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Natural History Museum
Of Los Angeles County
Invertebrate Paleontology

A MIOCENE HALIOTIS FROM SOUTHERN CALIFORNIA

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ABSTRACT

Haliotis is very rare in the fossil state, as are most rock-clinging mollusks. Specimens from the base of the Modelo formation of the Santa Monica Mountains represent the first Miocene abalone found in America. It closely resembles modern species living on the Pacific Coast.

Haliotis—the familiar abalone of rocky stretches of coast along the Pacific—has an extensive distribution in regions bordering the Pacific Ocean. The largest species are found on the Pacific coast of North America and in Japanese waters, but the greatest number are recorded from Australian seas.¹ Only one species (*H. dalli* Henderson, Galapagos) is known on the Pacific Coast of America south of Lower California. Also only one (*H. pourtalesii* Dall, Florida) has been found in the western Atlantic, and only one (*H. tuberculata* Linné) lives in European waters.

Fossil remains of *Haliotis* are rare. In Europe a doubtful species, "*Halcotis?*" *antiqua* Binkhorst,² is on record from the Upper Cretaceous (Maestrichtian). I do not have access to Binkhorst's report, but both Stoliczka and Cossmann doubt whether this Cretaceous species is a *Haliotis*. The first genuine European species are of Miocene age and are found in the Aquitanian of Aquitaine, the Burdigalian of the Vienna Basin, the Helvetian of the Piedmont Basin, and the Pontian of southern Russia. All the American fossil species are from the Pacific Coast. F. M. Anderson³ described an Upper Cretaceous species, "*Haliotis*" *lomaensis*, discovered by H. W. Fairbanks at Point Loma, near San

¹Pilsbry, H. A., *Man. Conch.*, vol. 12, p. 73, 1890.

²Binkhorst van den Binkhorst, J. T., *Monographie des gastéropodes et des céphalopodes de la craie supérieure du Limbourg*, p. 81, pl. 5^a2, fig. 4, Bruxelles et Maestricht, 1861. Since writing this account I have had opportunity to examine Binkhorst's book. His species is not at all convincing as a *Haliotis*. It is a mold, probably of a trochoid shell on which the spines near the aperture may have been broken. Dr. G. D. Hanna kindly called my attention to another doubtful Cretaceous species, "*Haliotis*" *cretacea* Lundgren (*Kongl. Sven. Vet.-Akad. Handl.*, vol. 26, no. 6, p. 52, pl. 2, fig. 1, 1894).

³Anderson, F. M., *Proc. Calif. Acad. Sci.*, 3rd ser., *Geology*, vol. 2, No. 1, p. 75, pl. 9, fig. 183, 1902.

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Diego. Through the kindness of Dr. G. D. Hanna, Curator of Invertebrate Paleontology of the California Academy of Sciences, I was permitted to examine the type and only specimen of this species, which fortunately survived the hazards of the San Francisco fire of 1906. The specimen is very small (length 12.7 mm., width 9.2 mm.) and smooth, aside from a shallow groove that lies above the four narrow perforations and a faint ridge lying above the groove. The shell is broken away at the apex, but aside from a slight twist of about 90 degrees, no trace of a spire can be seen. The shell also is broken away along the edge adjoining the perforations, revealing a narrow shelf, as in *Haliotis*. In view of the antiquity of this specimen and in view of the absence of a well-defined spire, it is doubtful whether it is a genuine *Haliotis*, though it may represent an ancestral genus. The only American Miocene species is the one described. The Pliocene and Pleistocene records on the following page are available. Dr. U. S. Grant IV kindly permitted me to have access to his notes in compiling this list.

