 mm.

Remarks: This specimen shows several similarities to *flexed triangle asymmetric* especially in the nature of the flexed margins and the asymmetry in the relationship of the margins to the inline that is common to many of the flexed triangle subtypes. *Flexed triangle asymmetric* occurs in the Paleocene and earliest Eocene (Doyle and Riedel 1985b). The Hesquiat Peninsula specimen differs from *flexed triangle asymmetric* by having: 1) two flexures; 2) one flexure nearer the apex that is curved and with a larger angle at about 150°; 3) a second basal flexure angled at about 120-130°; 4) two straight margins; and 5) a higher inline apex. This specimen only differs from *triangle double flex* Dunsworth et al. 1975 by having two flexes that are different and not at the same basal level.

Occurrence: 1 specimen; Hesquiat Peninsula; Oligocene; sample may be reworked.

wide triangle double flex Gupta 1991, p. 24 Figure 63

a8/b5+8/c2/d1,2/e90-115°/f35-40°/g1,2/h4/i≤1.5

Appendix 1.5.1

Remarks: Tofino Basin teeth are triangular, symmetric-elliptical and acute laterally in cross-section, and taller than wide (ratio about 1.5:1). Both tooth basal margins have angled flexure (angle about 90-115°) and each terminate below the inline base/transverse line. The apical angle is about 35-40°. Tooth margins have occlusal lateral flanges. The inline is high (near outline apex) and a similar shape to the outline.

Wide triangle double flex differs from *triangle double flex* Dunsworth et al. 1975 by having a greater apical angle (35-40°) and a height to width ratio of about 1.5:1 or less. *Wide triangle double flex* is known from Paleocene and Eocene deep-sea core strata, central Indian Ocean.

Occurrence: 4 specimens, 1 questionable specimen; Nootka Island, Hesquiat Peninsula, and offshore well Shell-Anglo Pluto I-87; Centrally Inflated Triangle With Canals ichthyolith interval; upper Eocene and Oligocene.

triangle double flex Dunsworth et al. 1975, p. 857 emend. Doyle and Riedel 1979a, p. 71 Figure 64

a8/b5+8/c2/d1,2/e90-130°/f25-35°/g1,2/h1,4/i≥1.5

Appendix 1.5.1

Remarks: Tofino Basin teeth are triangular, symmetric-elliptical and acute laterally in cross-section, and taller than wide (commonly ≥2:1; may be 1.5:1). Both tooth basal margins have angled flexure (angle about 90-130°) and each terminate below the inline base/transverse line. The apical angle is about 25-35°. The margins have occlusal lateral flanges. The inline is high (near outline apex) and a similar shape to the outline.

Triangle double flex is known to occur in the middle Eocene through the middle Miocene (Doyle and Riedel 1979a, p. 70).

Occurrence: 4 specimens; Nootka Island, Hesquiat Peninsula, and offshore well Shell-Anglo

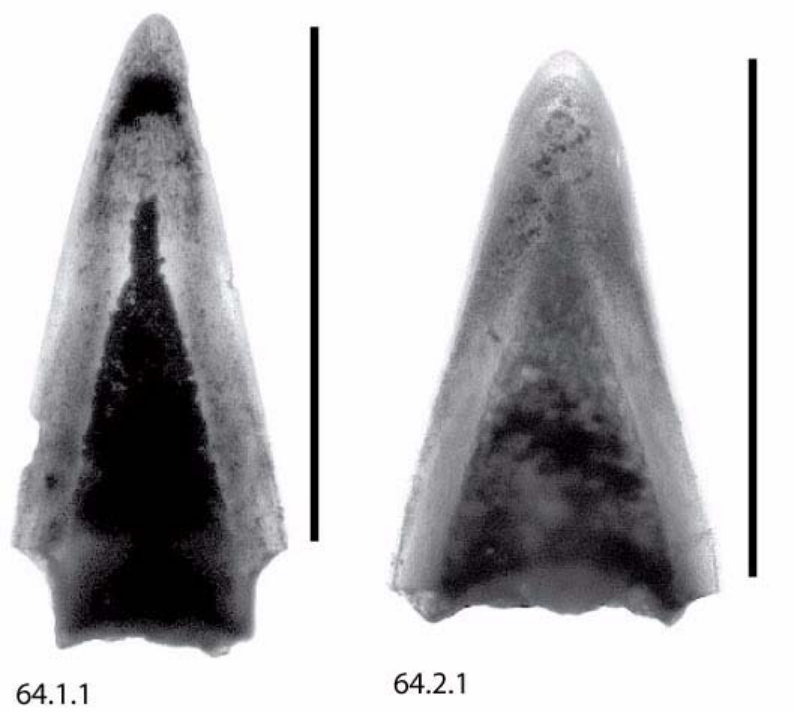

Figure 64. *triangle double flex* Dunsworth et al. 1975 emend. Doyle and Riedel 1979. **64.1.1** and **64.2.1.** Showing double-flexed margins and an inline that is a similar shape to the outline, GSC 124632 and 124633, scale bar = 0.5 mm.

Zeus D-14; Centrally Inflated Triangle With Canals ichthyolith interval; upper Eocene and Oligocene, reworked in lower Miocene.

Cone Teeth

Tofino Basin cone teeth (Figure 65) are triangular-shaped and without a cutting edge (occlusal crest). Some important characteristics are tooth curvature, margins, inline type and size, presence of striations, outline ornamentation, apex acuteness and shadow, and the nature of the transverse line.

Undescribed cone teeth (13 new subtypes) were too rare to designate a name and full description. The utilitarian code and a brief description in "Remarks" are provided. Another 8 distinct specimens were opaque, difficult to illustrate, and not described. An additional 9 specimens were fragments and could not be identified.

List of identified cone teeth:

cf. *triangle with parallel inline* Doyle et al. 1974

cf. *small triangle long striations* Dunsworth et al. 1975

cf. *striated triangle* Ramsey et al. 1976

cf. *curved triangle, parallel-sided inline* new subtype

small pointed triangle Tway et al. 1985

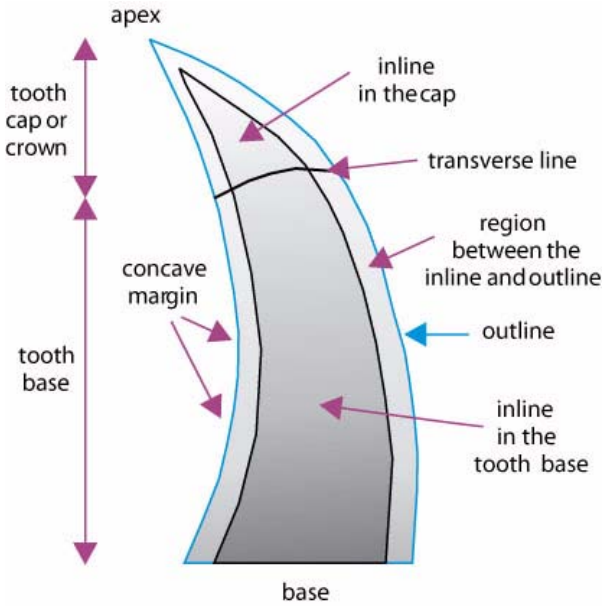

Figure 65. Schematic and cone tooth terms. **65.1.1.** Cone tooth crown and base.

cf. *curved triangle wide inline* new subtype

curved triangle wide inline new subtype

narrow tall triangle, cone inline new subtype

narrow tall triangle, inflated inline apex new subtype

narrow tall triangle, irregular threaded inline new subtype

shadowed high inline cone new subtype cf. long triangle stepped margin Doyle, Kennedy, and Riedel, 1974 and cf. a*ngled cone and bulbous base* new subtype

shadowed curved blunt triangle new subtype

dome-top triangle bowed inline new subtype

curved triangle, striated inline new subtype

cf. *curved flared triangle* Ramsey et al. 1976

curved triangle, parallel-sided inline new subtype

cf. *narrow curved triangle* Doyle et al. 1974

cf. *short triangle stepped margin* Doyle et al. 1974

cf. *long triangle stepped* margin Doyle et al. 1974

angled cone and bulbous base new subtype

cf. *triangle small top* Ramsey et al. 1976

cf. *triangular triangle* Kozarek and Orr 1980

Undescribed cone teeth (13 subtypes):

undescribed cone teeth, Form A
undescribed cone teeth, Form B
undescribed cone teeth, Form C
undescribed cone teeth, Form D
undescribed cone teeth, Form E
undescribed cone teeth, Form F
undescribed cone teeth, Form G
undescribed cone teeth, Form H
undescribed cone teeth, Form I
undescribed cone teeth, Form J
undescribed cone teeth, Form K
undescribed cone teeth, Form L
undescribed cone teeth, Form M

cf. *triangle with parallel inline* Doyle et al. 1974, p. 846
Figure 66

a9/b1/c1/d1/e1/f4a+b/g3+8/h1,2,5/i2,3/j2,3/k7/m0/n~2/p0/q10/r1/s3/t2/z0

Appendix 1.6.1

Characters: Tooth triangular and cone-shaped; with no occlusal crest ridge or flange; circular in cross-section; with thin tubular parallel sided inline that extends from base to beyond centre height of tooth but not to apex; inline hollow as seen at tooth base; with apical and lateral shadows; both margins straight to slightly convex; base breaks irregularly creating margins of different lengths; apex blunt; taller than wide (ratio ~2:1); outer surface pitted and with slightly raised short striations.

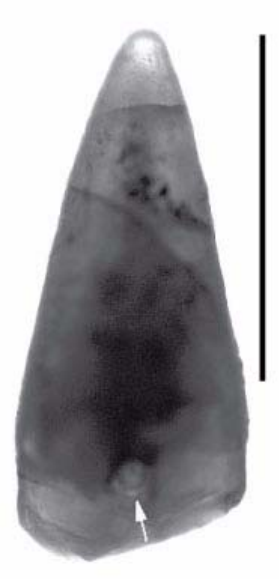

Figure 66. cf. *triangle with parallel inline* Doyle et al. 1974. **66.1.1.** The tooth is quite opaque making the central parallel inline difficult to see. At the central base of the tooth (arrowed), the circular hollow of the inline can be seen. GSC 124634, scale bar = 1.0 mm.

Remarks: This specimen differs from *triangle with parallel inline* by having 1) an inline apex well above the crown halfway position; 2) a base that is irregularly broken instead of straight across; 3) a blunt apex; and 4) a circular cross-section and no occlusal crest (many of the illustrated *triangle with parallel inline* specimens appear to have an occlusal crest, lateral flanges, and an acute lateral cross-section. This specimen has pitting and weak striations on the outer surface that may have resulted from abrasion or other alteration processes. The presence or absence of a ridged/flanged occlusal crest may help to recognize two different subtypes in future studies. *Triangle with parallel inline* occurs erratically throughout the Cenozoic (Doyle and Riedel 1979a, p. 120).

Occurrence: 1 specimen; near Matlahaw Point, Hesquiat Peninsula; Oligocene.

cf. *small triangle long striations*
Dunsworth et al. 1975, p. 857
Figure 67

a9/b1/c1/d1/e1/f(4a+b)+9+(12,13)+(14,15)/g1/h1,4,5/i3/j6/k0,1,5/m0/n1.4-1.7/p0/q2,9,10/r0,1/s1,2,3/t2/z0

Appendix 1.6.1

Characters: Tooth with long internal striations that extend from base to about three-quarters tooth height; many striations approximately vertical or may depart from centre at about 45° or more; one

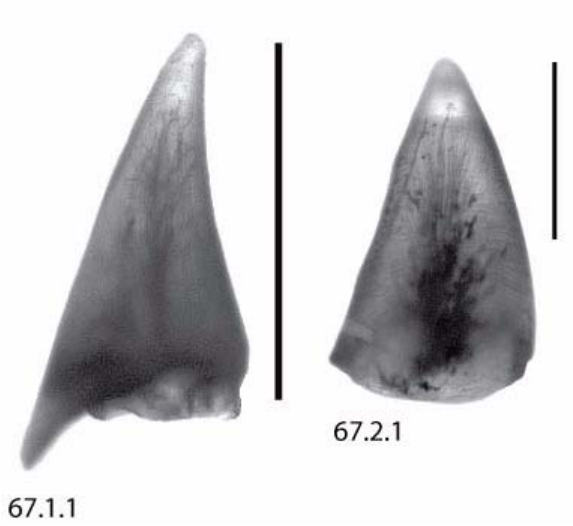

Figure 67. cf. *small triangle long striations* Dunsworth et al. 1975. **67.1.1** and **67.2.1.** Showing tooth long striations and margin curvature; GSC 124635 and 124636; scale bar = 0.4 mm.

margin slightly concave, other margin slightly convex; flares basally and curvature slightly asymmetric; apex rounded to acute; outline smooth; inline low arcuate or absent; with shadow; base irregularly broken to straight; height/width 1.4-1.7:1; circular cross-section; no transverse line; no occlusal crest.

Remarks: The Tofino Basin Shell-Anglo specimens differ from *small triangle long striations* Dunsworth et al. 1975 by having tooth crown shadow and a concave and convex margin (instead of straight margins). *Small triangle long striations* are known to occur in the lower Miocene to Quaternary (Dunsworth et al. 1975).

Occurrence: 2 specimens; offshore wells Shell-Anglo Cygnet J-100 and Zeus D-14; Bulbous Base ichthyolith Zone; middle to upper Miocene.

cf. *striated triangle* Ramsey et al. 1976, p. 132-133
Figure 68

a9/b1/c1/d1/e1/f9+12+14/g1/h2/i2,3,4/j2,3/k0,5/m0/n>2/p0/q6,10/r0,1/s1/t2/z0

Appendix 1.6.1

Characters: Tooth triangular and cone-shaped; with no occlusal crest ridge or flange; circular in cross-section; with internal striations that extend into upper crown and may originate near tooth base; basal crown opaque; base irregularly broken but somewhat curved; one basal margin region lower than other; both margins straight or slightly evenly to basally convex; taller than wide (ratio >2:1); apex approximately sharp.

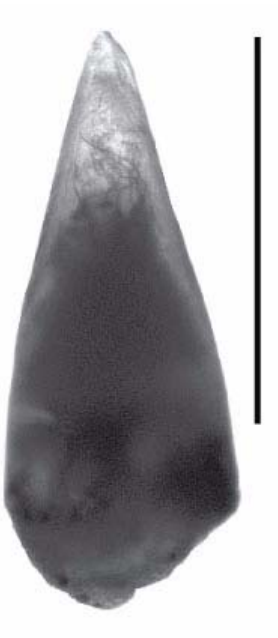

Figure 68. cf. *striated triangle* Ramsey et al. 1976. **68.1.1.** Tooth with internal striations and an irregular base; GSC 124637; scale bar = 0.5 mm.

Remarks: This specimen differs from *striated triangle* by being taller (height/width >2), having an irregularly broken base without a transverse line, and having an opaque basal region. *Striated triangle* has been recorded from the Upper Jurassic through Eocene (Doyle and Riedel 1979a, p. 134).

Occurrence: 1 specimen; near Matlahaw Point, Hesquiat Peninsula; Oligocene.

cf. *curved triangle, parallel-sided inline* new subtype
Figure 69

a9/b1,5/c1/d1/e1/f1/g1/h0/i0,1/j0,1/k0,1/m0/n0/p0/q0/r0/s0/t2/z0,2/cc1,7/dd1,7/ee1/ff1/gg1,7/hh0/jj4/kk3,4,5/mm0/nn0

Appendix 1.6.1

Characters: Tooth with cap missing. Tooth base: with long, central, thread-like parallel-sided inline; with rim and socket at base; circular in cross-section; one margin concave; second margin concave, convex, or sigmoid; may have faint vertical lines on basal outline.

Remarks: These Shell-Anglo specimens differ from *curved triangle, parallel sided inline* new subtype by having a thinner thread-like inline and a prominent rim and socket base. The curvature of the tooth cannot be determined because the tooth cap is missing on all specimens.

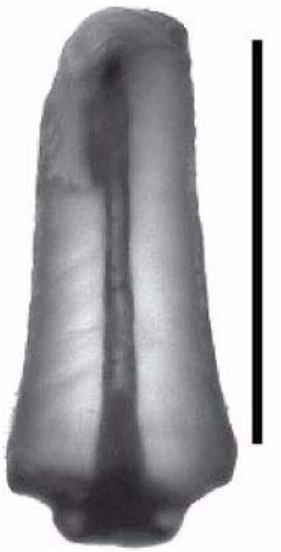

Figure 69. cf. *curved triangle*, *parallel-sided inline* new subtype. **69.1.1.** Showing narrow parallel sided inline and rim and socket base; GSC 124638, scale bar = 0.4 mm.

Occurrence: 10 specimen fragments, 6 questionable specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D-14; offshore core END-76B-6; and Hesquiat Peninsula; Miocene and lower Pliocene; possibly upper Oligocene.

small pointed triangle Tway et al. 1985, p. 306 Figure 70

a9/b1,5/c1/d1/e1/f1/g1/h4,5/i6/j3/k8+9/m0.4-0.7/n1.4-1.7/p0/q6,7,10/r1/s1,2/t2/z0

Appendix 1.6.1

Remarks: These Tofino Basin teeth are small and triangular, circular in cross-section, and have a height to width ratio of about 1.4-1.7:1. One tooth margin is evenly concave and the other evenly convex. The apex is moderately pointed and may have apical shadow. The tooth base is irregular, and a transverse line may be present (very faint). Two inlines have a similar shape to the outline, the outermost is at the outline margin and very close to the apex outline, and the innermost is cone-shaped, one-half to two-thirds the height of the tooth and not close to outline. The tooth base is centrally recessed (convex-up).

Tway et al. 1985 remarked that this subtype occurred in the upper Oligocene, and in undated samples it ranged from the middle Eocene through upper Oligocene. The Tofino Basin specimens may be reworked from older Oligocene sediments or at the top of the subtype range in the Miocene.

Occurrence: 2 specimens; offshore well Shell-Anglo Apollo J-14; reworked from ?Oligocene strata, deposited into middle/upper Miocene to lower Pliocene.

cf. *curved triangle wide inline* new subtype Figure 71

a9/b1,5/c1/d1/e1/f1/g1,3,8/h0/i0/j0/k0/m0/n0/p0/q0/r0,1/s0/t2/z0,2/cc1,7/dd1,7/ee1/ff0,1,3/gg1,7/hh0/jj3/kk4/mm0/nn0

Appendix 1.6.1

Characters: Tooth base with cap missing; commonly breaks straight across. Base curved, one concave and one convex margin; inline wide, similar shape to outline, commonly close to outline;

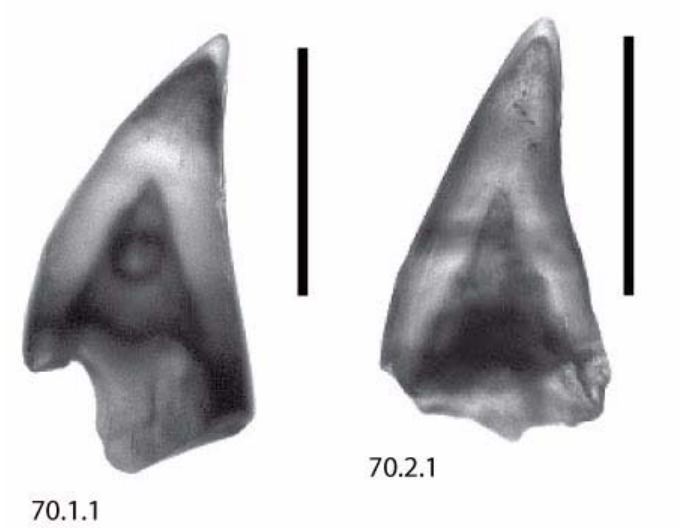

Figure 70. *small pointed triangle* Tway et al., 1985. **70.1.1** and **70.2.1.** Tooth crown showing two inlines, GSC 124639 and 124640; scale bar = 0.2 mm.

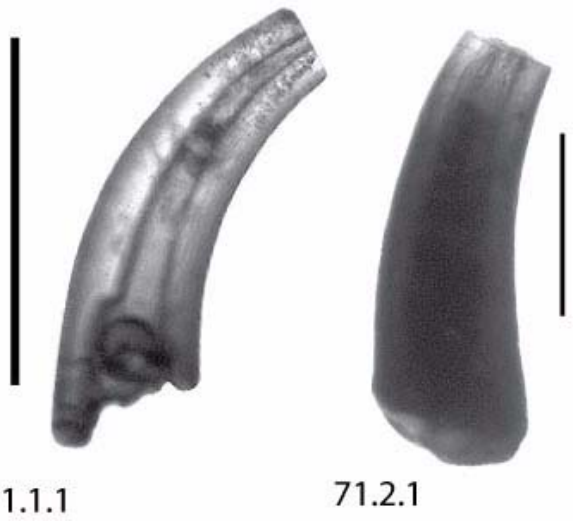

Figure 71. cf. *curved triangle wide inline* new subtype. **71.1.1** and **71.2.1.** Showing variability of the curved tooth and inline thicknesses; GSC 124641 and 124642; scale bars = 0.4 mm.

circular cross-section; basal rim present on some specimens; outline smooth, lightly pitted, or with irregular lines; height to width ratio may be >3.

Remarks: These specimens are taller and narrower than *curved triangle wide inline* and the base is not as flared. The inline is a similar shape to the outline, commonly close to the outline, and opaque.

The figured specimen (Figure 71.1.1) shows a narrow inline. Many specimens have a wider inline that is closer to the outline (Figure 71.2.1) but they were hard to photograph because they are dark or opaque.

Occurrence: 11 fragments, 13 questionable fragments; offshore wells Shell-Anglo Cygnet J-100, Prometheus H-68, and Zeus D-14; Bulbous Base ichthyolith Zone; Miocene and lower Pliocene; possibly upper Oligocene.

curved triangle wide inline new subtype
Figure 72

a9/b1,5/c1/d1/e1/f1,4a+b/g1,3,6,8/h0,1,5/i3/j6,9/k0/m1.8-3.0/n1-2/p0/q0/r0/s1,2/t2/z0,2/ cc0,1,7/dd0,1,7/ee1/ff1/gg1,4,7,8/hh1.8-3.0/jj3/kk4/mm1.5-2.5/nn0.15-0.5

Appendix 1.6.1

Characters: Tooth curved with one concave and one convex margin; flares slightly at base and may have thin rim; outline weakly stippled, pitted, or with weak vertical or irregular lines; circular cross-section; height to width ratio >1. Inline only in base below cap and transverse line; moderately close to outline, cone-shaped or irregular cone-shaped to acuminate near apex. Tooth apex conical; transparent or may have shadow; commonly missing from base; inline absent; outline smooth (no occlusal crest, no ornament); margins straight, convex or concave; apex acute. Transverse line faintly visible or absent.

Remarks: *Long triangle thin wall* Dunsworth et al. 1975 has a small cap, a base inline close to the outline, and a transverse line that is straight across much like *curved triangle wide inline,* however, it differs by not having distinctly curved concave/convex margins and the tooth base height is greater (≥4). *Long triangle thin wall* occurs in the lower Eocene through lower Miocene (Doyle and Riedel 1979a, p. 180).

The Shell Canada specimens have some similarities to *short triangle stepped margin* Doyle et al. 1974 by having a similar inline, tooth shape, and tooth cap. They differ by not having the stepped margin at the transverse line and by having a shallow rim at the tooth base. A similar undescribed form (Doyle and Riedel 1985b, Figure 25-5, p. 987) was found to be co-occurring with *short triangle stepped margin* and also lacks the stepped margin like the Shell Canada specimens. *Short triangle stepped margin* occurs near the Oligocene-Miocene boundary through the Quaternary.

Curved triangle wide inline differs from Shell Canada specimens *narrow curved triangle* Doyle et al. 1974 by not having a narrow and parallel-sided inline. Also, they differ from cf. *narrow curved triangle* Doyle et al. 1974 by not being flattened with an oval cross-section and by not having a reverse-stepped cap/base margin.

Occurrence: 5 specimens, 7 fragments, 2 questionable fragments; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D-14; offshore core END-76B-6D; Bulbous Base ichthyolith Zone; Miocene, lower Pliocene, and possibly upper Oligocene.

narrow tall triangle, cone inline new subtype
Figure 73

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0/m0/n>1/p0/q0/r0/s1,2/t2/z2/cc1,7/dd1,7/ee1/ff1/gg1,7/hh>3/jj2,3,5/kk2,4,5/mm2.5-3.5/nn≤0.2

Appendix 1.6.1

Characters: Tooth narrow and tall (height/width ≥3), moderately erect; margins sigmoidal; with rim base; transverse line straight across at base of cap. Inline only in base, irregular cone-shaped;

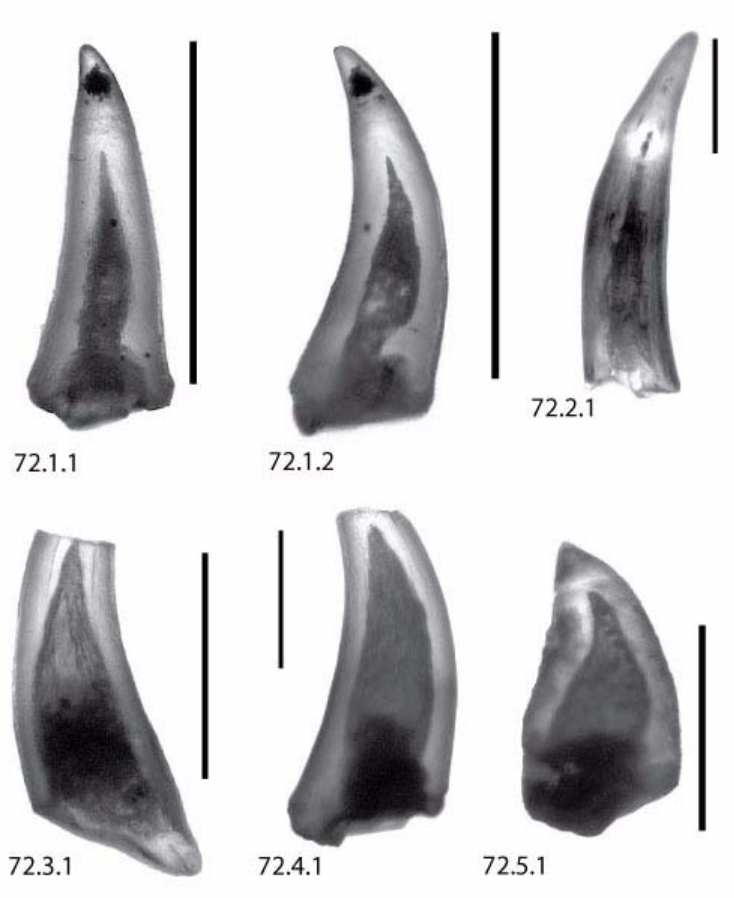

Figure 72. *curved triangle wide inline* new subtype. **72.1.1** and **72.1.2.** Two views of the same specimen showing tooth curvature, inline shape, and cap apical shadow; GSC 124643**. 72.2.1., 72.3.1., 72.4.1.,** and **72.5.1.** Showing variations of the inline shape and some vertical line texture on the outline (**71.2.1** and **71.3.1**); GSC 124644 to 124647. Scale bar = 0.3 mm.

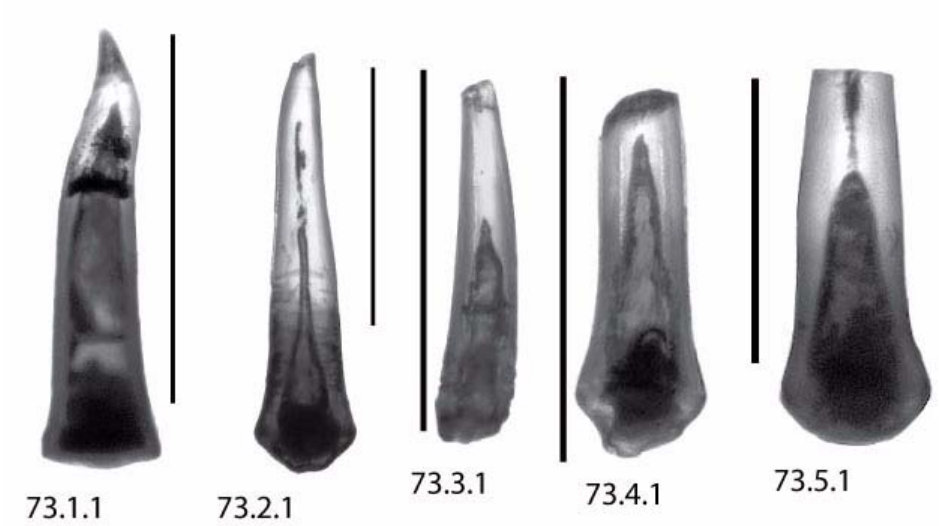

Figure 73. *narrow tall triangle, cone inline* new subtype. **73.1.1** through **73.5.1.** Showing variations in the tooth inline and margins; GSC 124648 through 124652; scale bar = 0.5 mm except **73.5.1** scale bar = 0.3 mm.

commonly extends one-third or more up from base; occasionally with a few irregular threads that extend from cone tip upwards towards cap. Base with sigmoid or curved margins or one margin convex and other concave; gradually widens (from apex to base) except near base with constriction above a wider basal rim; circular cross-section. Cap with acute apex; may be shadowed; one margin convex or straight; other margin concave or straight; height slightly greater than width; inline absent.

Remarks: *Narrow tall triangle, cone inline* has a distinct base with a cone inline greater than one-third the height of the base and a basal rim. The tooth is tall and narrow (height/width: ≥3). *Narrow tall triangle cone inline* is most similar to *curved triangle wide inline* new subtype but is taller and narrower and lacks prominent concave/convex curvature and instead has sigmoidal margins.

Occurrence: 1 specimen, 7 fragments; offshore wells Shell-Anglo Cygnet J-100, and Zeus D-14; Bulbous Base and Shadowed Cone ichthyolith zones; Miocene and Pliocene.

narrow tall triangle, inflated inline apex new subtype
Figure 74

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0,5,8/m0/n0/p0/q0/r0/s1,3/t2,3/z2/cc1,7/dd1,7/ee1/ff1/gg4,7/hh>4/jj5/kk5/mm2/nn0.125

Appendix 1.6.1

Characters: Tooth narrow and tall (height/width ≥5); with rim and socket base; transverse line straight across at base of small cap. Base with sigmoid margins; slightly inflated basally and apically; flattened oval to circular cross-section. Base inline prominent and long, commonly parallel-sided basally and slightly inflated apically. Cap small (equal to or slightly taller than tooth maximum width); with shadow; one margin convex or straight; other margin concave or straight; apex acute or rounded; inline absent or arcuate (extension of base inline).

Remarks: *Narrow tall triangle, inflated inline apex* differs from *angled cone and bulbous base* new subtype by not having a bulbous base (the upper base is only slightly inflated) and by not having a cap base width at the transverse line that is distinctively narrower than the inflated/bulbous region of the tooth base apex. Also, the base inline near the apex of the two subtypes is different; *angled cone and bulbous base* has a spray/flower-like apical inline instead of the slightly inflated bulbous-like shape of the tooth base apical inline of *narrow tall triangle, inflated inline apex*.

Figure 74. *narrow tall triangle, inflated inline apex* new subtype. **74.1.1**. GSC 124653; scale bar = 0.5 mm.

Occurrence: 4 specimens, 10 fragments, 8 questionable specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D-14; and offshore core END-76A-6E; long ranging; upper Eocene/Oligocene through Pliocene.

narrow tall triangle, irregular threaded inline new subtype
Figure 75

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0,8/m0/n~2/p0/q0/r0/s1,3/t2,3/z2/cc1,7/dd1,7/ee1/ff1/gg1,7/hh>4/jj3,5/kk4,5/mm1.8-2/nn0.20-0.25

Appendix 1.6.1

Characters: Tooth narrow and tall (height/width ≥5); with rim and socket base; transverse line straight across at base of cap. Base with sigmoid margins or one margin convex and other concave; gradually widens (from apex to base) except near base with constriction above a wider basal rim; circular cross-section to slightly oval. Basal tooth base with small parallel-sided inline or cone-inline,

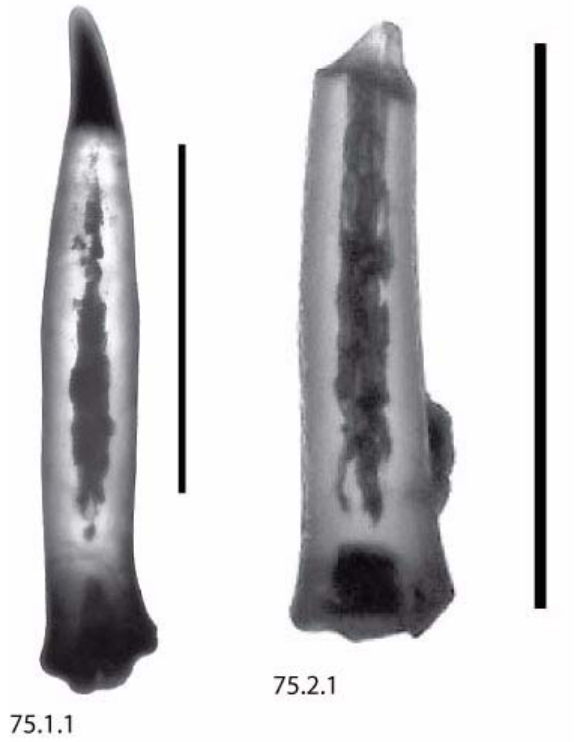

Figure 75. *narrow tall triangle, irregular threaded inline* new subtype. **75.1.1.** and **75.2.1.** GSC 124654 and 124655; scale bar = 0.4 mm.

commonly in basal one-quarter. Upper tooth base inline with irregular threads approximately parallel to outline and commonly extend to cap base. Cap dark with shadow; one margin convex or straight; other margin concave or straight; apex acute to rounded; height >2 times width; inline absent or high-shadowed.

Remarks: *Narrow tall triangle, irregular threaded inline* has a distinctive threaded base inline with a small basal cone or parallel-sided inline. The tooth is tall and narrow with a basal rim. The tooth base is not significantly inflated just below the cap. It differs from *narrow tall triangle inflated inline apex* new subtype by not having the inflated inline apex.

Occurrence: 1 specimen, 6 fragments, 1 questionable specimen, 2 questionable fragments; offshore wells Shell-Anglo Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D-14; and Flores Island (outcrop sample); long ranging; upper Eocene/Oligocene through Pliocene.

cf. *long triangle stepped margin* Doyle et al. 1974 and cf. *angled cone and bulbous base* new subtype; *"shadowed high inline cone"*
Figure 76

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i6,7,9/j2,4,7,9/k8/m<0.1/n1.5-2.5/p0/q0/r0/s1,2/t2/z2/

Appendix 1.6.1

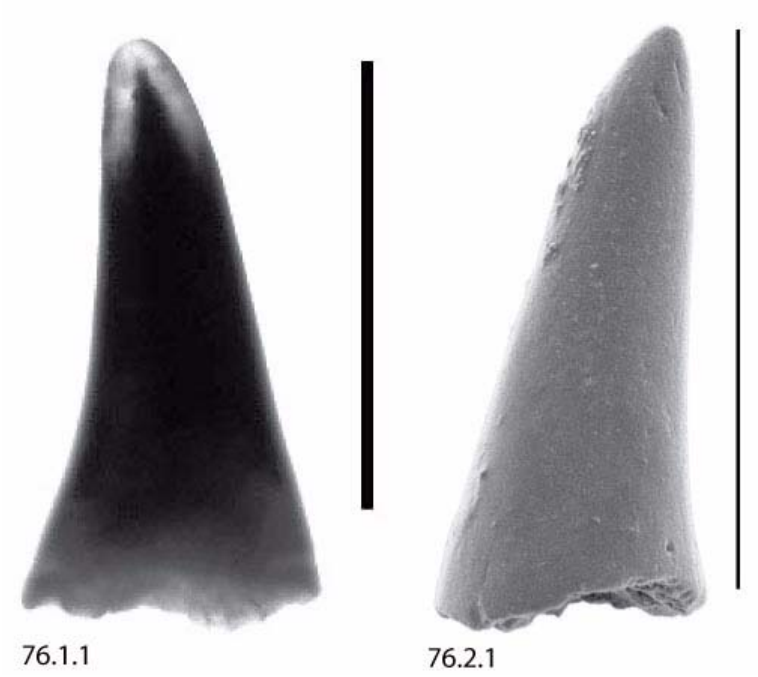

Figure 76. *Shadowed high inline cone* new subtype cf. l*ong triangle stepped margin* Doyle, Kennedy, and Riedel, 1974 and cf. *angled cone and bulbous base* new subtype. **76.1.1.** Transmitted light image showing tooth curvature, shadow, and high inline; GSC 124656. **76.2.1.** SEM image, GSC 124657. Scale bar = 0.3 mm.

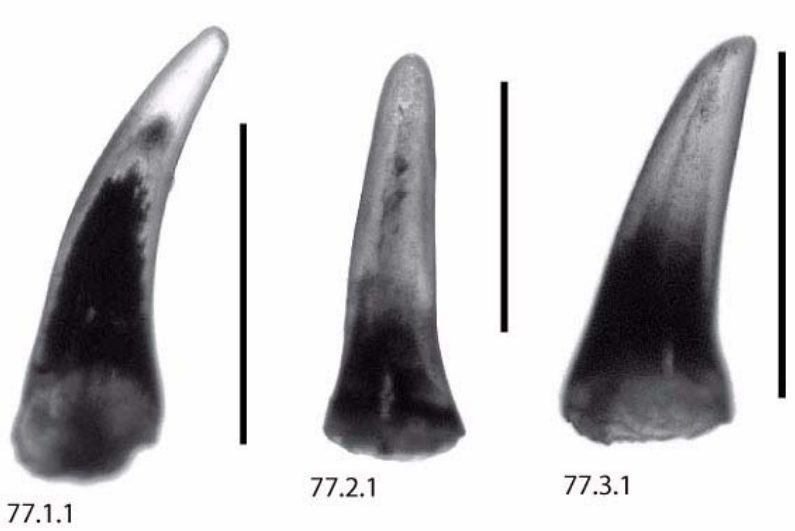

Figure 77. *shadowed curved blunt triangle* new subtype. **77.1.1, 77.2.1,** and **77.3.1.** Showing crown curvature, shadow, and inline; GSC 124658 to 124660; scale bar = 0.3 mm.

Characters: Tooth cone-shaped, height to width ratio about 1.5-2.5:1; circular cross-section; base wide and flared with equal length margins at straight-across transverse line. Cap apex moderately acute (not blunt or sharp); one margin concave or basally concave; other margin convex, sigmoid, basally concave, or straight; with apical and lateral dark shadows (enough to blacken cone), no occlusal crest. Inline same shape as outline; dark or black; high into apical region; base recessed (convex-up). No tooth base observed.

Remarks: The Shell-Anglo specimens differ from other similar subtypes: *curved flared triangle*, *flared triangle arcuate inline*, *triangle arcuate inline*, *straight flared triangle*, and *tall triangle low inline* (Ramsey et al. 1976 p. 130-132) by having a high inline, and dark shadowing of the inline and areas between the inline and outline.

Shadowed high inline cone differs from *shadowed curved blunt triangle* new subtype by being distinctly cone-shaped with a more acute apex, a wide or flared base, a circular cross-section, and a straight-across transverse line. Also, margin curvature is less than *shadowed curved blunt triangle.*

Shadowed high inline cone teeth (without bases) are indistinguishable from the caps of cf. *long triangle stepped margin* Doyle, Kennedy and Riedel 1974 and *angled cone and bulbous base* new subtype. Shadowed caps of cf. *long triangle stepped margin* commonly have a height to width ratio of 2:1 and a moderately acute cap. Shadowed caps of *angled cone and bulbous base* commonly have a height to width ratio ≤2:1 and have a rounded apex. All these caps are in within the range of cf. *long triangle stepped margin* and within the upper range of *angled cone and bulbous base* in upper Miocene to Pliocene Tofino Basin sediments.

