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Estuarine-type foraminifera from Australia's Permian to Cretaceous interior seas

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Mid-latitude estuarine environments are variable in terms of diurnal and seasonal changes in temperature, salinity, dissolved oxygen and nutrient levels. The foraminifera from these environments are characterized by organic-cemented agglutinated species with simple morphologies; absence of calcite-cemented agglutinated foraminifera; low-diversity calcareous hyaline morphotypes; and usually rare or absent porcelaneous foraminifera. Ancient interior seas located at mid to high latitudes and in a humid climate with significant freshwater inflow, have similar estuarine-type assemblages. This presentation traces the development of interior-sea assemblages through the Australian Permian to the Cretaceous. Many of the Permian-Cretaceous sedimentary successions remain relatively undeformed in mainland Australia and have a stratigraphic architecture and facies association indicative of shallow-water depositional environments. The estuarine-type assemblages are present in mudstone facies in siliciclastic-dominated successions.

The organic-cemented agglutinated foraminifera are very conservative in their development from the Permian to the Cretaceous. Early Permian genera such as *Aptotoichus*, *Ammobaculites*, *Ammodiscus*, *Ammovertella*, *Glomospirella*, *Haplophragmoides*, *Hyperammina*, *Kechenotiske*, *Lagenammina*, *Palustrella*, *Placentammina*, *Psammosphaera*, *Reophax*, *Sansabaina*, *Spiroplectammina*, *Thuramminoides*, *Trochammina*, and *Trochamminopsis* range through to the Cretaceous with very similar species. In the Triassic, the first high trochospiral and triserial organic-cemented agglutinated species appear, and are followed by other genera which show serial changes in chamber arrangement and/or modifications in apertural position. In general, Permian and Cretaceous morphotypes show a similar paleobathymetric distribution in the shallow-water interior seas.

The hyaline calcareous foraminifera are represented in the Permian estuarine-type assemblages by syzraniid and ichthyolariid precursors of later nodosariids and lenticulines of the Order Lagenida. Morphotypes that developed during the Triassic generally show little difference to those in the Cretaceous.

Polymorphinids became conspicuous for the first time during the latest Triassic, and the abundance of Permian-like *Ichthyolaria-Cryptoseptida* and *Paralingulina* decreased during the Jurassic.

Aragonitic trochospiral hyaline foraminifera of the Duostominacea appeared abruptly during the Middle Triassic and genera such as *Duostomina* are associated with the estuarine-type assemblages of the Middle and Late Triassic. During the Jurassic and Cretaceous, similar aragonitic foraminifera are represented by *Reinholdella* and *Epistomina*. In Australian interior basins, the oldest members of calcitic Orders Buliminida and Rotaliida are present in Lower Cretaceous (Aptian) strata. The buliminid and rotaliid assemblages of the Aptian-Albian interior seas include a distinctive suite of species that differ from contemporaneous species of the open continental shelf.