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MURACYPRAEA WOODRING, 1957 (GASTROPODA: CYPRAEIDAE)
IN THE UPPER MIOCENE AND LOWER PLIOCENE
LATRANIA FORMATION (IMPERIAL GROUP)
OF IMPERIAL COUNTY, SOUTHERN CALIFORNIA

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Introduction The cypraeid genus *Muracypraea* Woodring, 1957, first appeared in the Miocene of Trinidad (Schilder, 1939) and is known throughout the southern Caribbean region from the Miocene to the Recent. On the Pacific coast of the Americas, the only previously documented records are from the Pliocene of Ecuador (Pilsbry & Olsson, 1941) and the middle Miocene of Baja California Sur, México (Hertlein & Jordan, 1927; Smith, 1984). The only other published Pacific Coast record is in a faunal list for the Imperial Group of Imperial County, California (Powell, 1988), derived from unpublished work of T. E. Stump (1972). Efforts to confirm this report resulted in locating several additional specimens that are clearly referable to *Muracypraea*, confirming the presence of *Muracypraea* in the Imperial Group and its survival into the lower Pliocene in the proto-Gulf of California.

Background *Muracypraea* was erected by Woodring (1957) as a subgenus of *Cypraea* Linnaeus, 1758, to include the Recent species *Muracypraea mus* (Linnaeus, 1758) and its fossil relatives in the complex typified by *M. henekeni* (Sowerby, 1850). For many years *Muracypraea* was treated as a subgenus of *Siphocypraea* Heilprin, 1886,¹ and subsequently as a subgenus of *Barycypraea* Schilder, 1927 (Liltved & Le Roux, 1988; Kay, 1990). Recent systematic work raised *Muracypraea* to full generic rank (Kay, 1996; Bradner

& Kay, 1996). The *Muracypraea* literature contains a plethora of species and subspecies names. Woodring (1959) synonymized many of these names under *M. henekeni*. Specimens of *M. henekeni* from Panamá and the Dominican Republic, however, show clear morphological differences between the two regions, those from Panamá being noticeably humped and those from the Dominican Republic being significantly flatter, raising some doubt as to the validity of Woodring's synonymy.

Species of *Muracypraea* are found in Miocene and Pliocene formations throughout the Caribbean, with well documented records from the Dominican Republic, Trinidad, Venezuela, Colombia, Panamá, and Costa Rica (Woodring, 1959). Documented Pacific Coast records are limited to Ecuador and Baja California Sur, México (Hertlein & Jordan, 1927; Pilsbry & Olsson, 1941).

Stratigraphy The Imperial Formation (Hanna, 1926) was recently raised to group rank by Winker & Kidwell (1996). The Imperial Group crops out in central Riverside County and western Imperial County, California. The northern (Riverside County) and southern outcrops (Imperial County) are believed to represent two distinct depositional episodes, the northern ones being radiometrically dated as older than 6.0 Ma (late Miocene) (Powell, 1987) and the southern ones being dated by benthic foraminifera as younger than 5.2 Ma and most likely 5.2-3.9 Ma (late Miocene to early Pliocene) (Stump, 1972; Bell-Countryman, 1984; Winker & Kidwell, 1996).

¹ The publication date of *Siphocypraea* has usually been considered to be 1887. However it has been shown that the correct date is 1886 (Petit & Wilson, 1986).

The southern outcrops of the Imperial Group are divided into the Deguynos Formation (lower Pliocene), Latrania Formation (lowest Pliocene-uppermost Miocene), and Fish Creek Gypsum (upper Miocene). The Latrania Formation is further divided into the Wind Caves (lower Pliocene), Jackson Fork (lower Pliocene), Stone Wash (lowest Pliocene-uppermost Miocene), Lycium (upper Miocene), and Andrade (upper Miocene) Members (Winker, 1987; Winker & Kidwell, 1996). The Andrade Member is composed of coarse grained to fine grained, poorly cemented sandstone with pockets of limestone. In the Andrade Member in Fossil Canyon (Alverson Canyon) the preservation of aragonitic species is poor. In most cases, only internal and external molds are preserved. Calcitic species in the Ostreidae and Pectinidae, and the Echinoidea (e.g., *Arbacia*, *Clypeaster*, *Encope*) are typically well preserved. The Jackson Fork Member is a sandstone and conglomerate facies of very limited extent at the base of Vallecito Mountains in the North Fork of Fish Creek (Imperial County), and is notable for the excellent preservation of aragonitic species. This member represents a shallow, near shore marine environment (Winker, 1987).