Occurrence: 11 specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, and Prometheus H-68; Shadowed Cone ichthyolith Zone; Pliocene and upper Miocene; possibly middle Miocene.

shadowed curved blunt triangle new subtype
Figure 77

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i6,7/j2,3,9/k8,9/m0/n>2/p0/q0,6,7/r0,1/s1,3,4/t3/z0,2

Appendix 1.6.1

Characters: Tooth triangular with slight or no basal flare; height to width ratio >2, may be >3; flattened to rounded elliptical cross-section; apex rounded, blunt or truncate; one margin concave, other margin convex or sigmoid; with no occlusal crest; with dark apical and lateral shadows (enough to blacken cone); base straight-across transverse line or irregular but no great difference in margin lengths; inline same shape as outline, high into apical region, close to outline at base, and base recessed (convex-up). No tooth base observed.

Remarks: The Shell-Anglo specimens differ from *narrow straight triangle* Doyle and Riedel 1985b by having margin curvature, a slightly flared base, elliptical to oval cross-section, prominent shadow, and a height to width ratio commonly >2. They share in common the high inline, rounded apex, and a basal transverse line. *Narrow straight*

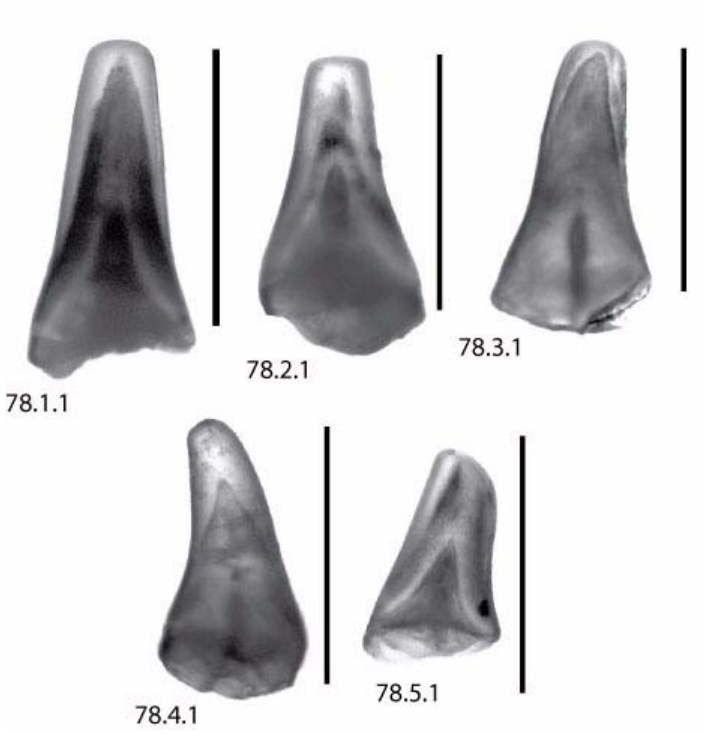

Figure 78. *dome-top triangle bowed inline* new subtype. **78.1.1.** Showing the double bowed-in inline; GSC 124661. **78.2.1.** Showing the double bowed-in inline and an inner inline with a slightly inflated apex; GSC 124662. **78.3.1.** Showing the outer bowed-in inline and an inner apically inflated parallel-sided inline; GSC 124663**. 78.4.1.** Showing the outer bowed-in inline and an inner parallel-sided inline; GSC 124664. **78.5.1.** Showing the straight-across transverse line at the tooth base; GSC 124665. Scale bar = 0.4 mm.

triangle ranges from upper Paleocene through earliest Eocene (Doyle and Riedel 1985b).

Occurrence: 10 specimens, 2 fragments; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, and Zeus D-14; Shadowed Cone ichthyolith Zone; Pliocene and upper Miocene; possibly middle Miocene.

dome-top triangle bowed inline new subtype
Figure 78

a9/b1,5/c1/d1/e1/f4a±b/g1/h0,1,5/i6,9/j6,9/k3/
m0.05-0.25/n1.5-2/p0/q0,2/r0,1/s3/t2,3/z0,2

Appendix 1.6.1

Characters: Tooth triangular and cone-shaped; with blunt/rounded shiny dome-top cap, flared base, and no flanged occlusal crest; outer inline bowed-in, close to outline at base, and apically close to outline apex (>three-quarters tooth height); interior inline parallel-sided with a slightly inflated apex or may be a second shorter bowed-in structure; circular to obtuse in cross-section; taller than wide (ratio 1.5-2.0:1); both margins sigmoidal, slightly concave, or straight; transverse line straight across at tooth base; shadow common in inline and between inline and outline.

Remarks: *Dome-top triangle bowed inline* is distinct with its blunt and shiny dome-top and its tall outer bowed inline and shorter inner bowed inline or apically inflated parallel inline.

Occurrence: 7 specimens, 1 questionable specimen; Hesquiat Peninsula; Centrally Inflated Triangle With Canals ichthyolith interval; upper Eocene and Oligocene.

curved triangle, striated inline new subtype
Figure 79

a9/b1,5/c1/d1/e1/f(4a+b)+(8,9)+(11,12)+14/g1,3,8/
h0,1,5/i2,3/j2,6/k0,1,7,11/m0/n1-1.5/p2.0-3.5/q0,2/
r0,1/s2,3/t2/z0,2/cc1,7/dd1,7/ee1/ff2/gg1,4,8/
hh2.5-3.5/jj3/kk4/mm1.5-4/nn0.1-0.3

Appendix 1.6.1

Characters: Tooth evenly curved, one margin convex, other margin concave; margin lengths similar; base may have shallow rim; circular cross-section; height to width about 2-3.5:1. Inline solid and close to outline at base, commonly with central parallel-sided inline; extends up tooth >one-half (commonly two-thirds to three-quarters); with irregular apex and striations. Inline striations common (may cover most of inline apex),

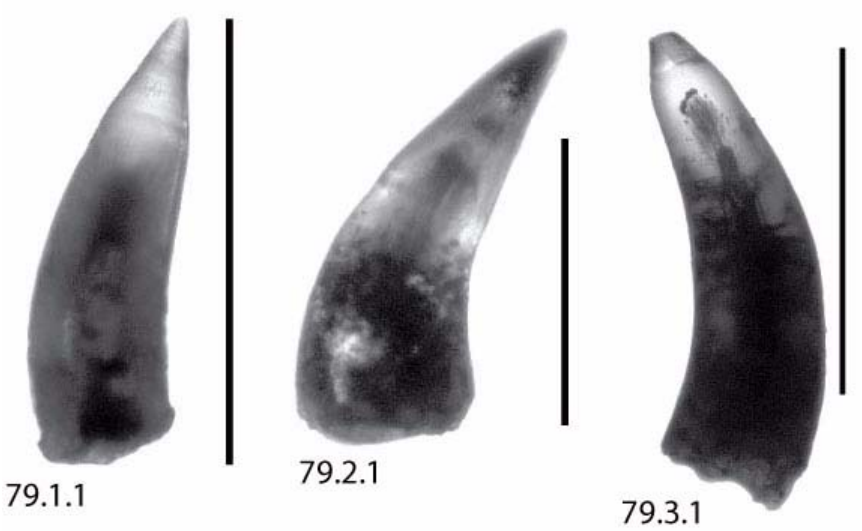

Figure 79. *curved triangle, striated inline* new subtype. **79.1.1** to **79.3.1.** Showing variations of the tooth base inline; GSC 124666, 124667, and 124668; scale bar = 0.4 mm

approximately vertical, and not long (do not extend to tooth cap). Outline smooth, lightly pitted, or with faint irregular striations. Tooth cap without inline; commonly with shadow and straight margins; apex acute to rounded; transverse line straight across; height/width ≥1:1.

Remarks: These specimens are distinct by having tooth concave-convex curvature, inline striations, and a parallel-sided inline. *Curved triangle, striated inline* mainly differs from *narrow curved triangle small top* Ramsey et al. 1976 by not having the small apical cap; *narrow triangle ragged base* Dunsworth et al. 1975 by not having the ragged base, and *curved flared triangle* Ramsey et al. 1976 by having a greater height to width ratio (>2:1) and not having an inline that is a similar shape to the outline.

Occurrence: 7 specimens, 2 questionable fragments; offshore wells Shell-Anglo Prometheus H-68 and Zeus D-14; Striated Triangle ichthyolith Zone; lower to middle Miocene.

cf. *curved flared triangle*
Ramsey et al. 1976, p. 130
Figure 80

a9/b1,5/c1/d1/e1/f(4a+b)±10±11±14/g1±7/h0/i6,7/j3/k3,8/m0.5-0.6/n1.8-2.0/p0/q0/r0/s3/t2/z2

Appendix 1.6.1

Characters: Tooth triangular; height to width ratio about 2-3:1; circular in cross-section; one margin basally concave; other margin evenly convex; apex rounded; with apical and lateral shadow; transverse line straight across at base; inline in bottom one-half to one-third, similar shape to outline or slightly bowed-in, not close to outline; with a few striations on inline apex.

Remarks: The Shell-Anglo specimen differs from *curved flared triangle* by having apical and lateral shadow, a rounded apex, an inline with a similar shape to the outline instead of arcuate, and inline height that is > one-quarter ≤one-half the height of the tooth. It is similar by having convex and concave margins, and striations between the inline and outline. *Curved flared triangle* occurs in the Upper Jurassic through middle Eocene (Doyle and Riedel 1979a, p. 102).

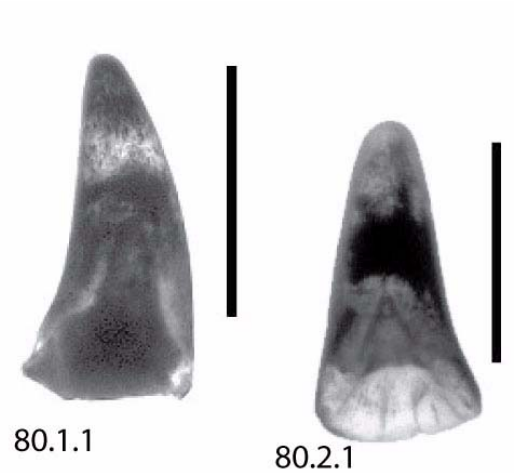

Figure 80. cf. *curved flared triangle* Ramsey et al., 1976. **80.1.1** and **80.2.1.** Showing margin curvature, the inline, and the straight-across transverse line at the base of the tooth; GSC 124669 and 124670; scale bar = 0.2 mm

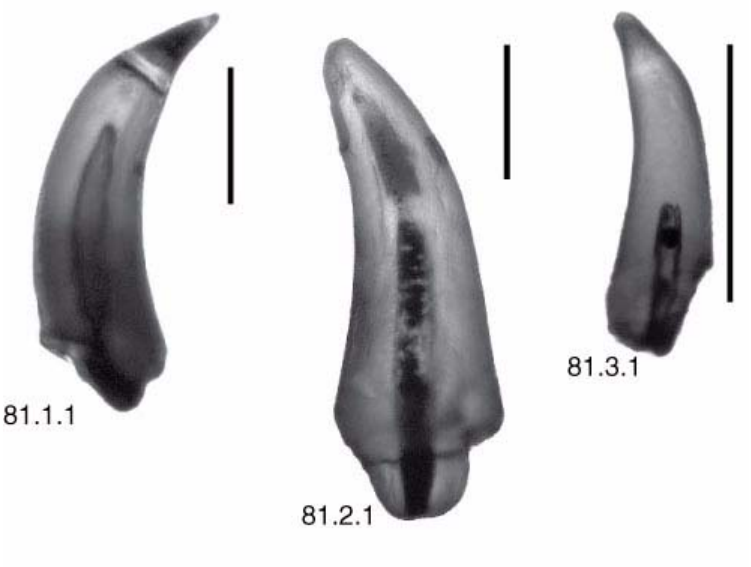

Figure 81. *curved triangle, parallel-sided inline* new subtype. **81.1.1** to **81.3.1.** Showing variations in the length of the parallel-sided inline; GSC 124671 to 124673; scale bar = 0.3 mm.

Occurrence: 2 specimens; offshore well Shell-Anglo Pluto I-87; upper Eocene/Oligocene, ?reworked from older strata.

curved triangle, parallel-sided inline new subtype
Figure 81

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0/m0/n<1.5/p0/q0/r0/s1,2,3/t2/z2/cc1,7/dd1,7/ee1/ff1,2/gg4/hh>2/jj3/kk4/mm2-4/nn0.16-0.36

Appendix 1.6.1

Characters: Tooth moderately robust with curved base and conical cap; transverse line straight across; parallel-sided inline of variable length but always in base below cap and transverse line; shadow common in cap and base; circular cross-section. Tooth base with one margin convex and the other concave; faintly stippled outline; maximum height 3 to 5 times maximum width; may have basal rim and socket. Tooth cap small; about as tall as wide or height ≤1.5 times width; one margin concave or straight, second margin convex or straight; may be one-third to one-sixth height of base; no internal features; outline not ornamented.

Remarks: This new subtype differs from *narrow curved triangle* Doyle et al. 1974 by having a variable length parallel-sided inline that is below the transverse line, a small cap with a height to width ratio ≤1.5, and a base with a faintly stippled outline. This new subtype differs from *curved triangle long top* Gupta 1991 by not having a long parallel-sided inline that extends to the transverse line.

Occurrence: 7 specimens, 5 fragments, 11 questionable fragments; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Pluto I-87, Prometheus H-68, and Zeus D14; long ranging; Bulbous Base ichthyolith Zone; Miocene and Pliocene; possibly upper Eocene/Oligocene.

cf. *narrow curved triangle* Doyle et al. 1974, p. 847; Doyle and Riedel 1979a, p. 187
Figure 82

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,6/j2,3/k0,1,12/m>2<2.5/n2-3/p0/q0/r0/s1,2/t3,2/z2/cc1/dd1/ee1/ff1,2/gg1,4/hh2-2.5/jj4/kk3/mm~2/nn0.4-0.45

Appendix 1.6.1

Characters: Tooth triangular, curved, and with no occlusal crest; first margin concave and second margin convex; transverse line straight across; base reverse-stepped (cap base significantly wider than tooth base apex); oval to circular cross-section. Tooth base inline tall (in upper two-thirds to three-quarters) and narrow cone-shaped; similar shape to outline but not near outline; with acute apex that may thin to a thread and may extend into cap. Tooth base curved, commonly longest margin convex, other margin concave; occasional both margins same length; outline weakly stippled or textured; with irregular to ragged base. Tooth cap apex acute; height to width ratio >2<2.5; unornamented/smooth; transparent or with shadow; one margin concave or straight, other margin convex or straight.

Remarks: The Shell-Anglo specimens differ from *narrow curved triangle* by not having a cap height/

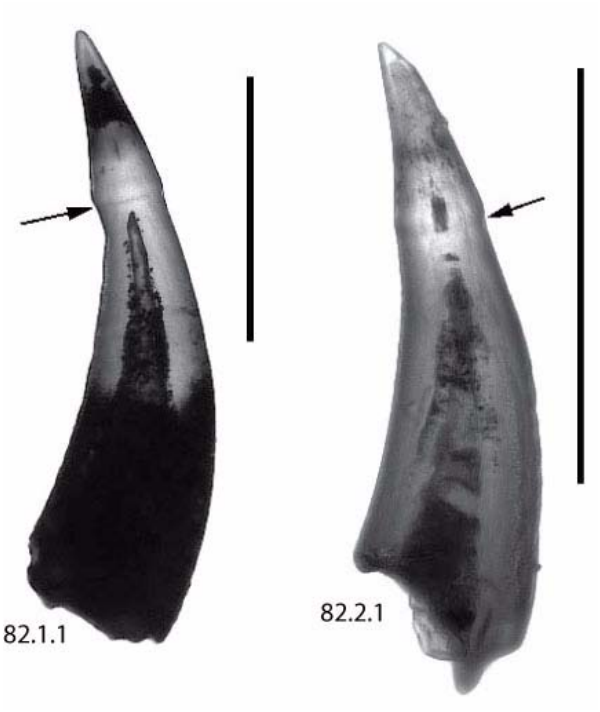

Figure 82. cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1974. **82.1.1** and **82.2.1.** Showing tooth reverse-stepped margin (arrows), margin curvature, and narrow cone-shaped inline; GSC 124674 and 124675; scale bar = 0.5 mm.

width ratio ≥2.75, much of the inline (only thread-like) above the transverse line, and an outline longitudinal line, and by having a reverse stepped margin at the cap/base junction, cap apical shadow on some specimens, and an oval cross-section and slightly flattened tooth.

Narrow curved triangle is known to occur in the deep-sea upper Oligocene through lower Miocene and two specimens have been found in the upper Eocene or lower Oligocene (Doyle and Riedel 1979a, p. 186).

Occurrence: 2 specimens, 16 fragments, 6 questionable fragments; offshore wells Shell-Anglo Cygnet J-100, Prometheus H-68, and Zeus D-14; Bulbous Base ichthyolith Zone, common in the middle to upper Miocene, a few in the lower Miocene, and rare in the Pliocene.

cf. *short triangle stepped margin* Doyle et al. 1974, p. 847; Doyle and Riedel 1979a, p. 183
Figure 83

a9/b5/c1/d1/e1/f±4a±b/g1/h0/i2,6/j2,3,6/k0/m0/n<2/p0/q0/r0/s0,1,3/t2/z3/cc1/dd1/ee1/ff1/gg3,7/hh~2/jj2,3,5/kk2,3/mm1.5-2.5/nn0.4-1.0

Appendix 1.6.1

Characters: Tooth cap and base separated by a transverse line that forms a stepped margin. Tooth cap conical; height to width ratio <2; outline smooth (no occlusal crest, no ornament); margins straight, convex, or concave; with apical shadow; apex acute to rounded. Tooth base margins straight, sigmoid, or convex near transverse line; inline similar shape to outline, restricted to within base, with somewhat parallel margins and not near outline margins; outline with weakly vertical and

Figure 83. cf. *short triangle stepped margin* Doyle et al. 1974. **83.1.1, 83.2.1,** and **83.3.1.** Showing variations of the tooth base inline and striations; GSC 124676 to 124678; scale bar = 0.3 mm.

irregular striations; circular cross-section; height to width ratio about 2:1.

Remarks: The stepped margin near the transverse line and the short height to width ratio of the tooth cap are distinguishing features of this subtype. The Shell-Anglo specimen differs by having apical shadow in the cap, faint vertical and irregular striations on the tooth base outline, and a shorter inline that is only present in the tooth base. *Short triangle stepped margin* occurs near the Oligocene/Miocene boundary through the Quaternary (Doyle and Riedel 1979a, p. 182).

Occurrence: 3 specimens, 3 questionable specimens; offshore wells Shell-Anglo Apollo J-14, Pluto I-87, and Zeus D-14; Bulbous Base ichthyolith Zone; mainly Miocene; possibly Pliocene.

cf. *long triangle stepped margin* Doyle et al. 1974, p. 847; Doyle and Riedel 1979a, p. 185
Figure 84

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,7,9/j2,3,9/k0,1,8/m0/n1.5-3/p0/q0/r0/s2/t2/z3/cc1,7/dd1,7/ee1/ff1,2,3/gg4,7/hh1.5-3/jj4/kk3/mm1.5-2.5/nn0.2-1.0

Appendix 1.6.1

Characters: Tooth curved; cap and base separated by a transverse line that forms a slightly stepped margin. Tooth cap conical; height to width ratio >1.5, commonly ≥2; outline smooth (no occlusal crest, no ornament); margins straight, concave basally, or slightly convex or sigmoid; with dark apical shadow; apex acute. Tooth base with shallow basal rim; outline well textured with stippling and irregular lines (especially basally); one margin concave or sigmoid, other margin convex or sigmoid; striations common in upper tooth base and below transverse line; inline hard to determine (well shadowed in region below striations); circular cross-section; height to width about 2:1.

Remarks: The curved tooth, slightly stepped margin near the transverse line, >1.5 and commonly ≥2 height to width ratio of the tooth cap, and the moderately acute cap apex are distinguishing features of this subtype. The Shell-Anglo specimens mainly differ by not having a well-developed stepped margin, and having a dark shadowed cap, base inline striations, a shallow base rim, and a stippled and textured base outline. The textured base and rim and the dark cap are similar to *angled cone and bulbous base* but these specimens do not have the bulbous base and a flower-like inline. *Long triangle stepped margin* occurs in latest Miocene to Recent (Doyle and Riedel 1979a, p. 184).

Figure 84. cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974. **84.1.1** and **84.2.1.** GSC 124679 and 124680; scale bar = 0.5 mm.

Occurrence: 5 specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100 and Prometheus H-68, and offshore core END76B-6C; Shadowed Cone ichthyolith Zone; upper Miocene and Pliocene.

***angled cone and bulbous base* new subtype**
Figure 85

a9/b5/c1/d1/e1/f4a+b/g1/h0/i6,9/j2,3,9/k8/m0/n<2.5/p0/q0/r0/s1,3/t2/z2/cc6,7/dd6,7/ee1/ff1/gg1,4/hh>1.5/jj5/kk5/mm1-2/nn0.3-0.5

Appendix 1.6.1

Characters: Tooth with a bulbous base just below a curved triangular cap; cap and base separated by a transverse line. Tooth cap outline smooth (no occlusal crest, no ornament); angled onto base; one margin concave or sigmoid, second margin convex or straight; inline greatly shadowed dark or black, high in cap (>three-quarters cap height); apex bluntly rounded to moderately acute (in narrower, less bulbous specimens); circular cross-section; commonly missing from base. Tooth base bulbous-shaped (widens from cap base, then narrows basally, then widens slightly at tooth base to form a rim); inline variable (may be a flower-like

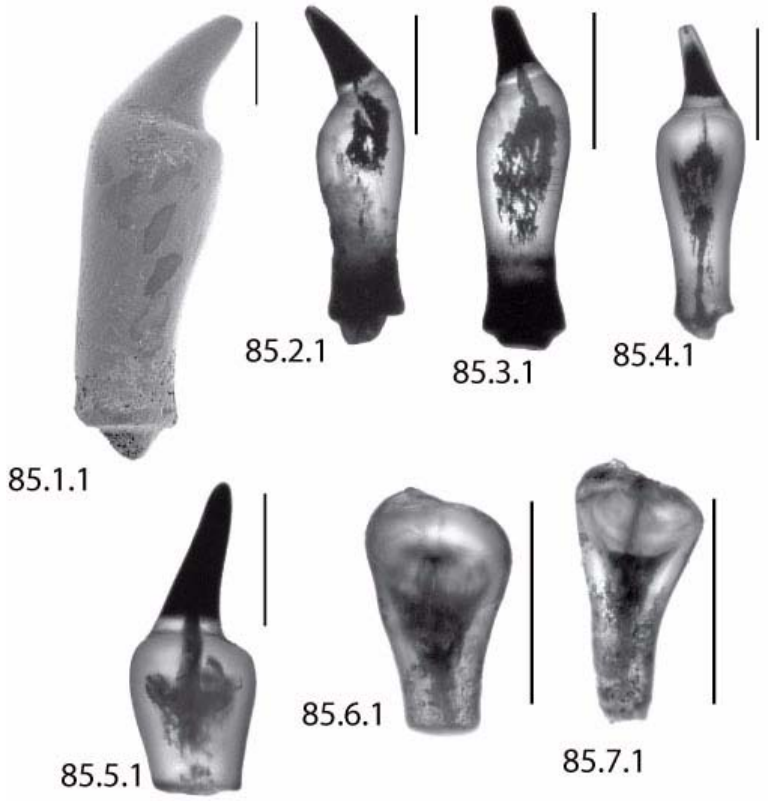

Figure 85. *angled cone and bulbous base* new subtype. **85.1.1.** A SEM image showing tooth external features; GSC 124681. **85.2.1** to **85.7.1.** Transmitted light images showing tooth shape and curvature, prominently shadowed cap, and variations of the inline; GSC 124682 to 124687. Scale bar = 0.4 mm.

spray, basally parallel to outline, thread-like, or broken); inline base may have central basal projection below outline (socket-like?); margins sigmoid-shaped; outline smooth except in most basal region may be stippled or rough-textured; circular cross-section. Tooth cap height/width commonly <2, rarely >2<2.5; tooth base height >1.5 times height of tooth cap.

Remarks: This new subtype is characterized by the bulbous nature of the tooth base, and the angled, prominently shadowed, and curved cap. The bulbous and elongate character may indicate a pharyngeal tooth form. Some teeth (5 specimens and 2 fragments) are taller and narrower and the bulbous nature of the base is not as developed (but still present); the cap is not as darkly shadowed, is taller than wide, and has a moderately acute apex but it still sits at an angle on the base, and has one concave or sigmoid margin and one convex or straight margin.

An undescribed form (Dengler et al. 1975; Plate 5, fig. 5) shows a similar bulbous character but has a different inline that is broad and extends from the base into the cap.

Occurrence: 23 specimens, 33 base fragments, 10 cap fragments; 3 questionable specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, Prometheus H-68, and Zeus D-14; offshore cores END-76B-5 and END-76B-6; Bulbous Base ichthyolith sub-assemblage, mainly Miocene; some in the Pliocene; possibly in the upper Oligocene (may be reworked).

cf. *triangle small top* Ramsey et al. 1976, p. 132; Doyle and Riedel 1979a, p.167
Figure 86

a9/b5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,3/j2/k0/m0/n~1/p0/q0/r0/s1,2/t2,3/z2/cc1/dd1/ee1/ff3/gg1,4,7/hh1.4-2.0/jj5/kk3/mm2.0-2.5/nn<0.18

Appendix 1.6.1

Characters: Tooth triangular with a small cap; height of cap about 1/6 height of base. Cap with shadow, margins straight, height to width ~1:1; apex sharp; transverse line straight across; inline absent. Base with one sigmoid and one convex margin; width at base about 2-2.5 times width at transverse line (basally widens); inline generally solid and near outline; striations may be present

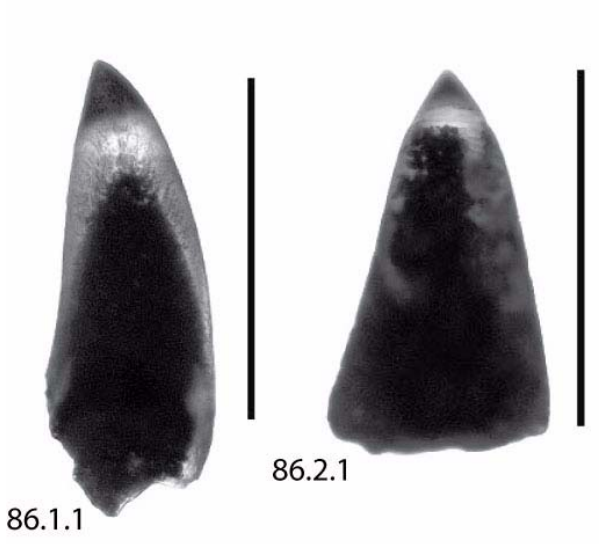

Figure 86. cf. *triangle small top* Ramsey et al., 1976. **86.1.1** and **86.2.1.** Note the small shadowed tooth cap and striations between the inline and outline in the tooth base; GSC 124688 and 124689; scale bar = 0.5 mm.

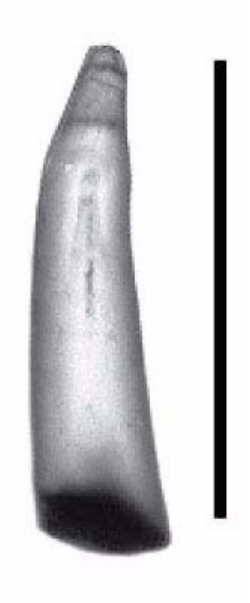

Figure 87. cf. *triangular triangle* Kozarek and Orr, 1980. **87.1.1.** GSC 124690; scale bar = 0.3 mm.

above inline apex; circular to oval cross-section; may have outline stippling and irregular lines.

Remarks: The Shell-Anglo specimen differs from *triangle small top* by having apical shadow, a base inline near the outline, base striations above inline apex, and stippling and irregular lines on the base outline. *Triangle small top* occurs in the Cretaceous through Quaternary (Doyle and Riedel 1979a, p. 166).

Occurrence: 3 specimens; offshore wells Shell-Anglo Prometheus H-68 and Zeus D-14; and offshore core END-76B-6A; Striated Triangle ichthyolith Zone; middle to lower Miocene.

cf. *triangular triangle* Kozarek and Orr 1980, p. 873
Figure 87

a9/b5/c1/d1/e1/f4b/g1/h0/i2,6/j2,3/k0/m0/n>1/p0/q0/r0/s0/t2/z2/cc1/dd1/ee1/ff1/gg1/hh>3/jj2,4/kk2,3/mm1.5/nn0,0.25-0.35

Appendix 1.6.1

Characters: Tooth tall, narrow, and transparent; height to width ratio >4; cap and base separated by a straight-across transverse line. Tooth cap conical; height to width ratio about >1:1; with apical shadow; margins straight or slightly concave or convex; outline smooth; inline absent. Tooth base with circular cross-section; height to width ratio >3; margins straight or slightly concave or convex; outline smooth; inline absent or very low arcuate; some faint shadow zones.

Remarks: The Shell-Anglo specimen differs from *triangular triangle* Kozarek and Orr 1980 by having a transverse line, a circular cross-section (not triangular), and a height to width ratio >5. However, Plate 6, Fig. 10 (Kozarek and Orr 1980) appears to illustrate a tooth height/width ratio >5 and a circular cross-section that is different from the description. *Triangular triangle* ranges in the Oligocene to Quaternary (Kozarek and Orr 1980).

Occurrence: 1 specimen; offshore well Shell-Anglo Apollo J-14; middle Miocene.

Undescribed cone tooth, Form A
Figure 88

a9/b1/c1/d1/e1/f9+12+15+22/g1/h3/i3,10/j6,10/k7/m0/n>2.5/p0/q9,10/r1/s3/t2/z0

Appendix 1.6.1

Remarks: This tooth has many inline to outline striations that radiate from a parallel-sided inline, the cap is small, and the margin curvature is sigmoidal, convex, or concave.

Occurrence: 3 specimens; offshore well Shell-Anglo Apollo J-14 and core END-76B-6A; middle Miocene.

Undescribed cone tooth, Form B
Figure 89

a9/b1,5/c1/d1/e1/f1/g1,6,8/h0,1,5/i2,3/j2,6/k1/m0/n1,2.8/p0/q2,9/r0,1/s1/t2/z0,2/cc0,1/dd0,1/ee0,1/ff0/gg0,3,7/hh1.8/jj3/kk4/mm2.9/nn0.19

Appendix 1.6.1

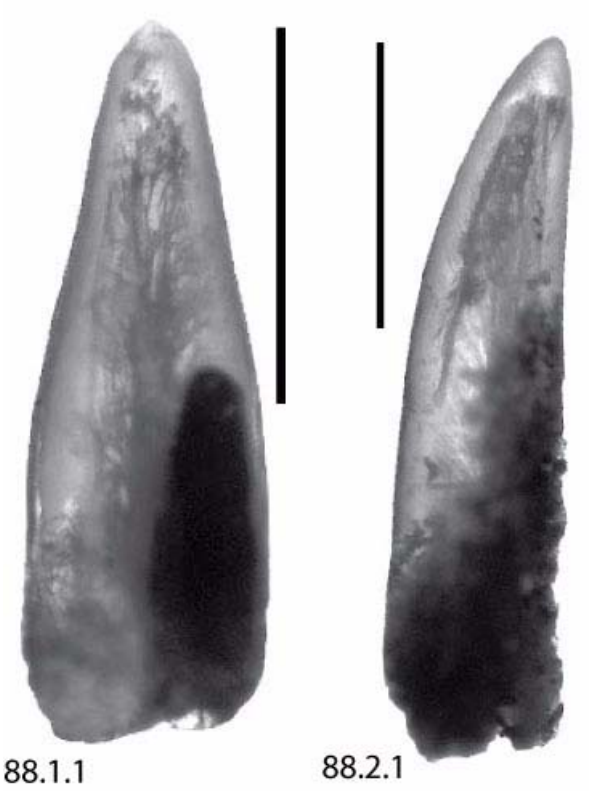

Figure 88. Undescribed cone tooth, Form A. **88.1.1.** and **88.2.1.** Transmitted light images showing tooth striations, parallel-sided inline and margin curvature; GSC 124691 and 124692; scale bar = 0.5 mm.

Figure 89. Undescribed cone tooth, Form B. **89.1.1.** A SEM image showing tooth curvature, vertical lines, and a small conical cap (possible transverse line at arrow); GSC 124693; scale bar = 0.5 mm.

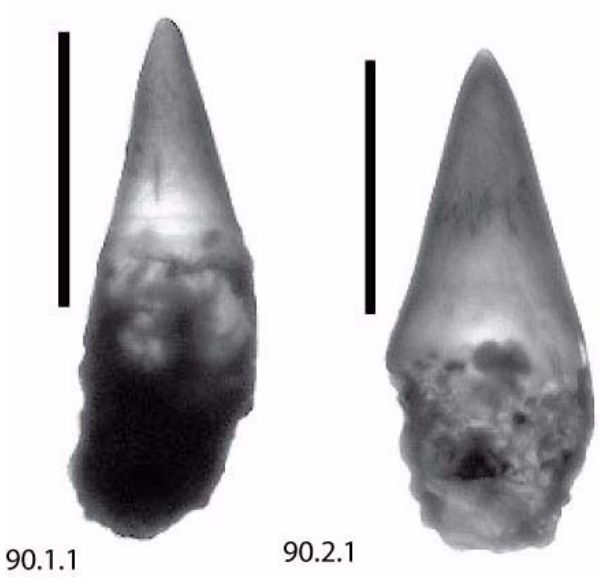

Figure 90. Undescribed cone tooth, Form C. **90.1.1** and **90.2.1.** Transmitted light images showing tooth straight margins, apical shadow and absence of inline; GSC 124694 and 124695; scale bar = 0.2 mm.

Remarks: This tooth is characterized by convex/concave margins and common vertical lines on the outline especially in the basal two-thirds of the tooth. The upper part of the tooth is smooth and unornamented with a possible small conical tooth cap (arrow shows possible transverse line).

Occurrence: 1 specimen; offshore well Shell-Anglo Pluto I-87; Oligocene.

Undescribed cone tooth, Form C
Figure 90

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2/j2/k0/m0/n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by straight margins, an acute apex, apical shadow, and no significant inline in the cap.

Occurrence: 4 specimens; offshore wells Shell-Anglo Cygnet J-100, and Zeus D-14; Miocene and Pliocene.

Undescribed cone tooth, Form D
Figure 91

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,3,5/j6,8/k3+9/m0.25/n3.2/p0/q0,2/r0,1/s1,2/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by apical convex/concave margins, a tall cone apex, and a tall and bowed inline.

Figure 91. Undescribed cone tooth, Form D. **91.1.1.** A transmitted light image showing tooth curvature and bowed inline; GSC 124696; scale bar = 0.5 mm.

Occurrence: 1 specimen; offshore well Shell-Anglo Cygnet J-100; Pliocene.

Undescribed cone tooth, Form E
Figure 92

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,5,3,9,10/ j2,6,9,10/k0,1/m0/n≥1, ≥3/ p0/q0,2/r0,1/s3/t2/z0,2

Appendix 1.6.1

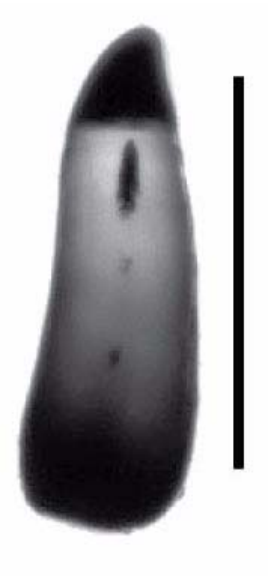

Figure 92. Undescribed cone tooth, Form E. **92.1.1.** A transmitted light image showing tooth curvature, shadowed apex, and possible parallel-sided inline; GSC 124697; scale bar = 0.3 mm.

Figure 93. Undescribed cone tooth, Form F. **93.1.1** and **93.2.1.** Transmitted light images showing tooth curvature and no significant inline in the cap; GSC 124698 and 124699; scale bar = 0.2 mm.

Remarks: This tooth is characterized by a dark shadowed cap, sigmoidal margins, and an irregular possibly parallel-sided inline.

Occurrence: 1 specimen; offshore well Shell-Anglo Cygnet J-100; Pliocene.

Undescribed cone tooth, Form F
Figure 93

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3/j6/k0/m0/ n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by convex/concave margins, an acute apex, apical shadow, and no significant inline in the cap.

Occurrence: 3 specimens; offshore wells Shell-Anglo Apollo J-14, Cygnet J-100, and Prometheus H-68; Pliocene and Miocene.

Undescribed cone tooth, Form G
Figure 94

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3,5/j6,8/k8,9/ m0.13/n2.9/p0/q0,2/r0,1/s1,3/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by some apical convex/concave margins, and a cone inline.

Occurrence: 1 specimen; offshore well Shell-Anglo Pluto I-87; upper Eocene/Oligocene.

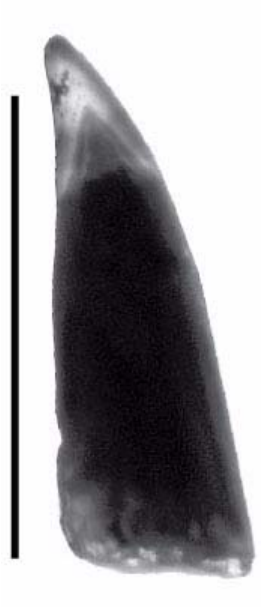

Figure 94. Undescribed cone tooth, Form G. **94.1.1.** A transmitted light image showing tooth curvature and cone inline; GSC 124700; scale bar = 0.5 mm.

Undescribed cone tooth, Form H
Figure 95

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3,9,10/j6,9,10/ k3,8,9/m0/n2-4/ p0/q0,2/r0,1/s1,2/t2/z0,2

Appendix 1.6.1

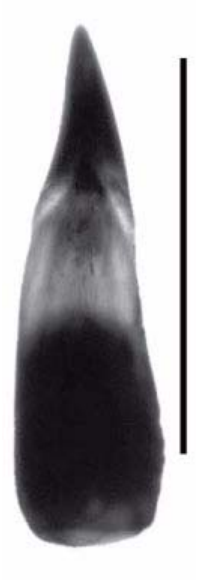

Figure 95. Undescribed cone tooth, Form H. **95.1.1.** A transmitted light image showing tooth curvature, shadowed apex, and bowed inline; GSC 124701; scale bar = 0.5 mm.

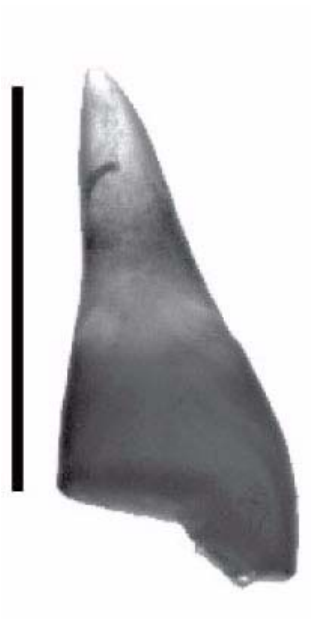

Figure 96. Undescribed cone tooth, Form I. **96.1.1.** A transmitted light image showing tooth curvature and no significant inline; GSC 124702; scale bar = 0.3 mm.

Remarks: This tooth is characterized by sigmoidal margins, a tall shadowed cone apex, and a bowed inline.

Occurrence: 1 specimen; offshore well Shell-Anglo Cygnet J-100; Pliocene.

Undescribed cone tooth, Form I
Figure 96

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,4/i4,9,10/j6,10/k0/ m0/n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by sigmoidal margins and no significant inline.

Occurrence: 1 specimen; offshore well Shell-Anglo Apollo J-14; ?Miocene.

Undescribed cone tooth, Form J
Figure 97

a9/b1,5/c1/d1/e1/f(4a+b)±8/g1/h0,1,5/i2,9,10/ j2,9,10/k7/m0/n≥1/p0/q0,2/r0,1/s1/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by slightly stepped margins (arrows) and a parallel-sided inline in the tooth base.

Occurrence: 1 specimen; offshore well Shell-Anglo Cygnet J-100; lower Pliocene.

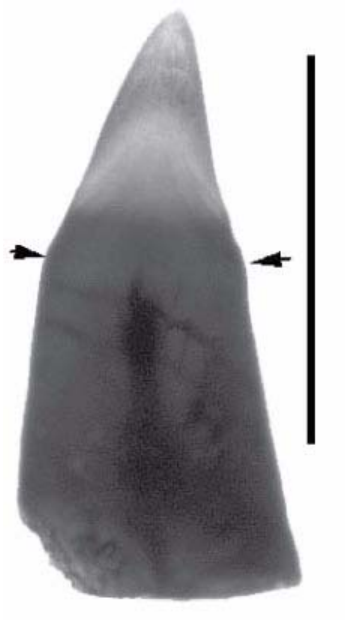

Figure 97. Undescribed cone tooth, Form J. **97.1.1.** Transmitted light image showing slightly stepped margins (arrowed) and a tooth base parallel-sided inline; GSC 124703; scale bar = 0.5 mm.

