

CALCAREOUS NANNOFOSSILS AS GEOLOGICAL MICROCHIPS

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Abstract

All fossils store information about the timing and nature of past events. But fossils, like computer microchips, vary greatly in their ability to record information, to resist subsequent degradation of the data, and to permit its accurate recovery. However, the noise can be reduced to a minimum if the most appropriate signal for the job in hand is selected. The best choice in many petroleum exploration industry situations is calcareous nannofossils. This diverse and very widely distributed group of minute marine microfossils first appeared in the late Triassic. They are abundant in many Jurassic, Cretaceous, and Cenozoic marine rocks and sediments. Most calcareous nannofossils consist of complexly constructed calcitic plates (coccoliths) shed from the cell walls of haptophytes, a widely distributed group of planktonic microalgae. Other, more simply built, forms (such as discoasters and sphenoliths) belong to extinct, but probably closely related, marine planktonic microalgal groups. Also conveniently included are several other associated, but unrelated, kinds of marine microfossil (notably ascidian spicules and dinoflagellate calcispheres).

Calcareous nannofossils can provide reliable, high resolution, age determinations for a broad range of marine rocks of early Jurassic to late Pleistocene age. Much less widely appreciated is that the assemblages also contain a valuable record of past environmental conditions. This record is mainly about conditions in the photic zone of the sea and at the seafloor. It can include information about the temperature, salinity, water-mass type and distance from land, plus the water depth, bottom current velocity, sediment provenance, and rate of deposition. Nannofossils can also greatly assist sequence stratigraphy studies by providing accurate biostratigraphic correlations and by identifying the position of events such as sequence boundaries, condensed sections, and maximum flooding surfaces. Yet another use they have is to provide biostratigraphic and other information from very small samples such as individual, sand-sized, drill cuttings. New Zealand examples are described for each of these applications.

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TONY EDWARDS is a micropaleontologist. His speciality is using calcareous nannofossils to determine the age and environment of Mesozoic and Cenozoic marine rocks. He also has experience of diatoms, silicoflagellates and several other marine microfossil groups. Tony's current research interests include integrated stratigraphy studies aimed at improving the precision and resolution of the geological time-scale. So far he has published about 60 refereed papers. Tony was involved in research for the NZ Geological Survey, DSIR between 1959 and 1990 when he established Stratigraphic Solutions. The aim of Stratigraphic Solutions is to provide an independent, paleontology-based, research and consultancy service.