

## Earliest Record of the Genus *Haliotis* (Mollusca: Gastropoda) from the Late Cretaceous (Campanian) of Los Angeles County, California

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**Abstract.** Cretaceous abalone are extremely rare and are known from only two valid species: *Haliotis lomaensis* Anderson, 1902, from the Late Cretaceous (latest Campanian/earliest Maastrichtian) of San Diego County, California and *H. antillesensis* Sohl, 1992, from the Late Cretaceous (late Maastrichtian) of southwestern Puerto Rico. The earliest record of the genus *Haliotis* is here documented from Late Cretaceous (middle middle to late middle Campanian) strata of the Tuna Canyon Formation, Garapito Creek area of Topanga Canyon, Santa Monica Mountains, Los Angeles County, California. This additional Cretaceous record for *Haliotis* could possibly indicate a North American origin for the family Haliotidae.

### INTRODUCTION

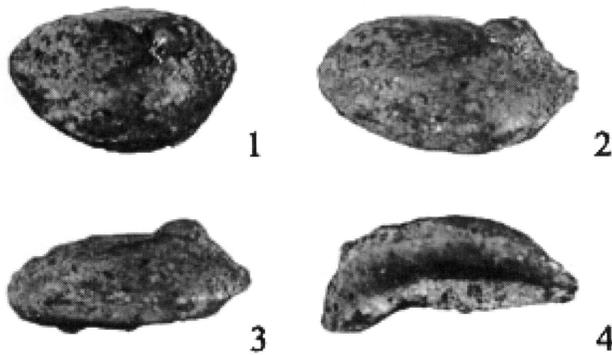
Cretaceous abalone species are extremely rare, currently comprising only two valid species (Sohl, 1992; Geiger & Groves, 1999; Geiger, 2000). These species include: *Haliotis lomaensis* Anderson, 1902 from the Late Cretaceous (latest Campanian/earliest Maastrichtian) Point Loma Formation, San Diego County, California and *H. antillesensis* Sohl, 1992 from the Late Cretaceous (late Maastrichtian) El Rayo Formation, Sabana Grande quadrangle, southwest Puerto Rico. Suspect records of Cretaceous abalone that have been relegated to pleurotomarioidean genera include *Haliotis?* [*sic*] *antiqua* Binkhorst, 1861 [= *Trochus limburgensis* Kaunhowen, 1897] from the Maastrichtian near Maastricht, Limburg Province, the Netherlands, *Pleurotomaria antiqua* (Binkhorst, 1861) of Weinzettl (1910) from the Late Cretaceous (Cenomanian) near Korycany, Czech Republic, and *Haliotis cretacea* Lundgren, 1894 [= *Pleurotomaria* sp.?] from the Late Cretaceous (Campanian) near Barnakällegrottan, southeastern Sweden [see Sohl (1992) for additional details]. A poorly preserved specimen identified as *Haliotis* sp. by Dawson (1978) and reported by Sundberg (1979, 1984) from the Late Cretaceous (Maastrichtian) Cabrillo Formation of San Diego County, California is actually a specimen of the calyptraeid genus *Lysis* (L.R. Saul, personal communication).

### MATERIAL

A single poorly preserved internal mold with little remaining original or recrystallized shell material, Natural History Museum of Los Angeles County, Invertebrate Paleontology (LACMIP) hypotype 13237 (Figs. 1–4) from LACMIP loc. 27110 (*ex* University of California, Los Angeles loc. 7110) that measures 5.9 mm in overall length retains several diagnostic features that validate it as a haliotid. Observed features include a flattened “shell” with low spire, wide columella, and a row of six tremata toward the left periphery. Because of such poor preservation we hesitate to describe a new species based on this sole example. Nevertheless, due to the uniqueness of this specimen from Late Cretaceous (middle middle to late middle Campanian) strata, it is noteworthy enough to mention as the earliest known worldwide representative of the genus *Haliotis*.

### LOCALITY

LACMIP loc. 27110 is on the north side of Garapito Creek just above the 1300 ft. contour line, 900 ft. north, 735 ft. east of SW corner of section 33 (projected), T1N, R16W San Vicente y Santa Monica Land Grant, northeast of Sylvia Park, United States Geological Survey (USGS) Topanga quadrangle (1976 ed.), Santa Monica Mountains, Los Angeles County, California.



Figures 1–4. *Haliotis* sp., hypotype LACMIP 13237, from LACMIP loc. 27110, 1 = dorsal view ( $\times 7.6$ ), 2 = oblique view ( $\times 10$ ), 3 = lateral view ( $\times 9.3$ ), 4 = columellar view ( $\times 10.3$ ).