Undescribed cone tooth, Form K
Figure 98

a9/b1,5/c1/d1/e1/f(4a+b)+8/g1/h1,5/i9,10/j9,10/k0,1/m0/n>2/p0/q0,2/r0,1/s3/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by sigmoidal margins and striations in the tooth base.

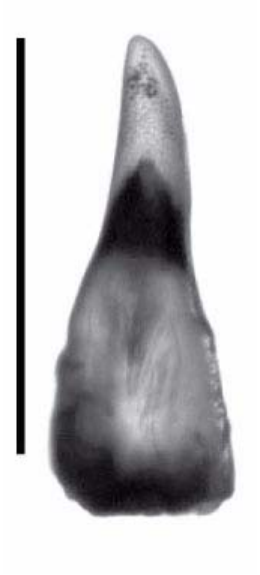

Figure 98. Undescribed cone tooth, Form K. **98.1.1.** Transmitted light image showing tooth curvature and basal striations; GSC 124704; scale bar = 0.5 mm.

Figure 99. Undescribed cone tooth, Form L. **99.1.1.** Transmitted light image tooth curvature and striations between the inline and outline; GSC 124705; scale bar = 0.5 mm

Occurrence: 1 specimen; offshore well Shell-Anglo Zeus D-14; middle to upper Miocene.

Undescribed cone tooth, Form L
Figure 99

a9/b1,5/c1/d1/e1/f(4a+b)+9+11+(14,15)/g1/h0,4/i5/j8/k8,9/m0/n>1,>2/p0/q0,2/r0,1/s1/t2/z0,2

Appendix 1.6.1

Remarks: This tooth is characterized by many striations between the inline and outline (in the cap base) and convex/concave margin and tooth curvature.

Occurrence: 1 specimen; offshore core END-76B-6C; ?Miocene.

Undescribed cone tooth, Form M
Figure 100

a9/b5/c1/d1/e1/f4a+b/g1/h0,1,5/i5/j8/k5,8,9/m0.13/n2.5/p0/q0,2/r0,1/s3/t2/z2

Appendix 1.6.1

Remarks: This tooth is characterized by apical convex/concave margins, cone inline, common apical shadow, and a cylindrical or tubular base.

Occurrence: 1 specimen; offshore well Shell-Anglo Prometheus H-68; Pliocene.

Figure 100. Undescribed cone tooth, Form M. **100.1.1.** A transmitted light image showing tooth curvature and cone inline; GSC 124706; scale bar = 0.4 mm.

Figure 101. Undescribed ichthyolith oddity, Form A. **101.1.1** SEM image showing margins and apex; GSC 124707; scale bar = 0.5 mm.

Other Tofino Basin Ichthyoliths (oddities)

Seven rare and odd Tofino Basin ichthyolith subtypes are not the common triangular tooth shape or elasmobranch teeth or dermal denticles. They are included in this group and are not formally named or described in detail. Ichthyoliths are in CUIIS sequential order.

List of other Tofino Basin ichthyoliths

Type	Ichthyolith	Figure no.
a1/b1	Undescribed ichthyolith oddity, Form A	101.1.1
a1/b1	Undescribed ichthyolith oddity, Form B	102.1.1 and 102.1.2
a12/b1	Undescribed ichthyolith oddity, Form C, "globular dome"	103.1.1 and 103.2.1
a12/b1,2,3	Undescribed ichthyolith oddity, Form D	104.1.1 and 104.1.2
a12/b3	Undescribed ichthyolith oddity, Form E	105.1.1 and 105.2.1
a12/b10	Undescribed ichthyolith oddity, Form F	106.1.1
a15/b10+12	Undescribed ichthyolith oddity, Form G	107.1.1

Undescribed ichthyolith oddity, Form A
Figure 101

a1/b1/c2

Appendix 1.10.1

Remarks: This ichthyolith is asymmetric with a small unornamented cone apex and one widely developed flanged margin.

Occurrence: 1 specimen; offshore well Shell-Anglo Zeus D-14; middle Miocene.

Undescribed ichthyolith oddity, Form B
Figure 102

a1/b1/c3

Appendix 1.10.1

Remarks: This ichthyolith is approximately triangular and has one curved projection on each face. One face is concave and the other is convex. The base is slightly flared and the apex is rounded and blunt.

Occurrence: 1 specimen; offshore well Shell-Anglo Prometheus H-68; Pliocene/Miocene.

Undescribed ichthyolith oddity, Form C, "globular dome"
Figure 103

a12/b1/c3/d0/e0/f0

Appendix 1.8.1

Remarks: The tooth cap is globular dome-shaped; short (height<width); apex bluntly rounded; commonly circular or lobed/globular; commonly

Figure 102. Undescribed ichthyolith oddity, Form B. **102.1.1** and **102.1.2.** SEM images showing margins and apex; GSC 124708; scale bar = 0.2 mm.

translucent; transverse line straight across; and subsurface is flat or concave. The tooth base is minimal; irregularly broken; and commonly wider than cap. The tooth is distinctive from other Cenozoic Tofino Basin subtypes, however, its features appear to be indistinguishable from Paleozoic specimens described by Tway (1983, figs 62 and 63).

Occurrence: 5 specimens, 3 questionable specimens; offshore wells Shell-Anglo Cygnet J-100, Prometheus H-68, and Zeus D-14; middle to upper Miocene and lower Pliocene; questionable specimens in the upper Eocene to lower Miocene.

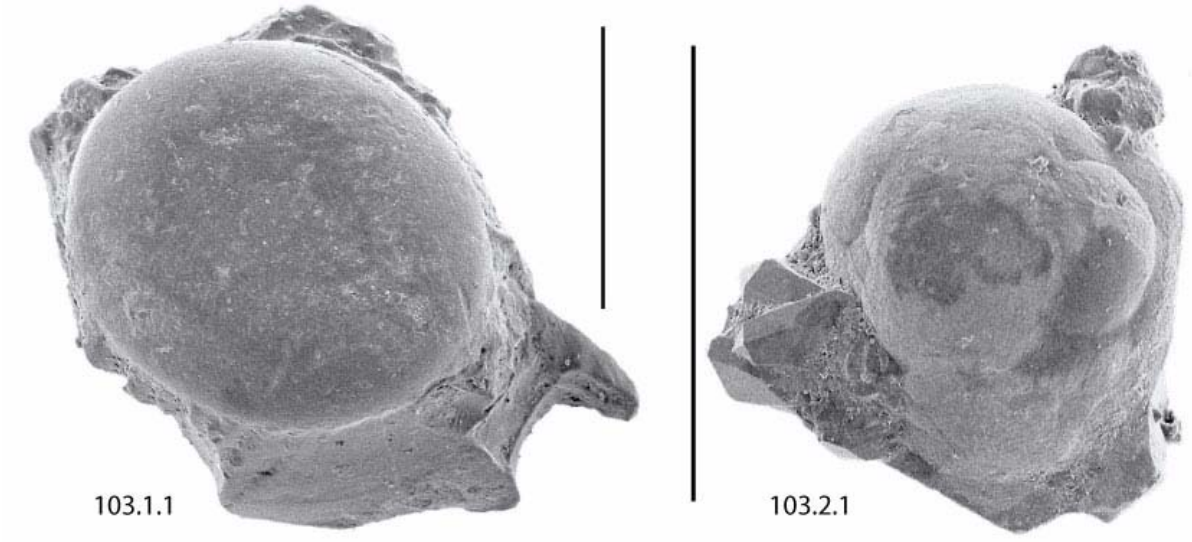

Figure 103. Undescribed ichthyolith oddity, Form C, “globular dome”. **103.1.1** and **103.2.1.** SEM images showing tooth cap and base; GSC 124710 and 124711; scale bar = 0.5 mm.

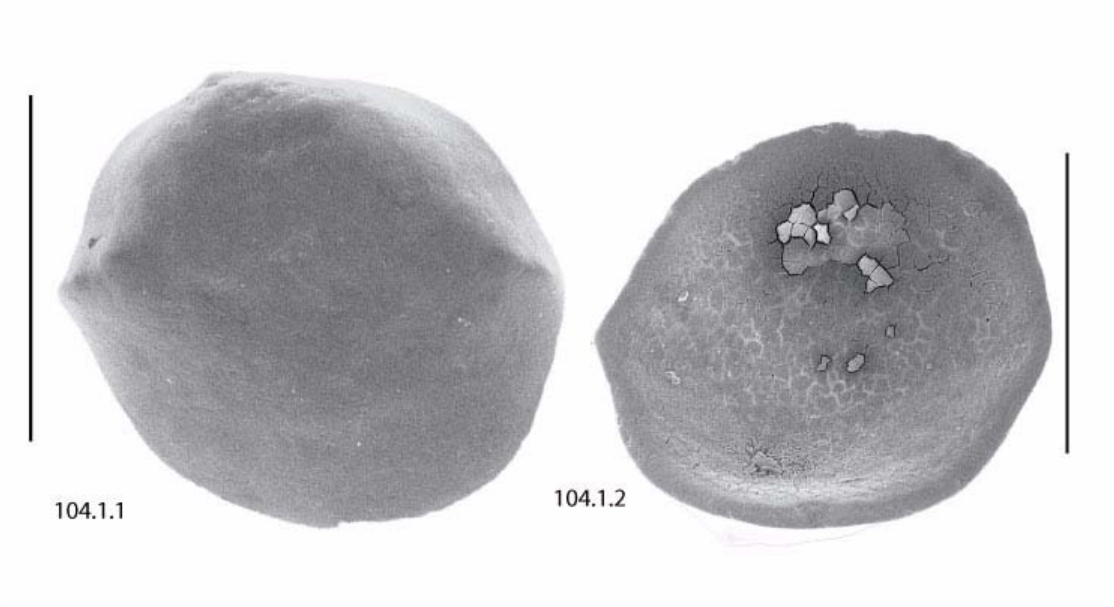

Figure 104. Undescribed ichthyolith oddity, Form D. **104.1.1 and 104.1.2.** SEM images showing tooth cap; GSC 124712; scale bar = 0.5 mm.

Undescribed ichthyolith oddity, Form D
Figure 104

a12/b1,2,3/c3/d1/e2/f3

Appendix 1.8.1

Remarks: An asymmetric dome-shaped tooth with a concave (bowled) subcrown and two short ridges on opposite margins and a possible third on another margin.

Occurrence: 1 specimen; offshore core END-76B-6C; ?Miocene.

Undescribed ichthyolith oddity, Form E
Figure 105

a12/b3/c1/d1/e1,3/f≤5

Appendix 1.8.1

Remarks: A pyramidal to dome-shaped ichthyolith with an acute or rounded apex and ridges that diverge from the apex to the base. As many as six faces are on the ichthyolith bordered by the ridges.

Occurrence: 2 specimens; Hesquiat Peninsula and offshore well Shell-Anglo Pluto I-87; upper Eocene/Oligocene or reworked from older strata.

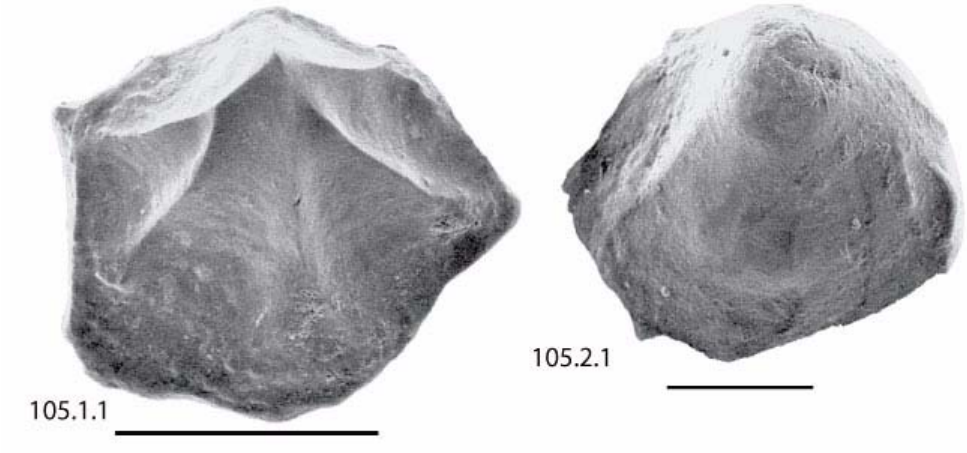

Figure 105. Undescribed ichthyolith oddity, Form E. **105.1.1.** and **105.2.1.** SEM images showing ichthyolith ridges and aces; GSC 124713 and 124714; scale bar = 0.2 mm.

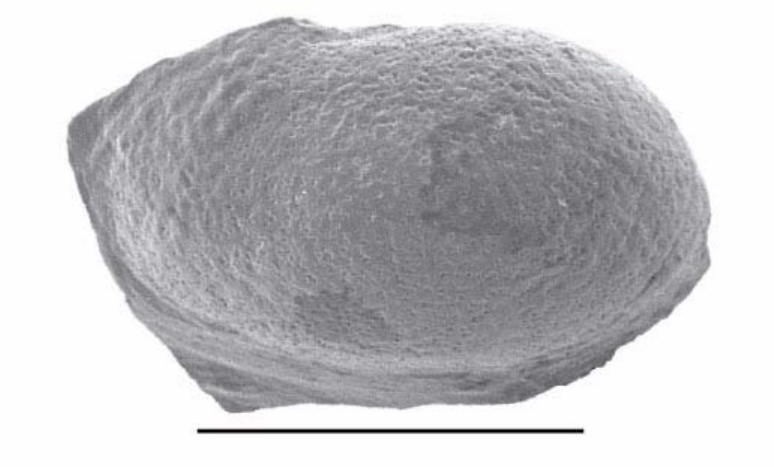

Figure 106. Undescribed ichthyolith oddity, Form F. **106.1.1.** SEM image showing upper surface and ornament; GSC 124715; scale bar = 0.5 mm.

Undescribed ichthyolith oddity, Form F
Figure 106

a12/b10

Appendix 1.8.1

Remarks: An asymmetric dome-shaped and rounded ichthyolith with an abundant pitted and stippled surface.

Occurrence: 1 specimen; offshore well Shell-Anglo Zeus D-14; middle to upper Miocene.

Undescribed ichthyolith oddity, Form G
Figure 107

a15/b10+12

Appendix 1.9.1

Remarks: Possible bony fragments of a plated or bar-shaped tooth, with abundant pitted and rounded stipples, and well raised irregular ridges.

Occurrence: 3 specimens; offshore wells Shell-Anglo Zeus D-14 and Zeus I-65; middle to upper Miocene and Pliocene.

SUMMARY AND DISCUSSION

Since the 1970s, usage of ichthyoliths (microscopic fish teeth, scales, and dermal denticles) for biostratigraphic studies has expanded from Cenozoic deep-sea core studies to those that include other environments and ages in the Cenozoic, Mesozoic, and Paleozoic (Table 1). Ichthyoliths have a calcium phosphate chemistry that makes

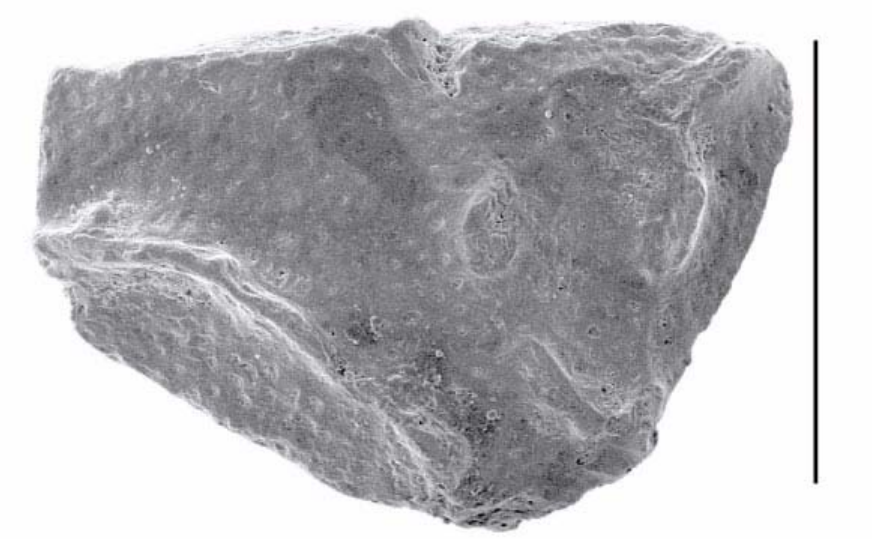

Figure 107. Undescribed ichthyolith oddity, Form G. **107.1.1.** SEM images showing ridges, stipples, and pits; GSC 124716; scale bar = 0.5 mm.

them more resistant to dissolution than many other fossils and a heavier specific gravity than many sediment particles, resulting in their concentration under certain depositional conditions. These factors offer new opportunities to better understand sedimentary processes, and date and correlate strata where ichthyoliths and not other fossils may be present. In this study, identifying, describing, and illustrating Tofino Basin ichthyoliths is the first stage for biostratigraphic study. The next stage follows with interpreting fossil ranges and environments, geology, and dating and correlating marine Tofino Basin strata. These data and interpretations are important to build basin models for assessing petroleum potential in the Tofino Basin, British Columbia.

This paper and catalogue include identification, description, and illustrations of 99 species, forms, or subtypes (17 new) of in situ upper Eocene to Pliocene and transported/reworked Cretaceous-Eocene Tofino Basin ichthyoliths. Some of the elasmobranch (shark) ichthyoliths are identified from the families Lamnidae, Scyliorhinidae, and Rajidae and Superorder Squalomorphii. Several of the Oligocene and Miocene Tofino Basin ichthyoliths are compared with similar faunas and stratigraphic intervals in deep-sea core sediments.

Tofino Basin ichthyoliths are correlated with foraminifers from the same samples and are correlated with other Pacific Northwest and Arctic foraminifer zones. With this foraminifer stratigraphic, age, and paleoenvironment control and also correlation with dated deep-sea ichthyoliths, distinct Tofino Basin indicator ichthyoliths are recognized for upper Eocene to Pliocene intervals (Figure 2.2).

Additional ichthyolith materials (slides from 200-300 samples) were reviewed from the Queen Charlotte and Nanaimo basins when potentially reworked Cretaceous ichthyoliths were discovered in some of the Tofino Basin samples. The specimens provide comparative identification materials and will contribute important data for analysis of basin processes and stratigraphic correlation.

Identifying and naming disarticulated fish teeth and scales is a common problem. The coded utilitarian ichthyolith identification system (CUIIS), developed by Doyle et al. 1974, provides a method to identify ichthyoliths and proceeds with biostratigraphic studies. Since its inception, modifications and updates to the system have been documented by many users of the system. In this paper, the coded system is used, further modifications are made to include new Tofino Basin subtypes, and the part relevant to Tofino Basin ichthyoliths is included herein and digitized (Appendix 1). Through electronic publishing we are testing its application. The electronic media allows use of the key and provides a link to the taxon illustration and description that are together on one or two pages in the catalogue. Because the catalogue is digitized, the user can reorganize it to their preference.

Tofino Basin ichthyoliths are grouped into elasmobranch teeth, elasmobranch dermal denticles, triangular teeth with canals, triangular flanged teeth, triangular flexed teeth, cone teeth, and other ichthyoliths. Within each group, the ichthyoliths have some morphological similarities. Differences between groups may represent functional differences (e.g., dermal denticles, scales, and teeth) and/or differences in species. However, until articulated fossil fish are found which allow confirmation of the association of different ichthyoliths, associations remain speculative.

Some ichthyolith morphologies are known to occur in certain Mesozoic-Cenozoic fishes such as elasmobranch teeth and dermal denticles, and actinopterygian cone teeth. The distribution pattern of Tofino Basin ichthyoliths indicates: 1) a predominance of elasmobranch dermal denticles and teeth from reworked Cretaceous-lower Cenozoic intervals; and 2) in situ ichthyoliths such as teeth with canals, flexed teeth, and some elasmobranch teeth and dermal denticles in upper Eocene and Oligocene strata. In the Miocene interval, the older faunas are replaced by mainly actinopterygian (teleost) cone teeth. The reworked Cretaceous ichthyoliths and the faunal change across the Oligocene/Miocene interval corresponds to regional geologic and tectonic activity that affected water depth, environments, and strata within the Tofino Basin. In addition, a global climatic cooling trend was occurring from the Oligocene through Pleistocene.

Over 3,100 onshore outcrop and offshore subsurface samples are used in this study. Rare but moderately diverse ichthyoliths are indicated mainly in fine-grained shale, mudstone, and siltstone samples of bathyal environments. Three coarser-grained (lag or turbidite) outcrop samples contain common and reworked Cretaceous-Eocene ichthyoliths from proximal or nearshore environments. Future sampling for ichthyoliths in certain coarser-grained sediments may produce additional important fossils and data to interpret sedimentary basin and geological processes.

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Coded Utilitarian Ichthyolith Identification System

In the 1970's and 1980's William Riedel foresaw the importance of computerizing microfossil identification. He and his students (e.g. Patricia Doyle, Linda Tway, and others) developed the original coded utilitarian ichthyolith identification system. Important to identifying ichthyoliths are the descriptors and illustrations, and the coded linkages which are essential to systemize the process and organize the information. Linda Tway contributed three dimensional descriptions of ichthyoliths, updated the identification system, and developed an early computer key, database and image system. The hard work by Patricia Doyle and Linda Tway, led by William Riedel, has raised awareness of ichthyoliths. This fossil group now has valuable utility in biostratigraphy, paleoceanography, and deep-sea to basin and coastal studies.

Presentation of this paper

Jennifer Rumford and the editors of *Palaeontologia Electronica* recognized the importance of ichthyolith studies and have given us the opportunity to bring part of the original and revised coded ichthyolith identification system to the Internet so that anyone may have the opportunity to explore the system's utility. This was no easy task. Jennifer Rumford spent many volunteer hours adapting this paper to the Internet, creating hyperlinks between the ichthyolith types, images, key, and references, and partitioning the paper into hyperlinked chapters. Her time, dedication, and tenacity to get the job completed are admirable. Her skills in communication and presentation are substantial, as is her knowledge.

Author roles

M.J. Johns completed all Tofino Basin ichthyolith research, systematics, identifications, descriptions, illustrations, and modifications to the original coded utilitarian ichthyolith identification system. C.R. Barnes developed the proposal for micropaleontologic and stratigraphic studies of the offshore basins, secured funding for this study through the Coasts Under Stress Project, and provided initial critical review of the manuscript. Y.R. Narayan provided an updated foraminifer zonation and included Tofino Basin foraminifer results from her M.Sc. thesis research (University of Victoria).

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APPENDIX 1.0
The "Coded Utilitarian Ichthyolith Identification System" (CUIIS)

Introduction

The coded utilitarian ichthyolith identification system was developed by Doyle et al. 1974 to provide a method to identify disarticulated fish remains (e.g. fish teeth and scales) when Linnean binomens could not be used or applied. The system was modified and updated to accommodate new subtypes by Dunsworth et al. 1975; Ramsey et al. 1976; Doyle et al. 1978; Doyle and Riedel 1979a, 1985 a and b; Tway 1979, 1984; Kozarek and Orr 1980; Gottfried et al. 1984a; Tway et al. 1985; Winfrey et al. 1987; Gupta 1991; Gebhardt 1986; Johns 1993; and Johns et al. 1997 (Table 1). Also, the CUIIS has been used by others to identify new and existing ichthyoliths and document and correlate their distribution (Dengler et al. 1975; Edgerton et al. 1977; Doyle and Riedel 1979b, 1980, 1981; Kaneps et al. 1981; Gottfried et al. 1984b; Hart and Mountain 1987; Doyle 1988; Tway and Zidek 1982, 1983; and Firth and Hull 1993; Table 1).

The CUIIS uses letters and numbers that are coded to important characteristics of ichthyoliths. At the highest level "a" (step 1), different characters describe the shape of the outline of the ichthyolith (Appendix 1.1). Each of the different characters under "a" is numbered. At the next level "b" (step 2), prominent features on the outline of the ichthyolith or crown are recognized (Appendix 1.2). Similarly, each of the different characters is numbered. The sequence of both "a" and "b" characters and numbers form an ichthyolith "Type". All other levels below this ("c" and downward to "zz" – if needed) determine the character of the "subtype". A code may look like: a2/b2±6/c2-5/d1/e1/f2/g2/h1/ i3+8/ j≥3. A forward slash "/" separates each letter and number character state. A "," indicates that either one of the characters may be present, a "+" indicates that both characters are present, a "±" indicates that the second character may or may not be present, a "-" indicates a range, and a "≥" indicates a number greater than or equal to the number given. The reader is encouraged to refer to the references (above and Table 1) for further details on the CUIIS.

Tofino Basin ichthyolith study

Relevant ichthyolith subtype descriptors and line drawings from the original CUIIS (e.g. Doyle et al. 1974; Doyle and Riedel 1979a) and later relevant revisions to the system (e.g. Table 1) are included in parts 1 and 2 of this Appendix to facilitate identification of Tofino Basin ichthyoliths. Table 1 lists previous papers that use or revise CUIIS. A footnote number (Table 1) is provided for each paper so that original material (e.g. previously used descriptors and/or line drawings) can be acknowledged. Not all ichthyolith subtypes, descriptors, and line drawings are included in the Tofino Basin CUIIS version but most could be added in future. The Tofino Basin CUIIS version provides digital/ electronic linkages between the taxa listed in the Appendices, CUIIS descriptors, line drawings and code, and ichthyolith descriptions and images (systematics section). Also, the key uses both two and three dimensional ichthyolith descriptors (e.g. Doyle et al. 1974; Doyle and Riedel 1979a; Tway 1979, 1984) in addition to new information. New line-drawings of ichthyoliths incorporate new or clarify old characteristics and express the relative dimensional (e.g., length vs. width) shapes of ichthyoliths.

To begin identifying an ichthyolith, first select from the "a. General outline" (Appendix 1.1) and then character(s) from "b. Features on the upper crown surface" (Appendix 1.2). These two parts of the code form the "Type". Next select the appropriate Type from Appendix 1.3 to 1.10. Then work through each of the type characteristics to determine a subtype and code.

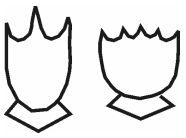
Appendix no.	Name	Contents
1.0	Introduction	Introduction to using CUIIS.
1.1	General outline	a. General outline (lists characters)
1.2	Upper crown features	b. Features on the upper crown surface (lists characters)
1.3	Type a2	Type a2/b(1,2)±6±10±12±13 key and list of taxa
1.4	Type a3,4	Type a3,4/b(1,2)±6±7±10±12 key and list of taxa
1.5	Type a8	Type a8/b1,5±8 key and list of taxa
1.6	Type a9	Type A9/b1,(±2±3±5±7±8±9±10±11±12) key and list of taxa
1.7	Type a11	Type a11/b(1,2,3)±6±8±10±12 key and list of taxa
1.8	Type a12	Type a12/b1,2,3 key and list of taxa
1.9	Type a15	Type a15/b1,2±6±7±10±12 key and list of taxa
1.10	Type a1	Type a1 list of taxa

APPENDIX 1.1

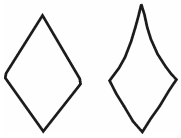
Coded utilitarian ichthyolith identification system step 1. To determine the "**general outline**" of the ichthyolith, select one or more characters from the list below. [2]

a. General outline: [2]

0. indeterminate
1. none of the following [2, 8, 9, 19, 31]
2. elliptical or lanceolate, one edge acutely dentate; may have platform or pedicle [2, 4, 8, 9, 19, 31, 32]

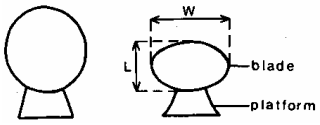


3. polygonal without a platform or pedicle [2, 9, 19, 31]



4. lanceolate or somewhat polygonal with a platform or pedicle [2, 9, 19, 31]

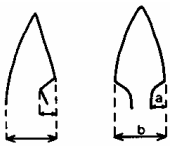
5. circular to elliptical with a platform or pedicle; if elliptical, width greater than length [2, 8, 9, 19, 31]



6. elliptical with a platform or pedicle; length greater than width [2, 8, 9, 19, 31]

7. approximately triangular with two or three lateral projections [9, 19]

8. approximately triangular with straight or curved axis, and with a prominent angular flexure (*a* must be at least 0.2 the length of *b*) of one or both margins [2, 8, 9, 19]



9. approximately triangular or conical with straight or curved axis, and without prominent flexure of either margin [2, 8, 9, 19]

10. multicuspid with cusps of equal size [9, 19]

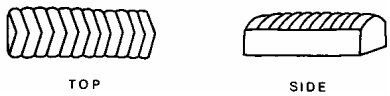
11. multicuspid with cusps of unequal size [9, 19]

12. dome-shaped [9, 19]

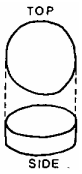
13. mushroom-shaped with rounded or flattened surface, with a platform or pedicle [9, 19, 31, 32]

14. pyramid-shaped [9, 19]

15. bar-shaped [9, 19]



16. circular to subcircular without a platform or pedicle[19, 31]



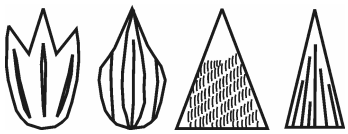
17. Sail-shaped, crown triangular, taller than wide, and with curved diagonal on a flaring pedicle that is broader at its basal edges than crown [30, 31]

APPENDIX 1.2

Coded utilitarian ichthyolith identification system step 2. To determine the "**features on the upper crown surface**" of the ichthyolith, select one or more characters from the list below. [2, 31]

b. Features on the upper crown surface (within or on the outline and excluding the tooth base or scale base/pedicle) [2, 19, 31, 32]

0. indeterminate
1. none of the following [2, 8, 9, 19, 31]
2. parallel or subparallel lines, ridges, and (or) keels; which if they radiate, radiate from an edge or from a point on the margin [2, 8, 9, 19, 31]



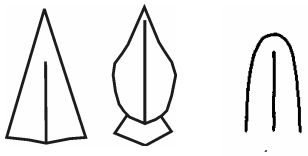
3. lines or ridges radiating from approximate centre of crown [2, 8, 9, 19, 31]

4. in an elliptical or subcircular form, one single or double, straight or arcuate line or ridge across greatest dimension [2, 8, 9, 19]

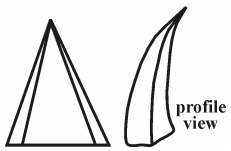
5. in triangular forms, a transverse line (the transverse line is the nearest line to the base that extends at least from one side of the inline to the other; and may extend to one or both outline margins); frequently the transverse line separates the tooth crown from the tooth base [2, 8, 9, 19]

6. a distinct curved or undulating line or ridge approximately parallel to a curved, undulating or dentate edge [2, 8, 9, 19, 31]

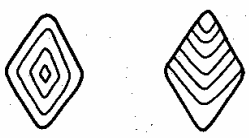
7. one median line, ridge, or keel [2, 8, 9, 19, 32]



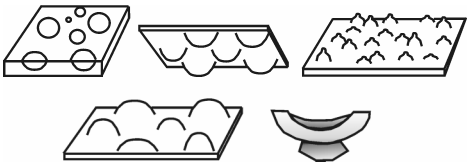
8. in triangular forms, a flanged occlusal crest that forms a cutting edge on two margins of tooth; it extends from tooth crown apex to its base on both margins [32]



9. concentric lines [9, 19]

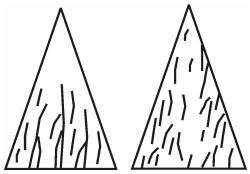


10. pores, pitted, stippled or nodular surface, or central depression [19, 22, 32]



11. granular surface [31]

12. short or long irregular lines or ridges, may bifurcate basally [32]



13. scalloped texture [32]

APPENDIX 1.3.0

Type a2/b1,2±6±10±12±13

General outline elliptical or lanceolate with one edge acutely dentate. May have a platform or pedicle. Upper crown surface variably ornamented.

List of Tofino Basin subtypes a2/

a2/b2±6/c3/d1,2/e1/f1,2/g1/h2,3/i2,10/j3-5/k0/l0/m1,2,5/n2+11/p0/q0/r0/s1 *short side peaks differentiated margin* Doyle, Kennedy and Riedel, 1974

a2/b2+6±12/c3/d1/e1/f1,2/g1/h1,2,3/i2+11+14/j3-5/k0,5,10/l3/m1/n11+15/p3/q0,1/r0,1/s1 *three peaks forked median ridge* new subtype

a2/b±2+10/c>2/d1.0-1.5/e1/f1-3/g1/h1/i2+15/j0-3/k0/l0,3/m0,4/n1/p3 undescribed elasmobranch dermal denticle, Form B

APPENDIX 1.3.1

Type a2/b1,2±6±10±12±13

General outline elliptical or lanceolate with one edge acutely dentate. May have a platform or pedicle. Upper crown surface variably ornamented.[32]

c. Number of peaks on posterior (dentate) margin (edge) [2, 8, 9, 19, 31]

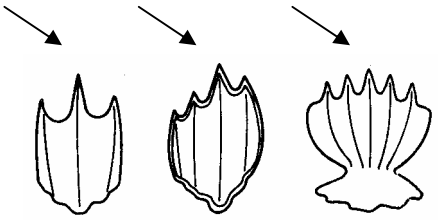
0. indeterminate [2, 9]

1. one (inapplicable, see Type a3,4) [2, 9, 19]

2. two [2, 9, 19]

3. three [2, 9, 19]

etc. [2, 9, 19]

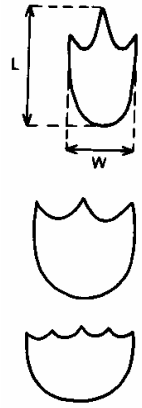


d. Length/width ratio of crown [2, 8, 9, 19]

0. indeterminate [2, 8, 9]

1. length greater than width [2, 8, 9, 19]

2. length approximately equal to width [2, 8, 9, 19]



3. length less than width [2, 8, 9, 19]

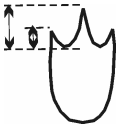
e. Crown symmetry (skewness) [2, 8, 9, 19, 31]

0. indeterminate [2, 8, 9]

1. crown symmetrical on both sides of median plane [8, 9, 31]

2. crown asymmetrical [8, 9, 19, 31]

f. Peak size; median peak in relation to lateral peaks [2, 8, 9, 19]



0. indeterminate [2, 8, 9, 19]

1. median peak less than twice length of lateral peaks [2, 8, 9, 19]

2. median peak twice to three times length of lateral peaks [2, 8, 9, 19]

3. median peak more than three times length of lateral peaks [2, 8, 9, 19]

4. median peak shorter than lateral peaks [19]

g. Depressions between peaks [2, 8, 9, 19]

0. indeterminate or none of the following [2, 8, 9, 19]

1. U-shaped [2, 8, 9, 19]

2. V-shaped [2, 8, 9, 19]

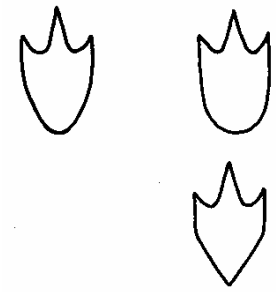
3. slit-like [2, 8, 9, 19]

h. Anterior crown margin opposite peaks [2, 8, 9, 19, 31]

0. indeterminate or none of the following [2, 8, 9, 19]

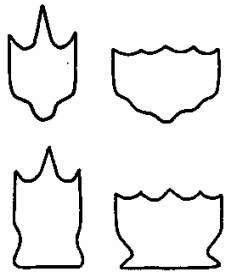
1. rounded [2, 8, 9, 19]

2. approximately V-shaped [2, 8, 9, 19]



3. irregular, uneven, or undulating (may have mesial protrusion) [2, 8, 9, 19, 31]

4. flared into an irregular structure [2, 8, 9, 19]



i. Features present on upper crown surface [2, 8, 9, 19, 31]

0. indeterminate, absent, or none of the following [2, 8, 9, 19, 22]

1. tridentate feature at crown anterior margin [9, 19, 31]

2. parallel or subparallel lines, ridges, or keels which do not converge [2, 8, 9, 19, 31]

3. subparallel lines, ridges, or keels converging at anterior margin (end opposite peaks) [2, 8, 9, 19, 31]

4. subparallel lines, ridges, or keels converging at posterior margin with peaks [2, 8, 9, 19, 31]

5. narrow differentiated area along all margins [2, 8, 9, 19, 31]

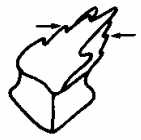
6. network of fine, transverse secondary lines [2, 8, 9, 19,]

7. dendritic pattern of secondary lines [2, 8, 9, 19]

8. scalloped pattern of secondary lines [2, 8, 9, 19]

9. toothed keels [19]

10. faint and often non-continuous line parallel to anterior crown margins [31, 32]



11. prominent and continuous line, ridge or keel parallel to anterior crown margins [31, 32]

12. lines, ridges or keels which curve over crown anterior and posterior margins [31, 32]

13. median keel or platform that is more raised and broader than lateral lines, ridges, keels or platforms [31, 32]

j. Number of lines, ridges, or keels on upper crown surface (includes those forming the mesial platform) [9, 19, 31]

0. indeterminate or absent [9, 19, 31]

Recorded as numbers [19, 31]

k. Outline of pedicle base subsurface [9, 19, 31]

0. indeterminate or none of the following [9, 19, 31]

1. circular to subcircular [9, 19]

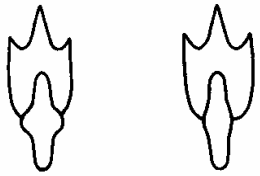
2. triangular with apex pointing anteriorly [9, 19]

3. triangular with apex pointing posteriorly [9, 19]

4. very elongated below crown [9, 19, 31]

5. square, rhombic to cruciform [9, 19]

6. ovoid to cruciform [9, 19]



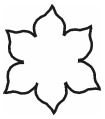
7. irregular [19]

8. crescentic [19]

9. lobed [19]

10. tetrapetaloid [31, 32]

11. multi-petaloid [31, 32]



l. Size of pedicle (at anterior and sides) [9, 19, 31]

0. indeterminate [9, 19]

1. pedicle wider than crown [9, 19, 31]

2. pedicle same width as crown [9, 19, 31]

3. pedicle narrower than crown [9, 19, 31]

m. Features on subcrown [31]

0. indeterminate or none of the following [31]

1. absent (smooth) [31, 32]

2. one median line, ridge, keel, or platform [31, 32]

3. two lines, ridges, keels, or platforms [31, 32]

4. three or more short parallel to subparallel lines, ridges, or keels which commonly do not exceed one half crown length [31, 32]

5. three or more long parallel to subparallel lines, ridges, or keels which commonly exceed one half crown length and often extend from posterior pedicle margin to posterior crown margin or apex [31, 32]

6. curved line, ridge, or keel near subcrown centre posterior region around pedicle [31, 32]

7. curved depression surrounding junction of crown and pedicle [31, 32]

n. Upper crown mesial platform (or differentiated structure) [31]

0. indeterminate or none of the following [31]

1. absent or considerably reduced [31, 32]

2. line, ridge, or keel [31, 32]

3. narrow and elongate lanceolate (rounded anterior margin, pointed posterior margin), (greater than five times longer than wide) [31, 32]

4. elongate lanceolate (three to five times longer than wide) [31, 32]

5. lanceolate (greater than one to less than three times longer than wide) [31, 32]

6. broad lanceolate (equally as long as wide, or wider than long) [31, 32]

7. narrow and elongate rhomboid (greater than five times longer than wide) [31, 32]

8. elongate rhomboid (three to five times longer than wide) [31, 32]

9. rhomboid (two to three times longer than wide) [31, 32]

10. broad rhomboid (equally as long as wide, or wider than long) [31, 32]

11. long, extends anterior to posterior (greater than one half crown length) [31, 32]

12. short, (less than or equal to one half crown length) [31, 32]

13. with internal lines, ridges, or keels (which are not closely paired) [31, 32]

14. with closely paired lines, ridges, or keels [31, 32]

15. single ridge that forks near the anterior margin [31, 32]

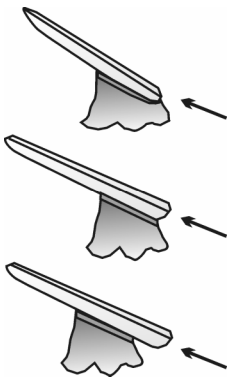
p. Anterior crown overhang of pedicle/crown junction [31]

0. indeterminate [31]

1. absent (crown drops obliquely or vertically to pedicle) [31, 32]

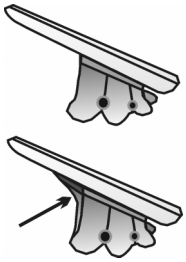
2. minor (crown slightly curves under to pedicle) [31, 32]

3. prominent (crown significantly under to pedicle) [31, 32]



q. Pedicle type [31]

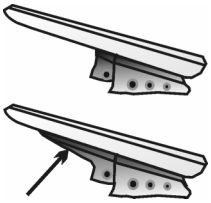
0. indeterminate or none of the following [31]



1. tetrahedroid [31, 32]

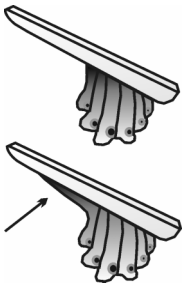
2. keeled tetrahedroid [31, 32]

3. expanded tetrahedroid [31, 32]



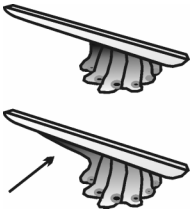
4. keeled expanded tetrahedroid [31, 32]

5. tall trunk [31, 32]



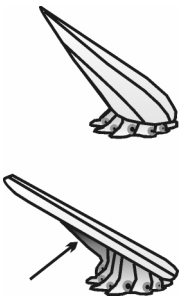
6. keeled tall trunk [31, 32]

7. trunk-like [31, 32]



8. keeled trunk [31, 32]

9. short trunk [31, 32]



10. keeled short trunk [31, 32]

r. Pedicle subsurface [31]

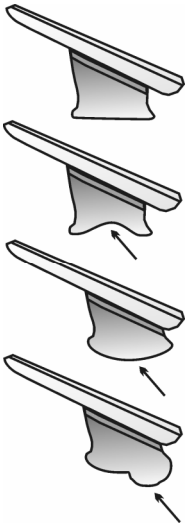
0. indeterminate or none of the following [31]

1. flat [31, 32]

2. concave [31, 32]

3. convex [31, 32]

4. convex with bulge to one side [31, 32]



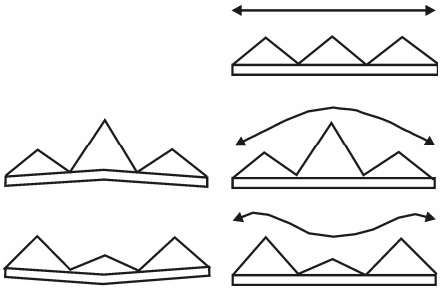
s. Crown curvature from side edge to edge (crown viewed in cross-section from side-to-side) [31]

0. indeterminate or none of the following [31]

1. approximately flat (may be equally undulating) [31, 32]

2. convex (may be undulating, but mesially highest) [31, 32]

3. concave (may be undulating, but mesially lowest) [31, 32]



APPENDIX 1.4.0

Type a3,4/b(1,2)±6±7±10±12

Lanceolate to polygonal shaped with one apex/acute prominence. With or without various crown ornament. May have pedicle, platform, or base.