The specimens here described were collected at the base of the Modelo formation on the south slope of the Santa Monica Mountains along the east side of Brown Canyon, where an isolated patch of basal Modelo rocks, consisting of slate fragments, rests on an uneven surface of the slate and argillite forming the crest of the range. This locality was discovered by Dr. H. W. Hoots during work carried on for the United States Geological Survey. The fossils found here have an interesting ecologic facies, which I think accounts for the presence of the first American Miocene abalone. Seven of the eight determinable genera of mollusks collected here are rock-clingers or nest among stones. *Haliotis* and *Tegula* cling to rocks; *Navicula*, better known as *Arca* s. s., and *Lima* nest among stones; *Hinnites* cements itself to stones; and *Mytilus* is attached by its byssus to rocks or other objects. It is quite clear that these animals lived on and among the rocks at the foot of a slate cliff against which the advancing Modelo sea beat as it crept over the present site of the eastern Santa Monica Mountains. The "Pectens," representing the only other determinable genus, probably flapped around in the kelp. In view of the abrupt overlaps and striking differences in stratigraphic succession in adjoining regions, such rocky coasts must have been common along the shores of the Tertiary seas of California, but as I have pointed out elsewhere,¹ rock-clinging mollusks generally are rare as fossils. The probability that they will be ground to pieces in the surging surf or dissolved as they lie in the constantly moving water

¹Woodring, W. P., Carnegie Inst. Washington Pub. 385, pp. 30-31, 1928.

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mollusks. Specimens represent modern species

along the Pacific coast of North America recorded in the Galapagos (California). The western Pacific species, Cretaceous, but both species is a large and are the Vienna of southern California. "Haliotis" near San

des céphalopodes. Maestricht, Binkhorst's probably of broken. Dr. H. W. Hoots' species, no. 6, p. 52,

No. 1, p. 75,

PLIOCENE AND PLEISTOCENE SPECIES OF *HALIOTIS* FROM THE PACIFIC COAST

<i>Species</i>	<i>Formation and Locality</i>	<i>Age</i>	<i>Source</i>
<i>Haliotis fulgens</i> Philippi	Arnold's Upper San Pedro formation, Deadman Island	Late Pleistocene	Arnold, Mem. Calif. Acad. Sci., vol. 3, pp. 336-337, 1903
<i>Haliotis fulgens</i> Philippi	Spanish Bight, San Diego	Late Pleistocene	Ditto
<i>Haliotis cracherodii</i> Leach	Chiton bed, Point Fermin, San Pedro	Late Pleistocene	E. P. and E. M. Chace, Lorquinia, vol. 2, No. 6, p. 2, 1919
<i>Haliotis rufescens</i> Swainson	Chiton bed, Point Fermin, San Pedro	Late Pleistocene	Ditto
<i>Haliotis</i> sp.	Base of Fernando group, north of Arroyo Santa Rosa, Ventura County	In beds of early Pleistocene age	H. G. Schenck, oral communication
<i>Haliotis rufescens</i> Swainson	Lawson's Wildcat formation, Humboldt County	Pliocene	J. P. Smith, oral communication
<i>Haliotis</i> sp.	Fernando group, Los Angeles	In beds of late Pliocene age	Moody, Univ. Calif. Pub. Bull. Dept. Geol., vol. 10, No. 4, pp. 43, 46, 1916
<i>Haliotis</i> sp.	Pico formation, Santa Paula quadrangle	Pliocene	H. G. Schenck, oral communication
<i>Haliotis rufescens</i> Swainson	Between Timber Canyon and Santa Paula Creek, Ventura County	Pliocene	U. S. Grant IV and H. R. Gale, written communication
<i>Haliotis corrugata</i> Gray	O'Hare Canyon, Ventura County	Middle Pliocene	Ditto
<i>Haliotis</i> sp.	San Diego formation, San Diego	Middle Pliocene	Moody, op. cit.
<i>Haliotis</i> cf. <i>rufescens</i> Swainson	Cedros Island, Lower California	Middle Pliocene	Jordan and Hertlein, Proc. Calif. Acad. Sci., 4th ser., vol. 15, No. 14, p. 449, 1926
<i>Haliotis fulgens</i> Philippi	Elsmere Canyon, Los Angeles County	Lower Pliocene	U. S. Grant IV and H. R. Gale, written communication

