

**AN ORGANIC GEOCHEMICAL APPROACH TO ADDRESS STRATIGRAPHIC ISSUES: A CASE STUDY OF THE LAYANG-LAYANGAN BEDS, LABUAN ISLAND, NW SABAH BASIN****Patrick Gou<sup>1,2</sup> & Wan Hasiah Abdullah<sup>1</sup>**<sup>1</sup>Geology Department, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia<sup>2</sup>Sarawak Shell Berhad, Geological Services, Locked Bag No. 1, 98009 Miri, Sarawak

The three main geological units on Labuan Island which is located within the NW Sabah Basin include the Temburong, Setap Shale and Belait Formations. The Temburong Formation (deep marine turbidites) is the oldest, followed by Setap Shale (outer neritic to littoral) and Belait Formations (fluvial and shallow marine). The sediments are generally divided into two phases of sediment deposition by a major unconformity known as the Lower Miocene Te5 unconformity (after Brondijk, 1962), or more popularly referred to in the petroleum industry as the Deep Regional Unconformity, or DRU (Levell, 1987).

This study is centred on the Layang-Layangan Beds that lie beneath the sandstone and conglomerate ridge of the fluvial Lower Belait Formation. Previous authors have assigned the Layang-Layangan Beds to all of the three major geological formations on Labuan Island; Belait Formation (Wilson & Wong, 1964; Lee, 1977; Albaghdady et al., 2003), Setap Shale Formation (Liechti et al., 1960), and Temburong Formation (Madon, 1994). This confusion is not surprising as the Tertiary sediments in the NW Borneo region can be very difficult to tell apart based on field observations or conventional geological methods alone.

Geochemical results from the analyses of the Labuan sediments, which included thermal maturity related-data derived from Source Rock Analyzer (SRA), organic petrography and

gas chromatography-mass spectrometry (GC-MS) were able to characterise the different sediments as each of them have significant differences in their geochemical properties to produce unique geochemical profiles. The Layang-Layangan Beds display similarities in its geochemical profile with the overlying Belait Formation, while the Temburong Formation has a different and distinct geochemical profile compared to the Layang-Layangan Beds and Belait Formation. However, the Setap Shale and Temburong Formations are geochemically quite similar to a certain extent.

Consequently, the existence of the DRU on Labuan Island that is thought to separate the Layang-Layangan Beds and the Lower Belait Formation is put into question since this regional unconformity surface is supposed to represent a drastic change in depositional environment (deep marine to fluvial), which appears to be a lot more subtle and gradual as indicated by the geochemistry data.

The geochemical analysis workflow to characterise outcrop geology as demonstrated in this study is relatively cheap and simple, and should be considered when other geological methods do not give convincing results. In addition to that, it serves as a good and reliable independent method to verify ambiguous geological interpretations.

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