Materials Studied Sixteen specimens were obtained from the collections of the Los Angeles County Museum of Natural History, Invertebrate Paleontology (LACMIP), San Diego State University, Geology (SDSU), the University of Chicago, Study Collection and the private collection of the author. The locality data for the University of Chicago specimen is very precise and can be traced to a specific shell bed in the Jackson Fork Member in the North Fork of Fish Creek, Imperial County (Winker, 1987). Locality data for the remaining specimens are very general and simply state "Coyote Mountain" or "Fossil Canyon". All of them are from the Andrade Member of the Latrania Formation and were probably collected at various localities in or near Fossil Canyon. In all cases the specimens are internal molds with very little shell remaining. Figure 1 shows a representative suite of specimens from the Andrade Member. The specimens range in length from 35 to 87 mm. Figure 2 shows the single specimen from the Jackson Fork Member. Figures 3, 4, 5, and 6 show dorsal and ventral views of the best Andrade Member specimen (LACMIP 16811) compared with *Muracypraea mus* (Linnaeus, 1758). Figure 7 shows the holotype of *M. amandusi* (Hertlein & Jordan, 1927) (CAS 6614801) from Baja California Sur, México.

The described *Muracypraea* species are generally rather short relative to width and generally rhomboidal in form. These characters are shown in the genotype species *Muracypraea mus* and separate the members of this genus from all other Recent Cypraeidae from the Americas. The two Recent cypraeid species most comparable to the *Muracypraea* are *Bernaya teulerei* (Cazenavette, 1846) and *Barycypraea fultoni* (Sowerby, 1903) from the western Indian Ocean. Characteristics of *Muracypraea* are clearly exhibited by all of the specimens shown in Figures 1, 2, 3, and 5. Because there are no other, Recent or fossil, Pacific Coast cypraeids with these characteristics, the specimens examined are referred to *Muracypraea*. Examination of *M. henekeni* from both Panamá and the Dominican Republic and *M. cayapa* (Pilsbry & Olsson, 1941) from Ecuador leads to the further conclusion that the Latrania Formation specimens represent one or more undescribed species quite distinct from the described Pacific coast species. There appear to be two forms in the material examined. The first form is inflated (*M. n. sp. A*), the second form is somewhat flattened and ovoid in outline (*M. n. sp. B*).

The inflated form (*Muracypraea n. sp. A*) is distinguished from *M. cayapa* and from the dorsally humped Panamá specimens of *M. henekeni* by its broad centrally located hump which differs from the posterior location and peaked form of *M. cayapa* and Panamá specimens of *M. henekeni*. The flattened form (*M. n. sp. B*) is distinguished from *M. cayapa* and from the dorsally humped Panamá specimens of *M. henekeni* by the lack of a dorsal hump and a generally oval outline. The oval outline of *M. n. sp. B* distinguishes it from the deltoidal *M. amandusi*. *M. n. sp. B* is closest in form to Dominican Republic specimens of *M. henekeni*, however the geographic distance and direct development life cycle of the *Muracypraea* indicates that they are distinct species.

Stump (1972) reported *M. amandusi* and *M. n. sp.* in his thesis. He based his observations on the A. Morlin Childers Collection, which cannot now be located by me. However, the SDSU material is part of Stump's (1972) thesis material and confirms his report of *Muracypraea* in the Andrade Member. However, his report of *M. amandusi* cannot yet be confirmed. The single specimen from the Jackson Form Member extends the stratigraphic range of *Muracypraea* upward into the lower Pliocene.

Conclusions The presence of the cypraeid genus