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before burial is too great for many of them to survive. Even if the remains are buried before being obliterated they may be exhumed during a storm of unusual severity and again run the gamut of buffeting by waves and rocks. In addition to these hazards conditioned by the mode of life, the shell of *Haliotis* decays in a particularly rapid and effective manner, at least in the air, as anyone knows who has dug them out of kitchen middens. They have a dead earthy or chalky appearance and readily flake. This disintegration seems to be due to the extraction of the original organic material that binds together the thin laminae. The fortunately preserved Miocene fossils from the Santa Monica Mountains represent some unusual condition or sequence of events. They may represent shells that dropped into relatively deep water at the foot of a cliff or narrow rock shelf after the animals died. At all events they point to rapid and successful burial close to the place where they lived and died.

GENUS HALIOTIS LINNÉ

Linné, 1758, Syst. Nat., ed. 10, p. 779.

Type (by subsequent designation, MONTFORT, 1810, *Conch. Syst.*, vol. 2, p. 119). *Haliotis asininus* Linné (emendation for *asinina*), Recent, Indo-Pacific.

It is unfortunate that Montfort chose as the type of *Haliotis* the least "typical" of all the species known to Linné or to anyone since Linné's time, but he did it deliberately according to his own words (p. 120). I suppose that inasmuch as *Haliotis*—a classical transcription of the vernacular name—means sea-ear, he considered that the type species should be one having a name suggesting some kind of ear and the ass-ear *Haliotis* was the only one that filled the requirements. This species has a long narrow shell and long foot, unlike any other. By those who recognize subdivisions of the genus it is placed in the subgenus *Teinotis* H. and A. Adams,¹ of which it is the type,² making it a perfect synonym of *Haliotis* s. s. The species of *Haliotis* form so homogeneous a group that subdivisions for the most part are not recognized. If it is desirable to recognize them, *Padollus* Montfort³ is the earliest name to consider for the common kind of *Haliotis*. This name might be rejected, however, as a *nomen dubium* on the grounds that the type species is unrecognizable.

¹Adams, H. and A., *Gen. Rec. Moll.*, vol. 1, p. 442, 1854.

²By subsequent designation, Stoliczka, *Cret. fauna Southern India*, vol. 2, p. 388, 1868.

³Montfort, Denys de, *Conch. Syst.*, vol. 2, p. 115, 1810; type (by original designation), *Padollus rubicundus* Montfort (? = *Haliotis tricostalis* Lamarck; see Pilsbry, *Man. Conch.*, vol. 12, p. 123, 1890), Recent, "Africa."

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In that event Cossmann's¹ inadvertent designation of *Haliotis incisa* Reeve as the type of *Sulculus* H. and A. Adams² makes *Sulculus* available for the group of *Haliotis tuberculata* Linné, the familiar European species which has been accepted as the type of *Haliotis* since Lamarck cited it as the sole example in 1799.³

HALIOTIS PALAEA WOODRING, N. SP.

Plate 6, figures 1-3

A moderately large strongly sculptured *Haliotis* bearing an indeterminate number of open holes. The shell is angulated along the row of perforations, which lie close to the edge. Between the perforations and the edge lies a deep narrow groove. The edge of the shell adjoining the perforations is abruptly bent to form a narrow columellar shelf, which slopes inward. The sculpture consists of strong spiral cords and of irregular crude lumps or waves more or less arranged in axial series.

Length 59.5 mm.; width 40 mm. (holotype, immature).

Type material. Holotype, immature specimen (Calif. Inst. Tech. No. 1205), figured. Paratypes, fragment of large specimen and imperfect very young specimen (Calif. Inst. Tech. No. 1206), both figured.

