GEOLOGY PAPER 12

# THE POSSIBLE SIGNIFICANCES OF COALS ENCOUNTERED IN CORED SECTIONS FROM THE CENTRAL MALAY BASIN; IMPLICATIONS FOR SEQUENCE STRATIGRAPHIC INTERPRETATION AND BASIN CHARACTER

**David Ince[1], Mazlan Madon[1], Abdul Hadi A Rahman[2], Ahmad Munif Bin Koraini[2], Mahani Mohamed[1], Sanatul Salwa Hasan[3] & Samsudin Jirin[3]**

[1]Petronas Carigali Sdn Bhd
[2]Orogenic Resources Ltd
[3]Petronas Research Sdn Bhd

Cores recently acquired from E Group sections from the central Malay Basin, have been the subject of detailed and integrated sedimentological and palaeontogical studies in order to provide the basis for improved understanding of reservoir sequences. These studies have included detailed core description and dense sampling for combined micropalaeontological and palynological analysis. The results of these programs have revealed significant results that allow the coals to be confidently assigned to a particular phase of relative sea level and, furthermore, shed light on the nature of the overall receiving basin. Models have been developed to account for the sequences observed. These may apply more generally to the Malay Basin sections, although variations on this basic theme may occur.

The coals studied have been shown to be of both freshwater and brackish origin, based on the palynological and micropalaeontological content. In all cases they represent phases of drying out of the basin, some being correlatable over wide areas. They are usually underlain by variably well-developed seat earths which show high levels of bioturbation/pedoturbation and also contain marine to brackish microfaunas. As such these seat earths often represent the most saline/marine sediments in a given sequence. This is a feature of many seat earths in the Malay Basin that we have been able to study in addition to those from Sepat. The coals are generally rootleted, and the seat earths are pale grey in colour indicative of the soil zone leaching that creates such deposits. Peat accumulation is invariably terminated by a flooding event, although this may be freshwater, or brackish, based on the palaeontology and level of bioturbation. One of the coals studied occurs as a split seam, with an enigmatic conglomeratic lithology present in the intervening interval.

The conclusion drawn from these observations is that at various stages of the fill of the Malay basin the areas was prone to regular drying out, with the establishment of widespread coal forming peats. River channels formed at the same time as these peats and dissected the area, which is thought to have been low relief, but occasionally flood events breached the channel margins and killing the peat mires, at least locally. Peat accumulation was brought to a close by flooding of the basin, either with fresh or brackish water. This suggests there to have been some form of barrier to the basin, preventing or restricting the ingress of saline water. The presence of brackish water coals may approximately locate the palaeo-coastal belt for a given cycle and the upward change in coal character indicates increasingly freshwater conditions. This in turn suggests that peat facies belts may have been migrating basin-wards during phases of falling sea levels, resulting in the establishment of more widespread peats. Reservoir sandstones in the cored sections were most probably deposited within fluvially dominated shallow water deltas or sub deltas in a lacustrine setting.

These observations can be combined to allow a simplified cycle to be developed for the coal bearing intervals in the fill of the Malay Basin. Given that the seat earths appear to be the most marine parts of the section it is considered that the coal forming peats began to form with the onset of falling sea levels, with both the brackish and freshwater peats migrating basin-wards with the coastal belt. Basin-wards migration would have halted at the onset of transgression and thus the S.E. limit of a given coal would delineate the regressive maximum for a particular cycle. Thus the bases of coal beds are likely to be significantly diachronous. The tops of coal beds may also be diachronous. Variations in the make-up of sequences occur, probably as a result of subtle interactions between sea level, subsidence in the receiving basin, and the tectonic or sedimentary factors creating a barrier at the S.E. end of the basin. Such short term changes in sea level, and consequently in the geomorphology of the



Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 37, No. 1, January-March 2011

Sunda Shelf, are unsurprising. Recent research (Sathiamurthy and Voris, 2006) using Digital Elevation Models has shown the possible response of the area to glacio-eustatic fall in sea level during the Last Glacial Maximum, some 21ka BP, when sea levels were some 116m lower than at present, with the development of former low-lying, potential lake, areas on the exposed shelf which formed Sundaland. Repetition of such changes is considered likely to have resulted in the accumulation of the strongly cyclical sequences typical of parts of the Malay Basin succession.

## REFERENCE

SATHIAMURTHY, E. AND VORIS H.K., 2006, Maps of Holocene Sea Level Transgression and Submerged lakes on the Sunda Shelf The Natural History Journal of Chulalonkorn University, Supplement 2: 1-44