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ARTICLE

ULTIMATE EOCENE (PRIABONIAN) CHONDRICHTHYANS (HOLOCEPHALI, ELASMOBRANCHII) OF ANTARCTICA

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ABSTRACT—The Eocene La Meseta Formation on Seymour Island, Antarctic Peninsula, is known for its remarkable wealth of fossil remains of chondrichthyans and teleosts. Chondrichthyans seemingly were dominant elements in the Antarctic Paleogene fish fauna, but decreased in abundance from middle to late Eocene, during which time remains of bony fishes increase. This decline of chondrichthyans at the end of the Eocene generally is related to sudden cooling of seawater, reduction in shelf area, and increasing shelf depth due to the onset of the Antarctic thermal isolation. The last chondrichthyan records known so far include a chimeroid tooth plate from TELM 6 (Lutetian) and a single pristiophorid rostral spine from TELM 7 (Priabonian). Here, we present new chondrichthyan records of *Squalus, Squatina, Pristiophorus, Striatolamia, Palaeohypotodus, Carcharocles*, and *Ischyodus* from the upper parts of TELM 7 (Priabonian), including the first record of *Carcharocles sokolovi* from Antarctica. This assemblage suggests that chondrichthyans persisted much longer in Antarctic waters despite rather cool sea surface temperatures of approximately 5°C. The final disappearance of chondrichthyans at the Eocene–Oligocene boundary concurs with abrupt ice sheet formation in Antarctica. Diversity patterns of chondrichthyans throughout the La Meseta Formation appear to be related to climatic conditions rather than plate tectonics.

SUPPLEMENTAL DATA—Supplemental materials are available for this article for free at www.tandfonline.com/ujvp

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INTRODUCTION

The modern Southern Ocean is delimited by the circum-Antarctic current (= Antarctic Convergence). The Antarctic continent is located within it, and these are amongst the most remote and coldest places in the world. They are key elements in any model of Earth processes and climatic change, as well as sites with unique scientific characteristics (Kriwet, 2005). The extant fish fauna within the Antarctic Convergence is striking in its low taxonomic diversity and high number of endemic taxa. Fishes that have evolved special morphological and physiological traits to survive in the extreme, low sea water temperatures are the dominant elements of this fauna (e.g., Eastman and Grande, 1989; Eastman, 1993; Albertson et al., 2010; Ingram and Mahler, 2011; Marshall, 2012; Near et al., 2012).

Chondrichthyans seemingly were major faunal components of pre-Oligocene Antarctic fish faunas, whereas chondrichthyan records from Neogene strata are still lacking. Similarly, the extant chondrichthyan fauna of the Southern Ocean surrounding Antarctica is extremely impoverished. Up to the present, only a few specimens belonging to three shark species have been reported, mostly off the Kerguelen Plateau (e.g., Gon and Heemstra, 1990), and it still is not established whether these sharks enter the Southern Ocean sporadically or represent permanent residents. Batoid diversity is slightly higher with eight described resident species (Gon and Heemstra, 1990; Long, 1994). Living holocephalans have not yet been recorded from Antarctic waters.

Post-Cretaceous and pre-Oligocene Antarctic fishes are mainly known from Seymour Island, which is located at the northern tip of the Antarctic Peninsula. Here, late early to late Eocene marine sediments of the La Meseta Formation yield the most diverse Paleogene ichthyofauna from the Southern Hemisphere to date, comprising cartilaginous and bony fishes (e.g., Welton and Zinsmeister, 1980; Jerzmanska, 1988; Eastman and Grande, 1989, 1991; Balushkin, 1994; Cione and Reguero, 1995, 1998; Doktor et al., 1996; Long, 1992a, 1992b, 1992c). The lack of post-Eocene fish records results in a gap of approximately 38 million years of unknown evolutionary history of Antarctic fishes between the Eocene–Oligocene boundary and the modern Antarctic fish fauna. Eocene Antarctic fishes consequently are very important for understanding evolutionary and adaptive processes in marine vertebrates related to abiotic causes such as plate-tectonically mediated dispersal and climatic perturbations, including the 'Early Eocene Climatic Optimum' and the onset of Antarctic ice-shield formation.

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