



Palynovegetational development of a Middle–Late Miocene coal-bearing rift succession in Vietnam – climatic versus tectonic controls

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Palynological analysis of the 500 m continuously cored sedimentary record of the ENRECA-1 well in the Song Ba Rift, central Vietnam, yields new information on the vegetational and climatic development of this area. The cored strata follow a pattern typical for rift successions: a fluvial-dominated basal part, a lacustrine-dominated lower–middle part, and a fluvial-dominated upper part. The latter part is more or less lean of organic matter, whereas two organic-rich lacustrine mudstones occur between ~290–310 m and ~360–390 m. These two units display the highest potential for generating liquid hydrocarbons. Both units are underlain by a coaly interval, but coal-rich levels occur scattered throughout the drilled section. The coals and coaly rocks have HI values from less than 50 mg HC/g TOC to nearly 350 mg HC/g TOC. The upper lacustrine unit is characterised by about 20 m of laminated mudstones with TOC contents up to more than 8 wt.%. These mudstones are highly oil-prone with HI values generally exceeding 500 mg HC/g TOC. The high generation potential is related to the organic matter composition, which is completely dominated by fluorescing amorphous organic matter, alginite (*Botryococcus*) and liptodetrinite. The lower lacustrine mudstones are also characterised by a considerable oil generation potential with TOC varying from 3–4 wt.% and HI values ranging from 300–400 mg HC/g TOC.

The pollen assemblages generally contain medium to high proportions of Elaeocarpaceae, Dipterocarpaceae, Euphorbiaceae, and palms, typical of tropical–subtropical lowland broadleaved forests. More montane elements such as *Quercus*

and *Lithocarpus/Castanopsis* (Fagaceae) are also generally abundant, the former often dominant, while *Pinus* and *Podocarpus* are rare. In the lower coal-rich interval a sudden increase of the more temperate, montane taxa *Alnus* and *Corylus* (Betulaceae), an increase in *Quercus*, but a decrease in *Lithocarpus/Castanopsis*, indicate cooler and moist conditions. In the lowland flora palms decrease significantly. This presumed cooler phase is succeeded by conditions that appear to fluctuate between warm and wet, warm and drier, cooler and drier conditions as indicated by the pollen record. The climatic changes recorded by the flora are superimposed by the tectonically controlled development of the rift and seem to have influenced the depositional pattern in the the rift recorded as shifts between fluvial and lacustrine dominance.

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