List of Tofino Basin subtypes a3,4/

a3/b2±12/c3/d5+6/e1/f1/g1+2/h3/i1.3-1.5/j3 cf. *rhombus kite* Gupta, 1991

a4/b2±6/c3/d2+3/e2/f3/g1+2/h1,2,3/i1-2/j3 *kite-shaped longitudinal line* Doyle, Kennedy, and Riedel, 1974

a4/b2±6/c3/d3/e1,2/f3/g1+4/h1/i1-1.5/j3,4 cf. *kite-shaped longitudinal line* Doyle, Kennedy, and Riedel, 1974

a4/b2±6±12/c2,4/d4±(7,8)+10±13/e3/f3,4/g1/h1,2/i1,2/j(4,5,6)+11+13/k0, 1,2,4±8/l1,2/m0,9/ n0,3,4 *pointed and skirted* Doyle, Dunsworth, and Riedel, 1978

a4/b2+6/c2/d4+8+10/e1,3/f4/g1,2/h2/i1/j(5,9)+11+13/k1,8/l2/m9/n3,4? cf. *pointed and skirted* Doyle, Dunsworth, and Riedel, 1978

a4/b6+8/c2/d2+8/e1/f0/g1,2/h1/i1,2/j2+(11,12)/k1/l3/m0/n1 *Raja* sp. A (Figure 14.1-14.4)

a4,6/b1/c2/d1/e0/f3,4/g3/h1/i1/j1/k1/l3/m0,1/n0,1 cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1985

Undescribed forms:

a3,4/b2/c2/d4+10/e2,3/f0/g0/h2/i1/j2+11/k3/l0/m0/n0 or a11/b2/c2/d0/e1/f3/g1/h2/i4+8/j4 undescribed elasmobranch dermal denticle or tooth, Form B

a4/b1,2/c2/d1,4/e1,3/f0/g0/h0,1/i1/j6+12+13/k1/l2/m0/n0 undescribed elasmobranch dermal denticle, Form C

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j(1,2)+11/k1/l2/m0/n0 undescribed elasmobranch dermal denticle, Form D

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j1+12/k1/l2/m0/n0 undescribed elasmobranch dermal denticle, Form E

a4/b2+6/c2/d4+8/e3/f0/g0/h1/i1/j6+12+13/k2/l3/m0/n0 undescribed elasmobranch dermal denticle, Form F

a4/b2+6±12/c2/d4+8+10+13/e3/f8/g3/h1,2/i1/j5+11+15/k2/l3/m1/n1 undescribed elasmobranch dermal denticle, Form G

a4/b(2,7)+6/c2/d(2,4)+8+10/e0,2/f3,4/g2,3/h1/i1,4/j2+11/k2/l1/m9/n2 undescribed elasmobranch dermal denticle, Form H

a4/b2+10/c2/d4+10+14/e3/f0/g2/h1/i1,4/j4+11+13/k4,5/l1,2/m0,2/n0 undescribed elasmobranch dermal denticle, Form I

a4/b2+13/c2/d4+12/e3,4/f0/g0/h1/i1/j0/k1/l1/m0/n0 undescribed elasmobranch dermal denticle, Form J

a4/b6+7/c2/d2+8/e1/f8/g3/h1/i1,2/j2+11/k1,2/l3/m1/n1 undescribed elasmobranch dermal denticle, Form K

APPENDIX 1.4.1

Type a3,4/b(1,2)±6±7±10±12

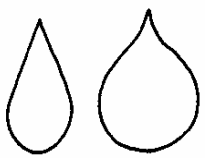
Lanceolate to polygonal shaped with one apex/acute prominence. With or without various crown ornament. May have pedicle, platform, or base. [31]

c. **Shape of the crown** [2, 9, 31]

0. **indeterminate or none of the following** [9, 19]

1. **not used** [32]

2. **lanceolate** [2, 8, 9, 19, 32]



d. Features on upper crown surface [31]

0. indeterminate or none of the following [2, 8, 9, 19]

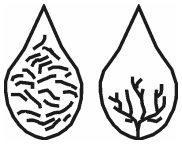
1. absent (smooth) [8, 9, 19, 31, 32]

2. one median line, ridge, keel, or platform [7, 8,19, 31, 32]

3. two lines, ridges, or keels [9, 19, 31, 32]

4. three or more parallel to subparallel lines, ridges, or keels which do not converge centrally [8, 9, 19, 31, 32]

5. three or more parallel to subparallel lines, ridges, or keels which converge centrally [9, 11, 19, 31]



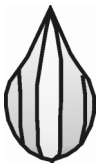
6. irregular network of lines, or dendritic lines [8, 9, 19, 22]

7. faint and often non-continuous line parallel to anterior crown margins [31, 32]

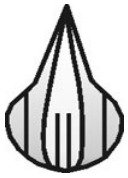
8. prominent and continuous line, ridge or keel parallel to anterior crown margins [31, 32]

9. lines, ridges or keels which curve over crown anterior and posterior margins [31, 32]

10. median keel or platform that is more raised and broader than lateral lines, ridges, keels or platforms without closely paired lines, ridges or keels [31, 32]



11. platform with interior paired lines, ridges or keels; furrows on each side of platform do not undercut [31, 32]



12. high platforms with interior paired lines, ridges or keels; deep furrows on each side of platform which undercut [31, 32]

13. one or more lines terminating in a Y-shaped fork at end opposite acute prominence [7, 8, 32]

14. nodular (especially where lines or ridges join anterior longitudinal line) [32]

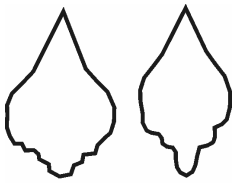
e. Anterior crown margin opposite the peak [9, 19, 31]

0. indeterminate or none of the following [9, 19, 31]

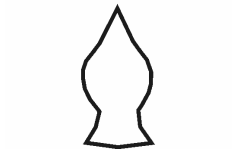
1. rounded [9, 19, 32]

2. approximately V-shaped, angular [9, 19, 32]

3. irregular, uneven, or undulating (may have mesial protrusion) [9, 19, 31, 32]



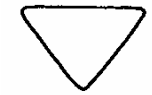
4. flared into an irregular structure [9, 19, 31, 32]



f. Outline of pedicle base subsurface [9, 19, 31]

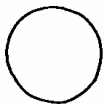
0. indeterminate or none of the following [9, 19]

1. equilateral triangle [9, 19]

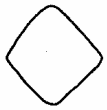


2. isosceles triangle [9, 19]

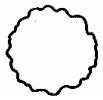
3. circular to subcircular, smooth margins [9, 19]



4. square to diamond (rhomboid) shaped [9, 19]



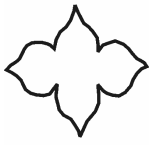
5. circular to subcircular, crenulated margins [9, 19]



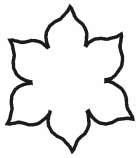
6. cruciform [9, 19]

7. ovoid to elliptical [19, 32]

8. tetrapetaloid [31, 32]



9. multi-petaloid [31, 32]



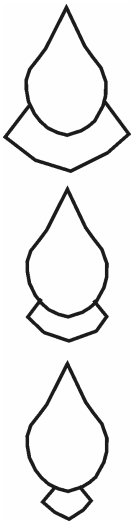
g. Size of pedicle (at anterior and sides) [9, 19, 31]

0. indeterminate or none of the following [9, 19]

1. pedicle wider than crown [9, 19, 31, 32]

2. pedicle same width as crown [9, 19, 31, 32]

3. pedicle narrower than crown [9, 19, 31, 32]



h. Development of lateral peaks on posterior crown [9, 19, 31]

0. indeterminate [9, 19]

1. no development, smooth margins [9, 19]

2. some development, irregular margins [9, 19]

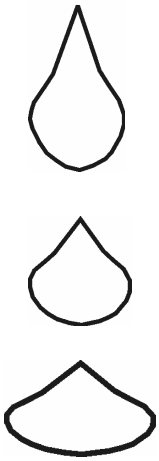
i. Length/width ratio of crown [19, 31]

0. indeterminate [19]

1. length greater than width, but less than three times width [19, 32]

2. length approximately equal to width [19, 32]

3. length less than width [19, 32]



4. length greater than three times width [19, 32]

j. Upper crown mesial platform (or differentiated structure) [31, 32]

0. indeterminate or none of the following [31, 32]

1. absent or considerably reduced [31, 32]

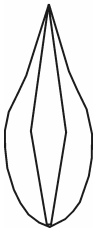
2. one line, ridge, or keel [31, 32]

3. narrow and elongate lanceolate (rounded anterior margin, pointed posterior margin), (greater than five times longer than wide [31, 32]

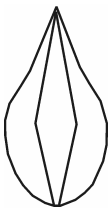
4. elongate lanceolate (three to five times longer than wide) [31, 32]

5. lanceolate (greater than one to less than three times longer than wide) [31, 32]

6. broad lanceolate (equally as long as wide, or wider than long) [31, 32]



7. narrow and elongate rhomboid (greater than five times longer than wide) [31, 32]



8. elongate rhomboid (three to five times longer than wide) [31, 32]

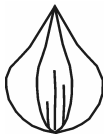
9. rhomboid (two to three times longer than wide) [31, 32]

10. broad rhomboid (equally as long as wide, or wider than long) [31, 32]

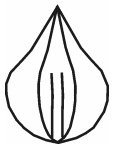
11. long, extends anterior to posterior (greater than 1/2 crown length) [31, 32]

12. short, (less than or equal to 1/2 crown length) [31, 32]

13. with internal lines, ridges, or keels (which are not closely paired) [31, 32]



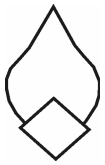
14. with closely paired lines, ridges, or keels [31, 32]



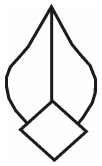
15. with lines or ridges which bifurcate anteriorly [32]

k. Features on the subcrown [31]

0. indeterminate or none of the following [31]



1. absent (smooth) [31, 32]



2. one median line, ridge, keel, or platform [9, 19, 32]

3. two lines, ridges, keels, or platforms [31, 32]

4. three or more short parallel to subparallel lines, ridges, or keels which commonly do not exceed 1/2 the crown length [31, 32]

5. three or more long parallel to subparallel lines, ridges, or keels which commonly extend from posterior pedicle margin to posterior crown margin or apex [31, 32]

6. curved line, ridge, or keel near the subcrown centre posterior region around pedicle [19, 31, 32]

7. curved depression surrounding junction of crown and pedicle [19, 31, 32]

8. stippled or pitted [32]

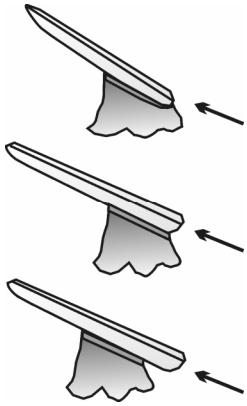
l. Anterior crown overhang of pedicle/crown junction [31, 32]

0. indeterminate [31, 32]

1. absent (crown drops obliquely or vertically to pedicle) [31, 32]

2. minor (crown slightly curves under to pedicle) [31, 32]

3. prominent (crown significantly curves under to pedicle) [31, 32]

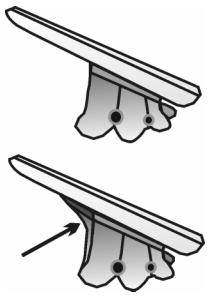


m. Pedicle type [31]

0. indeterminate or none of the following [31]

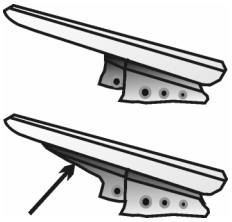
1. tetrahedroid [31, 32]

2. keeled tetrahedroid [31, 32]



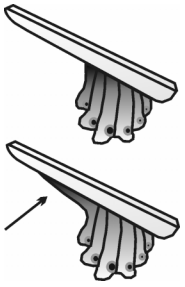
3. expanded tetrahedroid [31, 32]

4. keeled expanded tetrahedroid [31, 32]



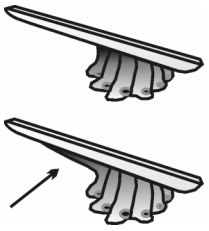
5. tall trunk [31, 32]

6. keeled tall trunk [31, 32]



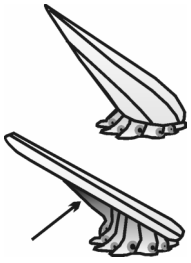
7. trunk-like [31, 32]

8. keeled trunk [31, 32]



9. short trunk [32]

10. keeled short trunk [32]



n. Pedicle subsurface [31]

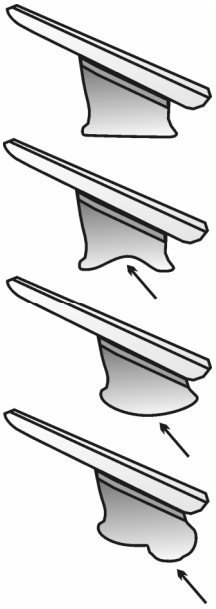
0. indeterminate or none of the following [31]

1. flat [31, 32]

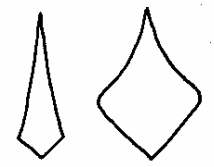
2. concave [31, 32]

3. convex [31, 32]

4. convex with bulge to one side [31, 32]



3. kite-shaped, with two longer sides [2, 8, 9, 19, 32]



d. Pattern of lines on upper crown surface [2, 8, 9]

0. indeterminate or none of the following [2, 8, 9]

1. absent [2, 8, 9]

2. one line [2, 8, 9]

3. three or more lines; parallel to subparallel [2, 8, 9]

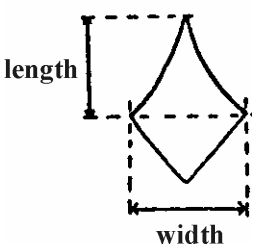
4. irregular network of lines or dendritic [2, 8, 9]

5. lines converge at acute prominence [2, 7]

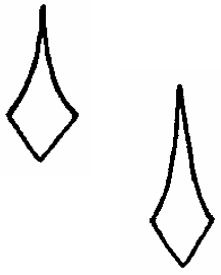
6. median line bifurcates [2, 7, 8]

e. Length of acute prominence (apex or pointed margin) [2, 8, 9]

0. indeterminate [2, 8, 9]



1. length equal to or less than width of base [2, 8, 9, 30]



2. length less than twice width of base [2, 8, 9]

3. length more than twice but less than three times width of base [2, 8, 9]

4. length more than three times width of base [2, 8, 9]

f. Narrow differentiated area at upper crown margin [2, 8, 9]

0. indeterminate [2, 8, 9]

1. absent [2, 8, 9]

2. present on long sides [2, 8, 9]

3. present on short sides [2, 8, 9]

g. Margin [2, 8, 9]

0. indeterminate or none of the following [2, 8, 9]

1. smooth and continuous on long sides (on sides of acute prominence) [2, 8, 9]

2. smooth and continuous on short sides (on sides opposite acute prominence) [2, 8, 9]

3. irregularly undulating on long sides (on sides of acute prominence) [2, 8, 9]

4. irregularly undulating on short sides (on sides opposite acute prominence) [2, 8, 9]

5. regularly undulating on long sides (on sides of acute prominence) [2, 8, 9]

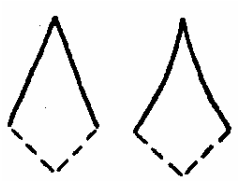
6. regularly undulating on short sides (on sides opposite acute prominence) [2, 8, 9]

7. broken on long sides (on sides of acute prominence) [2, 8, 9]

8. broken on short sides (on sides opposite acute prominence) [2, 8, 9]

h. Degree of curvature on sides of acute prominence [7, 8]

0. indeterminate or none of the following [8]



1. straight or slightly concave [7, 8]

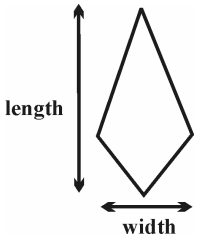
2. pronounced concave [7, 8]

3. sigmoid [32]

4. convex [32]

i. Length to width ratio [19, 32]

Recorded as numbers [32]



j. Degree of curvature on sides opposite acute prominence [32]

0. indeterminate or none of the following [32]

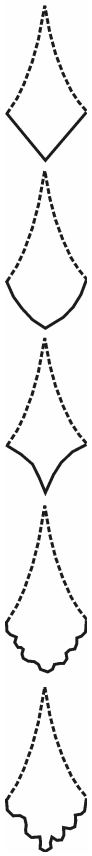
1. straight [32]

2. pronounced convex [32]

3. pronounced concave [32]

4. regularly undulating [32]

5. irregularly undulating [32]



4. **rhombic** [2, 8, 9, 19]

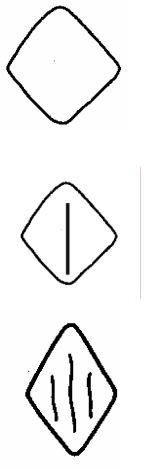
d. Pattern of lines, ridges, or keels on upper crown surface [2, 9, 19, 31]

0. indeterminate or none of the following [2, 9, 19]

1. absent [2, 9, 19]

2. one line, ridge, or keel [2, 9, 19, 31]

3. two or more parallel to subparallel lines, ridges, or keels not converging centrally or at a corner [2, 9, 19, 31]



4. three or more parallel to subparallel lines converging at or near one or more corner [2, 9, 19]

5. irregular network of lines, ridges, or keels [2, 9, 19, 31, 32]

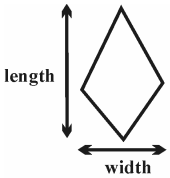
6. concentric chevrons, with centre at one corner of crown [9, 19, 31]

7. concentric rhombs with centre at middle of crown [9, 19, 31]

8. many parallel or subparallel lines arising predominantly from one or two edges of crown [19]

9. concentric rhombs with centre at one corner of crown [19, 31]

e. Length/width ratio of crown [9, 19, 31]



0. indeterminate [9, 19]

1. length greater than width [9, 19, 32]

2. length approximately same as width [9, 19]

3. length less than width [31, 32]

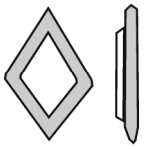
f. Other features present [9, 19]

0. indeterminate or none of the following [9, 19]

1. no other significant features [19]

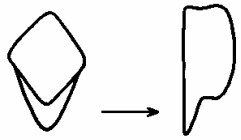
2. one line, ridge, or keel on subcrown [9, 19, 30, 31]

3. platform, pedicle, or base present (basal/subcrown and side views) [9, 19, 30, 31]

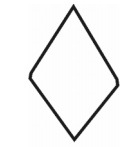


4. more than one line, ridge, or keel on subcrown [19, 30, 31]

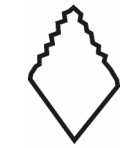
5. extension of crown into a peg-like structure [9, 19, 31]



6. subcrown smooth and unornamented [30, 31, 32]



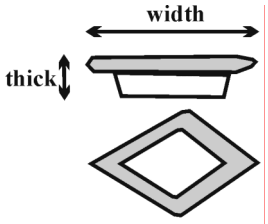
7. one or two crown edges serrated [30, 31, 32]



8. upper crown surface with stippled region(s) [30, 31, 32]

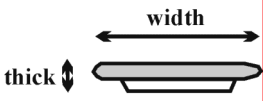
9. canal opening(s) or hooded foramina on upper crown surface [30, 31, 32]

g. Thickness of element (crown and base) [9, 19, 32]

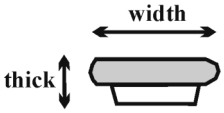


0. indeterminate [9, 19]

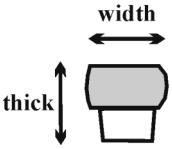
1. very flattened (thickness less than 1/4 maximum width) [9, 19, 31, 32]



2. moderately flattened (thickness = 1/4 - 1/2 maximum width) [9, 19, 32]



3. very thick (thickness greater than maximum width) [9, 19, 32]



5. **cruciform** [11]

APPENDIX 1.5.0

Type a8/b1,5±8

An approximate triangular form with a straight or curved axis and one or both margins with a prominent flexure.

List of Tofino Basin subtypes a8/

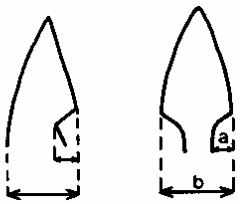
a8/b5+8/c1,2/d1,2/e120-150°/f25-30°/g1,2/h1,2/i2 cf. *flexed triangle asymmetric* Doyle and Riedel, 1985

a8/b5+8/c2/d1,2/e90-115°/f35-40°/g1,2/h4/i≤1.5 *wide triangle double flex* Gupta, 1991

a8/b5+8/c2/d1,2/e90-130°/f25-35°/g1,2/h1,4/i≥1.5 *triangle double flex* Dunsworth, Doyle, and Riedel, 1975; emend. Doyle and Riedel, 1979

APPENDIX 1.5.1

Type a8/b1,5±8



An approximate triangular form with a straight or curved axis and one or both margins with a prominent flexure (*a* must be at least 0.2 length of *b*). [2, 8]

c. Number of margins with prominent flexure [2, 8, 9, 19]

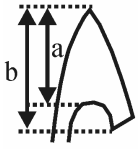
0. indeterminate [32]

1. one [2, 8, 9, 19]

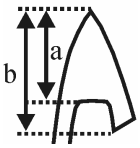
2. two [2, 8, 9, 19]

d. Position of base of inline (or transverse line if present) relative to lower termination of first flexure (first flexure is closest to apex) [2, 8, 9, 32]

0. indeterminate or none of the following [32]



1. base of inline (or transverse line) at same level as termination of first flexure or is below it [2, 8, 9]



2. base of inline (or transverse line) is above termination of first flexure; ratio of height above base of inline to total height (a/b=>0.85) [2, 8, 9, 32]

3. base of inline (or transverse line) is above termination of first flexure; ratio of height above base of inline to total height (a/b=<0.85) [2, 8, 9, 32]

e. Angle formed by flexure (or range for two flexures) [2, 8, 9]

Recorded in degrees [2, 8, 9]

f. Apical angle (disregarding convexity or concavity of flexed margin(s)); measured at level of flexure(s) [2, 8, 9]

Recorded in degrees [2, 8, 9]

g. Shape of first or prominent flexure [21]

0. indeterminate or none of the following [32]

1. angle/angle [21]

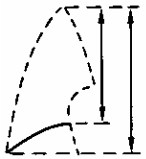
2. angle/curve [21]

h. Shape of transverse line [21]

0. indeterminate or none of the following [21, 32]

1. straight line terminates at margins at about same level [21]

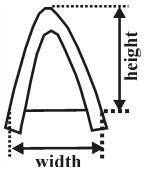
2. simply curved or straight line terminates at margins at different levels (perpendicular distance from apex of outline to level at which transverse line intersects margins differ by at least 5%) [21]



3. straight or simply curved line extends across sides of inline; one end runs through area between inline and outline, other terminates at flexed margin [21]

4. straight to gently curved transverse line above both flexures and terminates approximately at same level [27]

i. Height to width ratio of crown (measured from apex to level on transverse line closest to apex divided by width of crown at that same level on transverse line) [27]



Recorded as numbers [27]

APPENDIX 1.6.0

Type a9/b1,(±2±3±5±7±8±9±10±11±12)

Outline approximately triangular with a straight or curved axis. Neither margin has prominent flexure. A transverse line may separate crown and base.

List of Tofino Basin subtypes a9/

Tofino Basin triangular teeth of the subtype a9 are organized into four groups: 1) elasmobranch teeth; 2) triangular teeth with canals; 3) triangular flanged teeth; and 4) cone teeth. They are then ordered by the coded sequence.

Elasmobranch teeth, subtype a9

a9/b2+8+12/c19/d19/e1/f1/g6+7+8/h0/i6,7/j6,7/k0,1/m0/n0,~1/p0/q0/r0/s3/t4/z0 Family Scyliorhinidae Form A

a9/b8/c19/d19/e1/f1/g7/h0/i9/j9/k1/m0/n>1.2/p0/q0/r0,1/s0/t4/z1,2 *?Isurolamna* sp. A

a9/b8+11±12/c14+19/d19/e1/f(4a+b)+9+11+14/g7+8/h3/i2,9/j2,4,9/k5,8,9/m0/n≥0.8/p0/ q9,10/r1/s1,2/t4/z0 Family Squalidae Form D

a9/b8±12/c(12,13)+(16,17)+19/d(1,16,17)+19/e1/f(4a+b)+9+11+14/g7+8/h3/i4/j2,3/k5,8,9/m0/n≥1/p0/q9,10/r1,2/s1,2/t4/z0 Family Squalidae Form E

a9/b8±12/c(12,13)+19/d14+19/e1/f(4a+b)+9+11+14/g7+8/h3/i3,4/j3,4,10/k5,8,9/m0/n≥1/p0/ q1,9,10/r1,2/s1,2/t4/z0 Family Squalidae Form A

a9/b8±12/c12+19/d19/e1/f(4a+b)+9+11+14/g7+8/h3/i4/j2,6/k5,8,9/m0/n≥1/p0/ q9,10/r1,2/ s1,2/t4/z0 Family Squalidae Form B

a9/b8±12/c13±14+19/d19/e1/f(4a+b)+9+12+14/g7+8/h1,5,4,3/i2,4/j2,6/k5,8,9/m0/n~≥0.7/ p0/q9,10/r1,2/s3/t4/z0 Suborder Hexanchoidei Form B

a9/b8±12/c14+19/d±13+19/e1/f(4a+b)+9+(11,12)+14/g7+8/h3/i2,3,9/j2,3,4,9/k5,8,9/m0/n≥1/p0/q9,10/r1/s1,2/t4/z0 Family Squalidae Form C

a9/b8±12/c14+19/d19/e1/f(4a+b)+9+(11,12)+14/g7+8/h1,3,4,5/i3,9/j6,7,8/k5,8,9/m0/n~≥1/ p0/q9,10/r1/s1,2/t4/z0 Suborder Hexanchoidei Form A

a9/b8±12/c19/d19/e1/f(4a+b)+9+(12,13)+14/g7±8/h1,5/i2,3/j2,3/k5,8/m0/n≥1/p0/q9,10/r1/s1,2/ t4/z0 Suborder Hexanchoidei Form C

Unidentified elasmobranch teeth, subtype a9

a9/b2+8+12/c19/d19/e1/f(4a+b)+9+(12,13)+14/g4+7+8/h1,2,4,5/i3,9/j6,7/k5,8,9/m0/ n0≥1/ p0/q9,10/r1/s1/t4/z0 Unidentified elasmobranch tooth Form A

a9/b2+8+12/c19+20/d19+20/e1/f1/g6+7+8/h1,5/i7/j7/k0,1/m0/n~1/p0/q0/r0/s2/t4/z0,1 Unidentified elasmobranch tooth Form E

a9/b8/c19+20/d19+20/e1/f(4a+b)+9+(11,12)+14/g7/h1,5/i6,7,8,9/j6,7,8,9/k8/m0.05-0.35/ n1.2-2.0/p0/q9,10/r1/s3/t4/z0 Unidentified elasmobranch tooth Form B

a9/b8±12/c13+19/d13+19/e1/f(4a+b)+9+(12,13)+14/g7+8/h1,5/i9,10/j9,10/k8,9/m0/ n>1.5-3/p0/q9/r1/s3/t4/z0 Unidentified elasmobranch tooth Form C

a9/b8±12/c19/d19/e1/f±(4a+b)+9+(11,12)+14/g7±8/h1,5,4/i2,6,9/j2,6,9/k8,9/m0/ n>2/p0/q9,10/r1/s0,1,2/t4/z0 Unidentified elasmobranch tooth Form D

Triangular teeth with canals

a9/b1,5/c11,12/d20/e1,2/f1±4a+b/g1/h0,4,5/i2,3,4,9/j2,6,7,9/k1/m0/n>1.5/p0,>1.5/q0,9,10/ r0,1/s1,2/t2/z0,2/cc1/dd1/ee2/ff1/gg1,4/hh0,1-4/jj2,3/kk2,4/mm0,1-3/nn0,0.3-1.0 angled cone and basal canals new subtype

a9/b5+8/c19±(11,12,13)/d19±(11,12,13)/e2/f4a±b/g7±8/h0,1,2,3,4,5/i2,3,4,5/j2,3,4,5/ k8±(12,14)/m0.04-0.35/n≤2/p0/q0,3,4,5,9,10/r0,1/s1,3/t4/z10,11/cc5/dd5/ee2/ff0/gg6±8/hh0-1.3/jj2/kk2/mm0.44/nn0.3 centrally inflated triangle with canals new subtype

a9/b5+8/c13+19/d13+19/e2/f4a±b/g7/h0/i2,4/j2,4/k1/m0/n>1<2/p0/q0/r0/s1/t4/z7,11,12/cc5/dd5/ ee2/ff1/gg4+6/hh2.0-2.5/jj3,6/kk5,6/mm2.0-2.5/nn<0.3 triangle one canal above Doyle et al., 1974; and Doyle and Riedel, 1979a, p. 193

a9/b5+8/c13 +19/d13+19/e2/f(4a+b)±(8,22)/g7/h0,1,5/i2,4/j2,4/k1,12/m0,0.02-0.4/n1.9-2.5/p0/q0,6,7/r0,3,4/s1,3/t4/z4,7 cf. triangle transverse line across Doyle et al., 1974; emend. Doyle and Riedel, 1979a

a9/b5+8/c19/d19/e2/f4a+b/g7/h0,1,4,5/i2/j2/k1,12/m0,0.02-0.4/n1.9-2.5/p0/q0,3,6/r0,1,3,4/ s1,3/t4/z4,10,11 triangle transverse line across Doyle et al., 1974; emend. Doyle and Riedel, 1979a

a9/b8/c19/d19/e2/f1,(4a ±b)/g7/h0,1,4,5/i2,3,5/j2,3,5,6/k1,8/m0.1-0.5/n>1.5/p0/q9,10/r1/ s1,3/t4/z0 flanged triangle with canals new subtype

Triangular flanged teeth

a9/b1/c1/d1/e1/f4a±8/g1/h1,5/i5,9,10/j2,5,9,10/k1,8/m0.09-0.5/n≤2/p0/q2,9/r1/s4/t3/z0 triangle chisel-top new subtype

a9/b5+8/c(9,13)+19/d(9,13)+19/e1/f(9,10)+12+(14,15)/g7/h1,5/i3,4/j6,10/k5,7/m0.85-0.9/n>2/p0/q0,2,6/r0,1,4/s1/t4/z0,7,11 cf. triangle notched corner Doyle et al., 1974

a9/b5+8/c13+19/d13+19/e1/f1,4a/g7/h1,5/i2/j2/k7,8±12/m0/n0,>2/p0,>2/q1,2/r1,4/s0/t4/z0 beveled triangle high inline Doyle et al., 1978

a9/b5+8/c±13+19/d±13+19/e1/f4a+b/g7/h0,1,5/i1,4,5,10/j1,4,5,10/k3/m0.2-0.4/n1.4-2.0/ p0/q0,2/r0,1/s3/t4/z0,2 cf. triangle bowed inline Ramsey et al., 1976; emend. Doyle and Riedel, 1979a

a9/b5+8/c13+19/d13+19/e1/f4a+b/g7/h0,1,5/i2,4/j2,4/k3/m0.4-0.7/n1.2-2.0/ p0/q0,6,7/ r0,3/s1,3/t4/z4 triangle modified margin ends Doyle and Riedel, 1985b

a9/b5+8/c+13±19/d+13+19/e1/f4a+b/g7/h0,1,5/i2,4/j2,4/k5/m0.65-0.85/n<2/ p0/q0,2,6,7/ r0,1/s1,3,4/t2,4/z2,4/cc1/dd1/ee1/ff0/gg4/hh1.0-1.5/jj2/kk2/mm1/nn1 cf. simple triangle Winfrey et al., 1987

a9/b5+8/c13+19/d13+19/e1/f4a+b/g7/h0,1,5/i4/j4/k0/m0/n1-1.5/p0/q0,7,8/r0,3,4/s1/t2,4/ z4,7,11/cc1/dd1/ee1/ff1/gg3+4/hh2-3/jj3/kk4/mm1.5-3.0/nn0.2-0.5 cf. triangle curved margin ends Doyle and Riedel, 1985b

a9/b5+8/c13+19/d19/e1/f4a+b/g7/h0,4/i4/j2,6/k8,14/m0.3-0.6/n>1.5/p0/q0,3,4/r0,1/s1/t4/z10,11 narrow triangle straight inbase Doyle et al., 1974; Doyle and Riedel, 1979a

a9/b±5+8/c19/d19/e1/f(4a+b)+9+12+14/g(4,6)+7/h0/i9/j10/k7+8/m0/n>2/p0/q0,2,10/ r0,1/s1,2/ t4/z2 triangle sigmoid rough Ramsey et al., 1976

a9/b5+8±(10,12)/c19/d19/e1/f(4a±b)±8±22/g3+7+8/h0,1,3,5/i3,4/j3,4/k5,8/m<0.3/n0.4-1.4/ p0/q0,6,7/r0,1/s3/t4/z0,4,5,7,8,9,10,11 cf. wide triangle Dunsworth et al., 1975; Doyle and Riedel, 1979a

a9/b8/c13+19/d13+19/e1/f(4a+b)+8,(9+13+22)/g7/h0/i3,4/j2/k8/m0.8/n>1.5/p0/q10/r1/s3/t4/z0 cf. straight triangle keeled edges Ramsey et al., 1976

a9/b8±(10,12)/c19/d19/e1/f4a+b/g3+7/h3/i3,4/j2,3/k8/m0.15-0.25/n≤1/p0/q9/r1/s3/t4/z0 cf. wide crescent Doyle et al., 1978

Undescribed triangular flanged tooth

a9/b7+8/c19/d19/e1/f0/g5+7/h1,5/i2/j2/k1/m0.33/n2.9/p0/q0,6,9/r0,1/s1/t4/z0,11 undescribed triangular flanged tooth, Form A

Cone teeth

a9/b1/c1/d1/e1/f4a+b/g3+8/h1,2,5/i2,3/j2,3/k7/m0/n~2/p0/q10/r1/s3/t2/z0 cf. triangle with parallel inline Doyle et al., 1974

a9/b1/c1/d1/e1/f(4a+b)+9+(12,13)+(14,15)/g1/h1,4,5/i3/j6/k0,1,5/m0/n1.4-1.7/p0/ q2,9,10/r0,1/s1,2,3/t2/z0 cf. small triangle long striations Dunsworth et al., 1975

a9/b1/c1/d1/e1/f9+12+14/g1/h2/i2,3,4/j2,3/k0,5/m0/n>2/p0/q6,10/r0,1/s1/t2/z0 cf. striated triangle Ramsey et al., 1976

a9/b1,5/c1/d1/e1/f1/g1/h0/i0,1/j0,1/k0,1/m0/n0/p0/q0/r0/s0/t2/z0,2/cc1,7/dd1,7/ee1/ff1/gg1,7/ hh0/jj4/kk3,4,5/mm0/nn0 cf. curved triangle, parallel-sided inline new subtype

a9/b1,5/c1/d1/e1/f1/g1/h4,5/i6/j3/k8+9/m0.4-0.7/n1.4-1.7/p0/q6,7,10/r1/s1,2/t2/z0 small pointed triangle Tway et al., 1985

a9/b1,5/c1/d1/e1/f1/g1,3,8/h0/i0/j0/k0/m0/n0/p0/q0/r0,1/s0/t2/z0,2/ cc1,7/dd1,7/ee1/ff0,1,3/gg1,7/ hh0/jj3/kk4/mm0/nn0 cf. curved triangle wide inline new subtype

a9/b1,5/c1/d1/e1/f1,4a+b/g1,3,6,8/h0,1,5/i3/j6,9/k0/m1.8-3.0/n1-2/p0/q0/r0/s1,2/t2/z0,2/ cc0,1,7/dd0,1,7/ee1/ff1/gg1,4,7,8/hh1.8-3.0/jj3/kk4/mm1.5-2.5/nn0.15-0.5 curved triangle wide inline new subtype

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0/m0/n>1/p0/q0/r0/s1,2/t2/z2/cc1,7/dd1,7/ee1/ff1/gg1,7/hh>3/jj2,3,5/kk2,4,5/mm2.5-3.5/nn≤0.2 narrow tall triangle, cone inline new subtype

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0,5,8/m0/n0/p0/q0/r0/s1,3/t2,3/z2/cc1,7/dd1,7/ee1/ff1/ gg4,7/hh>4/jj5/kk5/mm2/nn0.125 narrow tall triangle, inflated inline apex new subtype

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0,8/m0/n~2/p0/q0/r0/s1,3/t2,3/z2/cc1,7/dd1,7/ee1/ff1/gg1,7/hh>4/jj3,5/kk4,5/mm1.8-2/nn0.20-0.25 narrow tall triangle, irregular threaded inline new subtype

a9/b1,5/c1/d1/e1/f4a+b/g1/h0/i6,7,9/j2,4,7,9/k8/m<0.1/n1.5-2.5/p0/q0/r0/s1,2/t2/z2/ cf. long triangle stepped margin Doyle et al., 1974; and cf. angled cone and bulbous base new subtype "shadowed high inline cone"

