

FRESHWATER CORBULIDAE (BIVALVIA): USING ISOTOPIC EVIDENCE TO UNCOVER ANCIENT ORIGINS OF FRESHWATER INVASION

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Members of the bivalve family Corbulidae are often used as paleoecologic indicators of marginal to shallow-marine conditions. As a result, the presence of corbulids in the Neogene Pebas Formation of western Amazonia and the Paleocene Fort Union Formation of the USA northern Great Plains contributed to long-standing debates over the salinity regime of wetlands associated with each unit's deposition (i.e., freshwater or brackish). Associated body and trace fossils in both units include diagnostic freshwater (e.g., unionoids) and marine (e.g., *Ophiomorpha*) body and/or trace fossils, obscuring paleoecologic interpretation.

Although much less diverse, Fort Union Formation corbulids are congeneric with those in the Pebas Formation and phylogenetic evidence places the Paleocene taxa in the same clades as Neogene species, although these taxa are not reported in intervening strata on either continent. Previous analyses, using strontium-, carbon- and oxygen- isotopic data, confirmed that all but one of +20 corbulid species in the Pebas Formation inhabited freshwater. Confirming the environmental distribution of Paleocene taxa is critical to inferring whether these species were 1) members of marginal-marine clades that later invaded and diversified in Lake Pebas; or 2) freshwater taxa with 50 Ma of unrecorded history.

New isotopic analyses of Paleocene Tongue River Member (Fort Union Formation) *Pachydon mactriiformis* show a clearly freshwater signal. Oxygen isotopic values for shell aragonite range from -11.4 to -17 per mil (VPDB), indicating waters values of -11 to -18 per mil (VSMOW). Isotopically calibrated growth series indicate a life-span of 2-3 year for this taxon. These isotopic profiles show no seasonal excursions to more positive values, indicating the absence of seasonal marine incursion. In fact, isotopic values are closely comparable to those of Paleocene unionoid bivalves of the region. In addition, a strontium isotope ratio of $0.709595 \pm \pm .000027$ (2 sigma) indicates continental conditions. This value is distinct from Late Cretaceous seawater (0.707), and is comparable to Paleocene river waters from the Powder River Basin (0.7094 and 0.7088).

These results confirm that freshwater corbulids have a history that extends at least to the earliest Cenozoic.

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