Type (and only) locality. South slope of Santa Monica Mountains, south end of ridge along east side of Brown Canyon, 1250 feet N. 3° W. from 756-B. M. along Los Angeles City Boundary, Sawtelle Quadrangle; H. D. Hobson, H. W. Hoots, R. D. Reed, and W. P. Woodring collectors (Calif. Inst. Tech. Loc. No. 52); base of Modelo formation (early upper Miocene).

The three specimens consist of molds, to which is attached some shell material, replaced by calcite. The holotype is the most perfect specimen, but is immature. The fragment of a large shell has a length of 98 mm., indicating a shell of much larger size than the holotype.

¹Cossmann, M., *Essais Paléconch. Comp.*, vol. 11, p. 315, 1918.

²Adams, H. and A., *Gen. Rec. Moll.*, vol. 1, p. 443, 1854.

³Lamarck, J. P. B. M. de, *Mem. Soc. Hist. Nat. Paris*, p. 77, 1799.

EXPLANATION OF PLATE 6

FIGS. 1-3.—*Haliotis palaea* Woodring, n. sp. 1, Holotype, immature specimen, × 1. Calif. Inst. Tech. No. 1205. Base of Modelo formation, Santa Monica Mountains, Calif. Inst. Tech. Loc. No. 52. 2, Paratype, very young specimen, × 1. Calif. Inst. Tech. No. 1206. Same locality. 3, Paratype, fragment of large specimen, × 1. Calif. Inst. Tech. No. 1206. Same locality.



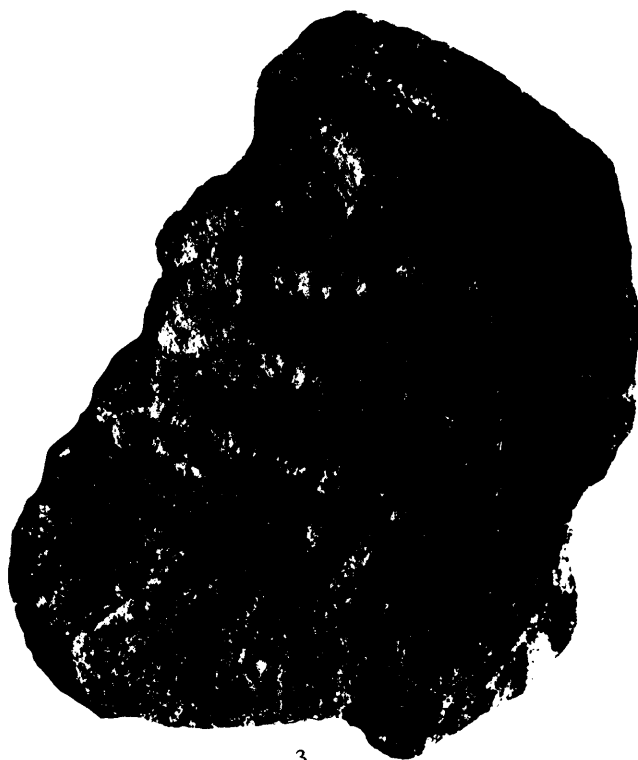
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A MIOCENE HALIOTIS FROM SOUTHERN CALIFORNIA 39

This Miocene species clearly belongs to the group of *H. corrugata* Gray, as defined by Pilsbry,¹ which is characteristic of the Pacific Coast of North America, all the species now living there except one (the black abalone, *H. cracherodii* Leach) belonging to it. The fossil species is perhaps most similar to *corrugata* itself, especially in the position of perforations and in the strong spiral cords, but the groove below the perforations and the lumps near the apex are more pronounced. *H. kamtschatkana* Jonas has the deep groove and apical lumps, but the shell is more elevated and both groove and perforations are closer to the edge.

Dating of the basal deposit of the Modelo formation at the *Haliotis* locality is afforded by echinoids of the genus *Astrodapsis*, as described elsewhere.²

¹Pilsbry, H. A., Man. Conch., vol. 12, pp. 76, 80, 1890.

²Woodring, W. P., Miocene echinoids of the genus *Astrodapsis* from Southern California (in preparation).