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i6,7/j2,3,9/k8,9/m0/n>2/p0/q0,6,7/r0,1/s1,3,4/t3/z0,2 shadowed curved blunt triangle new subtype

a9/b1,5/c1/d1/e1/f4a±b/g1/h0,1,5/i6,9/j6,9/k3/m0.05-0.25/n1.5-2/p0/q0,2/r0,1/s3/t2,3/z0,2 dome-top triangle bowed inline new subtype

a9/b1,5/c1/d1/e1/f(4a+b)+(8,9)+(11,12)+14/g1,3,8/h0,1,5/i2,3/j2,6/k0,1,7,11/m0/n1-1.5/p2.0-3.5/q0,2/r0,1/s2,3/t2/z0,2/cc1,7/dd1,7/ee1/ff2/gg1,4,8/hh2.5-3.5/jj3/kk4/mm1.5-4/nn0.1-0.3 curved triangle, striated inline new subtype

a9/b1,5/c1/d1/e1/f(4a+b)±10±11±14/g1±7/h0/i6,7/j3/k3,8/m0.5-0.6/n1.8-2.0/ p0/q0/r0/s3/t2/z2 cf. curved flared triangle Ramsey et al., 1976

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,3/j2,6/k0/m0/n<1.5/p0/q0/r0/s1,2,3/t2/z2/cc1,7/dd1,7/ee1/ff1,2/ gg4/hh>2/jj3/kk4/mm2-4/nn0.16-0.36 curved triangle, parallel-sided inline new subtype

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,6/j2,3/k0,1,12/m>2<2.5/n2-3/p0/q0/r0/s1,2/t3,2/z2/cc1/dd1/ ee1/ff1,2/gg1,4/hh2-2.5/jj4/kk3/mm~2/nn0.4-0.45 cf. narrow curved triangle Doyle et al., 1974; Doyle and Riedel, 1979a

a9/b5/c1/d1/e1/f±4a±b/g1/h0/i2,6/j2,3,6/k0/m0/n<2/p0/q0/r0/s0,1,3/t2/z3/cc1/dd1/ee1/ff1/gg3,7/hh~2/jj2,3,5/kk2,3/mm1.5-2.5/nn0.4-1.0 cf. short triangle stepped margin Doyle et al., 1974; Doyle and Riedel, 1979a

a9/b5/c1/d1/e1/f4a+b/g1/h0/i2,7,9/j2,3,9/k0,1,8/m0/n1.5-3/p0/q0/r0/s2/t2/z3/cc1,7/dd1,7/ee1/ ff1,2,3/gg4,7/hh1.5-3/jj4/kk3/mm1.5-2.5/nn0.2-1.0 cf. long triangle stepped margin Doyle et al., 1974; Doyle and Riedel, 1979a

a9/b5/c1/d1/e1/f4a+b/g1/h0/i6,9/j2,3,9/k8/m0/n<2.5/p0/q0/r0/s1,3/t2/z2/cc6,7/dd6,7/ee1/ff1/ gg1,4/hh>1.5/jj5/kk5/mm1-2/nn0.3-0.5 angled cone and bulbous base new subtype

a9/b5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,3/j2/k0/m0/n~1/p0/q0/r0/s1,2/t2,3/z2/cc1/dd1/ee1/ff3/gg1,4,7/hh1.4-2.0/jj5/kk3/mm2.0-2.5/nn<0.18 cf. triangle small top Ramsey et al., 1976; Doyle and Riedel, 1979a

a9/b5/c1/d1/e1/f4b/g1/h0/i2,6/j2,3/k0/m0/n>1/p0/q0/r0/s0/t2/z2/cc1/dd1/ee1/ff1/gg1/hh>3/jj2,4/kk2,3/mm1.5/nn0,0.25-0.35 cf. triangular triangle Kozarek and Orr, 1980

Undescribed cone teeth

a9/b1/c1/d1/e1/f9+12+15+22/g1/h3/i3,10/j6,10/k7/m0/n>2.5/p0/q9,10/r1/s3/t2/z0 Undescribed cone tooth, Form A

a9/b1,5/c1/d1/e1/f1/g1,6,8/h0,1,5/i2,3/j2,6/k1/m0/n1,2.8/p0/q2,9/r0,1/s1/t2/z0,2/cc0,1/dd0,1/ ee0,1/ff0/gg0,3,7/hh1.8/jj3/kk4/mm2.9/nn0.19 Undescribed cone tooth, Form B

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2/j2/k0/m0/n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2 Undescribed cone tooth, Form C

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,3,5/j6,8/k3+9/m0.25/n3.2/p0/q0,2/r0,1/s1,2/t2/z0,2 Undescribed cone tooth, Form D

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i2,5,3,9,10/j2,6,9,10/k0,1/m0/n>1,>3/p0/q0,2/r0,1/s3/t2/z0,2 Undescribed cone tooth, Form E

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3/j6/k0/m0/n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2 Undescribed cone tooth, Form F

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3,5/j6,8/k8,9/m0.13/n2.9/p0/q0,2/r0,1/s1,3/t2/z0,2 Undescribed cone tooth, Form G

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,1,5/i3,9,10/j6,9,10/k3,8,9/m0/n2-4/p0/q0,2/r0,1/s1,2/t2/z0,2 Undescribed cone tooth, Form H

a9/b1,5/c1/d1/e1/f4a+b/g1/h0,4/i4,9,10/j6,10/k0/m0/n>1.5/p0/q0,2/r0,1/s1,2/t2/z0,2 Undescribed cone tooth, Form I

a9/b1,5/c1/d1/e1/f(4a+b)+8/g1/h0,1,5/i2,9,10/j2,9,10/k7/m0/n≥1/p0/q0,2/r0,1/s1/t2/z0,2 Undescribed cone tooth, Form J

a9/b1,5/c1/d1/e1/f(4a+b)+8/g1/h1,5/i9,10/j9,10/k0,1/m0/n>2/p0/q0,2/r0,1/s3/t2/z0,2 Undescribed cone tooth, Form K

a9/b1,5/c1/d1/e1/f(4a+b)+9+11+(14,15)/g1/h0,4/i5/j8/k8,9/m0/n>1,>2/p0/q0,2/r0,1/s1/t2/z0,2 Undescribed cone tooth, Form L

a9/b5/c1/d1/e1/f4a+b/g1/h0,1,5/i5/j8/k5,8,9/m0.13/n2.5/p0/q0,2/r0,1/s3/t2/z2 Undescribed cone tooth, Form M

APPENDIX 1.6.1

Type a9/b1,(±2±3±5±7±8±9±10±11±12)

Outline approximately triangular with a straight or curved axis. Neither margin has prominent flexure. A transverse line may separate crown and base. [2, 32]

c. Modifications of the "first margin" above the transverse line if one is present and meets the margin. "First margin" is identified as possessing one of the following characters (in the priority listed):

- shallow reflexed angle or curve
- single triangular projection
- concave margin
- markedly shorter than the other margin
- margin which departs most from a straight line [2, 8]

0. indeterminate [32]

1. none of the following [2, 8]
2. (not used)
3. more than one triangular projection [8]
4. single triangular projection [2, 8]

5. shallow reflexed angle (a reflexed departure from a straight line, less pronounced than a prominent flexure) or curve in uppermost one-fifth [2, 8]

6. shallow reflexed angle or curve in second one-fifth [2, 8]

7. shallow reflexed angle or curve in middle one-fifth [2, 8]

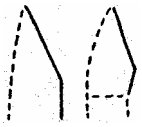
8. shallow reflexed angle or curve in fourth one-fifth [2, 8]

9. shallow reflexed angle or curve in fifth one-fifth [2, 8]

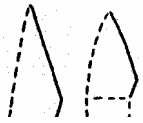
10. shallow simple outward angle (not reflexed) in uppermost quarter [2, 8]

11. shallow simple outward angle (not reflexed) in second quarter [2, 8]

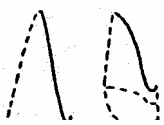
12. shallow simple outward angle (not reflexed) in third quarter [2, 8]



13. shallow simple outward angle (not reflexed) in fourth quarter [2, 8]

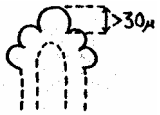


14. terminal part of margin “hooked” upward [2, 8]

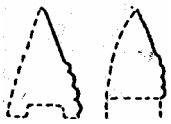


15. crenate, saw-toothed, or some other incised pattern on upper half of margin. No lateral projection longer than 0.3 mm. [2, 4, 8]

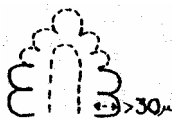
16. crenate, saw-toothed, or some other incised pattern on upper half of margin. At least one lateral projection longer than 0.3 mm. [4, 8]



17. crenate, saw-toothed, or some other incised pattern on lower half of margin. No lateral projection longer than 0.3 mm. [2, 4, 8]



18. crenate, saw-toothed, or some other incised pattern on lower half of margin. At least one lateral projection longer than 0.3 mm. [4, 8]



19. flanged occlusal crest or longitudinal blade-like or wing-like projection [5, 8, 9, 19, 32]

20. shallow simple inward angle in middle one third (not reflexed) [17]

21. margin straight in upper half and convex in lower half with a protuberance (e.g. Lady sandal) [27]

d. Modifications of second margin above transverse line if one is present and meets the margin (as in "c" above) [2, 8]

e. Features restricted to within the inline (above the transverse line if present) [2, 8]

0. indeterminate [32]

1. none of the following [2, 8]

2. branching canals [2, 8]

f. Features between apical inline and outline (or transverse line or base of outline if inline not present) and margins (above transverse line if present) [2, 8]

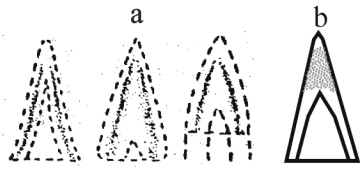
0. indeterminate [32]

1. none of the following [2, 8]

2. (not used)

3. longitudinal line from apex of outline, or near apex, toward apex of inline [2, 5, 8]

4. 4a= lateral shadow (a dark lateral zone separated from the margin by a narrow light zone); 4b=apical shadow (shadow in apical region) [2, 8, 32]



5. area between the inline and margins at least one third wider on one side than on the other [2, 8]

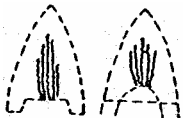
6. (not used)

7. (not used)

8. striations originating from inline (or, if inline not present, from base or transverse line). Location and extent of striations not recorded. [8]

9. striations originating from more than the central half of width of inline (or if inline not present, more than the central half of width of base or transverse line) [7, 8]

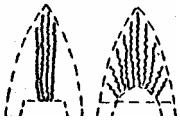
10. striations originating from central half or less than the central half of width of inline (or if inline not present, equal to or less than central half of width of base or transverse line) [7, 8]



11. striations restricted to lower half of area within outline [7, 8]

12. striations extending into upper half of outline, but not upper quarter [7, 8]

13. striations extending into upper quarter of outline [4, 7, 8]



14. majority of striations departing less than 45° from longitudinal axis [7, 8]

15. majority of striations departing more than 45° from longitudinal axis [7, 8]

16. simply or complexly curved line not parallel to inline terminating at both sides of the base or transverse line [2, 8]

17. line parallel to outline [8]

18. simply or complexly curved line terminating at both sides of the margin [2, 8]

19. two or more straight or curved lines terminating at both sides of the margin [8]

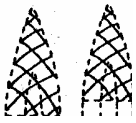
20. ornamented by semi-regularly spaced punctuate [8]

21. canals extending out from the inline [8]

22. irregular, dark, longitudinal markings, sufficient to darken image [17]

g. Features within outline, but not restricted to zone between inline and outline (above transverse line if present) [2, 8]

0. indeterminate [32]
1. none of the following [2, 8]



2. ornamented by two oblique intersecting sets of parallel lines [2, 8]
3. stippling or pitting [2, 8]

4. prominent and irregular longitudinal striations, sufficient to darken image [8]

5. a single prominent longitudinal line [8]

6. longitudinal, parallel to subparallel lines or ridges [24]

7. lateral occlusal crest, flange, or cutting edge at both margins [32]

8. short, irregular, slightly raised striations [32]

h. Relative lengths of margins (only if transverse line is not present or it does not intersect the margins) [2, 8]

0. indeterminate [8]

1. no marked difference [2, 32]

2. first margin markedly (at least 15%) longer [2, 8]

3. one margin markedly (at least 15%) longer [2, 8]

4. one margin 5-15% longer [4, 8]

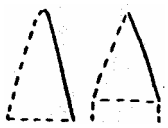
5. less than 5% difference between first and second margins [4, 8]

i. Gross shape of first margin (above transverse line if present and intersects the margin), excluding modifications of margin and details of its junction with apex and base of outline [2, 8]

0. indeterminate [32]

1. none of the following [2, 8]

2. straight [2, 8]



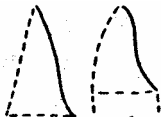
3. convex, with curvature evenly distributed [2, 8]

4. convex, with most of curvature basally [2, 8]

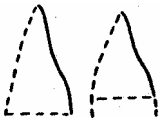
5. convex, with most of curvature apically [2, 8]

6. concave, with curvature evenly distributed [2, 8]

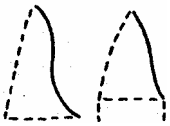
7. concave, with most of curvature basally [2, 8]



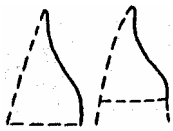
8. concave, with most of curvature apically [2, 8]



9. sigmoid (margin of tooth with upper part convex outward) [2, 8]



10. reverse sigmoid (margin of tooth with upper part concave outward) [4, 8]



j. Gross shape of the second margin (above transverse line if present and intersects the margin), excluding modifications of margin and details of its junction with apex and base of outline (as in "i" above) [2, 8]

k. Shape of the inline (above the transverse line if present) [2, 8]

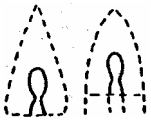
0. none [8]
1. indeterminate [32]
2. none of the following [2]

3. approximately parallel to outline but with sides bowed-in, curvature evenly distributed [2, 8]

4. approximately parallel to outline but markedly acuminate (with sides of inline below apical portion curved with convexity outward) [2, 8, 17]

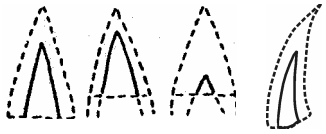
5. arcuate [2, 8]

6. both sides of inline forming a constriction [2, 8]



7. markedly narrower than outline, parallel-sided [2, 8]

8. approximately same shape as outline, but not with sides bowed-in, or markedly acuminate, or closely approaching outline at base [2, 4, 8, 32]



9. approximately same shape as outline, but not with sides bowed-in or markedly acuminate, but with margins closely approaching the outline at the base [4, 8, 32]

10. apical part of inline dendritically branched [7, 8]

11. apical part of inline not pointed, nor arcuate, but almost straight (transverse to the axis of the tooth) [7, 8]

12. apical part of inline drawn-out, thread-like [8]

13. one or more sinuous curves on both sides of inline [17]

14. markedly acuminate with sides of inline below apical portion straight and divergent [17]

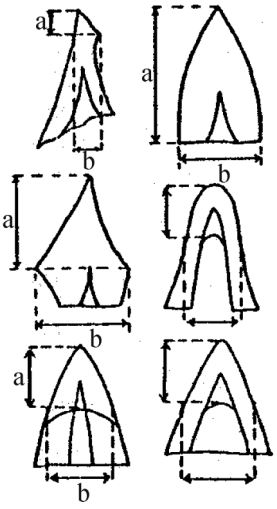
15. club-shaped [27]

m. Perpendicular length from apex or outline to apex of inline divided by length from apex of outline to base of inline (or to base of outline if inline not present) = a/b. If transverse line is present, measurements are to point on transverse line closest to apex. [2, 8, 32]

0. indeterminate [8]

Recorded as numbers [8]

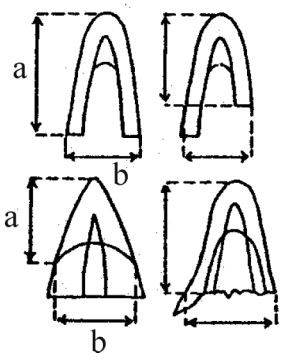
n. Perpendicular length from apex of outline to level of maximum width divided by maximum width = a/b. If base is reentrant (directed inward), length is measured from apex of outline to nearest point on reentrant (even if wider further below reentrant level). If transverse line is present, measurements are to point on transverse line closest to apex. [2, 8, 32]



0. indeterminate [2, 8]

Recorded as numbers [2, 8]

p. Perpendicular length from apex of outline to lowest level both margins are intact divided by the width at that level = a/b. If the transverse line which meets the margin is present, the measurement is made at the level farthest from the apex at which the transverse line meets the margin. [8, 32]



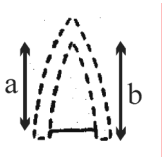
0. indeterminate, inapplicable, or not recorded since this ratio is identical with that of "n" [8]

Recorded as numbers [8]

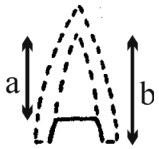
q. Character of base within inline, or if inline is not present then of base itself. Inapplicable if transverse line is present. [2, 8]

0. indeterminate or inapplicable because transverse line is present [8]
1. none of the following [2, 8]
2. an approximately straight line at same level as margin ends [2, 8]

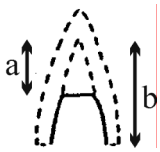
3. an approximately straight line above end of at least one margin; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = greater than 0.85 [2, 8, 32]



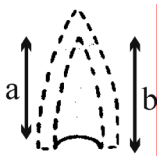
4. an approximately straight line above end of at least one margin; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = 0.85-0.75 [2, 8, 32]



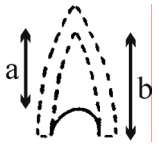
5. an approximately straight line above end of at least one margin; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = less than 0.75 [2, 8, 32]



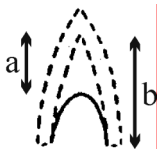
6. a curved line concave downward; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = greater than 0.85 [2, 8, 32]



7. a curved line concave downward; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = 0.85-0.75 [2, 8, 32]



8. a curved line concave downward; ratio of inline height divided by height from where both margins are basally intact to inline apex; a/b = less than 0.75 [2, 8, 32]



9. Irregularly jagged, as if broken. No downward projecting lobe as in q10. [5, 8]

10. Irregularly jagged, as if broken, with one or more lobes extend below lower limit of lateral margin. [5, 8]

r. Character of base between inline and outline. Inapplicable if transverse line is present. [2, 8]

0. indeterminate or inapplicable because transverse line is present [8]
1. none of the following [2, 8]

2. one base a straight line, other pointed [2, 8]

3. both bases pointed [2, 8]

4. both bases curving inward [2, 8]

5. both bases smoothly curved [2, 8]

s. Apex acuteness [2, 8, 9, 19]

0. indeterminate [9, 19]

1. none of the following or neither sharp nor blunt [17]

2. sharp [2, 8, 9, 19]

3. blunt [2, 8, 9, 19]

4. truncate [8]

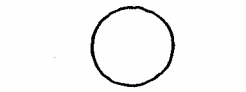
5. asymmetrical [8]

t. General outline in apical view or cross-section [5, 8, 32]

0. indeterminate [5, 8]

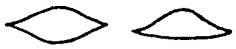
1. none of the following

2. approximately circular [5, 8, 19]



3. not circular but obtuse laterally [5, 8]

4. not circular but elliptical and acute laterally [5, 8, 32]



5. triangular [19]

z. Characters of the transverse line [2, 8]

0. absent or indeterminate [8, 32]

1. none of the following [2, 8]

2. straight line terminating at margins [2, 8]

3. straight or curved line extending beyond one or both margins of that part of outline immediately above transverse line [2, 8]

4. simply curved line terminating at sides of inline [2, 8]

5. simply curved or straight line terminating at sides of inline [2, 8]

6. simply curved line intersecting sides of inline and continuing into area between inline and outline [2, 8]

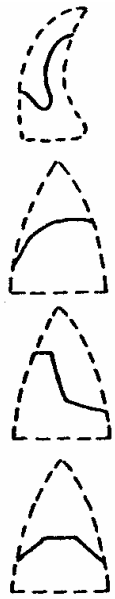
7. complexly curved line intersecting the margins at the same level [2, 8]

8. complexly curved line intersecting margins at different levels [2, 8]

9. simply curved line intersecting margins at different levels (length of margins above transverse line differ by at least 5%) [4, 8]

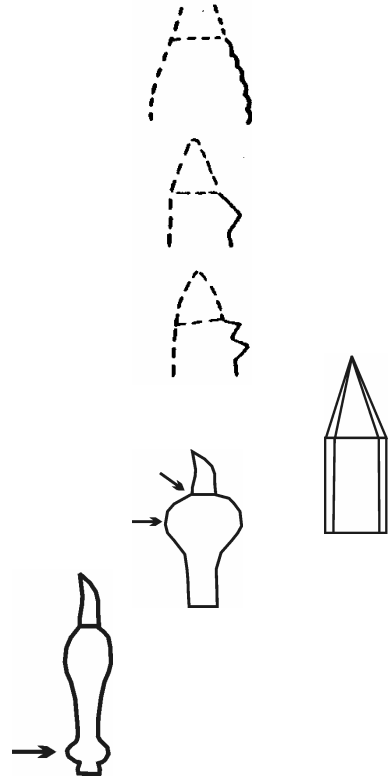
10. flexed line terminating at margins at different levels [7, 8]

11. flexed line terminating at margins at same level [8]



cc. Modifications of first margin below transverse line (if transverse line is present and meets margins) [2, 8]

0. indeterminate or inapplicable [8]
1. none of the following [2, 8]
2. crenate, saw-toothed or some other incised pattern [2, 8]
3. single triangular projection [2, 8]
4. two or more triangular projections
5. flanged occlusal crest or cutting edge [32]
6. rounded projection, "bulbous" and with stepped margin [32]
7. basal rim [32]



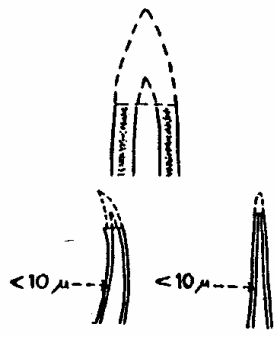
dd. Modifications of second margin below transverse line (as in "cc" above) [2, 8]

ee. Features restricted to within inline below transverse line (if transverse line is present) [2, 8]

0. indeterminate or inapplicable [8]
1. none of the following [2, 8]
2. branching canals [2, 8]

ff. Features between inline and outline below transverse line (if transverse line is present and meets margins) [4, 8]

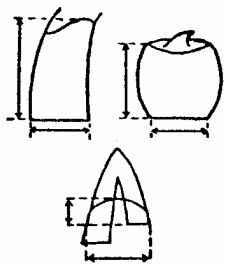
0. indeterminate or inapplicable [8]
1. none of the following [4, 8]
2. "lateral shadow [4, 8]
3. distance between inline and outline is less than 0.10 mm (10 microns) at its maximum [4, 8]



gg. Features within outline (below transverse line if present) and not restricted to region between inline and outline [2, 8]

0. indeterminate or inapplicable [8]
1. none of the following [2, 8]
2. ornamented with two oblique intersecting sets of parallel lines [2, 8]
3. vertical striations, lines, or ridges which are approximately parallel to margins [2, 8]
4. stippling or rough texture [4, 8, 32]
5. ornamented with lines or ridges which meet margins and approximately parallel to transverse line [8]
6. margin flanged occlusal crest or cutting edges [32]
7. irregular lines or ridges [32]

hh. If transverse line is present, perpendicular length from a point on transverse line closest to apex divided by width of base at which both margins are intact = a/b [8, 32]



0. indeterminate or inapplicable [8]

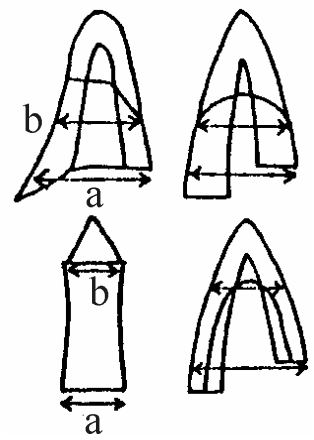
Recorded as numbers [8]

jj. Gross shape of first margin below transverse line (if present), excluding details of its junction with transverse line [2, 8]

0. indeterminate or inapplicable [8]
1. none of the following [2, 8]
2. straight [2, 8]
3. convex [2, 8]
4. concave [2, 8]
5. sigmoid [2, 8]
6. reverse sigmoid [8]

kk. Gross shape of second margin below transverse line (if present), excluding details of its junction with transverse line (as in "jj" above) [2, 8]

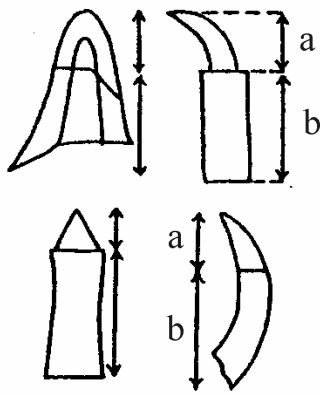
mm. If transverse line is present and its meets margins, width as far down ichthyolith which both margins are intact divided by width at point of intersection (farthest from apex) of margins and transverse line = a/b. If transverse line does not meet margins, division is distance between points of intersection of transverse line and inline. [8, 32]



0. indeterminate or inapplicable [8]

Recorded as numbers [8]

nn. If transverse line is present, perpendicular length from apex of outline to a point on transverse line closest to apex divided by length from same point on transverse line to lowest level of longer margin = a/b. [8, 32]



0. indeterminate or inapplicable [8]

Recorded as numbers [8]

APPENDIX 1.7.0

Type a11/b(1,2,3)±6±8±10±12

A multicusp form with cusps of unequal size.

Tofino Basin subtype a11/

a11/b2/c2/d0/e1/f3/g1/h2/i4+8/j4 or
a3,4/b2/c2/d4+10/e2,3/f0/g0/h2/i1/j2+11/k3/l0/m0/n0 undescribed elasmobranch dermal denticle or tooth, Form B

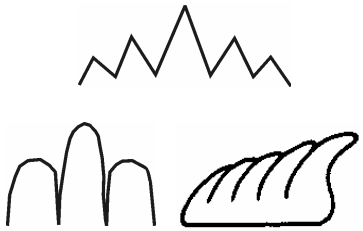
APPENDIX 1.7.1

Type a11/b(1,2,3)±6±8±10±12

A multicusp form with cusps of unequal size.

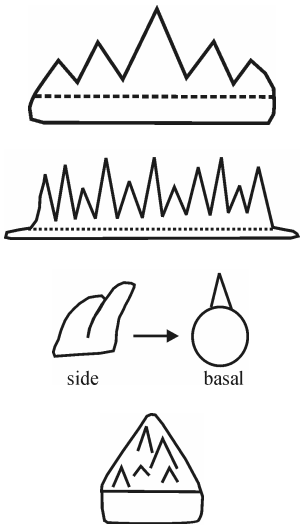
c. Arrangement of projections (cusps): [9, 19, 31]

0. indeterminate [9, 19]
1. widely spaced [9, 19]
2. close together [9, 19]



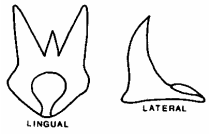
d. Shape of base (root) from which cusps arise: [9, 19, 31]

0. indeterminate [9, 19]
1. none of the following [9, 19]
2. elongate and bar-shaped [9, 19]
3. flat and plate-like [9, 19]
4. circular to subcircular in outline, but not flattened [9, 19]
5. thick and polygonal [9, 19]

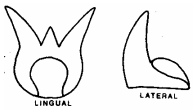


6. curved [9, 19]

7. circular to subcircular and flat with a button-like process [19]



8. circular to subcircular and thick with a button-like process [19]



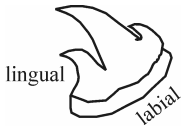
9. flat and star-shaped [19]

e. Shape of projections (cusps): [9, 19, 31]

0. indeterminate [9, 19]

1. triangular, not curved [9, 19]

2. triangular, curved lingually [9, 19]



3. triangular, curved laterally (mesially or distally) [9, 19, 31]

4. broad and blunt [9, 19]

5. none of the above [19]

f. Number of projections (cusps) [9, 19, 31]

Recorded as numbers [19]

g. Position of projections (cusps) [9, 19, 31]

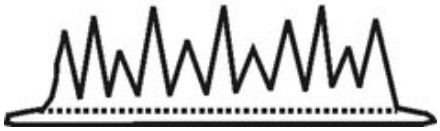
0. indeterminate [9, 19]

1. linearly arranged [9, 19]

2. not linearly arranged [9, 19]

h. In linear forms, geometry of cusps [9, 19, 31]

0. indeterminate or none of the following [31, 32]



1. cusps of different sizes with no order to their distribution [9, 19]

2. medial cusp with lateral cusps decreasing in size from medial cusp to edge of element; symmetrical [9, 19]

3. medial cusp with smaller lateral cusps, one of lateral cusps larger than lateral cusp nearest medial cusp; symmetrical [9, 19]

4. posterior cusp largest, succeeding anterior cusps decreasing in size; asymmetrical [9, 19]

5. medial cusp smaller than lateral cusps; symmetrical [9, 19]

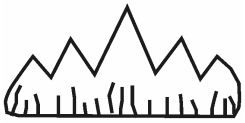
i. Crown labial surface features [31]

0. indeterminate [31]

1. absent (smooth) [31, 32]

2. lines or ridges multiple (greater than number of cusps), long (greater than 1/2 height of crown), and approximately vertical [31, 32]

3. lines or ridges multiple (greater than number of cusps), short (less than 1/2 height of crown), and approximately vertical [31, 32]



4. lines or ridges few (same as or less than number of cusps), long (greater than 1/2 height of crown), and approximately vertical [31, 32]

5. lines or ridges few (same as or less than number of cusps), short (shorter than 1/2 height of crown), and approximately vertical [31, 32]

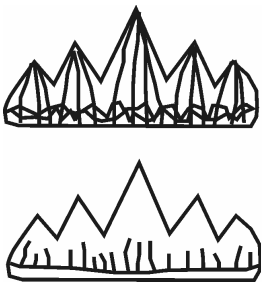
6. one node below each cusp on crown shoulder [31, 32]

7. more than one node below each cusp on crown shoulder [31, 32]

8. prominent peg (protrusion) on crown shoulder below principal cusp [31, 32]

9. rounded protrusion (not prominent peg) on crown shoulder below principal cusp [31, 32]

10. Longitudinal line(s) or ridge(s) on and traversing lower crown shoulder, may be networked, may be discontinuous [31, 32]



j. Crown lingual surface features. Refer to characteristics: “i” 0 to 10 (above) [31]

Refer to characteristics: “i” 0 to 10 (above) [31]

APPENDIX 1.8.0

Type a12/b1,2,3

A dome-shaped form without a pedicle or base.

List of Tofino Basin subtypes a12/b1,2,3

a12/b1/c3/d0/e0/f0 undescribed ichthyolith oddity, Form C ("globular dome")

a12/b1,2,3/c3/d1/e2/f3 undescribed ichthyolith oddity, Form D

a12/b3/c1/d1/e1,3/f≤5 undescribed ichthyolith oddity, Form E

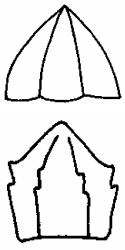
a12/b10 undescribed ichthyolith oddity, Form F

APPENDIX 1.8.1

Type a12/b1,2,3
A dome-shaped form without a pedicle.

c. Nature of crown
    0. none of the following [19]
    1. pointed [19]
    2. flat [19]
    3. rounded [32]

d. Nature of crown keels, ridges, or lines [19]
    0. absent or none of the following [32]
    1. smooth [19]
    2. toothed or serrated [19, 32]



e. Length of crown keels, ridges, or lines [32]
    0. absent or none of the following [32]

1. all long: extend from crown base to apex [32]

2. all short: do not extend from crown base to apex [32]

3. mixed (mixed short and long) [32]

f. Number of crown keels, ridges, or lines [32]

Recorded as numbers [32]

APPENDIX 1.9.0

Type a15/b1,2±6±7±10±12

A bar-shape form without cusps. May have various crown ornamentation.

Tofino Basin subtype a15/b1,2±6±7±10±12

a15/b10+12 undescribed ichthyolith oddity, Form G

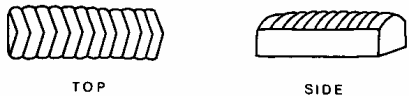
APPENDIX 1.9.1

Type a15/b1,2±6±7±10±12
A bar-shape form without cusps. May have various crown ornamentation.

c. crown ornamentation [31]

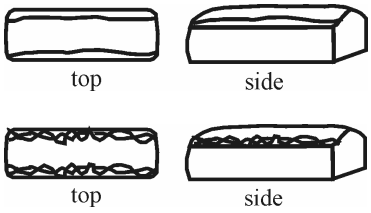
0. indeterminate or none [9, 19, 31, 32]

1. lines or ridges, parallel or approximately parallel [31]



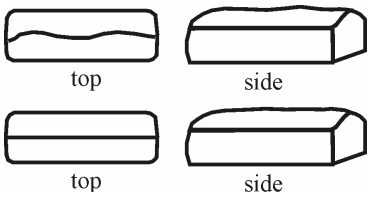
2. lines or ridges radiate from a margin [31, 32]

3. lines or ridges extend longitudinally along shoulders, may be networked [31, 32]



4. lines or ridges radiate from crown central region [32]

5. median line or ridge [32]



6. irregular lines or ridges [32]

7. pitted or pores [32]

8. stippled or nodular [32]

APPENDIX 1.10.0

Type a1/b1

Ichthyoliths that do not fit any of the general outline characters (Tofino Basin ichthyolith oddities).

List of Tofino Basin subtypes a1/b1

a1/b1/c2 undescribed ichthyolith oddity, Form A

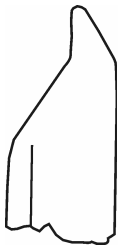
a1/b1/c3 undescribed ichthyolith oddity, Form B

APPENDIX 1.10.1

Type a1/b1
Ichthyoliths that do not fit any of the general outline characters

c. Margin modifications

0. indeterminate
1. none of the following



2. flared-asymmetric into a flange-like structure

3. curved projections on each face

APPENDIX 2.

Ichthyolith database including: GSC specimen and PE figure numbers, abbreviated CUIIS identification, Tofino Basin ichthyoliths, sample and interval data, provisional ichthyolith zone or interval, and stratigraphic position based on Tofino Basin and deep-sea ichthyoliths, foraminifers (Narayan 2003; Narayan 2005; Cameron 1980), and Shell Canada Limited biostratigraphic data.

Appendix 2.1.

Sorted by ichthyolith.

Appendix 2.2.

Sorted by location.

