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Timing, Distribution And Tectonics Of Unconformities In The South China Sea

(Original short abstract)

Christopher Morley
Petroleum Geophysics, M.Sc. Program, Department of Geological Sciences
Chiang Mai University, Thailand

The timing and distribution of major unconformities and equivalent surfaces affecting the Cenozoic sedimentary rocks in the South China Seas are well described in the literature yet are a number of issues understanding them including: 1) reliability of dating, 2) how the unconformities are correlated regionally on different data sets, 3) understanding the tectonic and/or eustatic significance of the unconformities, 4) terminology, and use of appropriate names. Although several recent papers discuss the timing, and nature of particular unconformities even in the recent literature significant discrepancies in the timing and significance of events can be found.

The most significant tectonic event affecting the South China Seas is Cenozoic rifting and seafloor spreading. This origin of the spreading is explained by two competing, end member models: 1) that 500+ km of sinistral motion on the Ailao Shan-Red River Fault Zone drove extension in the South China Seas, and 2) That subduction of the Proto-South China Seas crust beneath NW Borneo drove extension, until the continental crust entered the subduction zone and jammed it. Hence the major regional unconformities reflect not only extensional processes, but the effects of subduction and compression (on the southern margin), and strike-slip deformation on the northern margin, together with eustacy, and more regional tectonics.

The problems with identifying and naming unconformities in the SCS reflect difficulties with relating them to a single process (e.g. break-up unconformity), which can be time-transgressive, versus naming them for a particular time period (e.g. Middle Miocene Unconformity, MMU; Early Miocene Unconformity, EMU), which implies they are not time transgressive. In the case of the EMU the time-equivalence means that unconformities arising from different causal mechanisms (contraction, uplift erosion; forebulge development, inversion of rift structures, cessation of rifting; onset of sand-prone deltatic deposition) are combined due to their approximate age equivalence. In some places the EMU and MMU appear to be conflated (e.g. Nam Con Son Basin), where some workers place the end of rifting (incorrectly) at the late Early Miocene, while others propose it occurs at the MMU (~10.4 Ma).

Break-up occurred around 33-32 Ma in the eastern South China Sea, and 23-20 Ma in the southwestern South China Sea. Early Oligocene break-up unconformities are described from the eastern South China Sea, but in the western half rifting, at least locally and episodically, continued for a considerable time after break-up. On the western Vietnam margin the first rifting phas is reported to end in places around the Early-Late Oligocene boundary (~28 Ma), corresponding with the major ridge jump in the SCS, or at 23-21 Ma, which approximately coincides with either the onset of seafloor spreading around 23 Ma, or the cessation of spreading around 20 Ma. This timing pre-dates and does not appear to correlate with the EMU on the southern margin.

The regional distribution of unconformities in the South China Sea provides insights into the way local and regional tectonics and different driving mechanisms have affected the South China Sea. They strongly suggest that the later Miocene extension is occurring independently of regional tectonics since much of SE Asia has passed into a phase of post-rift subsidence, commonly accompanied by inversion at this time. Local processes such as the evolution of slab pull and slab detachment need to be considered for their influence on the initiation and termination of late extension.