PALEOBIOLOGY AND PALEOENVIRONMENTS OF EOCENE ROCKS, MCMURDO SOUND, EAST ANTARCTICA
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FISH REMAINS FROM THE EOCENE OF MOUNT DISCOVERY, EAST ANTARCTICA

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Recent geological and paleontological investigations into the Eocene deposits of East Antarctica yielded teeth from one teleost tentatively identified as Gadidae genus and species indeterminate, and two taxa of sharks, one *Carcharias* sp. *cf. C. macrota*, and one triakid, *Galeorhinus* sp. These fossils represent the first Cenozoic fishes from that section of the Southern Hemisphere. This small ichthyofauna suggests a relatively shallow, temperate marine climate of the Eocene of East Antarctica, similar to the better known Eocene ichthyofaunas of the Antarctic Peninsula.

INTRODUCTION

The middle to upper Eocene marine deposits of the La Meseta Formation of Seymour Island on the Antarctic Peninsula have revealed a rich ichthyofauna, and have produced the most diverse Paleogene teleost and elasmobranch fauna from anywhere in the Southern Hemisphere [Balushkin, 1994; Cione and Reguero, 1994, 1995, 1998; Cione, et al., 1995; Doktor, et al. 1996; Jerzmanska, 1988, 1991; Jerzmanska and Swidnicki, 1992; Long, 1991, 1992a-b, 1994a; Eastman and Grande, 1991; Ward and Grande, 1991; Welton and Zinsmeister, 1980]. However, virtually nothing is known about Paleogene fish faunas in other areas of Antarctica. This situation is due largely to the inaccessibility of other Paleogene deposits on the continent, and to the lack of prospecting for fossils in areas outside of the Antarctic Peninsula.

Recently, investigations into Paleogene deposits of Mount Discovery in East Antarctica have uncovered new fossil-bearing strata, preserved as glacial erratics, including Eocene marine units that have produced several specimens of teleost and shark teeth. While fragmentary in nature, this material is identifiable to at least three taxa, and represent some new and important occurrences in both Antarctica and the Southern Hemisphere. For additional information on geography, geology, stratigraphy, and age of these deposits, please see other papers in this volume.

SYSTEMATIC PALEONTOLOGY

Taxonomy for the shark and teleost taxa presented follows Compagno [1984] and Cohen, et al. [1990], and tooth morphology terminology follows Long [1992a].

Class Chondrichthyes
Order Lamniformes Compagno, 1973
Family Odontaspididae Mueller and Henle, 1838
Genus ***Carcharias*** Rafinesque, 1810
Carcharias sp. *cf. C. macrota* (Agassiz, 1843)
Plate 1, Figures a and b

Description. Two isolated tooth crowns; they are mesodistally narrow and apicobasally elongate, showing a weakly convex labial crown face and a smooth, moderately convex lingual crown face; the crown apex is very acute, and a sharp, non-serrated cutting edge extends from this apex to just above the crown foot on the mesial and distal sides. No root or lateral cusplets are present on these broken teeth.

