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Interpretation of Conodont Color Alteration and Thermal Maturation in Amadeus Basin, Central Australia

The Amadeus basin of central Australia contains about 11,500 m (38,000 ft) of late Proterozoic to middle Paleozoic (Late Devonian) sediment, generally thickening northward across the basin toward the MacDonnell Range. A complex series of anticlinal structures, some of them fault-bounded, in the north-central part of the basin contains accumulations of hydrocarbons in sediments of Early Ordovician, Cambrian, and late Proterozoic ages. Hydrocarbons have been produced from the Ordovician in two fields, the Palm Valley gas field and the Mereenie gas and oil field.

Study of conodont color alteration to define organic maturation levels and trends is based principally on samples collected from the Early Ordovician (Arenig) Horn Valley Siltstone from both outcrop and subsurface localities. Additional faunas have been recovered from the overlying Early-Middle Ordovician Stairway Sandstone and Stokes Formation.

The conodont color alteration isograds in the Amadeus basin appear to be primarily related to events of the Alice Springs orogeny, when the thick mass of molasse sediments (Pertnjara Group) resulting from erosion of the uplifted Arunta Block was deposited. Anomalies to the conodont color isograds appear to be related to erosion associated with the Rodingan orogeny and also possibly to the effects of salt structures.

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Paleobathymetry of Late Cretaceous–Paleogene Agglutinated ("Flysch Type") Benthic Foraminiferal Faunas and a Modern Analog

A diverse (~30 genera, >50 taxa) fauna—the so-called "flysch type," or A assemblage-with definite taxonomic affinities to contemporaneous assemblages from the Alpine-Carpathian flysch basin, has been recognized in Upper Cretaceous to Paleogene deposits in geologic trench and graben type basins and in the deep sea from lat. 65°N to 65°S. This assemblage consists of (predominantly) coarse-grained, larger sized tests, in which simple (*Rhabdammina, Bathysiphon, Ammodiscus*) forms predominate over biserial (*Spiroplectammina, Textularia*), multiserial (*Gaudryina, Dorothia*), trochospiral (*Recurvoides, Trochammina*), and planispiral (*Cyclammina, Cribrostomoides, Haplophragmoides*) forms. Paleobathymetric interpretations of these assemblages range from continental (lacustrine, paludal, tidal flat, fluviatile lagoonal) to marine (neritic, upper bathyal, middle to lower bathyal, abyssal; i.e., 0 to 5,000 m, 0 to 16,404 ft). Several lines of evidence now converge to place constraints upon, and realistic estimates of, the paleobathymetric range of this assemblage: (1) backtracking DSDP sites on oceanic crust leads to paleodepth estimates ranging from >2.5 km to >4 km; Cenozoic shallow ridges in the Norwegian-Greenland Sea yield upper values of >0.7 km; (2) the association of several components of these assemblages (*Trochammina, Cyclammina, Bathysiphon*, etc) in various stratigraphic sections (such as the Lodo Formation, California) with other, clearly "shallow" faunal indicators (*Cibicides, Nonion, Eponides*, etc) indicates upper depth limits near the shelf/slope break at least, in some cases; (3) seismic stratigraphy indicates updip extension of this biofacies close to, if not contiguous with, the distal parts of deltaic wedges in the North Sea.

Modern day distribution patterns of open-ocean agglutinated taxa show a rather clearly defined upper limit at about 500 m (1,640 ft) (in general agreement with our estimate of the upper depth limit of "flysch type" faunas based on geologic evidence).

There is a taxonomic resemblance of modern Newfoundland slope faunas to the flysch-type assemblages from basins situated on the Newfoundland shelf and slope at the family and generic level, with the notable exception of a greater variety (diversity) in the Astrorhizidae and Saccamminidae in the Holocene assemblages, a function, no doubt, of differential preservation. A qualitative generic communality of over 50% between the two assemblages with the same genera tending to dominate the two (with the notable and unexplained exception of the rarity of *Cyclammina* in the modern assemblage) and a tendency toward an increase in species diversity and absolute abundance between 1,500 to 3,000 m (4,920 to 9,840 ft) (similar to that seen in the flysch faunas between the margins and center of the Labrador-Newfoundland and North Sea Basins) support the interpretations of the "flysch-type" fauna as being predominantly a slope fauna. Low species communality is probably due to evolutionary turnover and/or differential preservation.

Studies of 37 HEBBLE area box cores (4,800 m; 15,748 ft) from the lower Nova Scotian Rise show that in addition to sharing certain physical and chemical parameters, the two environments experience(d) short term catastrophic events affecting the benthic fauna. While turbidites characterize the flysch basin, the HEBBLE area is subject to periodic high velocity boundary currents capable of resuspending and transporting bottom sediments. In both environments the epibenthic foraminiferal population is presumably locally destroyed by turbidity associated with a high energy event and repopulated during times of relative quiescence, which in the HEBBLE area lasts on the order of a few weeks or months.

Flysch-type assemblages have generally been linked with high organic carbon and various, associated, hydrographic limitations, as low O_2, high CO_2, low pH, low Eh, and poor circulation. However, data on Holocene and fossil assemblages suggest that, at least in some circumstances, high organic carbon may not be a controlling factor.

The flysch type fauna is clearly not related to depth per se; while predominantly a slope fauna its paleodepth distribution probably extended from <500 m (<1,640 ft) to over 4 km (2.5 mi). Its distribution is linked with a complex set of interrelated factors that may differ under different geologic settings. These different factors may be ultimately related to a single, unifying cause but we do not yet understand this relationship.

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Diagenesis of Viola Limestone (Middle and Upper Ordovician), Southeastern Arbuckle Mountains, Oklahoma

The Viola Limestone in the Arbuckle Mountains was deposited on a carbonate ramp within the southern Oklahoma aulacogen. Depositional environments within the Viola ranged from anaerobic deep-ramp, through dysaerobic mid-ramp, to fully oxygenated shallow-ramp conditions. Corresponding microfacies in the southeastern Arbuckles include, respectively, nonbioturbated, spiculitic pelletal packstones; thoroughly