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The Eocene/Oligocene benthic foraminiferal turnover at ODP Site 647, southern Labrador Sea

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The biostratigraphical record of ODP Hole 647A in the southern Labrador Sea is exceptional in the northern Atlantic, because it provides the only direct calibration of the benthic foraminiferal biostratigraphy to the standard chronostratigraphy by means of a well-constrained age model. Moreover, it is the only site in the western North Atlantic that recovered a reasonably complete Eocene/Oligocene boundary interval, whereas at other sites the boundary is present as a hiatus. Palaeobathymetrically, it was the deepest site in the northwestern Atlantic and was in the pathway of bottom water flowing through the Charlie Gibbs Fracture Zone, thereby giving unique insight into the nature of the abyssal biofacies and changes in bottom water properties over the boundary interval. Our high-resolution study of the faunal record at Site 647 confirms earlier findings (e.g. Van Couvering et al. 1981, Kaminski et al., 1989) that the E/O transition was an interval of significant faunal change among benthic foraminifera.

The E/O transition in Hole 647A is characterised by a major extinction event among deep-water agglutinated foraminiferal species (DWAF), especially among taxa that use organic cement to constrict their tests. In total, 90 DWAF species and generic groupings are observed in our record. Species diversity falls from ca. 25 DWAF species/sample in the uppermost Eocene to 3 – 5 species across the E/O boundary interval. The uppermost Eocene is characterised by an acme in large suspension-feeding tubular forms such as Psammatodendron and Bathysiphon, suggesting increased bottom water activity and improved ventilation. The boundary interval in Core 647A-30R is nearly devoid of DWAF, with only the calcareous-cemented DWAF surviving. This interval also displays the first appearance of the calcareous benthic species Turrilina alsatica and a major acme of Nuttallides umbonifer (up to 70% of the assemblage) suggesting the sudden appearance of a southern hemisphere water mass. This species is linked to Antarctic Bottom Water in the modern ocean and at the E/O boundary. Several organically-cemented DWAF species reappear as Lazarus taxa in the lowermost Oligocene, but diversity never recovered to Eocene values. The decline in DWAF and in the proportions miliolids suggest improved ventilation of the bottom water in the Labrador Sea across the E/O boundary interval. Infaunal taxa (such as nodosariids, pleurostomellids, and stilomellids) show an increase in relative abundance across the interval, reflecting increased levels of productivity in agreement with earlier studies of organic carbon and biogenic silica content (Bohrmann & Stein, 1989). This high-resolution faunal record enables a better understanding of the palaeoceanographic and palaeoclimatic change at the E-O transition in the northern North Atlantic.