

Biostratigraphic Review of IODP data with focus on the MMU: Implications for the Evolution of the South China and Sulu Seas

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Key regional Cenozoic unconformities in the South China Sea Basin (SCS) have a range of different interpreted ages and missing sections. Typically it is not clear what data the interpretation of these unconformities are based upon and there is no clear agreement on what geological processes actually caused the development of these unconformities.

Biostratigraphic data from a dozen or so IODP wells in the South China (SCS) Sulu & Celebes Seas drilled during Legs 124 & 184 have been reviewed in detail. This data has been in the public domain for 25 and 15 years respectively. A key result is that Shell dates a gap in the biostratigraphy around the 'MMU' (base nannozone NN9A versus top NN6) at 11MY. That is about 5 million years younger than the 'MMU's commonly published age of 16Ma (e.g. Hutchinson, 2004).

A current basin model includes a SCS rift propagating from the northeast to the southwest so therefore one could infer that any breakup unconformity would also young from northeast to southwest. Oligocene unconformities referred to by previous workers in Site 1148 have not been identified and are not supported by the same data.

The biostratigraphic gap at around 11 MY is very consistent over a very wide area in the SCS. It is seen at the margin of Luconia in the southwest and ~300km due south of Hong Kong. No spatial young-ing of the 'MMU' is observed in the SCS. Also, and surprisingly, the same biostratigraphic gap is present in the Sulu Sea wells and it is therefore observed on both sides of Palawan Island.

This age difference with previous interpretations may be due to the fact that Shell use the Gradstein timescale and apply slightly different calibration of biozones versus the chronostrat/geochronology scale. These observations are still worthy of note as they could impact the interpretation of these basins evolution.

The MMU is not Middle Miocene – the oldest sediments above the unconformity are Upper Miocene (Tortonian). In Sarawak the MMU cuts progressively deeper into Middle and Lower Miocene strata (from Luconia towards Balingian). Other less dramatic Neogene biostrat gaps have also been identified in several wells and are commented upon herein but these were not the focus of this study.

This work is an example of how a major jump in knowledge can be made if we ignore dogma and look objectively at the actual data. This approach helps to reduce the inherent uncertainty associated with dealing with exploration datasets by using an internally consistent framework instead of assigning events to old unconformity names. Early – Mid Miocene extension in the basin is well documented. It would appear that the cessation of active fault induced topography and the transition to a more passive post rift type setting occurred later than has previously been assumed.

Also the transition appears to have occurred over a much larger area at around the same time during the Late Miocene. Therefore we may have to look at plate movements outside of the SCS region to find the cause of this regional event and subsequently modify our plate reconstructions and related petroleum systems & basin analysis accordingly.