Appendix 2. Ichthyolith (sorted by ichthyolith) database

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks ….interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated ….interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
do not delete row			last update: 2004-11-30					**0.3048**																	
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	3980	3990	1213.1	1216.2										X	Pliocene and upper Miocene		lower Pliocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	4060	4080	1237.5	1243.6										X	Pliocene and upper Miocene		upper Miocene		lower Pliocene	bathyal
124657	76.2.1	good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	4230	4260	1289.3	1298.4										X	Pliocene and upper Miocene		upper Miocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	2595	2626	791.0	800.4										X	upper-lower Pliocene; pos. upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	3648	3679	1111.9	1121.4										X	Pliocene and upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4080	4111	1243.6	1253.0										X	Pliocene and upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4364	4393	1330.1	1339.0										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4426	4457	1349.0	1358.5										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	6516	6546	1986.1	1995.2										X	Pliocene and upper Miocene		lower Pliocene		upper Miocene	bathyal
124656	76.1.1	good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Prometheus H-68	4850	4870	1478.3	1484.4										X	lower Pliocene to upper Miocene		lower Pliocene		Miocene	
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Prometheus H-68	5170	5190	1575.8	1581.9										X	lower Pliocene to upper Miocene		lower Pliocene		Miocene	
124520	12.1.1 to 12.1.4	spec	a9/b8/c19/d19	*?Isurolamna* sp. A	BC-74-14, #5, Rafael Point, Flores Island	170	172	51.8	52.4											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		2 base frags	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula									X						Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74-14, #3; Rafael Point, Flores Island	93	126	28.3	38.4					X						Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74-17, #14, Dagger Point, Flores Island	359	393	109.4	119.8					X						Oligocene-upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5410	5420	1649.0	1652.0					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5480	5490	1670.3	1673.4					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5960	5970	1816.6	1819.7					X						upper Eocene-Oligocene; reworked into lower Miocene		upper Oligocene		Miocene to Oligocene	
124587	41.1.1	good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	6560	6570	1999.5	2002.5					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	6970	6980	2124.5	2127.5					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	7140	7150	2176.3	2179.3					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
124588	41.2.1	good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	8420	8430	2566.4	2569.5					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	8860	8870	2700.5	2703.6					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Prometheus H-68	5770	5780	1758.7	1761.7					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	
		spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Zeus D-14	6850	6860	2087.9	2090.9					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		?fair cap	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Apollo J-14	7960	7980	2426.2	2432.3					X						Oligocene-upper Eocene; reworked into Miocene strata				Miocene	upper bathyal
		frag?	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Pluto I-87	6880	6890	2097.0	2100.1					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		fair cap	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Zeus D-14	4040	4060	1231.4	1237.5					X						Oligocene-upper Eocene; reworked into Miocene strata		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5160	5170	1572.8	1575.8									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
124686	85.6.1	frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5560	5570	1694.7	1697.7									X		Miocene		upper-lower Miocene		Miocene	upper bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5900	5910	1798.3	1801.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8240	8260	2511.6	2517.6									X		Miocene		lower Pliocene		Miocene	upper bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8460	8470	2578.6	2581.7									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8460	8470	2578.6	2581.7									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8570	8580	2612.1	2615.2									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8940	8950	2724.9	2728.0									X		Miocene		mixed interval		undiagnostic	undiagnostic
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	9010	9020	2746.2	2749.3									X		Miocene		mixed interval		undiagnostic	undiagnostic
124687	85.7.1	frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	9450	9460	2880.4	2883.4									X		Miocene		mixed interval		undiagnostic	undiagnostic
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	4518	4549	1377.1	1386.5									X		Pliocene and Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	7691	7722	2344.2	2353.7									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6A			0m	0.29m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6A			0m	0.29m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6B			0.29m	0.52m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6B			0.29m	0.52m									X		Miocene and Pliocene					
124683	85.3.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6D			0.87m	1.16m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6D			0.87m	1.16m									X		Miocene and Pliocene					
124682	85.2.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
124684	85.4.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
124685	85.5.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	4810	4830	1466.1	1472.2									X		Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5230	5240	1594.1	1597.2									X		Miocene and Pliocene		lower Pliocene		Miocene	

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		cap	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5250	5260	1600.2	1603.2									X		Miocene and Pliocene		lower Miocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5310	5320	1618.5	1621.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5440	5450	1658.1	1661.2									X		Miocene and Pliocene		middle Miocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	6780	6790	2066.5	2069.6									X		Miocene		mixed interval/volcanics		Eocene volcanics	
124681	85.1.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	7250	7260	2209.8	2212.8									X		Miocene		mixed interval/volcanics		Eocene volcanics	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	3360	3380	1024.1	1030.2									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4260	4280	1298.4	1304.5									X	x	Miocene and Pliocene		upper Miocene		Miocene	bathyal
		cap	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4620	4640	1408.2	1414.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4730	4740	1441.7	1444.8									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5090	5100	1551.4	1554.5									X		Miocene		middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5570	5580	1697.7	1700.8									X		Miocene		Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6130	6140	1868.4	1871.5									X		Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6160	6170	1877.6	1880.6									X		Miocene		lower Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6180	6190	1883.7	1886.7									X		Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6540	6550	1993.4	1996.4									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6870	6880	2094.0	2097.0									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6930	6940	2112.3	2115.3									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6970	6980	2124.5	2127.5									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6970	6980	2124.5	2127.5									X		Miocene		mixed interval		Miocene	bathyal
		good	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	7050	7060	2148.8	2151.9									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	7550	7560	2301.2	2304.3									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	3840	3860	1170.4	1176.5									X		Miocene		upper Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
124611	50.1.1	fair	a9/b5+8/c13+19/d13+19	*beveled triangle high inline* Doyle, Dunsworth, and Riedel, 1978	Pluto I-87	7420	7430	2261.6	2264.7											upper Eocene-Oligocene	lower Paleocene through lower Eocene; rare Campanian;	lower Oligocene-upper Eocene		Oligocene	
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-71-5, near Escalante Point, Hesquiat Peninsula	392	407	119.5	124.1						X					upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124590	42.2.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124592	42.4.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

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		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124591	42.3.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124593	42.5.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124589	42.1.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124594	42.6.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124595	42.7.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		11+ base frags	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula										X					Oligocene; may be reworked from Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-2, #38, Leclair Point, Hesquiat Peninsula	653.5	676	199.2	206.0						X					upper Eocene; may be reworked Cretaceous to lower Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-3 #10; Leclair Point, Hesquiat Peninsula	150	165	45.7	50.3						X					upper Eocene; may be reworked Cretaceous to lower Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-7 #1, Estevan Point, Hesquiat Peninsula	0	5	0.0	1.5						X					upper Eocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-8, #11, Smokehouse Bay, Hesquiat Peninsula	310	341	94.5	103.9						X					upper Eocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	Pluto I-87	8770	8780	2673.1	2676.1						X					Oligocene-upper Eocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
124669	80.1.1	good	a9/b1,5/c1/d1	cf. *curved flared triangle* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	6260	6270	1908.0	1911.1											Oligocene-upper Eocene; ?reworked from older strata	Upper Jurassic through Middle Eocene	upper Oligocene			
124670	80.1.2	spec	a9/b1,5/c1/d1	cf. *curved flared triangle* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	7720	7730	2353.1	2356.1											Oligocene-upper Eocene; ?reworked from older strata	Upper Jurassic through Middle Eocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Apollo J-14	8420	8430	2566.4	2569.5									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula													x		Miocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Cygnet J-100	5865	5896	1787.7	1797.1									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	END-76B-6B			0.29m	0.58m									X		Miocene and Pliocene					
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
124638	69.1.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Pluto I-87	5840	5850	1780.0	1783.1									X		Miocene; ?sloughed into Oligocene		upper Oligocene		Miocene to Oligocene	
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	6500	6510	1981.2	1984.2									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	7110	7120	2167.1	2170.2									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	7210	7220	2197.6	2200.7									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8040	8060	2450.6	2456.7									X		Miocene				Miocene	upper bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Cygnet J-100	5033	5064	1534.1	1543.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Prometheus H-68	5710	5720	1740.4	1743.5									X		Miocene		mixed interval		Miocene	
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6010	6020	1831.8	1834.9									X		Miocene		lower Miocene		Miocene	bathyal

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		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6680	6690	2036.1	2039.1									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6870	6860	2094.0	2090.9									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Cygnet J-100	4874	4906	1485.6	1495.3									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Cygnet J-100	5523	5554	1683.4	1692.9									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Prometheus H-68	5170	5190	1575.8	1581.9									X	x	Miocene and Pliocene		lower Pliocene		Miocene	
124641	71.1.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Prometheus H-68	5640	5650	1719.1	1722.1									X		Miocene		mixed interval, with Miocene		Miocene	
124642	71.2.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	3160	3180	963.2	969.3									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	4850	4860	1478.3	1481.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6240	6250	1902.0	1905.0									X		Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6730	6740	2051.3	2054.4									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6790	6800	2069.6	2072.6									X		Miocene		mixed interval		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Cygnet J-100	7753	7784	2363.1	2372.6									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Prometheus H-68	5710	5720	1740.4	1743.5									X		Miocene		mixed interval		Miocene	
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	3240	3260	987.6	993.6									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	4790	4800	1460.0	1463.0									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	4890	4900	1490.5	1493.5									X		Miocene and Pliocene		middle Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5190	5200	1581.9	1585.0									X		Miocene		middle Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5880	5890	1792.2	1795.3									X		Miocene		Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5990	6000	1825.8	1828.8									X		Miocene		lower Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	6400	6410	1950.7	1953.8									X		Miocene		mixed interval		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	6870	6880	2094.0	2097.0									X		Miocene		mixed interval		Miocene	bathyal
124629	62.1.1	spec	a8/b5+8/c1,2/d1,2	cf. *flexed triangle asymmetric* Doyle & Riedel, 1985	BC-74-6, #36, Estevan Point, Hesquiat Peninsula	1096	1104	334.1	336.5											deposited in Oligocene strata; ?reworked from older strata	Paleocene and earliest Eocene		Oligocene (*Turrilina alsatica* foraminifer zone); pos. reworked		
124560	25.1.1, 25.1.2	spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124679	84.1.1	good	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	5490	5500	1673.4	1676.4										X	Pliocene and upper Miocene	latest Miocene to Recent	upper-lower Miocene		Miocene	upper bathyal
		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Cygnet J-100	3648	3679	1111.9	1121.4										X	Pliocene and upper Miocene	latest Miocene to Recent	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Cygnet J-100	7167	7207	2184.5	2196.7										X	Pliocene and upper Miocene	latest Miocene to Recent	lower Pliocene		upper Miocene	bathyal
		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	END-76B-6C			0.58m	0.87m										X	Pliocene and upper Miocene	latest Miocene to Recent				
124680	84.2.1	good	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	4420		1347.2											X	lower Pliocene to upper Miocene	latest Miocene to Recent	lower Pliocene		Miocene	

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		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	3840	3860	1170.4	1176.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
124675	82.2.1	spec	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4750	4760	1447.8	1450.8									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4770	4780	1453.9	1456.9									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4830	4840	1472.2	1475.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4930	4940	1502.7	1505.7									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4950	4960	1508.8	1511.8									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5490	5500	1673.4	1676.4									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5590	5660	1703.8	1725.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
124674	82.1.1	spec	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5610	5620	1709.9	1713.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5650	5660	1722.1	1725.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5840	5860	1780.0	1786.1									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	7590	7600	2313.4	2316.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval/volcanics		Eocene volcanics	undiagnostic
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Cygnet J-100	4395	4426	1339.6	1349.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper-lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Prometheus H-68	5550	5560	1691.6	1694.7									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval, with Miocene		Miocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4990	5000	1521.0	1524.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5880	5890	1792.2	1795.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5880	5890	1792.2	1795.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	6580	6590	2005.6	2008.6									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval		Miocene	bathyal
		frag	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1985	Pluto I-87	5870	5880	1789.2	1792.2				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	upper Oligocene		Miocene to Oligocene	
124572	28.1.1	spec	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1986	Pluto I-87	6140	6150	1871.5	1874.5				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	upper Oligocene		Miocene to Oligocene	
		frag	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1987	Pluto I-87	7970	7980	2429.3	2432.3				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	lower Oligocene-upper Eocene		Oligocene	
124571	27.2.1	spec	a4/b2+6/c2/d4+8+10	cf. *pointed and skirted* Doyle, Dunsworth, & Riedel, 1978	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through lower Eocene; rare later Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124570	27.1.1	spec	a4/b2+6/c2/d4+8+10	cf. *pointed and skirted* Doyle, Dunsworth, & Riedel, 1978	Prometheus H-68	5710	5720	1740.4	1743.5		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene / Oligocene / Miocene	Campanian through lower Eocene; rare later Cenozoic	mixed interval		Miocene	
124556	23.1.1	spec	a3/b2+12/c3/d5+6	cf. *rhombus kite* Gupta, 1991	BC-74-7, #10, Estevan Point, Hesquiat Peninsula	226	264	68.9	80.5											Oligocene; may be reworked Cretaceous to lower Eocene	Paleogene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124676	83.1.1	good	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	5490	5500	1673.4	1676.4									X		Miocene; ?sloughed into Oligocene	Oligocene/Miocene boundary through Quaternary	lower Miocene		Miocene to Oligocene	
124677	83.2.1	spec	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	4680	4690	1426.5	1429.5									X		lower Pliocene and Miocene	Oligocene/Miocene boundary through Quaternary	upper Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	4990	5000	1521.0	1524.0									X		Miocene and Pliocene	Oligocene/Miocene boundary through Quaternary	middle Miocene		Miocene	bathyal
124678	83.3.1	good	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene	Oligocene/Miocene boundary through Quaternary	lower Miocene		Miocene	bathyal
		?fair	a9/b5/c1/d1	cf. *short triangle stepped margin?* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	9800	9810	2987.0	2990.1									X		Miocene	Oligocene/Miocene boundary through Quaternary	mixed interval		undiagnostic	undiagnostic
		?frag	a9/b5/c1/d1	cf. *short triangle stepped margin?* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene	Oligocene/Miocene boundary through Quaternary	lower Pliocene		Miocene	
124618	53.2.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Cygnet J-100	4489	4518	1368.2	1377.1											?reworked from older strata	Cretaceous and older strata	upper-lower Pliocene		lower Pliocene	mainly bathyal
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Pluto I-87	6450	6460	1966.0	1969.0											deposited in Oligocene-upper Eocene strata; ?reworked from older strata	Cretaceous and older strata	upper Oligocene		Miocene to Oligocene	
124619	53.3.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Pluto I-87	6590	6600	2008.6	2011.7											deposited in Oligocene-upper Eocene strata; ?reworked from older strata	Cretaceous and older strata	upper Oligocene		Miocene to Oligocene	
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Prometheus H-68	5770	5780	1758.7	1761.7											?reworked from older strata	Cretaceous and older strata	mixed interval		Miocene	
124617	53.1.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Zeus D-14	5350	5360	1630.7	1633.7											?reworked from older strata	Cretaceous and older strata	middle Miocene		Miocene	bathyal
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Zeus D-14	6280	6290	1914.1	1917.2											?reworked from older strata	Cretaceous and older strata	lower Miocene		Miocene	bathyal
124635	67.1.1	spec	a9/b1/c1/d1	cf. *small triangle long striations* Dunsworth, Doyle, and Riedel, 1975	Cygnet J-100	6516	6546	1986.1	1995.2										X	Pliocene and upper Miocene	lower Miocene through Quaternary	lower Pliocene		upper Miocene	bathyal
124636	67.2.1	spec	a9/b1/c1/d1	cf. *small triangle long striations* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	5530	5540	1685.5	1688.6											Miocene	lower Miocene through Quaternary	middle-upper Miocene		Miocene	bathyal
		spec	a9/b8/c13+19/d13+19	cf. *straight triangle keeled edges* Ramsey, Doyle, and Riedel, 1976	Cygnet J-100	2750	2781	838.2	847.6											?reworked	Upper Jurassic through Miocene	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124626	58.1.1	spec	a9/b8/c13+19/d13+19	cf. *straight triangle keeled edges* Ramsey, Doyle, and Riedel, 1976	Zeus I-65	3450	3460	1051.6	1054.6											mixed interval	Upper Jurassic through Miocene	upper-middle Miocene		lower Miocene / Oligocene; Eocene?	>600'
124637	68.1.1	spec	a9/b1/c1/d1	cf. *striated triangle* Ramsey, Doyle, & Riedel, 1976	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula															Oligocene; ?reworked Eocene through Cretaceous	Upper Jurassic through Eocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124612	51.1.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *triangle bowed inline* Ramsey, Doyle, & Riedel, 1976	BC-71-4; 40' below lower contorted zone, near Escalante Point; Hesquiat Peninsula	500		152.4												upper Eocene	Cretaceous through Eocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124613	51.2.1	spec	a9/b1,5/c19/d19	cf. *triangle bowed inline* Ramsey, Doyle, & Riedel, 1976	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7											upper Eocene	Cretaceous through Eocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Apollo J-14	9240	9250	2816.4	2819.4							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	mixed interval		undiagnostic	undiagnostic
124621	54.2.1, 54.2.2, 54.2.3	spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Pluto I-87	5330	5340	1624.6	1627.6							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	lower Miocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Pluto I-87	5360	5370	1633.7	1636.8							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	lower Miocene		Miocene to Oligocene	
124620	54.1.1, 54.1.2	spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Zeus D-14	4040	4060	1231.4	1237.5							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	upper Miocene		Miocene	bathyal
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Zeus D-14	5840	5860	1780.0	1786.1							X				?reworked from older Cenozoic strata	upper Paleocene through lowermost Eocene	Miocene	Miocene; lower Paleocene through lower Eocene	Miocene	bathyal
124610	49.1.1	good	a9/b5+8/c(9,13)+19/d(9,13)+19	cf. *triangle notched corner* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	5000	5015	1524.0	1528.6									x		mixed interval, reworked?	upper Eocene to Oligocene/ Miocene boundary	upper-lower Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1/	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	END-76B-6A			0m	0.29m												Cretaceous through Quaternary				
124688	86.1.1	spec	a9/b1/c1/d1	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	Prometheus H-68	6160	6170	1877.6	1880.6								X			middle-lower Miocene	Cretaceous through Quaternary	mixed interval/volcanics		Eocene volcanics	
124689	86.2.1	spec	a9/b5/c1/d1	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	Zeus D-14	6130	6140	1868.4	1871.5								X			middle and lower Miocene	Cretaceous through Quaternary	mixed interval		Miocene	bathyal
124598	44.1.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	5540	5580	1688.6	1700.8					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	lower Miocene		Miocene to Oligocene	
124600	44.3.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	5500	5510	1676.4	1679.4					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval, with Miocene		Miocene	
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	7220		2200.7						X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval/volcanics		Eocene volcanics	
124599	44.2.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6580	6590	2005.6	2008.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6580	6590	2005.6	2008.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
124634	66.1.1	spec	a9/b1/c1/d1	cf. *triangle with parallel inline* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked from Eocene through Cretaceous	erratic throughout Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124690	87.1.1	spec	a9/b5/c1/d1	cf. *triangular triangle* Kozarek and Orr, 1980	Apollo J-14	5490	5500	1673.4	1676.4									x	x	Miocene	Oligocene to Quaternary	upper-lower Miocene		Miocene	upper bathyal
124627	59.1.1, 59.1.2	good	a9/b5+8+(10,12)/c19/d19	cf. *wide crescent* Doyle, Dunsworth, & Riedel, 1978	BC-74-1, #18; Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1											lower Oligocene-upper Eocene	Campanian to lower Paleocene; rare Eocene and Miocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		spec	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	540	560	164.6	170.7											Oligocene-upper Eocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene		Oligocene (*Bulimina* cf. *alsatica/* Turrilina alsatica foraminifer zone)		
		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	2300	2320	701.0	707.1											Oligocene-upper Eocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene		Oligocene (*Turrilina alsatica/ Chilogembelina cubensis* foraminifer zone)		
124625	57.1.1	good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-South of Escalante Bay; C535A, Hesquiat Peninsula																lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene				
		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	Cygnet J-100	3276	3307	998.5	1008.0									x		Pliocene - Miocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal

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		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	3800	3820	1158.2	1164.3											?reworked	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	5520	5530	1682.5	1685.5									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	5690	5700	1734.3	1737.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
124671	81.1.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	9120	9130	2779.8	2782.8									X		Miocene		mixed interval		undiagnostic	undiagnostic
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	3089	3121	941.5	951.3									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	3214	3245	979.6	989.1									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	5800	5835	1767.8	1778.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
124673	81.3.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Pluto I-87	7070	7080	2154.9	2158.0									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Prometheus H-68	4950	4970	1508.8	1514.9									X		Miocene and Pliocene		lower Pliocene		Miocene	
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Prometheus H-68	5150	5160	1569.7	1572.8									X		Miocene and Pliocene		lower Pliocene		Miocene	
124672	81.2.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	5030	5040	1533.1	1536.2									X		Miocene		middle Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	5210	5220	1588.0	1591.1									X		Miocene		middle Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	6890	6900	2100.1	2103.1									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	5000	5015	1524.0	1528.6									X		Miocene		upper-lower Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	5490	5500	1673.4	1676.4									X	x	Miocene		upper-lower Miocene		Miocene	upper bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8560	8570	2609.1	2612.1									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8960	8970	2731.0	2734.1									X		Miocene		mixed interval		undiagnostic	undiagnostic
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5290	5300	1612.4	1615.4									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5290	5300	1612.4	1615.4									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5410	5420	1649.0	1652.0									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Prometheus H-68	5200	5210	1585.0	1588.0									X		Miocene and Pliocene		lower Pliocene		Miocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5230	5240	1594.1	1597.2									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5550	5560	1691.6	1694.7									X		Miocene		Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5670	5680	1728.2	1731.3									X		Miocene		Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Prometheus H-68	5350	5360	1630.7	1633.7								X			middle and lower Miocene		upper Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Prometheus H-68	5480	5490	1670.3	1673.4								X			mixed interval		mixed interval, with Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	5650	5660	1722.1	1725.2								X			middle and lower Miocene		Miocene		Miocene	bathyal
124668	79.3.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	5910	5920	1801.4	1804.4								X			middle and lower Miocene		Miocene		Miocene	bathyal
124666	79.2.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	6010	6020	1831.8	1834.9								X			middle and lower Miocene		lower Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	7210	7220	2197.6	2200.7								X			mixed interval		mixed interval		Miocene	bathyal
124667	79.1.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	7560	7570	2304.3	2307.3								X			mixed interval		mixed interval/volcanics		Eocene volcanics	undiagnostic
		?frag	a9/b1,5/c1/d1	*curved triangle, striated inline?* new subtype	Zeus D-14	6160	6170	1877.6	1880.6								X			mixed interval		lower Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, striated inline?* new subtype	Zeus D-14	6240	6250	1902.0	1905.0								X			mixed interval		lower Miocene		Miocene	bathyal
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Apollo J-14	8920	8930	2718.8	2721.9									X		Miocene		mixed interval		pos. lower Miocene	bathyal
124645	72.3.1	good frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Apollo J-14	9120	9130	2779.8	2782.8									X		Miocene		mixed interval		undiagnostic	undiagnostic
124646	72.4.1	good frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Cygnet J-100	6516	6546	1986.1	1995.2									X	x	lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
124647	72.5.1	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Cygnet J-100	7629	7660	2325.3	2334.8									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal

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124644	72.2.1	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	END-76B-6D			0.87m	1.16m									X		lower Pliocene and Miocene					
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Pluto I-87	5520	5530	1682.5	1685.5									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Prometheus H-68	5170	5190	1575.8	1581.9									X	x	Miocene and Pliocene		lower Pliocene		Miocene	
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	3640	3660	1109.5	1115.6									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	3840	3860	1170.4	1176.5									X		Miocene		upper Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	6300	6310	1920.2	1923.3									X		Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	6790	6800	2069.6	2072.6									X		Miocene		mixed interval		Miocene	bathyal
124643	72.1.1, 72.1.2	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	7560	7570	2304.3	2307.3									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
		?frag	a9/b1,5/c1/d1	*curved triangle, wide inline?* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, wide inline?* new subtype	Zeus D-14	6500	6510	1981.2	1984.2									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7						X					upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124661	78.1.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124665	78.5.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124662	78.2.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124663	78.3.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124664	78.4.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74-7, #6; Estevan Point, Hesquiat Peninsula	84	114	25.6	34.7						X					Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		?spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline?* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124544	13.1.1, 13.1.2	spec	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124545	13.2.1	spec	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124522	3.5.1, 4.2.1	~whole	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124521	3.4.1, 4.1.1	~whole	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124523	4.3.1	base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

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		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124524	4.4.1	spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	Zeus D-14	5030	5040	1533.1	1536.2	X										Cretaceous to lower Eocene; reworked into upper Eocene / Oligocene / Miocene strata		middle Miocene		Miocene	bathyal
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c12+19/d19	Family Squalidae, Form B	BC-74 spot check, Flores Island					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene					
124525	5.1.1	spec	a9/b8+12/c12+19/d19	Family Squalidae, Form B	BC-74-1, #13; Leclair Point, Hesquiat Peninsula	267	269	81.4	82.0	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			upper Eocene to lower Oligocene (*Chiloguembelina cubensis* foraminifer zone)		
124534	6.1.1	spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks .... interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated .... interval	cf. triangle curved ... interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	Pluto I-87	5240	5250	1597.2	1600.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Miocene		Miocene to Oligocene	
124533	7.1.1	spec	a9/b8+11+12/c14+19/d19	Family Squalidae, Form D	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+11+12/c14+19/d19	Family Squalidae, Form D	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124530	8.1.1	spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124531	8.2.1	spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124532	8.3.1	frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Harlequin D-86	4855	4866	1479.8	1483.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			lower-middle Miocene (Patterson, 1988)	lower to middle Miocene	
		?frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Harlequin D-86	4855	4866	1479.8	1483.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			lower-middle Miocene (Patterson, 1988)	lower to middle Miocene	
		?spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Pluto I-87	5240	5250	1597.2	1600.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Pluto I-87	9220	9230	2810.3	2813.3	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Osprey D-36	2700	2750	823.0	838.2					x	x					Oligocene-upper Eocene; ?reworked			Quaternary-Pliocene (Patterson, 1988)	lower Pliocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7220	7230	2200.7	2203.7					x	x					upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7360	7370	2243.3	2246.4					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7420	7430	2261.6	2264.7					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7650	7660	2331.7	2334.8					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	9220	9230	2810.3	2813.3					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex*, *centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	10260	10270	3127.2	3130.3					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene			Oligocene	continental margin slope

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Zeus D-14	7150	7160	2179.3	2182.4					x	x					upper Eocene-Oligocene		mixed interval		Miocene	bathyal
124606	46.1.1	spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-15, #12, Rafael Point, Flores Island	363	393	110.6	119.8					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #5, Dagger Point, Flores Island	99	132	30.2	40.2					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #5, Dagger Point, Flores Island	99	132	30.2	40.2					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #7, Dagger Point, Flores Island	164	197	50.0	60.0					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	END-76B-6E			1.16m	1.45m		x			X						upper Eocene and Oligocene; reworked into lower and middle Miocene					
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6490	6500	1978.2	1981.2					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6630	6640	2020.8	2023.9					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6660	6670	2030.0	2033.0					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6980	6990	2127.5	2130.6					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	?	?	?	?					X						upper Eocene-Oligocene					
124607	46.2.1	spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Prometheus H-68	5440	5450	1658.1	1661.2					X						Oligocene and upper Eocene; reworked into lower Miocene		middle Miocene		Miocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5220	5230	1591.1	1594.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5420	5430	1652.0	1655.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5450	5460	1661.2	1664.2					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5640	5650	1719.1	1722.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5710	5720	1740.4	1743.5					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5860	5870	1786.1	1789.2					X						upper Eocene-Oligocene; reworked into lower Miocene		upper Oligocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	6740	6750	2054.4	2057.4					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7060	7070	2151.9	2154.9					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7140	7150	2176.3	2179.3					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7860	7870	2395.7	2398.8					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6500	6510	1981.2	1984.2					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6680	6690	2036.1	2039.1					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6970	6980	2124.5	2127.5					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	7390	7400	2252.5	2255.5					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		undiagnostic	undiagnostic

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124557	24.1.1, 24.1.2	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124558	24.2.1	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124559	24.3.1, 24.3.2	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag?	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line?* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		frag?	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line?* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124650	73.3.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3555	3586	1083.6	1093.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124651	73.4.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3555	3586	1083.6	1093.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124652	73.5.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124649	73.2.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	4080	4111	1243.6	1253.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	4620	4640	1408.2	1414.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	4700	4710	1432.6	1435.6									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
124648	73.1.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	5510	5520	1679.4	1682.5									X		Miocene		Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene		lower Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Apollo J-14	4230	4260	1289.3	1298.4									X	x	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Apollo J-14	5690	5900	1734.3	1798.3									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Pluto I-87	7110	7120	2167.1	2170.2									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Pluto I-87	8570	8580	2612.1	2615.2									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5250	5260	1600.2	1603.2									X		Miocene and Pliocene		lower Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5640	5650	1719.1	1722.1									X		Miocene		mixed interval, with Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5670	5680	1728.2	1731.3									X		Miocene		mixed interval, with Miocene		Miocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5770	5780	1758.7	1761.7									X		Miocene		mixed interval		Miocene	
124653	74.1.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	7400	7410	2255.5	2258.6									X		Miocene		mixed interval/volcanics		Eocene volcanics	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Zeus D-14	3160	3180	963.2	969.3									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Zeus D-14	6080	6090	1853.2	1856.2									X		Miocene		lower Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Cygnet J-100	5585	5615	1702.3	1711.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Pluto I-87	5570	5580	1697.7	1700.8									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Pluto I-87	6140	6150	1871.5	1874.5									X		Miocene; ?sloughed into Oligocene		upper Oligocene		Miocene to Oligocene	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	6040	6050	1841.0	1844.0									X		Miocene		mixed interval/volcanics		Eocene volcanics	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	7220		2200.7										X		Miocene		mixed interval/volcanics		Eocene volcanics	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	7250	7260	2209.8	2212.8									X		Miocene		mixed interval/volcanics		Eocene volcanics	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Zeus D-14	5880	5890	1792.2	1795.3									X		Miocene		Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Zeus D-14	7130	7140	2173.2	2176.3									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	BC-74-13, Dagger Point, Flores Island	1129	1150	344.1	350.5									x		known in Miocene; deposited in lower Oligocene/upper Eocene strata			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Pluto I-87	5380	5390	1639.8	1642.9									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Prometheus H-68	4530	4540	1380.7	1383.8									X		Pliocene and Miocene		lower Pliocene		Miocene	
124654	75.1.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Prometheus H-68	5790	5800	1764.8	1767.8									X		Miocene		mixed interval		Miocene	
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	5550	5560	1691.6	1694.7									X		Miocene		Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	7370	7380	2246.4	2249.4									X		Miocene		mixed interval		undiagnostic	undiagnostic
124655	75.2.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	7590	7600	2313.4	2316.5									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Apollo J-14	3990	4030	1216.2	1228.3									X	x	upper Miocene and Pliocene		lower Pliocene		lower Pliocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Pluto I-87	5240	5250	1597.2	1600.2									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?spec	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Zeus D-14	7130	7140	2173.2	2176.3									X		Miocene		mixed interval		Miocene	bathyal
124622	55.1.1	spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7					X						upper Eocene	upper Paleocene through Quaternary		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel 1974	BC-69-2, Skuna Bay, Nootka Island	3460	3480	1054.6	1060.7					X						Oligocene-upper Eocene	upper Paleocene through Quaternary		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124623	55.2.1	spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel 1974	Zeus D-14	6950	6960	2118.4	2121.4					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through Quaternary	mixed interval		Miocene	bathyal
		spec?	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase?* Doyle, Kennedy, & Riedel 1974	Zeus D-14	5730	5740	1746.5	1749.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through Quaternary	Miocene		Miocene	bathyal
124561	26.1.1	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form A	BC-71-2, near Escalante Point, Hesquiat Peninsula	554	564	168.9	171.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		upper Eocene (*Cibicides haydoni* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-69-2, Skuna Bay, Nootka Island	3220	3240	981.5	987.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks .... interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated .... interval	cf. triangle curved ... interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124562	26.2.1, 26.2.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124563	26.3.1, 26.3.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74-1, #1, Leclair Point, Hesquiat Peninsula	0	4	0.0	1.2		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74-1, #18, Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	5800	5810	1767.8	1770.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	5850	5860	1783.1	1786.1		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6100	6110	1859.3	1862.3		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6120	6130	1865.4	1868.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6140	6150	1871.5	1874.5		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6390	6400	1947.7	1950.7		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	7140	7150	2176.3	2179.3		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	7630	7640	2325.6	2328.7		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	lower Oligocene-upper Eocene		Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	10,030	10,040	3057.1	3060.2		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic			Oligocene	continental margin slope
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124565	26.5.1, 26.5.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks … interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124564	26.4.1, 26.4.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74-8, #11, Bag A, Smokehouse Bay, Hesquiat Peninsula	310	341	94.5	103.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-72-9, #5; north-western Hesquiat Peninsula	75	85	22.9	25.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124568	26.8.1, 26.8.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124566	26.6.1, 26.6.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124567	26.7.1, 26.7.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	Pluto I-87	6570	6580	2002.5	2005.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	Pluto I-87	6980	6990	2127.5	2130.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124569	26.9.1, 26.9.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form E	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124518	14.3.1 and 14.3.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	Apollo J-14	4200	4230	1280.2	1289.3										X	upper Miocene and Pliocene	frequently inhabit cool shelf waters	upper Miocene		lower Pliocene	bathyal
124517	3.2.1, 3.2.2; 14.2.1, 14.2.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	END-76B-6E			1.16m	1.45m										X	Pliocene-upper Miocene	frequently inhabit cool shelf waters				
124516	3.1.1; 14.1.1 and 14.1.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	Zeus I-65	1820	1850	554.7	563.9										X	Pliocene to upper Miocene	frequently inhabit cool shelf waters	upper-lower Pliocene		lower Miocene / Oligocene	>600'
124519	14.4.1	frag?	a4/b6+8/c1/d2+8	*Raja?* sp.	Apollo J-14	4500	4530	1371.6	1380.7										X	upper Miocene and Pliocene	frequently inhabit cool shelf waters	upper Miocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4140	4160	1261.9	1268.0										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4140	4160	1261.9	1268.0										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4230	4260	1289.3	1298.4										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124660	77.3.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4290	4320	1307.6	1316.7										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	5490	5500	1673.4	1676.4										X	upper Miocene and Pliocene		upper-lower Miocene		Miocene	upper bathyal
124658	77.1.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	5900	5910	1798.3	1801.4										X	upper Miocene and Pliocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	8580	8590	2615.2	2618.2										X	upper Miocene and Pliocene		lower Pliocene		pos. lower Miocene	bathyal
124659	77.2.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	8590	8600	2618.2	2621.3										X	upper Miocene and Pliocene		lower Pliocene		pos. lower Miocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	9140	9160	2785.9	2792.0										X	upper Miocene and Pliocene		mixed interval		undiagnostic	undiagnostic
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Cygnet J-100	4395	4426	1339.6	1349.0										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Zeus D-14	4260	4280	1298.4	1304.5										X	Pliocene and upper Miocene		upper Miocene		Miocene	bathyal
		spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	BC-74-15, #7, Rafael Point, Flores Island	213	243	64.9	74.1				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks .... interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated .... interval	cf. triangle curved ... interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124548	21.2.1	spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	Pluto I-87	5250	5260	1600.2	1603.2				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	
124547	21.1.1	spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	Pluto I-87	5540	5550	1688.6	1691.6				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula								X							upper Eocene and Oligocene	upper Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula								X							upper Eocene and Oligocene	upper Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74-14, #6; Rafael Point, Flores Island	191	210	58.2	64.0				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
124549	21.3.1	?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74-3, #9, Leclair Point, Hesquiat Peninsula	136	150	41.5	45.7				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124550	21.4.1	?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	Pluto I-87	8110	8120	2471.9	2475.0				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
124640	70.2.1	spec	a9/b1,5/c1/d1	*small pointed triangle* Tway, Doyle, and Riedel, 1985	Apollo J-14	4500	4530	1371.6	1380.7											mixed interval, reworked?	middle Eocene through upper Oligocene	upper Miocene		lower Pliocene	bathyal
124639	70.1.1	spec	a9/b1,5/c1/d1	*small pointed triangle* Tway, Doyle, and Riedel, 1985	Apollo J-14	8990	9000	2740.2	2743.2											mixed interval, reworked?	middle Eocene through upper Oligocene	mixed interval		undiagnostic	undiagnostic
124526	9.1.1	spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74-14, #6; Rafael Point, Flores Island	191	210	58.2	64.0	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124527	9.2.1	spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	Pluto I-87	11,220	11,230	3419.9	3422.9	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene				Eocene	
124528	10.1.1, 10.1.2	spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		?spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks … interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124529	11.1.1, 11.1.2	spec	a9/b8+12/c19/d19	Superorder Hexanchoidei, Form C	BC-74-11, #8; near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124551	22.1.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124552	22.2.1, 22.2.2	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124555	22.5.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #6, Rafael Point, Flores Island							X								common in Oligocene; ?reworked Eocene through Cretaceous					
124554	22.4.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124553	22.3.1	? spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		?spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		?frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	Pluto I-87	5990	6000	1825.8	1828.8			X								common in Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	4850	4880	1478.3	1487.4									X		Miocene		upper Miocene		lower Pliocene	bathyal
124609	48.2.1, 48.2.2	spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	6320	6340	1926.3	1932.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	8560	8570	2609.1	2612.1									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
124608	48.1.1	spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Zeus D-14	7590	7600	2313.4	2316.5									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
		spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	140	160	42.7	48.8						X					Oligocene-upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	1100	1120	335.3	341.4						X					Oligocene-upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
124633	64.2.1	spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-3, #10, Leclair Point, Hesquiat Peninsula	150	165	45.7	50.3						X					upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124632	64.1.1	spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	6380	6390	1944.6	1947.7						X					Oligocene-upper Eocene; ?reworked into lower Miocene strata	middle Eocene through middle Miocene	mixed interval		Miocene	bathyal
124615	52.2.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Apollo J-14	8860	8880	2700.5	2706.6											reworked?	lower Paleocene	lower Pliocene		pos. lower Miocene	bathyal
124616	52.3.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Zeus D-14	4870	4880	1484.4	1487.4											reworked?	lower Paleocene	upper Miocene		Miocene	bathyal
124614	52.1.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Zeus I-65	980	990	298.7	301.8											mixed interval	lower Paleocene	Pleistocene-Pliocene		lower Miocene	mixed shallow & deep faunas in deep water >600'; transported?
124596	43.1.1	spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	BC-74-13, #20, Dagger Point, Flores Island	685	718	208.8	218.8					X						Oligocene-upper Eocene	lower Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	5320	5330	1621.5	1624.6					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	
124597	43.2.1	spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	6140	6150	1871.5	1874.5					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	upper Oligocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	7170	7180	2185.4	2188.5					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	7270	7280	2215.9	2218.9					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a9/b5+8/c19/d19	*triangle sigmoid rough* Ramsey, Doyle, and Riedel, 1976	Murrelet K-15	1318	1347	401.7	410.6											Oligocene; ?reworked	Upper Jurassic through Eocene; rare Oligocene		Quaternary-Pliocene (Patterson, 1988)	Pliocene - lower Pliocene	
124624	56.1.1 to 56.1.5	spec	a9/b5+8/c19/d19	*triangle sigmoid rough* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	5950	5960	1813.6	1816.6											Oligocene	Upper Jurassic through Eocene; rare Oligocene	upper Oligocene		Miocene to Oligocene	
124605	45.5.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula									X						upper Eocene and Oligocene	upper Paleocene through lower Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
124604	45.4.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	7630	7640	2325.6	2328.7					X						upper Eocene-Oligocene	upper Paleocene through lower Miocene	lower Oligocene-upper Eocene		Oligocene	
124601	45.1.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6060	6070	1847.1	1850.1					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	lower Miocene		Miocene	bathyal
		spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6870	6880	2094.0	2097.0					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
		frag	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7070	7080	2154.9	2158.0					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
124602	45.2.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7350	7360	2240.3	2243.3					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		undiagnostic	undiagnostic
124603	45.3.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7550	7560	2301.2	2304.3					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval/volcanics		Eocene volcanics	undiagnostic
124691	88.1.1	spec	a9/b1/c1/d1	undescribed cone tooth Form A	Apollo J-14	5000	5015	1524.0	1528.6											Miocene		upper-lower Miocene		Miocene	bathyal
		spec	a9/b1/c1/d1	undescribed cone tooth Form A	Apollo J-14	5610	5620	1709.9	1713.0											Miocene		upper-lower Miocene		Miocene	upper bathyal
124692	88.2.1	spec	a9/b1/c1/d1	undescribed cone tooth Form A	END-76B-6A			0m	0.29m											Miocene?					
124693	89.1.1	spec	a9/b5/c1/d1	undescribed cone tooth Form E	Pluto I-87	6340	6350	1932.4	1935.5											Oligocene-upper Eocene		upper Oligocene		Miocene to Oligocene	
124694	90.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Cygnet J-100	4426	4457	1349.0	1358.5											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124695	90.2.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Cygnet J-100	5127	5153	1562.7	1570.6											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Zeus D-14	6200	6210	1889.8	1892.8											Miocene		lower Miocene		Miocene	bathyal
124696	91.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form D	Cygnet J-100	3648	3679	1111.9	1121.4											Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124697	92.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form E	Cygnet J-100	1636	1667	498.7	508.1											Pliocene		upper-lower Pliocene		Pleistocene-Pliocene	outer neritic to upper bathyal
124699	93.2.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Apollo J-14	4120	4130	1255.8	1258.8											upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124698	93.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Cygnet J-100	4270	4301	1301.5	1310.9											Pliocene and Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Prometheus H-68	5440	5450	1658.1	1661.2											Miocene		middle Miocene		Miocene	
124700	94.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form G	Pluto I-87	7970	7980	2429.3	2432.3											upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	
124701	95.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form H	Cygnet J-100	4395	4426	1339.6	1349.0											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124702	96.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form I	Apollo J-14	9430	9440	2874.3	2877.3											mixed interval		mixed interval		undiagnostic	undiagnostic
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form I	Cygnet J-100	4426	4457	1349.0	1358.5											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124703	97.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form J	Cygnet J-100	4644	4675	1415.5	1424.9											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal
124704	98.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form K	Zeus D-14	3920	3940	1194.8	1200.9											Miocene		upper Miocene		Miocene	bathyal
124705	99.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form L	END-76B-6C			0.58m	0.87m											Miocene?					
124706	100.1.1	spec	a9/b5/c1/d1	undescribed cone tooth Form M	Prometheus H-68	3550	3560	1082.0	1085.1											lower Pliocene		lower Pliocene		Pliocene	open marine, >600'
124575	30.1.1, 30.1.2	spec	a3,4/b2/c2/d4+10	undescribed elasmobranch dermal denticle (tooth?), Form B	Cygnet J-100	5460	5500	1664.2	1676.4											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal

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124573	29.1.1	spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124574	29.2.1	spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	Pluto I-87	6970	6980	2124.5	2127.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	Prometheus H-68	7030	7040	2142.7	2145.8											mixed interval		mixed interval/volcanics		Eocene volcanics	
124576	31.1.1	spec	a4/b1,2/c2/d1,4	undescribed elasmobranch dermal denticle; Form C	Prometheus H-68	5620	5630	1713.0	1716.0											?Oligocene and upper Eocene; reworked into lower Miocene		mixed interval, with Miocene		Miocene	
124577	32.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124578	33.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124579	34.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form F	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula															Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124580	35.1.1	spec	a4/b2+6+12/c2/d4+8+10	undescribed elasmobranch dermal denticle; Form G	Pluto I-87	6780	6790	2066.5	2069.6											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
124581	35.2.1	spec	a4/b2+6+12/c2/d4+8+10	undescribed elasmobranch dermal denticle; Form G	Pluto I-87	8590	8600	2618.2	2621.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Oligocene	continental margin slope
124582	36.1.1	spec	a4/b(2,7)+6/c2/d(2,4)+8+10	undescribed elasmobranch dermal denticle; Form H	Pluto I-87	5270	5280	1606.3	1609.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
124583	37.1.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	6790	6800	2069.6	2072.6											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
124584	37.2.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	7090	7100	2161.0	2164.1											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
124585	37.3.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	7810	7820	2380.5	2383.5											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval/volcanics		Eocene volcanics	undiagnostic
124709	38.1.1	spec	a1/b2+13	undescribed elasmobranch dermal denticle; Form J	Zeus D-14	6420	6430	1956.8	1959.9											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
124586	39.1.1	spec	a4/b6+7/c2/d2+8	undescribed elasmobranch dermal denticle; Form K	Pluto I-87	5710	5720	1740.4	1743.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		spec	a4/b6+7/c2/d2+8	undescribed elasmobranch dermal denticle; Form K	Pluto I-87	5710	5720	1740.4	1743.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		?spec	elasmobranch	undescribed elasmobranch tooth	END-76B-5A																				
124628	60.1.1, 60.1.2	spec	a9/b7+8/c19/d19	undescribed flanged tooth with mesial ridge	Pluto I-87	7010	7020	2136.6	2139.7											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Miocene to Oligocene	
124707	101.1.1	spec	a9/b1	undescribed ichthyolith oddity Form A	Zeus D-14	4990	5000	1521.0	1524.0											Miocene		middle Miocene		Miocene	bathyal
124708	102.1.1, 102.1.2	spec	a9/b1	undescribed ichthyolith oddity Form B	Prometheus H-68	5310	5320	1618.5	1621.5											Miocene and Pliocene		lower Pliocene		Miocene	
124710	103.1.1	spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	5460	5500	1664.2	1676.4											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	5460	5500	1664.2	1676.4											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
124711	103.2.1	spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	6516	6546	1986.1	1995.2											lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	7568	7598	2306.7	2315.9											lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Zeus D-14	3960	3980	1207.0	1213.1											Miocene		upper Miocene		Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Zeus D-14	5760	5780	1755.6	1761.7											Miocene		Miocene		Miocene	bathyal
		??spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Pluto I-87	10,060	10,070	3066.3	3069.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous				Oligocene	continental margin slope
		??spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Pluto I-87	10,060	10,070	3066.3	3069.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous				Oligocene	continental margin slope

