Low Latitude Paleocene to early Eocene radiolarian systematics, biochronology and paleoenvironmental analysis

Sarah-Jane Jackett

Thesis Abstract

Highly diverse radiolarian faunas of latest Maastrichtian to early Eocene age have been recovered from the low latitude realm in order to contribute to the clarification of radiolarian taxonomy, construct a zonation based on a discrete sequence of co-existence intervals of species ranging from the late Paleocene to early Eocene and to describe a rich low latitude latest Cretaceous to late Paleocene fauna.

225 samples of late Paleocene to early Eocene age have been collected from ODP Leg 171B-Hole 1051A (Blake Nose), DSDP Leg 43-Site 384 (Northwest Atlantic) and DSDP Leg 10-Sites 86, 94, 95, 96. Sequences consist of mainly pelagic oozes and chalks, with some clay and ash layers.

A new imaging technique is devised to perform (in particular on topotypic material) both transmitted light microscopy and SEM imaging on individual radiolarian specimens. SEM precedes transmitted light imaging. Radiolarians are adhered to a cover slip (using nail varnish) which is secured to a stub using conductive levers. Specimens are then photographed in low vacuum (40-50Pa ; 0.5mbar), which enables charge neutralization by ionized molecules of the chamber atmosphere. Thus conductive levers are unscrewed and the cover slip is simply overturned and mounted with Canada balsam. In an attempt towards a post-Haeckelian classification, the initial spicule (Entactinaria), micro- or macrosphere (Spumellaria) and initial spicule and cephalis (Nassellaria) have been studied by slicing Entactinaria and Spumellaria, and by tilting Nassellaria in the SEM chamber. A new genus of the family Coccodiscidae is rerected and Spongatractus HAECKEL is re-located to the subfamily Axopruninae.

The biochronology has been carried out using the Unitary Association Method (Guex 1977, 1991). A database recording the occurrences of 112 species has been used to establish asuccession of 22 Unitary Associations. Each association is correlated to chronostratigraphy via calcareous microfossils that were previously studied by others authors. The 22 UAs have been united into seven Unitary Associations Zones (UAZones) (JP10-JE4). The established zones permit to distinguish supplementary subdivisions within the existing zonation.

The low-latitude Paleocene radiolarian zonation established by Sanfilippo and Nigrini (1998a) is incomplete due to the lack of radiolarian-bearing early Paleocene sediments. In order to contribute to the study of sparsely known low latitude early Paleocene faunas, 80 samples were taken from the highly siliceous Guayaquil Formation (Ecuador). The sequence consists of black cherts, shales, siliceous limestones and volcanic ash layers. The carbonate content increases up section.

Age control is supplied by sporadic occurrences of silicified planktonic foraminifera casts. One Cretaceouszone and seven Paleocene zones have been identified. The existing zonation for the South Pacific can be applied to the early-early late Paleocene sequence, although certain marker species have significantly shorter ranges (notably Buryella foremanae and B. granulata). Despite missing markers species in the late Paleocene, faunal ditribution correlates reasonably to the Low-Latitude zonation.

An assemblage highly abundant in Lithomelissa, Lophophaena and Cycladophora in the upper RP6 zone (correlated by the presence of Pterocodon poculum, Circodiscus circularis, Pterocodon ? sp. Aff. P. tenellus and Stylotrochus nitidus) shows a close affinity to contemporaneous faunas reported from Site 1121, Campbell Plateau. Coupled with a high diatom abundance (notably Aulacodiscus spp. and Arachnoidiscus spp.), these faunas are interpreted as reflecting a period of enhanced biosiliceous productivity during the late Paleoce. The youngest sample is void of radiolarians, diatoms and sponge spicules yet contains many pyritized infaunal benthic foraminifera which are akin to the midway-type fauna. The presence of this fauna suggests deposition in a neritic environment. This is in contrast to the inferred bathyal slope depositional environment of the older Paleocene sediments and suggests a shoaling of the depositional environment which may be related to a coeval major accretionary event.