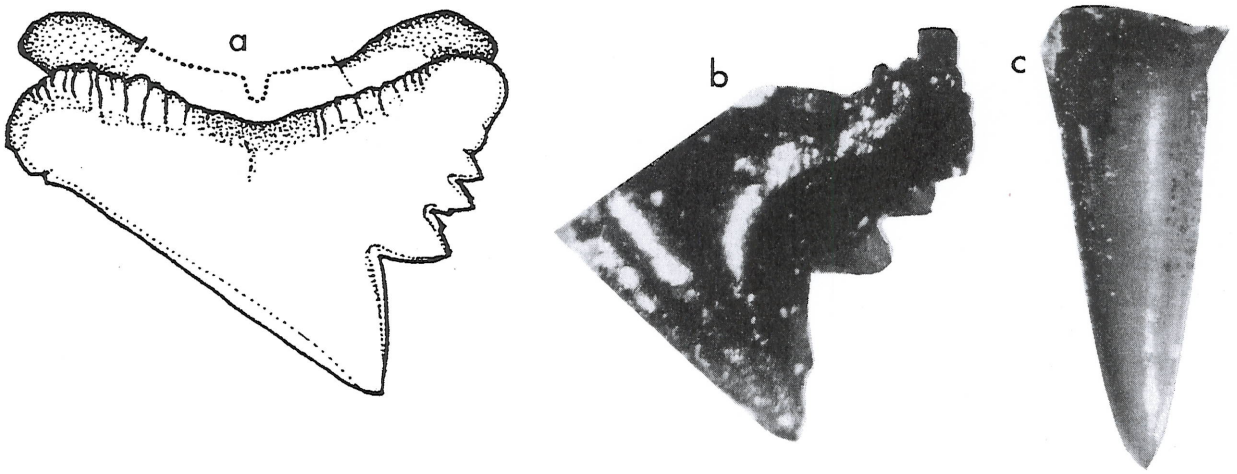

Plate 1

Figs. a and b. *Galeorhinus* sp. A. Camera-lucida drawing of the labial face of an upper lateral tooth from the Eocene of Mt Discovery, East Antarctica, USNM 494034, c.x15. B. Photograph of the same specimen, c.x15.
Fig. c. *Carcharias* sp. *cf. C. macrota* (Agassiz). Photograph of isolated tooth crown from the Eocene of Mt Discovery, East Antarctica, USNM 494032, c.x2.

Figured specimens. USNM 494032; USNM 494033.

Localities. Site T, E145; Site J, E151.

Remarks. These tooth crowns are identifiable as juvenile or subadult odontaspidid teeth, as characterized by their sigmoidal narrow crowns, the sharp but unserrated cutting edge, acute crown apex, very convex lingual crown face, and weakly convex labial crown face. However, exact specific designation is difficult because of their fragmentary nature. These specimens lack the increased sigmoidal curvature and the strongly convex lingual crown face, and narrow crown base of *Odontaspis*, but rather show characters like a moderately convex lingual crown face, weakly sigmoidal curvature, and widened crown base attributable to *Carcharias*. In comparison to smaller specimens of *C. macrota* from the Eocene of Seymour Island, they show the basic similarities in most aspects of crown morphology and are likely assignable to that species. Additionally, there have been no other species of *Carcharias* reported from the Eocene of Antarctica.

Order Carcharhiniformes Compagno, 1973
Family Triakididae Gray, 1851
Genus ***Galeorhinus*** (Linnaeus, 1758)
Galeorhinus sp.

Plate 1, Figure c

Description. This single complete upper lateral tooth is embedded in dense sandstone with only the labial crown face exposed. The tooth consists of a mesodistally expanded crown with a single large, distally inclined central cusp and a weakly convex crown face. The mesial edge is nearly straight, and a smooth but sharp cutting edge extends from the acute crown apex of the moderately triangular cusp to the upper anterior edge of the mesial root lobe. Three well developed distal cusplets are posterior to the central cusp; the cusplets are triangular and blunt with a smooth cutting edge; the cusplets decrease in size away from the cusp. The root lobes are widely divergent and rounded; the crown foot shows a moderate apical arch, and strong but short plications are present on the crown foot on both sides of the arch to near the ends of the root lobes. Little of the root is exposed, but it appears to be apicobasally narrow and slightly recessed under the crown foot; it extend slightly past the distal root lobe, but does not extend beyond the mesial root lobe.

Figured specimen. USNM 494034.

Locality. Site T, E145.

Remarks. The morphology of this tooth is consistent with basic familial characters diagnostic for Triakididae

and for generic characters diagnostic for *Galeorhinus,* [see Compagno, 1970, 1988], but a specific designation is problematical. This genus contains many nominal species from the Late Cretaceous and Cenozoic; most of these have poor original diagnoses and illustrations, or are regional taxa that have not been validated by later workers [see partial reviews in Antunes and Jonet, 1970; Cappetta, 1970, 1987; Herman, 1977; Long, 1994b]. Additionally, many of these fossil forms may prove to be from other extant genera of Carcharhiniform sharks not yet identified from the fossil record [see Compagno, 1970, 1988]. *Galeorhinus* also shows a wide range of individual and ontogenetic variation that is often overlooked [see Long 1994b], potentially creating more confusion when identifying fossil taxa. For these reasons, and because only a single specimen is known from East Antarctica, it is identified to the generic level only. However, the species shows characters consistent with other fossil teeth identified as *Galeorhinus minor* and *G. minutissimus* as shown and described in Arambourg [1952], but additional specimens of these teeth, and clarification of *Galeorhinus* species-level taxonomy, are essential for a correct species assignment.

Class Osteichthyes
Subclass Actinopterygii
Subdivision Teleostei
Order Gadiformes (*sensu* Cohen, 1984)
Gadidae Rafinesque, 1810
Gadidae genus and species indeterminate
not figured

Description. A single bony tooth core embedded in a piece of sandstone; narrow and triangular with a somewhat blunt crown apex and sub-rounded tooth base; labial and lingual crown faces are moderately convex and devoid of enameloid but show some very weak apicobasally oriented striations.

Museum specimen. USNM 494035.

Locality. Site T, E372.