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		?spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Prometheus H-68	5480	5490	1670.3	1673.4											Miocene		mixed interval, with Miocene		Miocene	
		?spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Zeus D-14	6680	6690	2036.1	2039.1											Miocene		mixed interval		Miocene	bathyal
124712	104.1.1, 104.1.2	spec	a12/b1,4?	undescribed ichthyolith oddity Form D	END-76B-6C			0.58m	0.87m											Miocene?					
124714	105.2.1	spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124713	105.1.1	spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	Pluto I-87	6870	6880	2094.0	2097.0											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	Prometheus H-68	5620	5630	1713.0	1716.0											?Oligocene and upper Eocene; reworked into lower Miocene		mixed interval, with Miocene		Miocene	
124715	106.1.1	spec	a12/b10	undescribed ichthyolith oddity Form F	Zeus D-14	4870	4880	1484.4	1487.4											Miocene		upper Miocene		Miocene	bathyal
		spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus D-14	4890	4900	1490.5	1493.5											Miocene		middle Miocene		Miocene	bathyal
124716	107.1.1	spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus D-14	5910	5920	1801.4	1804.4											Miocene		Miocene		Miocene	bathyal
		spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus I-65	1790	1820	545.6	554.7											mixed interval		upper-lower Pliocene		lower Miocene / Oligocene	>600'
		spec		unidentified cone tooth	Apollo J-14	4200	4230	1280.2	1289.3											upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		spec		unidentified cone tooth	BC-72-11, #4; near Split Cape, Hesquiat Peninsula	170		51.8												Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag		unidentified cone tooth	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec		unidentified cone tooth	BC-74-12, #17; Hesquiat Point	501	537	152.7	163.7											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		spec		unidentified cone tooth	Cygnet J-100	1636	1667	498.7	508.1											Pliocene		upper-lower Pliocene		Pleistocene-Pliocene	outer neritic to upper bathyal
		spec		unidentified cone tooth	Cygnet J-100	4489	4518	1368.2	1377.1											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		spec		unidentified cone tooth	Cygnet J-100	5523	5554	1683.4	1692.9											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal
		spec		unidentified cone tooth	END-76B-6C			0.58m	0.87m																
		spec		unidentified cone tooth	END-76B-6C			0.58m	0.87m																
		spec		unidentified cone tooth	Pluto I-87	6940	6950	2115.3	2118.4											upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec		unidentified cone tooth	Pluto I-87	7930	7940	2417.1	2420.1											upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	
		spec		unidentified cone tooth	Prometheus H-68	4530	4540	1380.7	1383.8											Pliocene and Miocene		lower Pliocene		Miocene	
		spec		unidentified cone tooth	Prometheus H-68	5730	5740	1746.5	1749.6											mixed interval		mixed interval		Miocene	
		spec		unidentified cone tooth	Zeus D-14	5430	5440	1655.1	1658.1											Miocene		Miocene		Miocene	bathyal
		spec		unidentified cone tooth	Zeus D-14	6790	6800	2069.6	2072.6											Miocene		mixed interval		Miocene	bathyal
		spec		unidentified elasmobranch dermal denticle	Apollo J-14	8940	8950	2724.9	2728.0											mixed interval		mixed interval		undiagnostic	undiagnostic
		spec		unidentified elasmobranch dermal denticle	Apollo J-14	9060	9070	2761.5	2764.5											mixed interval		mixed interval		undiagnostic	undiagnostic
		spec		unidentified elasmobranch dermal denticle	BC-71-5, extreme base of section; near Escalante Point, Hesquiat Peninsula	680		207.3												upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-12, #13, Hesquiat Point	383	390	116.7	118.9											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-13, #30; Dagger Point, Flores Island	972	1000	296.3	304.8											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-13, #37; Flores Island	1192	1196	363.3	364.5											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec		unidentified elasmobranch dermal denticle	BC-74-23, #2; Beano Bay, Nootka Island															upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec		unidentified elasmobranch dermal denticle	END-76B-6C			0.58m	0.87m																
		spec		unidentified elasmobranch dermal denticle	END-76B-6C			0.58m	0.87m																
		spec		unidentified elasmobranch dermal denticle	END-76B-6D			0.87m	1.16m																
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	5330	5340	1624.6	1627.6											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	6070	6080	1850.1	1853.2											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	7170	7180	2185.4	2188.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Zeus D-14	6640	6650	2023.9	2026.9											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
124535	15.1.1, 15.1.2	spec	a9/b2+8+12/c19/d19/	unidentified elasmobranch tooth, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-71-1, 30' into 990'; Escalante Point, Hesquiat Peninsula															upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124538	16.3.1	spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-71-4' 10' below lower contorted zone, near Escalante Point, Hesquiat Peninsula	470		143.3												upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124537	16.2.1	spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124536	16.1.1, 16.1.2	slab spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74-19, #79; Bajo Point, Nootka Island	3090	3131	941.8	954.3											Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124540	17.2.1, 17.2.2	spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124539	17.1.1, 17.1.2	?spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124541	17.3.1	spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74-19, #27, Bajo Point, Nootka Island	1037	1077	316.1	328.3											Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124543	18.2.1	?spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-69-2, Skuna Bay, Nootka Island	1080	1500	329.2	457.2											Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124542	18.1.1	?spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74-2, #38, Leclair Point, Hesquiat Peninsula	653.5	676	199.2	206.0											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124546	19.1.1, 19.1.2	spec	a9/b2+8+12/c19+20/d19+20	unidentified elasmobranch tooth, Form E	Prometheus H-68	5350	5360	1630.7	1633.7											Miocene; ?reworked from older strata		upper Miocene		Miocene	
124631	63.2.1	spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-1, #18, Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1						X					upper Eocene/Oligocene	Paleocene - Eocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124630	63.1.1	spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-6, #44, Bag A, Estevan Point, Hesquiat Peninsula	1345	1389	410.0	423.4						X					upper Eocene/Oligocene	Paleocene - Eocene		Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	Pluto I-87	9820	9830	2993.1	2996.2						X					upper Eocene/Oligocene	Paleocene - Eocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
		?spec	a8/b5+8/c2/d1,2	*wide triangle double flex?* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	3660	3680	1115.6	1121.7						X					upper Eocene/Oligocene	Paleocene - Eocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		?spec	a8/b5+8/c2/d1,2	*wide triangle double flex?* Dunsworth, Doyle, and Riedel, 1975	BC-74-6, #36, Estevan Point, Hesquiat Peninsula	1096	1104	334.1	336.5						X					upper Eocene/Oligocene	Paleocene - Eocene		Oligocene (*Turrilina alsatica* foraminifer zone); pos. reworked		

Appendix 2. Ichthyolith (sorted by location) database

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks ….interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated ….interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
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		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	3980	3990	1213.1	1216.2										X	Pliocene and upper Miocene		lower Pliocene		lower Pliocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Apollo J-14	3990	4030	1216.2	1228.3									X	x	upper Miocene and Pliocene		lower Pliocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	4060	4080	1237.5	1243.6										X	Pliocene and upper Miocene		upper Miocene		lower Pliocene	bathyal
124699	93.2.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Apollo J-14	4120	4130	1255.8	1258.8											upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4140	4160	1261.9	1268.0										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4140	4160	1261.9	1268.0										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124518	14.3.1 and 14.3.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	Apollo J-14	4200	4230	1280.2	1289.3										X	upper Miocene and Pliocene	frequently inhabit cool shelf waters	upper Miocene		lower Pliocene	bathyal
		spec		unidentified cone tooth	Apollo J-14	4200	4230	1280.2	1289.3											upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124657	76.2.1	good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Apollo J-14	4230	4260	1289.3	1298.4										X	Pliocene and upper Miocene		upper Miocene		lower Pliocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Apollo J-14	4230	4260	1289.3	1298.4									X	x	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4230	4260	1289.3	1298.4										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124660	77.3.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	4290	4320	1307.6	1316.7										X	upper Miocene and Pliocene		upper Miocene		lower Pliocene	bathyal
124519	14.4.1	frag?	a4/b6+8/c1/d2+8	*Raja?* sp.	Apollo J-14	4500	4530	1371.6	1380.7										X	upper Miocene and Pliocene	frequently inhabit cool shelf waters	upper Miocene		lower Pliocene	bathyal
124640	70.2.1	spec	a9/b1,5/c1/d1	*small pointed triangle* Tway, Doyle, and Riedel, 1985	Apollo J-14	4500	4530	1371.6	1380.7											mixed interval, reworked?	middle Eocene through upper Oligocene	upper Miocene		lower Pliocene	bathyal
		spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	4850	4880	1478.3	1487.4									X		Miocene		upper Miocene		lower Pliocene	bathyal
124610	49.1.1	good	a9/b5+8/c(9,13)+19/d(9,13)+19	cf. *triangle notched corner* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	5000	5015	1524.0	1528.6									x		mixed interval, reworked?	upper Eocene to Oligocene/ Miocene boundary	upper-lower Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	5000	5015	1524.0	1528.6									X		Miocene		upper-lower Miocene		Miocene	bathyal
124691	88.1.1	spec	a9/b1/c1/d1	undescribed cone tooth Form A	Apollo J-14	5000	5015	1524.0	1528.6											Miocene		upper-lower Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5160	5170	1572.8	1575.8									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
124679	84.1.1	good	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	5490	5500	1673.4	1676.4										X	Pliocene and upper Miocene	latest Miocene to Recent	upper-lower Miocene		Miocene	upper bathyal
124690	87.1.1	spec	a9/b5/c1/d1	cf. *triangular triangle* Kozarek and Orr, 1980	Apollo J-14	5490	5500	1673.4	1676.4									x	x	Miocene	Oligocene to Quaternary	upper-lower Miocene		Miocene	upper bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	5490	5500	1673.4	1676.4									X	x	Miocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	5490	5500	1673.4	1676.4										X	upper Miocene and Pliocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	5520	5530	1682.5	1685.5									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
124686	85.6.1	frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5560	5570	1694.7	1697.7									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		spec	a9/b1/c1/d1	undescribed cone tooth Form A	Apollo J-14	5610	5620	1709.9	1713.0											Miocene		upper-lower Miocene		Miocene	upper bathyal
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	5690	5700	1734.3	1737.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Apollo J-14	5690	5900	1734.3	1798.3									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	5900	5910	1798.3	1801.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
124658	77.1.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	5900	5910	1798.3	1801.4										X	upper Miocene and Pliocene		upper-lower Miocene		Miocene	upper bathyal
124609	48.2.1, 48.2.2	spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	6320	6340	1926.3	1932.4									X		Miocene		upper-lower Miocene		Miocene	upper bathyal
		?fair cap	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Apollo J-14	7960	7980	2426.2	2432.3					X						Oligocene-upper Eocene; reworked into Miocene strata				Miocene	upper bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8040	8060	2450.6	2456.7									X		Miocene				Miocene	upper bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8240	8260	2511.6	2517.6									X		Miocene		lower Pliocene		Miocene	upper bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Apollo J-14	8420	8430	2566.4	2569.5									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8460	8470	2578.6	2581.7									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8460	8470	2578.6	2581.7									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8560	8570	2609.1	2612.1									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b1/c1/d1	*triangle chisel-top* new subtype	Apollo J-14	8560	8570	2609.1	2612.1									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8570	8580	2612.1	2615.2									X		Miocene		lower Pliocene		pos. lower Miocene	bathyal
		frag	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	8580	8590	2615.2	2618.2										X	upper Miocene and Pliocene		lower Pliocene		pos. lower Miocene	bathyal
124659	77.2.1	good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	8590	8600	2618.2	2621.3										X	upper Miocene and Pliocene		lower Pliocene		pos. lower Miocene	bathyal
124615	52.2.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Apollo J-14	8860	8880	2700.5	2706.6											reworked?	lower Paleocene	lower Pliocene		pos. lower Miocene	bathyal
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Apollo J-14	8920	8930	2718.8	2721.9									X		Miocene		mixed interval		pos. lower Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	8940	8950	2724.9	2728.0									X		Miocene		mixed interval		undiagnostic	undiagnostic
		spec		unidentified elasmobranch dermal denticle	Apollo J-14	8940	8950	2724.9	2728.0											mixed interval		mixed interval		undiagnostic	undiagnostic
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Apollo J-14	8960	8970	2731.0	2734.1									X		Miocene		mixed interval		undiagnostic	undiagnostic
124639	70.1.1	spec	a9/b1,5/c1/d1	*small pointed triangle* Tway, Doyle, and Riedel, 1985	Apollo J-14	8990	9000	2740.2	2743.2											mixed interval, reworked?	middle Eocene through upper Oligocene	mixed interval		undiagnostic	undiagnostic
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	9010	9020	2746.2	2749.3									X		Miocene		mixed interval		undiagnostic	undiagnostic
		spec		unidentified elasmobranch dermal denticle	Apollo J-14	9060	9070	2761.5	2764.5											mixed interval		mixed interval		undiagnostic	undiagnostic
124671	81.1.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Apollo J-14	9120	9130	2779.8	2782.8									X		Miocene		mixed interval		undiagnostic	undiagnostic
124645	72.3.1	good frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Apollo J-14	9120	9130	2779.8	2782.8									X		Miocene		mixed interval		undiagnostic	undiagnostic
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Apollo J-14	9140	9160	2785.9	2792.0										X	upper Miocene and Pliocene		mixed interval		undiagnostic	undiagnostic
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Apollo J-14	9240	9250	2816.4	2819.4							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	mixed interval		undiagnostic	undiagnostic
124702	96.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form I	Apollo J-14	9430	9440	2874.3	2877.3											mixed interval		mixed interval		undiagnostic	undiagnostic
124687	85.7.1	frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Apollo J-14	9450	9460	2880.4	2883.4									X		Miocene		mixed interval		undiagnostic	undiagnostic
		?fair	a9/b5/c1/d1	cf. *short triangle stepped margin?* Doyle, Kennedy, and Riedel, 1974	Apollo J-14	9800	9810	2987.0	2990.1									X		Miocene	Oligocene/Miocene boundary through Quaternary	mixed interval		undiagnostic	undiagnostic
		spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	140	160	42.7	48.8						X					Oligocene-upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	540	560	164.6	170.7											Oligocene-upper Eocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene		Oligocene (*Bulimina* cf. *alsatica*/ Turrilina alsatica foraminifer zone)		
124543	18.2.1	?spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-69-2, Skuna Bay, Nootka Island	1080	1500	329.2	457.2											Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	1100	1120	335.3	341.4						X					Oligocene-upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	2300	2320	701.0	707.1											Oligocene-upper Eocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene		Oligocene (*Turrilina alsatica*/ *Chilogembelina cubensis* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-69-2, Skuna Bay, Nootka Island	3220	3240	981.5	987.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
		spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel 1974	BC-69-2, Skuna Bay, Nootka Island	3460	3480	1054.6	1060.7					X						Oligocene-upper Eocene	upper Paleocene through Quaternary		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		?spec	a8/b5+8/c2/d1,2	*wide triangle double flex?* Dunsworth, Doyle, and Riedel, 1975	BC-69-2, Skuna Bay, Nootka Island	3660	3680	1115.6	1121.7						X					upper Eocene/Oligocene	Paleocene - Eocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		frag	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-71-1, 30' into 990'; Escalante Point, Hesquiat Peninsula															upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124561	26.1.1	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form A	BC-71-2, near Escalante Point, Hesquiat Peninsula	554	564	168.9	171.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		upper Eocene (*Cibicides haydoni* foraminifer zone)		

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124538	16.3.1	spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-71-4' 10' below lower contorted zone, near Escalante Point, Hesquiat Peninsula	470		143.3												upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124612	51.1.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *triangle bowed inline* Ramsey, Doyle, & Riedel, 1976	BC-71-4; 40' below lower contorted zone, near Escalante Point; Hesquiat Peninsula	500		152.4												upper Eocene	Cretaceous through Eocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-71-5, extreme base of section; near Escalante Point, Hesquiat Peninsula	680		207.3												upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-71-5, near Escalante Point, Hesquiat Peninsula	392	407	119.5	124.1						X					upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124613	51.2.1	spec	a9/b1,5/c19/d19	cf. *triangle bowed inline* Ramsey, Doyle, & Riedel, 1976	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7											upper Eocene	Cretaceous through Eocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7						X					upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124622	55.1.1	spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel	BC-71-5, near Escalante Point, Hesquiat Peninsula	525	570	160.0	173.7					X						upper Eocene	upper Paleocene through Quaternary		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec		unidentified cone tooth	BC-72-11, #4; near Split Cape, Hesquiat Peninsula	170		51.8												Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-72-9, #5; north-western Hesquiat Peninsula	75	85	22.9	25.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124534	6.1.1	spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124533	7.1.1	spec	a9/b8+11+12/c14+19/d19	Family Squalidae, Form D	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124530	8.1.1	spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124531	8.2.1	spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124526	9.1.1	spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124537	16.2.1	spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124590	42.2.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124592	42.4.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

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		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124560	25.1.1, 25.1.2	spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d3	cf. *kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124557	24.1.1, 24.1.2	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124558	24.2.1	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124559	24.3.1, 24.3.2	spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		frag?	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line?* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		frag?	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line?* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124551	22.1.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124552	22.2.1, 22.2.2	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124553	22.3.1	? spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		? frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks … interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124579	34.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form F	BC-74 spot check #15, near Matlahaw Point, Hesquiat Peninsula															Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124637	68.1.1	spec	a9/b1/c1/d1	cf. *striated triangle* Ramsey, Doyle, & Riedel, 1976	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula															Oligocene; ?reworked Eocene through Cretaceous	Upper Jurassic through Eocene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124661	78.1.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124665	78.5.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #15; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124555	22.5.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #6, Rafael Point, Flores Island							X								common in Oligocene; ?reworked Eocene through Cretaceous					
124591	42.3.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124593	42.5.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124522	3.5.1, 4.2.1	~whole	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

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		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124569	26.9.1, 26.9.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form E	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #7, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		2 base frags	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula									X						Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124589	42.1.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124594	42.6.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124595	42.7.1	spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

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		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		11+ base frags	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula										X					Oligocene-upper Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula													x		Miocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124571	27.2.1	spec	a4/b2+6/c2/d4+8+10	cf. *pointed and skirted* Doyle, Dunsworth, & Riedel, 1978	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through lower Eocene; rare later Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124544	13.1.1, 13.1.2	spec	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124545	13.2.1	spec	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b2+8+12/c19/d19/	Family Scyliorhinidae indet., Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124521	3.4.1, 4.1.1	~whole	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124523	4.3.1	base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		base frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks .... interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated .... interval	cf. triangle curved ... interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A or B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6/c3/d2+3	*kite-shaped longitudinal line* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous	Maestrichtian through Oligocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
124562	26.2.1, 26.2.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124563	26.3.1, 26.3.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124565	26.5.1, 26.5.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124568	26.8.1, 26.8.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula						X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula								X							upper Eocene and Oligocene	upper Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula								X							upper Eocene and Oligocene	upper Eocene through middle Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
124528	10.1.1, 10.1.2	spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks .... interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated .... interval	cf. triangle curved ... interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		?spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124554	22.4.1	spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		?spec	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula							X								common in Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124605	45.5.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula									X						upper Eocene and Oligocene	upper Paleocene through lower Miocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
124573	29.1.1	spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124577	32.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124578	33.1.1	spec	a4/b2+6/c2/d4+8	undescribed elasmobranch dermal denticle; Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124714	105.2.1	spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		frag		unidentified cone tooth	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124535	15.1.1, 15.1.2	spec	a9/b2+8+12/c19/d19/	unidentified elasmobranch tooth, Form A	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124540	17.2.1, 17.2.2	spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		

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		spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74 spot check #8, near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked Eocene through Cretaceous			Oligocene (*Turrilina alsatica* foraminifer zone)		
124634	66.1.1	spec	a9/b1/c1/d1	cf. *triangle with parallel inline* Doyle, Kennedy, & Riedel, 1974	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula															upper Eocene to Oligocene; ?reworked from Eocene through Cretaceous	erratic throughout Cenozoic		Oligocene (*Turrilina alsatica* foraminifer zone)		
124662	78.2.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124663	78.3.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124664	78.4.1	spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		?spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline?* new subtype	BC-74 spot check #8; near Matlahaw Point, Hesquiat Peninsula										X					upper Eocene/Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8+12/c12+19/d19	Family Squalidae, Form B	BC-74 spot check, Flores Island					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene					
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74-1, #1, Leclair Point, Hesquiat Peninsula	0	4	0.0	1.2		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
124525	5.1.1	spec	a9/b8+12/c12+19/d19	Family Squalidae, Form B	BC-74-1, #13; Leclair Point, Hesquiat Peninsula	267	269	81.4	82.0	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	BC-74-1, #18, Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
124631	63.2.1	spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-1, #18, Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1						X					upper Eocene/Oligocene	Paleocene - Eocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124627	59.1.1, 59.1.2	good	a9/b5+8+(10,12)/c19/d19	cf. *wide crescent* Doyle, Dunsworth, & Riedel, 1978	BC-74-1, #18; Leclair Point, Hesquiat Peninsula	337	348	102.7	106.1											lower Oligocene-upper Eocene	Campanian to lower Paleocene; rare Eocene and Miocene		upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124566	26.6.1, 26.6.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124567	26.7.1, 26.7.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	BC-74-11, #8, near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124529	11.1.1, 11.1.2	spec	a9/b8+12/c19/d19	Superorder Hexanchoidei, Form C	BC-74-11, #8; near Estevan Point, Hesquiat Peninsula	261	303	79.6	92.4	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		frag	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula										X					Oligocene; may be reworked from Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+11+12/c14+19/d19	Family Squalidae, Form D	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c13+14+19/d19	Superorder Hexanchoidei, Form B	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula					X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124536	16.1.1, 16.1.2	slab spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124539	17.1.1, 17.1.2	?spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74-11, F#1; near Estevan Point, Hesquiat Peninsula															Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-12, #13, Hesquiat Point	383	390	116.7	118.9											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec		unidentified cone tooth	BC-74-12, #17; Hesquiat Point	501	537	152.7	163.7											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124596	43.1.1	spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	BC-74-13, #20, Dagger Point, Flores Island	685	718	208.8	218.8					X						Oligocene-upper Eocene	lower Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-13, #30; Dagger Point, Flores Island	972	1000	296.3	304.8											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-13, #37; Flores Island	1192	1196	363.3	364.5											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	BC-74-13, Dagger Point, Flores Island	1129	1150	344.1	350.5									x		known in Miocene; deposited in lower Oligocene/upper Eocene strata			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74-14, #3; Rafael Point, Flores Island	93	126	28.3	38.4					X						Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124520	12.1.1 to 12.1.4	spec	a9/b8/c19/d19	*?Isurolamna* sp. A	BC-74-14, #5, Rafael Point, Flores Island	170	172	51.8	52.4											lower Oligocene-upper Eocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
		?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74-14, #6; Rafael Point, Flores Island	191	210	58.2	64.0				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		lower Oligocene-upper Eocene (*Chilogembelina cubensis* foraminifer zone)		
		spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	BC-74-14, #6; Rafael Point, Flores Island	191	210	58.2	64.0	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			upper Eocene to lower Oligocene *(Chiloguembelina cubensis* foraminifer zone)		
124606	46.1.1	spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-15, #12, Rafael Point, Flores Island	363	393	110.6	119.8					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	BC-74-15, #7, Rafael Point, Flores Island	213	243	64.9	74.1				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	BC-74-17, #14, Dagger Point, Flores Island	359	393	109.4	119.8					X						Oligocene-upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #5, Dagger Point, Flores Island	99	132	30.2	40.2					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #5, Dagger Point, Flores Island	99	132	30.2	40.2					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	BC-74-17, #7, Dagger Point, Flores Island	164	197	50.0	60.0					X						upper Eocene-Oligocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminifer zone)		
124541	17.3.1	spec	a9/b8+12/c13+19/d13+19	unidentified elasmobranch tooth, Form C	BC-74-19, #27, Bajo Point, Nootka Island	1037	1077	316.1	328.3											Oligocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b8/c19+20/d19+20	unidentified elasmobranch tooth, Form B	BC-74-19, #79; Bajo Point, Nootka Island	3090	3131	941.8	954.3											Oligocene-upper Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		

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		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-2, #38, Leclair Point, Hesquiat Peninsula	653.5	676	199.2	206.0						X					upper Eocene; may be reworked Cretaceous to lower Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124542	18.1.1	?spec	a9/b8+12/c19/d19	unidentified elasmobranch tooth, Form D	BC-74-2, #38, Leclair Point, Hesquiat Peninsula	653.5	676	199.2	206.0											upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec		unidentified elasmobranch dermal denticle	BC-74-23, #2; Beano Bay, Nootka Island															upper Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-3 #10; Leclair Point, Hesquiat Peninsula	150	165	45.7	50.3						X					upper Eocene; may be reworked Cretaceous to lower Eocene			upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124633	64.2.1	spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-3, #10, Leclair Point, Hesquiat Peninsula	150	165	45.7	50.3						X					upper Eocene; may be reworked Cretaceous to lower Eocene	middle Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124549	21.3.1	?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	BC-74-3, #9, Leclair Point, Hesquiat Peninsula	136	150	41.5	45.7				X							upper Eocene and Oligocene	upper Eocene through middle Miocene		upper Eocene (*Globorotalia* aff. *postcretacea* foraminfer zone)		
124629	62.1.1	spec	a8/b5+8/c1,2/d1,2	cf. *flexed triangle asymmetric* Doyle & Riedel, 1985	BC-74-6, #36, Estevan Point, Hesquiat Peninsula	1096	1104	334.1	336.5											deposited in Oligocene strata; ?reworked from older strata	Paleocene and earliest Eocene		Oligocene (*Turrilina alsatica* foraminifer zone); pos. reworked		
		?spec	a8/b5+8/c2/d1,2	*wide triangle double flex?* Dunsworth, Doyle, and Riedel, 1975	BC-74-6, #36, Estevan Point, Hesquiat Peninsula	1096	1104	334.1	336.5						X					upper Eocene/Oligocene	Paleocene - Eocene		Oligocene (*Turrilina alsatica* foraminifer zone); pos. reworked		
124630	63.1.1	spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	BC-74-6, #44, Bag A, Estevan Point, Hesquiat Peninsula	1345	1389	410.0	423.4						X					upper Eocene/Oligocene	Paleocene - Eocene		Oligocene (*Turrilina alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-7 #1, Estevan Point, Hesquiat Peninsula	0	5	0.0	1.5						X					upper Eocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Turrilina alsatica* foraminifer zone)		
124556	23.1.1	spec	a3/b2+12/c3/d5+6	cf. *rhombus kite* Gupta, 1991	BC-74-7, #10, Estevan Point, Hesquiat Peninsula	226	264	68.9	80.5											Oligocene; may be reworked Cretaceous to lower Eocene	Paleogene		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b1,5/c1/d1	*dome-top triangle bowed inline* new subtype	BC-74-7, #6; Estevan Point, Hesquiat Peninsula	84	114	25.6	34.7						X					Oligocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124564	26.4.1, 26.4.2	spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form C	BC-74-8, #11, Bag A, Smokehouse Bay, Hesquiat Peninsula	310	341	94.5	103.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic		Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	BC-74-8, #11, Smokehouse Bay, Hesquiat Peninsula	310	341	94.5	103.9						X					upper Eocene; may be reworked Cretaceous to lower Eocene			Oligocene (*Bulimina* cf. *alsatica* foraminifer zone)		
124625	57.1.1	good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	BC-South of Escalante Bay; C535A, Hesquiat Peninsula																lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene				
124697	92.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form E	Cygnet J-100	1636	1667	498.7	508.1											Pliocene		upper-lower Pliocene		Pleistocene-Pliocene	outer neritic to upper bathyal
		spec		unidentified cone tooth	Cygnet J-100	1636	1667	498.7	508.1											Pliocene		upper-lower Pliocene		Pleistocene-Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	2595	2626	791.0	800.4										X	upper-lower Pliocene; pos. upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b8/c13+19/d13+19	cf. *straight triangle keeled edges* Ramsey, Doyle, and Riedel, 197(	Cygnet J-100	2750	2781	838.2	847.6											?reworked	Upper Jurassic through Miocene	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	3089	3121	941.5	951.3									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	3214	3245	979.6	989.1									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	Cygnet J-100	3276	3307	998.5	1008.0									x		Pliocene - Miocene	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124650	73.3.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3555	3586	1083.6	1093.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124651	73.4.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3555	3586	1083.6	1093.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	3648	3679	1111.9	1121.4										X	Pliocene and upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal

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		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Cygnet J-100	3648	3679	1111.9	1121.4										X	Pliocene and upper Miocene	latest Miocene to Recent	upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124696	91.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form D	Cygnet J-100	3648	3679	1111.9	1121.4											Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124652	73.5.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Cygnet J-100	3987	4018	1215.2	1224.7									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4080	4111	1243.6	1253.0										X	Pliocene and upper Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124649	73.2.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Cygnet J-100	4080	4111	1243.6	1253.0									X		Pliocene and Miocene		upper-lower Pliocene		upper Pliocene	outer neritic to upper bathyal
124698	93.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Cygnet J-100	4270	4301	1301.5	1310.9											Pliocene and Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4364	4393	1330.1	1339.0										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Cygnet J-100	4395	4426	1339.6	1349.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Cygnet J-100	4395	4426	1339.6	1349.0										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124701	95.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form H	Cygnet J-100	4395	4426	1339.6	1349.0											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	4426	4457	1349.0	1358.5										X	Pliocene and upper Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124694	90.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Cygnet J-100	4426	4457	1349.0	1358.5											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form I	Cygnet J-100	4426	4457	1349.0	1358.5											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124618	53.2.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Cygnet J-100	4489	4518	1368.2	1377.1											?reworked from older strata	Cretaceous and older strata	upper-lower Pliocene		lower Pliocene	mainly bathyal
		spec		unidentified cone tooth	Cygnet J-100	4489	4518	1368.2	1377.1											Pliocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	4518	4549	1377.1	1386.5									X		Pliocene and Miocene		upper-lower Pliocene		lower Pliocene	mainly bathyal
124703	97.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form J	Cygnet J-100	4644	4675	1415.5	1424.9											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Cygnet J-100	4874	4906	1485.6	1495.3									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Cygnet J-100	5033	5064	1534.1	1543.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
124695	90.2.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Cygnet J-100	5127	5153	1562.7	1570.6											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
124575	30.1.1, 30.1.2	spec	a3,4/b2/c2/d4+10	undescribed elasmobranch dermal denticle (tooth?), Form E	Cygnet J-100	5460	5500	1664.2	1676.4											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal
124710	103.1.1	spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	5460	5500	1664.2	1676.4											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	5460	5500	1664.2	1676.4											Pliocene-Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Cygnet J-100	5523	5554	1683.4	1692.9									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		spec		unidentified cone tooth	Cygnet J-100	5523	5554	1683.4	1692.9											lower Pliocene		lower Pliocene		lower Pliocene	mainly bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Cygnet J-100	5585	5615	1702.3	1711.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Cygnet J-100	5800	5835	1767.8	1778.5									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Cygnet J-100	5865	5896	1787.7	1797.1									X		lower Pliocene and Miocene		lower Pliocene		lower Pliocene	mainly bathyal
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Cygnet J-100	6516	6546	1986.1	1995.2										X	Pliocene and upper Miocene		lower Pliocene		upper Miocene	bathyal
124635	67.1.1	spec	a9/b1/c1/d1	cf. *small triangle long striations* Dunsworth, Doyle, and Riedel, 1975	Cygnet J-100	6516	6546	1986.1	1995.2										X	Pliocene and upper Miocene	lower Miocene through Quaternary	lower Pliocene		upper Miocene	bathyal
124646	72.4.1	good frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Cygnet J-100	6516	6546	1986.1	1995.2									X	x	lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
124711	103.2.1	spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	6516	6546	1986.1	1995.2											lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Cygnet J-100	7167	7207	2184.5	2196.7										X	Pliocene and upper Miocene	latest Miocene to Recent	lower Pliocene		upper Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Cygnet J-100	7568	7598	2306.7	2315.9											lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
124647	72.5.1	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Cygnet J-100	7629	7660	2325.3	2334.8									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Cygnet J-100	7691	7722	2344.2	2353.7									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Cygnet J-100	7753	7784	2363.1	2372.6									X		lower Pliocene and Miocene		lower Pliocene		upper Miocene	bathyal
		?spec	elasmobranch	undescribed elasmobranch tooth	END-76B-5A																				

