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Faunal changes of Oligocene benthic foraminifera in the Eastern Equatorial Pacific sites of ODP Leg 199

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Deep-sea paleoceanographic conditions during the transition from the Eocene into the Oligocene varied considerably, under the influence of fluctuations in volume of the Antarctic ice sheets and of deep water formation in the Southern Ocean. As an example, the Calciumcarbonate Compensation Depth (CCD) dropped precipitously close to the Eocene/Oligocene boundary (*e.g*. Coxall *et al.*, 2005. *Nature*), and there were several increases in values of benthic foraminiferal oxygen isotope values in the Oligocene (Oi events, *e.g*., Miller *et al.*, 1991. *JGR*). Benthic foraminiferal faunal assemblages during the Oligocene are expected to record these paleoceanographic changes. The Oligocene faunal succession of benthic foraminifera at various water depths has been summarized for the Atlantic Ocean (Katz & Miller, 2003. *Micropaleontology*) and the Indian Ocean (Nomura, 1995. *Micropaleontology*). These authors documented the paleobathymetric distribution of benthic foraminiferal species and the relationship between their distribution and paleoceanographic changes, including the Oi events. An outline of Oligocene benthic foraminiferal faunas for the eastern equatorial Pacific Ocean was presented by Thomas (1985. *DSDP Init. Rep.*), but our knowledge of short-term fluctuations in the assemblages of Oligocene benthic foraminiferal faunas in the Pacific Ocean remains limited. Sites 1218 (4826m water depth) and 1219 (5063m water depth) of ODP Leg 199 in the East Equatorial Pacific Ocean provide the opportunity for conducting a detailed study of faunal change, because the drilled sections contain well-preserved foraminifera in almost all samples. The objectives of our study are to investigate the Oligocene faunal succession of benthic foraminifera and to consider their relation to paleoceanographic changes at abyssal depths in the East Equatorial Pacific Ocean.

The common constituents of the benthic foraminiferal association at Sites 1218 and 1219 are *Nuttallides umbonifer*, *Globocassidulina subglobosa*, *Pseudoparrella exigua*, *Oridorsalis umbonatus* and *Cibicidoides mundulus0*(Takata & Nomura, 2005. *ODP Sci. Results*). Based on factor

analysis, three factor assemblages were recognized. The Factor 2 assemblage is characterized by *Cibicidoides* spp. and *O. umbonatus*, and is common in the lower part of the lower Oligocene, whereas the Factor 1 assemblage, characterized by *N. umbonifer,* is abundant mainly in the upper part of the lower Oligocene and the upper Oligocene. The Factor 3 assemblage, dominated by *P. exigua*, is common around the Oligocene/Miocene boundary.

In addition, the Factor 1 and 2 assemblages show several relatively short-term fluctuations throughout the Oligocene, mainly associated with Oi events (Miller *et al.*, 1991; Pekar *et al.*, 2002. *Geology*). The Factor 2 assemblage occurred abundantly around Oi1a, Oi1b and Oi2, whereas peak abundances of the Factor 1 assemblage were observed around Oi2a, Oi2b and Oi2c. Thus, relatively short-term fluctuations of these benthic foraminifera at abyssal depths of the Eastern Equatorial Pacific Ocean are likely related to Oi events. *N. umbonifer*, the dominant species of the Factor 1 assemblage, is related to Southern Ocean deepwater flow and/or carbonate undersaturation of deep waters. Therefore we suggest that changes in the characteristics of the deep watermasses may be responsible for such relatively short-term fluctuations in foraminiferal assemblages. In addition, the down-hole distribution of planktonic foraminiferal abundance is negatively correlated to the Factor 1 assemblage. Relatively short-term occurrences of benthic foraminifera in the Equatorial Pacific Ocean may be related not only to the corrosivity of deep waters but also to the production of calcareous materials in the surface waters.

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