Remarks. This single broken and weathered tooth lacks diagnostic features definitely attributable to previously identified Eocene bony fishes from Antarctica [e.g. Long, 1991, 1992b; Cione, et al., 1994; Jerzmanska, 1988, 1991]. The tooth lacks the type of thick enamel consistent with any other potential marine vertebrate such as archaeocetes and crocodilians. It is also dissimilar from the thick, enameloid-covered caniform teeth of Labrid fishes, and the long, lanceolate teeth of Trichiurid fishes, both of which are known from the Eocene of Antarctica [Long 1991, 1992b]. However, this tooth shows similarities with the teeth of an as yet unidentified teleost commonly collected from the Eocene La Meseta Formation. The La Meseta teeth have been assigned to a taxa of gadoid teleost genus informally named ìMesetaichthysî [Jerzmanska and Swindnicki, 1992]. Since this name is used tentatively in the literature and no species was formally designated for the La Meseta specimens, a specific identification of this tooth is not possible at this time. The diverse and often fragmentary nature of the fossil material attributable to Gadiform fishes suggests that there are likely several different undescribed and unidentified taxa from the Eocene of Antarctica [Doktor, et al., 1996; Eastman and Grande, 1991; Grande and Eastman, 1986; Jerzmanska, 1988; Jerzmanska and Swindnicki, 1992; Long, unpublished data]. Additionally, some of this material may eventually be identified as other non-gadoid taxa, such as nothenoid fishes [Grande and Eastman, 1986; Balushkin, 1994].

DISCUSSION

The teeth of *Carcharias* sp. *cf. C. macrota* and *Galeorhinus* sp. from E145 in the moraine deposits of Mount Discovery are associated with several macroinvertebrate taxa, including *Linucula? mcmurdoensis* n. sp., *Leionucula nova* [Wilckens], *Yoldiella?* n. sp., *Neilo beui* Stilwell and Zinsmeister, *Saxolucina sharmani* [Wilckens], *Nemocardium (Pratulum?) minutum* n. sp., *Crassatella* sp., *Hiatella harringtoni* n. sp., *Struthiolarella mcmurdoensis* n. sp., *Perissodonta* n. sp.? *cf. P. laevis* [Wilckens], *?Penion australocapax* Stilwell and Zinsmeister, *Acteon eoantarcticus* Stilwell and Zinsmeister, *Crenilabium suromaximum* Stilwell and Zinsmeister, and Dentaliidae genus and species indeterminate [see Stilwell, this volume, for details of these taxa]. These invertebrate taxa along with the teeth, recovered from the medium-grained quartzose sandstone facies of E145, corroborate a shallow shelf environment of deposition.

Although this ichthyofauna is very limited in its taxonomic diversity, it does provide some paleoecological and biogeographical information that can be used to better interpret the Eocene marine deposits of East Antarctica. The presence of *Carcharias* is not unusual, since it is a cosmopolitan genus that lives in shallow tropical to temperate waters, and has previously been recorded from the Eocene of Antarctica [Long, 1992a and c]. This new locality record suggests *C. macrota* had a circum-Antarctic distribution in the Eocene.

Galeorhinus has not been recorded from Antarctica, and this is the first such Paleogene record of the genus

from the Southern Hemisphere. The extant species *Galeorhinus galeus* is found world-wide, and its range extends well into shallow, cool temperature waters of the Southern Hemisphere [Compagno, 1984]. Fossil examples of this species in the Southern Hemisphere were previously known only from Pliocene deposits in Chile [Long, 1993]. Although the identity of this specimen of *Galeorhinus* is currently unknown, it may prove to belong to a Paleogene species known from other localities in the Northern Hemisphere.

Gadiform fishes are usually abundant in temperate to polar waters around the globe [Cohen, et al., 1990]. These suspected Eocene gadiform fossil forms apparently had a circum-Antarctic distribution as well, but since the identity of the fossil tooth remains uncertain, more pertinent biogeographical information is presently unattainable.

This new Eocene East Antarctic marine fauna includes widely distributed taxa known from other Northern Hemisphere localities. Such occurrences suggest that there was little regional endemicity of the ichthyofauna during that time, and that the Southern Hemisphere ichthyofauna was largely cosmopolitan in nature [Long, 1992a, 1994a]. Like the better known Eocene faunas from the La Meseta Formation Seymour Island, this fauna seems to consist of taxa that are associated with a temperate to cool temperate marine environment in relatively shallow waters [Long, 1992c]. Further discovery and interpretation of new fossil taxa will greatly assist in forming a more concrete paleoecological and bio- geographical framework for the Eocene marine environments of East Antarctica.

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