

## A MACTRID BIVALVE FROM PLEISTOCENE DEPOSITS OF LAKE RUSSELL, MONO BASIN, CALIFORNIA

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### INTRODUCTION

**R**ANGIA DES MOULINS, 1832 is a small genus of macrid bivalves that is currently distributed in estuarine waters of the eastern United States, Gulf of Mexico, and Gulf of California (Keen, 1971; Abbott, 1974). (One congener, *R. cuneata* [Sowerby, 1831], was recently introduced to the Antwerp (Belgium) harbor [Verween et al., 2006].) Although these clams are euryhaline and capable of living in freshwater as adults, they require an estuarine-like salinity regime for successful reproduction and recruitment (Cain, 1973; Hopkins et al., 1974), which has constrained their ability to penetrate the North American continental interior through coastal drainages (Cain, 1974; Swingle and Brand, 1974). The Neogene and Quaternary fossil record of the genus is also restricted to coastal or near-coastal marine-influenced depositional systems, with the exception of Holocene specimens of *R. cuneata* from two archeological sites in the central United States which were obviously introduced by humans (Baker, 1941; Hill, 1983), and a Pleistocene(?) occurrence of this species from along the Pecos River in New Mexico (more than 800 km from the sea) which has been attributed to transport of Gulf Coast immigrants on waterfowl (Metcalf, 1980; Taylor, 1985). Here we provide fossil evidence that the biogeographic history of this predominantly brackish-coastal genus also includes avian-assisted colonization of a far inland lake in the western United States—Pleistocene Lake Russell, Mono Basin, California (Fig. 1).

The Mono Basin specimens of *Rangia* described herein were recently discovered by one of us (ASJ) in a sandy deposit closely proximal to beach cobbles, a wave-cut notch and trim line (Fig. 2). This site is in the southeastern portion of the basin near the elevation of the penultimate highstand of Lake Russell, which was constrained by the Adobe spillway into the Owens River drainage (Blackwelder, 1931; Putnam, 1949, 1950; Reheis et al., 2002). This highstand was coeval with the Tahoe (penultimate) glaciation, which probably occurred 130–150 ka (oxygen isotope stage 6) (Reheis et al., 2002; Kaufman et al., 2004; Jayko and Bacon, 2008). The shells were reworked and, although fairly abundant, mostly found as broken fragments. Abundant fragments and a few nearly intact shells were also found in a very shallow road cut; this deposit was previously mapped as older beach gravel (Reheis et al., 2002). We consider the Mono Basin occurrence of *Rangia* to be native because none of the shells were found with perforations, ground surfaces or other indications of ornamental reworking by indigenous people (e.g., Fisher et al., 1979) and because the area in which the shells were found did not contain any lithic scatter (small worked flakes of obsidian or cherty material) or ceramics typically associated with middens or human occupation sites.

A planorbid gastropod, *Vorticifex gesteri* (Hanna, 1963), was also collected from Tahoe strandline deposits about 2 km to the south-southwest of the *R. lecontei* locality. This snail and other freshwater mollusks were previously reported in other parts of the basin from deposits thought to be Pliocene in age (Hanna, 1963; Firby, 1969; Taylor, 1985). More recent field investigations and U-series dating suggest a late Pleistocene age for these deposits

consistent with the results reported herein (Reheis et al., 2002; Jayko, unpublished mapping).

Institutional abbreviations are as follows: ANSP, Academy of Natural Sciences of Philadelphia; LACMIP, Department of Invertebrate Paleontology, Los Angeles County Museum of Natural History; USNM, former United States National Museum, collections now in National Museum of Natural History, Smithsonian Institution, Washington, D.C.

### SYSTEMATIC PALEONTOLOGY

Family MACTRIDAE Lamarck, 1809

Genus RANGIA Des Moullins, 1832

RANGIA LECONTEI Conrad, 1853

Figure 3.1–8

*Gnathodon lecontei* CONRAD, 1853, pl. XXIV, figs. 1, 2.

*Rangia lecontei*, CONRAD, 1860:232.

Additional synonymy provided by Taylor (1966:58–59).

**Diagnosis.**—Shell medium-sized (length, 16–30 mm); ovate-triangular; posterior (umbonal) slope carinate; lateral teeth long, serrated. Differs from its western North American congener, *R. mendica* (Gould, 1851), in its heavier shell and longer lateral teeth. Distinguished from closely similar eastern North American *R. cuneata* by its smaller, lighter shell; more closely adjacent beaks; and smaller pallial sinus.

**Referred material.**—USNM 1113911, three disarticulated valves from well-developed strandline of pluvial Lake Russell, Mono Basin, Mono County, California, UTM zone 11, 0345661E, 4216553N, elevation 2195 m, Alameda Wells 7.5' quadrangle, coll. ASJ 6/15/2007.

**Other material examined.**—USNM 6833, in bank of Carrizo Creek, Arizona (probable syntypes); USNM 612220, USNM 612204, 91.4 m (100 yards) toward Bombay Beach from highway (California State Route 111), Salton Basin, Imperial County, California.

**Occurrence.**—Palm Spring and Borrego Formations, Salton Basin, California (Pliocene–Pleistocene); plus new record from Lake Russell highstand deposits, Mono Basin, California (middle Pleistocene).

**Discussion.**—Mono Basin specimens are chalky white, coated with light tufa or secondary carbonate, and lack any trace of periostracum. The single almost-entire valve that was found (Fig. 3.1, 3.2) was 24 mm long; fragments of others suggest considerably larger specimens. Although the specimens are worn, they closely conform to Conrad's description and illustrations and to material collected from the type locality area (Fig. 3.3, 3.4; also see Taylor, 1966, pls. 2, 3).

Conrad (1853) described *R. lecontei* from material that J. L. LeConte collected from limestone beds north of Carisco (=Carrizo per Taylor, 1966) Creek in the southern part of the Salton Basin. He did not mention types or provide museum catalog numbers in his description, but he illustrated (bereft of measurements or a scale) three shells (Conrad, 1853, pl. XXIV, figs. 1, 2), including two apparently different right valves. Dall (1894:100) referred to USNM 6833, which consists of two valves, as the type lot of *R. lecontei* and illustrated one of the shells (Fig. 3.5, 3.6),