

## Phylogenetic Reconstruction of a Freshwater Radiation: Corbulidae In the Miocene of Western Amazonia

**Laurie C. Anderson**, Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA, **Frank P. Wesselingh**, Department of Palaeontology, Naturalis, Leiden, Netherlands and **Joseph H. Hartman**, Dept. of Geology and Geological Engineering, University of North Dakota, Grand Forks, ND

The Miocene Pebas Formation of western Amazonia is predominantly composed of freshwater assemblages rich in endemic species, including 23 described species of Corbulidae (Bivalvia). These species show tremendous morphologic variation including chordate valves with heavily calcified umbos (e.g., *Pachydon*), concavo-convex shells (*Exallocorbula*), hyatelliform species (*Anticorbula*), and species convergent with *Raeta* (*Concentricavalva*). These innovations are apparently adaptive as they correlate well with particular lacustrine or fluvial niches. Further morphologic disparity seen in Pebasian taxa include dramatic hinge modifications such as reorientation and elongation of the chondrophore and resilifer pit so that they resemble the external ligament of other heterodonts in form and function.

In spite of this widespread morphologic convergence with the morphology of other bivalve families, a cladistic analysis of this Miocene corbulid fauna (with congeneric species of *Pachydon*, *Anticorbula*, and *Ostomya* from the Paleocene Tongue River Formation of the northern Great Plains of the USA incorporated) firmly place *Ostomya* and *Anticorbula* (previously assigned to either Corbulidae or Lyonsiidae) and newly described highly divergent taxa (e.g., *Concentricavalva*) within the Corbulidae. Further, phylogenetic analysis reveals that the Pebas fauna represents radiation(s) within a limited number of subclades, three of which have evolutionary histories dating back at least to the Paleocene. *Pachydon* species form two derived subclades within the ingroup, one of which has a less chordate shape and typical chondrophore morphology (Paleocene *Pachydon mactriiformis* falls within this subclade). Also included in the larger *Pachydon* clade is *Exallocorbula* and a well-supported subclade of *Anticorbula* spp. The monophyly of *Ostomya* (in which species have a more or less pronounced myiform shape) is less well supported, with members falling basally within the ingroup. Clearly, although several of these lineages have evolutionary histories spanning the Cenozoic, species radiations within the Miocene Pebas Formation can be considered endemic to that basin.

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