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6A			0m	0.29m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6A			0m	0.29m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1/	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	END-76B-6A			0m	0.29m												Cretaceous through Quaternary				
124692	88.2.1	spec	a9/b1/c1/d1	undescribed cone tooth Form A	END-76B-6A			0m	0.29m											Miocene?					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6B			0.29m	0.52m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6B			0.29m	0.52m									X		Miocene and Pliocene					
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	END-76B-6B			0.29m	0.58m									X		Miocene and Pliocene					
124683	85.3.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	END-76B-6C			0.58m	0.87m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	END-76B-6C			0.58m	0.87m										X	Pliocene and upper Miocene	latest Miocene to Recent				
124705	99.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form I	END-76B-6C			0.58m	0.87m											Miocene?					
124712	104.1.1, 104.1.2	spec	a12/b1,4?	undescribed ichthyolith oddity Form D	END-76B-6C			0.58m	0.87m											Miocene?					
		spec		unidentified cone tooth	END-76B-6C			0.58m	0.87m																
		spec		unidentified cone tooth	END-76B-6C			0.58m	0.87m																
		spec		unidentified elasmobranch dermal denticle	END-76B-6C			0.58m	0.87m																
		spec		unidentified elasmobranch dermal denticle	END-76B-6C			0.58m	0.87m																
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6D			0.87m	1.16m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6D			0.87m	1.16m									X		Miocene and Pliocene					
124644	72.2.1	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	END-76B-6D			0.87m	1.16m									X		lower Pliocene and Miocene					
		spec		unidentified elasmobranch dermal denticle	END-76B-6D			0.87m	1.16m																
124682	85.2.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
124684	85.4.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
124685	85.5.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	END-76B-6E			1.16m	1.45m		x			X						upper Eocene and Oligocene; reworked into lower and middle Miocene					
		frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	END-76B-6E			1.16m	1.45m									X		Miocene and Pliocene					
124517	3.2.1, 3.2.2; 14.2.1, 14.2.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	END-76B-6E			1.16m	1.45m										X	Pliocene-upper Miocene	frequently inhabit cool shelf waters				
124532	8.3.1	frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Harlequin D-86	4855	4866	1479.8	1483.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			lower-middle Miocene (Patterson, 1988)	lower to middle Miocene	
		?frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Harlequin D-86	4855	4866	1479.8	1483.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene			lower-middle Miocene (Patterson, 1988)	lower to middle Miocene	
		frag	a9/b5+8/c19/d19	*triangle sigmoid rough* Ramsey, Doyle, and Riedel, 1976	Murrelet K-15	1318	1347	401.7	410.6											Oligocene; ?reworked	Upper Jurassic through Eocene; rare Oligocene		Quaternary-Pliocene (Patterson, 1988)	Pliocene - lower Pliocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Osprey D-36	2700	2750	823.0	838.2					x	x					Oligocene-upper Eocene; ?reworked			Quaternary-Pliocene (Patterson, 1988)	lower Pliocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5220	5230	1591.1	1594.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		spec	a9/b8+12/c14+19/d+13+19	Family Squalidae, Form C	Pluto I-87	5240	5250	1597.2	1600.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Miocene		Miocene to Oligocene	
		?spec	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Pluto I-87	5240	5250	1597.2	1600.2	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Pluto I-87	5240	5250	1597.2	1600.2									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
124548	21.2.1	spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	Pluto I-87	5250	5260	1600.2	1603.2				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	
124582	36.1.1	spec	a4/b(2,7)+6/c2/d(2,4)+8+10	undescribed elasmobranch dermal denticle; Form H	Pluto I-87	5270	5280	1606.3	1609.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5290	5300	1612.4	1615.4									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5290	5300	1612.4	1615.4									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	5320	5330	1621.5	1624.6					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	
124621	54.2.1, 54.2.2, 54.2.3	spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Pluto I-87	5330	5340	1624.6	1627.6							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	lower Miocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	5330	5340	1624.6	1627.6											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Pluto I-87	5360	5370	1633.7	1636.8							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	lower Miocene		Miocene to Oligocene	
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Pluto I-87	5380	5390	1639.8	1642.9									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5410	5420	1649.0	1652.0					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Pluto I-87	5410	5420	1649.0	1652.0									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5420	5430	1652.0	1655.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5450	5460	1661.2	1664.2					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5480	5490	1670.3	1673.4					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
124676	83.1.1	good	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	5490	5500	1673.4	1676.4									X		Miocene; ?sloughed into Oligocene	Oligocene/Miocene boundary through Quaternary	lower Miocene		Miocene to Oligocene	
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Pluto I-87	5520	5530	1682.5	1685.5									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
124598	44.1.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	5540	5580	1688.6	1700.8					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	lower Miocene		Miocene to Oligocene	
124547	21.1.1	spec	a2/b2+6/c3/d1,2	*short side peaks differentiated margin* Doyle, Kennedy & Riedel, 1974	Pluto I-87	5540	5550	1688.6	1691.6				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Miocene		Miocene to Oligocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Pluto I-87	5570	5580	1697.7	1700.8									X		Miocene; ?sloughed into Oligocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5640	5650	1719.1	1722.1					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5710	5720	1740.4	1743.5					X						upper Eocene-Oligocene; reworked into lower Miocene		lower Miocene		Miocene to Oligocene	
124586	39.1.1	spec	a4/b6+7/c2/d2+8	undescribed elasmobranch dermal denticle; Form K	Pluto I-87	5710	5720	1740.4	1743.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		spec	a4/b6+7/c2/d2+8	undescribed elasmobranch dermal denticle; Form K	Pluto I-87	5710	5720	1740.4	1743.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Miocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	5800	5810	1767.8	1770.9		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124638	69.1.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Pluto I-87	5840	5850	1780.0	1783.1									X		Miocene; ?sloughed into Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	5850	5860	1783.1	1786.1		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	5860	5870	1786.1	1789.2					X						upper Eocene-Oligocene; reworked into lower Miocene		upper Oligocene		Miocene to Oligocene	
		frag	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1985	Pluto I-87	5870	5880	1789.2	1792.2				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	upper Oligocene		Miocene to Oligocene	
124624	56.1.1 to 56.1.5	spec	a9/b5+8/c19/d19	*triangle sigmoid rough* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	5950	5960	1813.6	1816.6											Oligocene	Upper Jurassic through Eocene; rare Oligocene	upper Oligocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	5960	5970	1816.6	1819.7					X						upper Eocene-Oligocene; reworked into lower Miocene		upper Oligocene		Miocene to Oligocene	
		?frag	a2/b2+6+12/c3/d1	*three peaks forked median ridge?* new subtype	Pluto I-87	5990	6000	1825.8	1828.8			X								common in Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	6070	6080	1850.1	1853.2											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6100	6110	1859.3	1862.3		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6120	6130	1865.4	1868.4		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124572	28.1.1	spec	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1986	Pluto I-87	6140	6150	1871.5	1874.5				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	upper Oligocene		Miocene to Oligocene	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Pluto I-87	6140	6150	1871.5	1874.5									X		Miocene; ?sloughed into Oligocene		upper Oligocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6140	6150	1871.5	1874.5		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124597	43.2.1	spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	6140	6150	1871.5	1874.5					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	upper Oligocene		Miocene to Oligocene	
124669	80.1.1	good	a9/b1,5/c1/d1	cf. *curved flared triangle* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	6260	6270	1908.0	1911.1											Oligocene-upper Eocene; ?reworked from older strata	Upper Jurassic through Middle Eocene	upper Oligocene			
124693	89.1.1	spec	a9/b5/c1/d1	undescribed cone tooth Form E	Pluto I-87	6340	6350	1932.4	1935.5											Oligocene-upper Eocene		upper Oligocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	6390	6400	1947.7	1950.7		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Pluto I-87	6450	6460	1966.0	1969.0											deposited in Oligocene-upper Eocene strata; ?reworked from older strata	Cretaceous and older strata	upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6490	6500	1978.2	1981.2					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
124587	41.1.1	good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	6560	6570	1999.5	2002.5					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	Pluto I-87	6570	6580	2002.5	2005.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124619	53.3.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Pluto I-87	6590	6600	2008.6	2011.7											deposited in Oligocene-upper Eocene strata; ?reworked from older strata	Cretaceous and older strata	upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6630	6640	2020.8	2023.9					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6660	6670	2030.0	2033.0					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	6740	6750	2054.4	2057.4					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
124580	35.1.1	spec	a4/b2+6+12/c2/d4+8+10	undescribed elasmobranch dermal denticle; Form G	Pluto I-87	6780	6790	2066.5	2069.6											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
124713	105.1.1	spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	Pluto I-87	6870	6880	2094.0	2097.0											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		frag?	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Pluto I-87	6880	6890	2097.0	2100.1					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec		unidentified cone tooth	Pluto I-87	6940	6950	2115.3	2118.4											upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	6970	6980	2124.5	2127.5					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
124574	29.2.1	spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	Pluto I-87	6970	6980	2124.5	2127.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		upper Oligocene		Miocene to Oligocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	6980	6990	2127.5	2130.6					X						upper Eocene-Oligocene		upper Oligocene		Miocene to Oligocene	
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form D	Pluto I-87	6980	6990	2127.5	2130.6		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	upper Oligocene		Miocene to Oligocene	
124628	60.1.1, 60.1.2	spec	a9/b7+8/c19/d19	undescribed flanged tooth with mesial ridge	Pluto I-87	7010	7020	2136.6	2139.7											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7060	7070	2151.9	2154.9					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
124673	81.3.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Pluto I-87	7070	7080	2154.9	2158.0									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Pluto I-87	7110	7120	2167.1	2170.2									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	7140	7150	2176.3	2179.3					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7140	7150	2176.3	2179.3					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	7140	7150	2176.3	2179.3		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	7170	7180	2185.4	2188.5					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec		unidentified elasmobranch dermal denticle	Pluto I-87	7170	7180	2185.4	2188.5											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7220	7230	2200.7	2203.7					x	x					upper Eocene-Oligocene		lower Oligocene-upper Eocene		Miocene to Oligocene	
		spec	a9/b5+8/c13+19/d13+19	*triangle one canal above* Doyle, Kennedy, & Riedel, 1974	Pluto I-87	7270	7280	2215.9	2218.9					X						Oligocene-upper Eocene	lower Eocene through middle Miocene	lower Oligocene-upper Eocene		Miocene to Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7360	7370	2243.3	2246.4					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
124611	50.1.1	fair	a9/b5+8/c13+19/d13+19	*beveled triangle high inline* Doyle, Dunsworth, and Riedel, 1978	Pluto I-87	7420	7430	2261.6	2264.7											upper Eocene-Oligocene	lower Paleocene through lower Eocene; rare Campanian;	lower Oligocene-upper Eocene		Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7420	7430	2261.6	2264.7					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	7630	7640	2325.6	2328.7		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic	lower Oligocene-upper Eocene		Oligocene	
124604	45.4.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Pluto I-87	7630	7640	2325.6	2328.7					X						upper Eocene-Oligocene	upper Paleocene through lower Miocene	lower Oligocene-upper Eocene		Oligocene	
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	7650	7660	2331.7	2334.8					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	
124670	80.1.2	spec	a9/b1,5/c1/d1	cf. *curved flared triangle* Ramsey, Doyle, and Riedel, 1976	Pluto I-87	7720	7730	2353.1	2356.1											Oligocene-upper Eocene; ?reworked from older strata	Upper Jurassic through Middle Eocene	lower Oligocene-upper Eocene		Oligocene	
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Pluto I-87	7860	7870	2395.7	2398.8					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	
		spec		unidentified cone tooth	Pluto I-87	7930	7940	2417.1	2420.1											upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a4,6/b1/c2/d1	cf. *ogee lanceolate* Tway, Doyle, and Riedel, 1987	Pluto I-87	7970	7980	2429.3	2432.3				X							upper Eocene to middle Miocene	lower Eocene to middle Miocene	lower Oligocene-upper Eocene		Oligocene	
124700	94.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form G	Pluto I-87	7970	7980	2429.3	2432.3											upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	
124550	21.4.1	?frag	a2/b2+6/c3/d1,2	*short side peaks differentiated margin?* Doyle, Kennedy & Riedel, 1974	Pluto I-87	8110	8120	2471.9	2475.0				X							upper Eocene and Oligocene	upper Eocene through middle Miocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
124588	41.2.1	good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	8420	8430	2566.4	2569.5					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Pluto I-87	8570	8580	2612.1	2615.2									X		Miocene; ?sloughed into Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
124581	35.2.1	spec	a4/b2+6+12/c2/d4+8+10	undescribed elasmobranch dermal denticle; Form G	Pluto I-87	8590	8600	2618.2	2621.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		spec	a9/b5+8/c19+(11,12,13)/d19+(11,12,13)/	*centrally inflated triangle with canals* new subtype	Pluto I-87	8770	8780	2673.1	2676.1						X					Oligocene-upper Eocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		base frag	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Pluto I-87	8860	8870	2700.5	2703.6					X						upper Eocene-Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		?frag	a9/b8+12/c(12,13)+(16,17)+19/d(1,16,17)+19	Family Squalidae, Form E	Pluto I-87	9220	9230	2810.3	2813.3	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene		lower Oligocene-upper Eocene		Oligocene	continental margin slope
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	9220	9230	2810.3	2813.3					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
		spec	a8/b5+8/c2/d1,2	*wide triangle double flex* Dunsworth, Doyle, and Riedel, 1975	Pluto I-87	9820	9830	2993.1	2996.2						X					upper Eocene/Oligocene	Paleocene - Eocene	lower Oligocene-upper Eocene		Oligocene	continental margin slope
		spec	a4/b2+6+12/c2,4/d4+(7,8)+10+13	*pointed and skirted* Doyle, Dunsworth, & Riedel, 1978; Form B	Pluto I-87	10,030	10,040	3057.1	3060.2		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene	Campanian through upper Eocene; rare other Cenozoic			Oligocene	continental margin slope
		??spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Pluto I-87	10,060	10,070	3066.3	3069.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous				Oligocene	continental margin slope
		??spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Pluto I-87	10,060	10,070	3066.3	3069.3											upper Eocene to Oligocene; ?reworked Eocene through Cretaceous				Oligocene	continental margin slope
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Pluto I-87	10260	10270	3127.2	3130.3					x	x					upper Eocene-Oligocene	Oligocene-upper Eocene			Oligocene	continental margin slope
124527	9.2.1	spec	a9/b8+12/c14+19/d19	Superorder Hexanchoidei, Form A	Pluto I-87	11,220	11,230	3419.9	3422.9	X										Cretaceous to lower Eocene; reworked into upper Eocene/Oligocene				Eocene	
		spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Pluto I-87	?	?	?	?					X						upper Eocene-Oligocene					
124706	100.1.1	spec	a9/b5/c1/d1	undescribed cone tooth Form M	Prometheus H-68	3550	3560	1082.0	1085.1											lower Pliocene		lower Pliocene		Pliocene	open marine, >600'
124680	84.2.1	good	a9/b5/c1/d1	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	4420		1347.2											X	lower Pliocene to upper Miocene	latest Miocene to Recent	lower Pliocene		Miocene	
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Prometheus H-68	4530	4540	1380.7	1383.8									X		Pliocene and Miocene		lower Pliocene		Miocene	
		spec		unidentified cone tooth	Prometheus H-68	4530	4540	1380.7	1383.8											Pliocene and Miocene		lower Pliocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	4810	4830	1466.1	1472.2									X		Miocene and Pliocene		lower Pliocene		Miocene	
124656	76.1.1	good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Prometheus H-68	4850	4870	1478.3	1484.4										X	lower Pliocene to upper Miocene		lower Pliocene		Miocene	
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Prometheus H-68	4950	4970	1508.8	1514.9									X		Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
		?frag	a9/b5/c1/d1	cf. *short triangle stepped margin?* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	5090	5110	1551.4	1557.5									X		Miocene and Pliocene	Oligocene/Miocene boundary through Quaternary	lower Pliocene		Miocene	
		frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Prometheus H-68	5150	5160	1569.7	1572.8									X		Miocene and Pliocene		lower Pliocene		Miocene	
		good	a9/b1,5/c1/d1	*"shadowed high inline cone"*	Prometheus H-68	5170	5190	1575.8	1581.9										X	lower Pliocene to upper Miocene		lower Pliocene		Miocene	
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Prometheus H-68	5170	5190	1575.8	1581.9									X	x	Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Prometheus H-68	5170	5190	1575.8	1581.9									X	x	Miocene and Pliocene		lower Pliocene		Miocene	

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Prometheus H-68	5200	5210	1585.0	1588.0									X		Miocene and Pliocene		lower Pliocene		Miocene	
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5230	5240	1594.1	1597.2									X		Miocene and Pliocene		lower Pliocene		Miocene	
		cap	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5250	5260	1600.2	1603.2									X		Miocene and Pliocene		lower Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5250	5260	1600.2	1603.2									X		Miocene and Pliocene		lower Miocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5310	5320	1618.5	1621.5									X		Miocene and Pliocene		lower Pliocene		Miocene	
124708	102.1.1, 102.1.2	spec	a9/b1	undescribed ichthyolith oddity Form B	Prometheus H-68	5310	5320	1618.5	1621.5											Miocene and Pliocene		lower Pliocene		Miocene	
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Prometheus H-68	5350	5360	1630.7	1633.7								X			middle and lower Miocene		upper Miocene		Miocene	
124546	19.1.1, 19.1.2	spec	a9/b2+8+12/c19+20/d19+20	unidentified elasmobranch tooth, Form E	Prometheus H-68	5350	5360	1630.7	1633.7											Miocene; ?reworked from older strata		upper Miocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5440	5450	1658.1	1661.2									X		Miocene and Pliocene		middle Miocene		Miocene	
124607	46.2.1	spec	a9/b8/c19/d19	*flanged triangle with canals* new subtype	Prometheus H-68	5440	5450	1658.1	1661.2					X						Oligocene and upper Eocene; reworked into lower Miocene		middle Miocene		Miocene	
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form F	Prometheus H-68	5440	5450	1658.1	1661.2											Miocene		middle Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Prometheus H-68	5480	5490	1670.3	1673.4								X			mixed interval		mixed interval, with Miocene		Miocene	
		?spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Prometheus H-68	5480	5490	1670.3	1673.4											Miocene		mixed interval, with Miocene		Miocene	
124600	44.3.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	5500	5510	1676.4	1679.4					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval, with Miocene		Miocene	
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Prometheus H-68	5550	5560	1691.6	1694.7									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval, with Miocene		Miocene	
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	5620	5630	1713.0	1716.0									X		Miocene		mixed interval, with Miocene		Miocene	
124576	31.1.1	spec	a4/b1,2/c2/d1,4	undescribed elasmobranch dermal denticle; Form C	Prometheus H-68	5620	5630	1713.0	1716.0											?Oligocene and upper Eocene; reworked into lower Miocene		mixed interval, with Miocene		Miocene	
		spec	a12,14/b3/c1/d1	undescribed ichthyolith oddity Form E	Prometheus H-68	5620	5630	1713.0	1716.0											?Oligocene and upper Eocene; reworked into lower Miocene		mixed interval, with Miocene		Miocene	
124641	71.1.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Prometheus H-68	5640	5650	1719.1	1722.1									X		Miocene		mixed interval, with Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5640	5650	1719.1	1722.1									X		Miocene		mixed interval, with Miocene		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5670	5680	1728.2	1731.3									X		Miocene		mixed interval, with Miocene		Miocene	
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Prometheus H-68	5710	5720	1740.4	1743.5									X		Miocene		mixed interval		Miocene	
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Prometheus H-68	5710	5720	1740.4	1743.5									X		Miocene		mixed interval		Miocene	
124570	27.1.1	spec	a4/b2+6/c2/d4+8+10	cf. *pointed and skirted* Doyle, Dunsworth, & Riedel, 1978	Prometheus H-68	5710	5720	1740.4	1743.5		X									Upper Cretaceous to lower Eocene; reworked into upper Eocene / Oligocene / Miocene	Campanian through lower Eocene; rare later Cenozoic	mixed interval		Miocene	
		spec		unidentified cone tooth	Prometheus H-68	5730	5740	1746.5	1749.6											mixed interval		mixed interval		Miocene	
		good spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Prometheus H-68	5770	5780	1758.7	1761.7					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Prometheus H-68	5770	5780	1758.7	1761.7											?reworked from older strata	Cretaceous and older strata	mixed interval		Miocene	
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	5770	5780	1758.7	1761.7									X		Miocene		mixed interval		Miocene	
124654	75.1.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Prometheus H-68	5790	5800	1764.8	1767.8									X		Miocene		mixed interval		Miocene	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	6040	6050	1841.0	1844.0									X		Miocene		mixed interval/volcanics		Eocene volcanics	
124688	86.1.1	spec	a9/b1/c1/d1	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	Prometheus H-68	6160	6170	1877.6	1880.6								X			middle-lower Miocene	Cretaceous through Quaternary	mixed interval/volcanics		Eocene volcanics	
		cap frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	6780	6790	2066.5	2069.6									X		Miocene		mixed interval/volcanics		Eocene volcanics	

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		spec	a2/b+2+10/c>2/d1.0-1.5	undescribed elasmobranch dermal denticle; Form A	Prometheus H-68	7030	7040	2142.7	2145.8											mixed interval		mixed interval/volcanics		Eocene volcanics	
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Prometheus H-68	7220		2200.7						X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval/volcanics		Eocene volcanics	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	7220		2200.7										X		Miocene		mixed interval/volcanics		Eocene volcanics	
124681	85.1.1	spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Prometheus H-68	7250	7260	2209.8	2212.8									X		Miocene		mixed interval/volcanics		Eocene volcanics	
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Prometheus H-68	7250	7260	2209.8	2212.8									X		Miocene		mixed interval/volcanics		Eocene volcanics	
124653	74.1.1	spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Prometheus H-68	7400	7410	2255.5	2258.6									X		Miocene		mixed interval/volcanics		Eocene volcanics	
124642	71.2.1	frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	3160	3180	963.2	969.3									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Zeus D-14	3160	3180	963.2	969.3									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	3240	3260	987.6	993.6									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	3360	3380	1024.1	1030.2									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		fair frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	3640	3660	1109.5	1115.6									X		Miocene		upper Miocene		Pliocene	contenetal shelf edge to bathyal
		good	a9/b5+8+(10,12)/c19/d19	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	3800	3820	1158.2	1164.3											?reworked	lower Eocene through lower Miocene; rare Paleocene, upper Miocene and Pliocene	upper Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	3840	3860	1170.4	1176.5									X		Miocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	3840	3860	1170.4	1176.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	3840	3860	1170.4	1176.5									X		Miocene		upper Miocene		Miocene	bathyal
124704	98.1.1	spec	a9/b1,5/c1/d1	undescribed cone tooth Form K	Zeus D-14	3920	3940	1194.8	1200.9											Miocene		upper Miocene		Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Zeus D-14	3960	3980	1207.0	1213.1											Miocene		upper Miocene		Miocene	bathyal
		fair cap	a9/b1,5/c11,12/d20	*angled cone and basal canals?* new subtype	Zeus D-14	4040	4060	1231.4	1237.5					X						Oligocene-upper Eocene; reworked into Miocene strata		upper Miocene		Miocene	bathyal
124620	54.1.1, 54.1.2	spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Zeus D-14	4040	4060	1231.4	1237.5							X				?reworked into younger Cenozoic strata	upper Paleocene through lowermost Eocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4260	4280	1298.4	1304.5									X	x	Miocene and Pliocene		upper Miocene		Miocene	bathyal
		good	a9/b1,5/c1/d1	*shadowed curved blunt triangle* new subtype	Zeus D-14	4260	4280	1298.4	1304.5										X	Pliocene and upper Miocene		upper Miocene		Miocene	bathyal
		cap	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4620	4640	1408.2	1414.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4620	4640	1408.2	1414.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	4620	4640	1408.2	1414.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
124675	82.2.1	spec	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4680	4690	1426.5	1429.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal

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124677	83.2.1	spec	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	4680	4690	1426.5	1429.5									X		lower Pliocene and Miocene	Oligocene/Miocene boundary through Quaternary	upper Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	4700	4710	1432.6	1435.6									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	4730	4740	1441.7	1444.8									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4750	4760	1447.8	1450.8									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4770	4780	1453.9	1456.9									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	4790	4800	1460.0	1463.0									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4830	4840	1472.2	1475.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	upper Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	4850	4860	1478.3	1481.3									X		Miocene and Pliocene		upper Miocene		Miocene	bathyal
124616	52.3.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Zeus D-14	4870	4880	1484.4	1487.4											reworked?	lower Paleocene	upper Miocene		Miocene	bathyal
124715	106.1.1	spec	a12/b10	undescribed ichthyolith oddity Form F	Zeus D-14	4870	4880	1484.4	1487.4											Miocene		upper Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	4890	4900	1490.5	1493.5									X		Miocene and Pliocene		middle Miocene		Miocene	bathyal
		spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus D-14	4890	4900	1490.5	1493.5											Miocene		middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4930	4940	1502.7	1505.7									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4950	4960	1508.8	1511.8									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	4990	5000	1521.0	1524.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	middle Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	4990	5000	1521.0	1524.0									X		Miocene and Pliocene	Oligocene/Miocene boundary through Quaternary	middle Miocene		Miocene	bathyal
124707	101.1.1	spec	a9/b1	undescribed ichthyolith oddity Form A	Zeus D-14	4990	5000	1521.0	1524.0											Miocene		middle Miocene		Miocene	bathyal
124672	81.2.1	spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	5030	5040	1533.1	1536.2									X		Miocene		middle Miocene		Miocene	bathyal
124524	4.4.1	spec	a9/b8+12/c(12,13)+19/d14+19	Family Squalidae, Form A	Zeus D-14	5030	5040	1533.1	1536.2	X										Cretaceous to lower Eocene; reworked into upper Eocene / Oligocene / Miocene strata		middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5090	5100	1551.4	1554.5									X		Miocene		middle Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5190	5200	1581.9	1585.0									X		Miocene		middle Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	5210	5220	1588.0	1591.1									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5230	5240	1594.1	1597.2									X		Miocene		middle Miocene		Miocene	bathyal
124617	53.1.1	spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Zeus D-14	5350	5360	1630.7	1633.7											?reworked from older strata	Cretaceous and older strata	middle Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, wide inline?* new subtype	Zeus D-14	5390	5400	1642.9	1645.9									X		Miocene		middle Miocene		Miocene	bathyal
		spec		unidentified cone tooth	Zeus D-14	5430	5440	1655.1	1658.1											Miocene		Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5490	5500	1673.4	1676.4									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124648	73.1.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	5510	5520	1679.4	1682.5									X		Miocene		Miocene		Miocene	bathyal
124636	67.2.1	spec	a9/b1/c1/d1	cf. *small triangle long striations* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	5530	5540	1685.5	1688.6											Miocene	lower Miocene through Quaternary	middle-upper Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5550	5560	1691.6	1694.7									X		Miocene		Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	5550	5560	1691.6	1694.7									X		Miocene		Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	5570	5580	1697.7	1700.8									X		Miocene		Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5590	5660	1703.8	1725.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
124674	82.1.1	spec	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5610	5620	1709.9	1713.0									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5650	5660	1722.1	1725.2									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	5650	5660	1722.1	1725.2								X			middle and lower Miocene		Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	*curved triangle, parallel-sided inline?* new subtype	Zeus D-14	5670	5680	1728.2	1731.3									X		Miocene		Miocene		Miocene	bathyal
		spec?	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase?* Doyle, Kennedy, & Riedel 1974	Zeus D-14	5730	5740	1746.5	1749.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through Quaternary	Miocene		Miocene	bathyal
		spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C, "globular dome"	Zeus D-14	5760	5780	1755.6	1761.7											Miocene		Miocene		Miocene	bathyal
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5840	5860	1780.0	1786.1									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle curved margin ends* Doyle and Riedel, 1985	Zeus D-14	5840	5860	1780.0	1786.1							X				?reworked from older Cenozoic strata	upper Paleocene through lowermost Eocene	Miocene	Miocene; lower Paleocene through lower Eocene	Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5880	5890	1792.2	1795.3									X		Miocene		Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5880	5890	1792.2	1795.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	5880	5890	1792.2	1795.3									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Zeus D-14	5880	5890	1792.2	1795.3									X		Miocene		Miocene		Miocene	bathyal
124668	79.3.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	5910	5920	1801.4	1804.4								X			middle and lower Miocene		Miocene		Miocene	bathyal
124716	107.1.1	spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus D-14	5910	5920	1801.4	1804.4											Miocene		Miocene		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	5990	6000	1825.8	1828.8									X		Miocene		lower Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6010	6020	1831.8	1834.9									X		Miocene		lower Miocene		Miocene	bathyal
124666	79.2.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	6010	6020	1831.8	1834.9								X			middle and lower Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene		lower Miocene		Miocene	bathyal
124678	83.3.1	good	a9/b5/c1/d1	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene	Oligocene/Miocene boundary through Quaternary	lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*narrow tall triangle, cone inline* new subtype	Zeus D-14	6040	6050	1841.0	1844.0									X		Miocene		lower Miocene		Miocene	bathyal
124601	45.1.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6060	6070	1847.1	1850.1					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	lower Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex new subtype*	Zeus D-14	6080	6090	1853.2	1856.2									X		Miocene		lower Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6130	6140	1868.4	1871.5									X		Miocene		lower Miocene		Miocene	bathyal
124689	86.2.1	spec	a9/b5/c1/d1	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	Zeus D-14	6130	6140	1868.4	1871.5								X			middle and lower Miocene	Cretaceous through Quaternary	mixed interval		Miocene	bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6160	6170	1877.6	1880.6									X		Miocene		lower Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, striated inline?* new subtype	Zeus D-14	6160	6170	1877.6	1880.6								X			mixed interval		lower Miocene		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6180	6190	1883.7	1886.7									X		Miocene		lower Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	undescribed cone tooth Form C	Zeus D-14	6200	6210	1889.8	1892.8											Miocene		lower Miocene		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6240	6250	1902.0	1905.0									X		Miocene		lower Miocene		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, striated inline?* new subtype	Zeus D-14	6240	6250	1902.0	1905.0								X			mixed interval		lower Miocene		Miocene	bathyal
		spec	a9/b5+8/c+13+19/d+13+19	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	Zeus D-14	6280	6290	1914.1	1917.2											?reworked from older strata	Cretaceous and older strata	lower Miocene		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	6300	6310	1920.2	1923.3									X		Miocene		lower Miocene		Miocene	bathyal
124632	64.1.1	spec	a8/b5+8/c2/d1,2	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	Zeus D-14	6380	6390	1944.6	1947.7						X					Oligocene-upper Eocene; ?reworked into lower Miocene strata	middle Eocene through middle Miocene	mixed interval		Miocene	bathyal
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	6400	6410	1950.7	1953.8									X		Miocene		mixed interval		Miocene	bathyal
124709	38.1.1	spec	a1/b2+13	undescribed elasmobranch dermal denticle; Form J	Zeus D-14	6420	6430	1956.8	1959.9											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		?frag	a9/b5/c1/d1	*angled cone and bulbous base?* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6460	6470	1969.0	1972.1									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	6500	6510	1981.2	1984.2									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*curved triangle, wide inline?* new subtype	Zeus D-14	6500	6510	1981.2	1984.2									X		Miocene		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6500	6510	1981.2	1984.2					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6540	6550	1993.4	1996.4									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b5/c1/d1	cf. *narrow curved triangle?* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	6580	6590	2005.6	2008.6									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval		Miocene	bathyal
124599	44.2.1	spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6580	6590	2005.6	2008.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
		spec	a9/b5+8/c13+19/d13+19	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6580	6590	2005.6	2008.6					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
		spec		unidentified elasmobranch dermal denticle	Zeus D-14	6640	6650	2023.9	2026.9											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6680	6690	2036.1	2039.1									X		Miocene		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6680	6690	2036.1	2039.1					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		?spec	a12/b1,8/c0,1,2	undescribed ichthyolith oddity Form C?, "globular dome"	Zeus D-14	6680	6690	2036.1	2039.1											Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6730	6740	2051.3	2054.4									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline* new subtype	Zeus D-14	6790	6800	2069.6	2072.6									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	6790	6800	2069.6	2072.6									X		Miocene		mixed interval		Miocene	bathyal
124583	37.1.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	6790	6800	2069.6	2072.6											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		spec		unidentified cone tooth	Zeus D-14	6790	6800	2069.6	2072.6											Miocene		mixed interval		Miocene	bathyal
		spec	a9/b1,5/c11,12/d20	*angled cone and basal canals* new subtype	Zeus D-14	6850	6860	2087.9	2090.9					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6870	6880	2094.0	2097.0									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline?* new subtype	Zeus D-14	6870	6860	2094.0	2090.9									X		Miocene		mixed interval		Miocene	bathyal

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved …. interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
		? frag	a9/b1,5/c1/d1	cf. *curved triangle, wide inline?* new subtype	Zeus D-14	6870	6880	2094.0	2097.0									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	6870	6880	2094.0	2097.0					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
		spec	a9/b5/c1/d1	*curved triangle, parallel-sided inline* new subtype	Zeus D-14	6890	6900	2100.1	2103.1									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6930	6940	2112.3	2115.3									X		Miocene		mixed interval		Miocene	bathyal
124623	55.2.1	spec	a9/b5+8/c13+19/d19/	*narrow triangle straight inbase* Doyle, Kennedy, & Riedel 1974	Zeus D-14	6950	6960	2118.4	2121.4					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through Quaternary	mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6970	6980	2124.5	2127.5									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	6970	6980	2124.5	2127.5									X		Miocene		mixed interval		Miocene	bathyal
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	6970	6980	2124.5	2127.5					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		good	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	7050	7060	2148.8	2151.9									X		Miocene		mixed interval		Miocene	bathyal
		frag	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7070	7080	2154.9	2158.0					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		Miocene	bathyal
124584	37.2.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	7090	7100	2161.0	2164.1											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	7110	7120	2167.1	2170.2									X		Miocene		mixed interval		Miocene	bathyal
		?frag	a9/b1,5/c1/d1	*narrow tall triangle, inflated inline apex? new subtype*	Zeus D-14	7130	7140	2173.2	2176.3									X		Miocene		mixed interval		Miocene	bathyal
		?spec	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline? new subtype*	Zeus D-14	7130	7140	2173.2	2176.3									X		Miocene		mixed interval		Miocene	bathyal
		frag	a8,9/b5+8	flanged tooth similar to *triangle double flex , centrally inflated triangle with canals* or *narrow triangle straight inbase*	Zeus D-14	7150	7160	2179.3	2182.4					x	x					upper Eocene-Oligocene		mixed interval		Miocene	bathyal
		frag	a9/b1,5/c1/d1	cf. *curved triangle, parallel-sided inline* new subtype	Zeus D-14	7210	7220	2197.6	2200.7									X		Miocene		mixed interval		Miocene	bathyal
		spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	7210	7220	2197.6	2200.7								X			mixed interval		mixed interval		Miocene	bathyal
124602	45.2.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7350	7360	2240.3	2243.3					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval		undiagnostic	undiagnostic
		frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	7370	7380	2246.4	2249.4									X		Miocene		mixed interval		undiagnostic	undiagnostic
		base frag	a9/b8/c19/d19	*flanged triangle with canals* or *triangle one canal above*	Zeus D-14	7390	7400	2252.5	2255.5					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval		undiagnostic	undiagnostic
		frag	a9/b5/c1/d1	*angled cone and bulbous base* new subtype	Zeus D-14	7550	7560	2301.2	2304.3									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
124603	45.3.1	spec	a9/b5+8/c19/d19	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	Zeus D-14	7550	7560	2301.2	2304.3					X						Oligocene-upper Eocene; ?reworked into lower Miocene strata	upper Paleocene through lower Miocene	mixed interval/volcanics		Eocene volcanics	undiagnostic
124667	79.1.1	spec	a9/b1,5/c1/d1	*curved triangle, striated inline* new subtype	Zeus D-14	7560	7570	2304.3	2307.3								X			mixed interval		mixed interval/volcanics		Eocene volcanics	undiagnostic
124643	72.1.1, 72.1.2	spec	a9/b1,5/c1/d1	*curved triangle, wide inline* new subtype	Zeus D-14	7560	7570	2304.3	2307.3									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
		frag	a9/b5/c1/d1	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1976	Zeus D-14	7590	7600	2313.4	2316.5									X		mainly upper to middle Miocene; rare lower Pliocene, lower Miocene	upper Oligocene through lower Miocene; rare upper Eocene-lower Oligocene	mixed interval/volcanics		Eocene volcanics	undiagnostic
124655	75.2.1	frag	a9/b1,5/c1/d1	*narrow tall triangle, irregular threaded inline new subtype*	Zeus D-14	7590	7600	2313.4	2316.5									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
124608	48.1.1	spec	a9/b1/c1/d1	*triangle chisel-top* new subtype	Zeus D-14	7590	7600	2313.4	2316.5									X		Miocene		mixed interval/volcanics		Eocene volcanics	undiagnostic
124585	37.3.1	spec	a4/b2+10/c2/d4+10+14	undescribed elasmobranch dermal denticle; Form I	Zeus D-14	7810	7820	2380.5	2383.5											Oligocene-upper Eocene; ?reworked into lower Miocene strata		mixed interval/volcanics		Eocene volcanics	undiagnostic
124614	52.1.1	spec	a9/b5+8/c13+19/d13+19	*triangle modified margin ends* Doyle and Riedel, 1985	Zeus I-65	980	990	298.7	301.8											mixed interval	lower Paleocene	Pleistocene-Pliocene		lower Miocene	mixed shallow & deep faunas in deep water >600'; transported?
		spec	a12,15/b10+12	undescribed ichthyolith oddity Form G	Zeus I-65	1790	1820	545.6	554.7											mixed interval		upper-lower Pliocene		lower Miocene / Oligocene	>600'

GSC Specimen No.	PE Fig. no.	Spec	CUIIS identification (a/b/c/d only)	Ichthyolith	Shell-Anglo well or outcrop sample number and location	interval (feet)	interval (feet)	interval (metres)	interval (metres)	Squaloid teeth interval	Pointed & Skirted interval	Three Peaks …. interval	Short Side Peaks Zone	Teeth With Canals Zone	Centrally inflated …. interval	cf. triangle curved … interval	Striated Triangle Zone	Bulbous Base Zone	Shadowed Cone Zone	Stratigraphic position (Tofino Basin ichthyoliths)	Stratigraphic position (deep-sea core ichthyoliths)	Stratigraphic position, Tofino Basin foraminifers (Narayan, 2003)	Stratigraphic position and foraminifer zone (Cameron, 1980)	Stratigraphic position (Shell Canada Ltd. paleontological reports)	Biofacies (Shell Canada Ltd. paleontological reports)
124516	3.1.1; 14.1.1 and 14.1.2	spec	a4/b6+8/c1/d2+8	*Raja* sp. A	Zeus I-65	1820	1850	554.7	563.9										X	Pliocene to upper Miocene	frequently inhabit cool shelf waters	upper-lower Pliocene		lower Miocene / Oligocene	>600'
124626	58.1.1	spec	a9/b8/c13+19/d13+19	cf. *straight triangle keeled edges* Ramsey, Doyle, and Riedel, 197€	Zeus I-65	3450	3460	1051.6	1054.6											mixed interval	Upper Jurassic through Miocene	upper-middle Miocene		lower Miocene / Oligocene; Eocene?	>600'

Table 2. Stratigraphic interval and Tofino Basin ichthyolith groups, taxa, abundances, and provisional zones and intervals.

Ichthyolith group	Provisional ichthyolith zone or interval										ET	ET	ET	ET	ET	ET
stratigraphic interval / ichthyolith	Squaloid Teeth interval	Pointed and Skirted interval	Three Peaks Forked Median Ridge interval	Short Side Peaks Differentiated Margin Zone	Teeth With Canals Zone	Centrally Inflated Triangle With Canals interval	cf. Triangle Curved Margin Ends interval	Striated Cone Zone	Bulbous Base Zone	Shadowed Cone Zone	Family Squalidae indet., Forms A to E	Suborder Hexanchoidei indet., Forms A to C	*?Isurolamna* sp. A	Family Scyliorhinidae indet., Form A	*Raja* sp. A	undescribed and unidentified elasmobranch teeth
Holocene/Pleistocene																
upper Pliocene																
lower Pliocene															4	
upper Miocene / lower Pliocene																
upper Miocene																1
middle Miocene	rw			DS	DS		rw			?	1					
lower Miocene				DS	DS		rw									
upper Oligocene / lower Miocene			DS	DS	DS		rw					1				
upper Oligocene	rw	rw	DS	DS	DS						44	12		3		12
lower Oligocene	rw	rw	DS	DS	DS											
upper Eocene / lower Oligocene	rw	rw	DS	DS	DS						3	1	1			
upper Eocene	rw	rw	DS	DS	DS											3
middle-lower Eocene	?	DS	DS	DS	DS		DS									
Paleocene	?	DS	DS		DS		DS									
Upper Cretaceous	DQN	DQN	DQN													
Lower Cretaceous	DQN															

Ichthyolith group	EDD	EDD	EDD	EDD	EDD	EDD	EDD	EDD	EDD	canals	canals	canals	canals	canals	canals
stratigraphic interval / ichthyolith	*pointed and skirted* Doyle, Dunsworth, and Riedel, 1978	cf. *pointed and skirted* Doyle, Dunsworth, and Riedel, 1978	*three peaks forked median ridge* new subtype	*kite-shaped longitudinal line* Doyle, Kennedy, and Riedel, 1974	cf. *kite-shaped longitudinal line* Doyle, Kennedy, and Riedel, 1974	cf. *rhombus kite* Gupta 1991	*short side peaks differentiated margin* Doyle, Kennedy and Riedel, 1974	*ogee lanceolate* Tway, Doyle and Riedel, 1985	undescribed and unidentified elasmobranch dermal denticles	*centrally inflated triangle with canals* new subtype	*triangle one canal above* Doyle, Kennedy, and Riedel, 1974	*flanged triangle with canals* new subtype	*angled cone and basal canals* new subtype	*triangle transverse line across* Doyle, Kennedy, and Riedel, 1974	cf. *triangle transverse line across* Doyle, Kennedy, and Riedel, 1974
Holocene/Pleistocene															
upper Pliocene															
lower Pliocene									1						
upper Miocene / lower Pliocene															
upper Miocene															
middle Miocene															
lower Miocene									4						
upper Oligocene / lower Miocene		1					2		1		1	1	6	5	4
upper Oligocene	26	1	10	13	4	1	2		11	39	3	4	1	1	1
lower Oligocene															
upper Eocene / lower Oligocene	14						2	3	9	1			8	1	
upper Eocene	2						2		6	3	1	4	1		
middle-lower Eocene															
Paleocene															
Upper Cretaceous															
Lower Cretaceous															

Ichthyolith group	flange	flange	flange	flange	flange	flange	flange	flange	flange	flange	flange	flex	flex	flex
stratigraphic interval / ichthyolith	*narrow triangle straight inbase* Doyle, Kennedy, and Riedel, 1974	cf. *wide crescent* Doyle, Dunsworth, and Riedel, 1978	*beveled triangle high inline* Doyle, Dunsworth, and Riedel, 1978	*triangle sigmoid rough* Ramsey, Doyle, and Riedel, 1976	cf. *straight triangle keeled edges* Ramsey, Doyle, and Riedel, 1976	cf. *wide triangle* Dunsworth, Doyle, and Riedel, 1975	cf. *simple triangle* Winfrey, Doyle and Riedel, 1987	cf. *triangle curved margin ends* Doyle and Riedel, 1985	*triangle chisel-top* new subtype	cf. *triangle notched corner* Doyle, Kennedy, and Riedel, 1974	*triangle modified margin ends* Doyle and Riedel, 1985	*triangle double flex* Dunsworth, Doyle, and Riedel, 1975	*wide triangle double flex* Gupta, 1991	cf. *flexed triangle asymmetric* Doyle and Riedel, 1985
Holocene/Pleistocene														
upper Pliocene					1	1	1				2			
lower Pliocene									1					
upper Miocene / lower Pliocene					1	1			1					
upper Miocene											1			
middle Miocene							1	1	2	1				
lower Miocene							2							
upper Oligocene / lower Miocene	2							4				1		
upper Oligocene					1	2	2					2	2	1
lower Oligocene														
upper Eocene / lower Oligocene	1	1	1	1									3	
upper Eocene	1											1		
middle-lower Eocene														
Paleocene														
Upper Cretaceous														
Lower Cretaceous														

Ichthyolith group	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone
stratigraphic interval / ichthyolith	cf. *triangle bowed inline* Ramsey, Doyle, and Riedel, 1976	cf. *curved flared triangle* Ramsey, Doyle, and Riedel, 1976	*dome-top triangle bowed inline* new subtype	cf. *triangle with parallel inline* Doyle, Kennedy, and Riedel, 1974	cf. *striated triangle* Ramsey, Doyle, and Riedel, 1976	*curved triangle, striated inline* new subtype	cf. *triangle small top* Ramsey, Doyle, and Riedel, 1976	*narrow tall triangle, irregular threaded inline* new subtype	*narrow tall triangle, inflated inline apex* new subtype	*curved triangle, parallel-sided inline* new subtype	cf. *curved triangle, parallel-sided inline* new subtype	cf. *short triangle stepped margin* Doyle, Kennedy, and Riedel, 1974
Holocene/Pleistocene												
upper Pliocene										6		
lower Pliocene								2	2		2	1
upper Miocene / lower Pliocene												
upper Miocene												
middle Miocene						4		1	5	11	3	3
lower Miocene												
upper Oligocene / lower Miocene						5	2	5	9	5	7	2
upper Oligocene			7	1	1				1		1	
lower Oligocene												
upper Eocene / lower Oligocene		2	1					1	3	1	1	
upper Eocene	2											
middle-lower Eocene												
Paleocene												
Upper Cretaceous												
Lower Cretaceous												

Ichthyolith group	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone	cone	odds	odds
stratigraphic interval / ichthyolith	*curved triangle wide inline* new subtype	cf. *curved triangle wide inline* new subtype	*angled cone and bulbous base* new subtype	cf. *narrow curved triangle* Doyle, Kennedy, and Riedel, 1974	*small pointed triangle* Tway, Doyle, and Riedel, 1985	cf. *triangular triangle* Kozarek and Orr, 1980	*narrow tall triangle, cone inline* new subtype	cf. *small triangle long striations* Dunsworth, Doyle, and Riedel, 1975	cf. *long triangle stepped margin* Doyle, Kennedy, and Riedel, 1974	*shadowed high inline cone* new subtype	*shadowed curved blunt triangle* new subtype	undescribed and unidentified cone teeth	"globular dome"	ichthyolith oddities
Holocene/Pleistocene														
upper Pliocene			12	1			4		3		3	13		2
lower Pliocene	3	4								9			4	
upper Miocene / lower Pliocene					1			1			7			
upper Miocene								1	1	2				
middle Miocene	4	9	16 + 24?	20		1	4					8+ 4?	2	4
lower Miocene														
upper Oligocene / lower Miocene	5	8	17	3	1							3	2	1
upper Oligocene												2		1
lower Oligocene														
upper Eocene / lower Oligocene												4	2	1
upper Eocene														
middle-lower Eocene														
Paleocene														
Upper Cretaceous														
Lower Cretaceous														

Key

DQN = deep-sea, Queen Charlotte Basin or Nanaimo Basin occurrence

DS = deep-sea occurrence

shaded = Tofino Basin occurrence

rw = reworked

11/30/2004