### STRATIGRAPHY & AGE

The specimen was collected by the junior author on 21 December, 1983 from the base of informal “member D” of Wilson (1941) [= map unit Ktd of Yerkes et al. (1994)] within the Late Cretaceous (late middle to early late Campanian), *Metaplacenteras pacificum* ammonite zone [33N chron] (Elder & Saul, 1996) part of the Tuna Canyon Formation of Yerkes & Campbell (1979) [= Unnamed strata of Dibblee, 1992]. This ammonite zone was cited as Late Cretaceous (middle middle to late middle Campanian) [C33 chron] by Squires & Saul (2003) and we follow this usage. “Member D” is a fossiliferous fine-grained sandstone that occurs immediately above a thick, cobble conglomerate informally designated as “member C” by Wilson (1941) [= map unit Ktc of Yerkes et al. (1994)] and is equivalent to the lowermost part of a fine-grained sandstone reported by Popenoe (1954). LACMIP loc. 27110 is within an unusual small lens of “member D” that disappears along strike within 100 ft. (33 m). Unfortunately, Dibblee (1992) incorrectly mapped this lens of “member D” as Paleocene Santa Susana Formation as did Yerkes et al. (1994). However, recent field work by the junior author combined with the fauna listed below, correctly place the locality within the Tuna Canyon Formation.

In addition to the ammonite *Metaplacenteras pacificum* (Smith, 1900), LACMIP 27110 also yielded the ammonite *Baculites* cf. *B. inornatus* Meek, 1862, the gastropods *Atira* sp., *Turritella chicoensis pescaderoensis* Arnold, 1908, *Gyrodes pacificum* Popenoe & others, 1987, *Volutoderma* n. sp., and *Biplica obliqua* (Gabb, 1864), and the bivalves *Pterotrignia evansana* (Meek, 1858), *Glycymeris veatchii* (Gabb, 1864), mytilid sp., *Ostrea* sp., and *Calva* sp.

### PALEOBIOGEOGRAPHY

Geiger & Groves (1999), Geiger (2000), and Geiger & Poppe (2000) discussed three possible haliotid radiation

models as follows: 1) An “Indo-Pacific” model, also discussed by Lindberg (1992), indicates that living abalone are most diverse in the central Indo-Pacific, which implied that this was their center of radiation; 2) A “Pacific Rim” model proposed by Talmadge (1963), where abalones originated on an island arc from Japan to northern Australia and radiated to California, southern Australia, and the Indo-Pacific; and 3) A “chromosomal” model where species with a low diploid number (28) live in the eastern Mediterranean Sea and species with higher diploid numbers (32) in the Indo-Pacific and (36) in the North Pacific, abalones dispersed eastward from the Mediterranean. However, because these models do not consider the fossil record they could be rejected. Moreover, this confirmation of the earliest known haliotid from Late Cretaceous (middle middle to late middle Campanian) strata of southern California combined with the fact that Cretaceous abalones are known exclusively from North America further strengthens the possibility of a North American origin for the family Haliotidae. Kiel & Bandel (2000) described *Temnotropis frydai* (Family Temnotropidae) from the Late Cretaceous (late Campanian) Valcarga Formation near Torallola, Lérida Province, Catalonia Region, northeastern Spain and speculated that *Temnotropis* is a likely ancestor of *Haliotis*. *Temnotropis* has a *Haliotis*-like shell with a slit rather than a row of tremata. With a possible ancestor in Spain, the haliotids may have originated in the eastern Atlantic (S. Kiel, personal communication, 2007). However, should a haliotid be found in strata older than middle middle to late middle Campanian a reevaluation of their origin will be necessary.

**Acknowledgments.** We express our thanks to our colleagues Richard L. Squires (California State University, Northridge, Geological Sciences), LouElla R. Saul (LACMIP), and Ángel Valdés (LACM Malacology) for reviewing the manuscript and adding valuable suggestions. Daniel L. Geiger (Santa Barbara Museum of Natural History) is acknowledged for examining the specimen, confirming the identification, and reviewing the manuscript. His unsurpassed knowledge of abalone morphology and phylogenetics is greatly appreciated. Many thanks to Steffen Kiel (University of Leeds, Leeds, England, UK) for his thoughtful review of the manuscript and valuable insights. LouElla R. Saul identified additional mollusks from LACMIP loc. 27110. Special thanks to N. Scott Rugh (San Diego Natural History Museum) for the loan of Dawson’s (1978) *Haliotis* sp. Ángel Valdés is also thanked for assisting with digital photography. Many thanks to Cathy L. Groves (LACM Echinoderms Section) for assistance with digital image manipulations.

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