Biostratigraphically constrained Neogene palaeoenvironments of the Red Sea rift

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Marine sediments deposited in response to the Neogene opening of the Red Sea during divergence of the African-Arabian plate margin provide micropalaeontological chronological evidence to calibrate synchronous palaeoenvironmental events from the Gulf of Suez to the Gulf of Aden. This facility provides insights to the timing and relative rates of tectonic subsidence associated with the rifting episodes of the region. Biostratigraphic index forms include planktonic and benthonic foraminifera and calcareous nannofossils. These, combined with various associated microfossils and macrofossil fragments, permit interpretation of a range of depositional environments that span intertidal to bathyal regimes. Onset and recovery from various hypersaline events are similarly interpreted by integrating microfossils and lithology. Following an episode of emergence and sporadic volcanicity, subsidence and the first Neogene marine transgression created brackish to shallow marine lagoons during the Early Miocene (Foraminiferal Letter Stage Upper Te). Rapid subsidence and accumulation of deep marine mudstones, of local hydrocarbon source-rock quality, with thinly interbedded siliciclastic and calciclastic debris flows commenced in the Early Miocene (Planktonic foraminiferal zones N5-N8; Nannofossil zones NN3-NN5). The debris flows increased in abundance and provide good hydrocarbon reservoirs. The Gulf of Suez and Red Sea experienced episodic isolation from the Indian Ocean during the latest Early Miocene and earliest Middle Miocene (Planktonic foraminiferal zones N8-N9; Nannofossil zone NN5 Foraminiferal Letter Stage Middle-Upper Tf1), resulting in hypersaline events with precipitation of submarine gypsum and halite. The isolation is attributed to constriction of the southern Red Sea, in the vicinity of the Bab El Mandab Straits, by eustatic sea level fall as well as probable tectonic activity; the synchronous Gulf of Aden succession does not display evidence for such hypersaline events. A prolonged hypersaline phase extended over most of the Middle Miocene, for which absence of biostratigraphic data precludes age control. During the latest Middle Miocene to Late Miocene, rejuvenation of the hinterland cause rapid deposition of terrestrial and fluvialite coarse and fine siliciclastics, with similar biostratigraphic paucity except for rare diatoms and palynomorphs. Renewed subsidence, associated with opening of the Aqaba Fault, combined with eustatic sea level rise caused marine deposition to recommence in the Pliocene.