

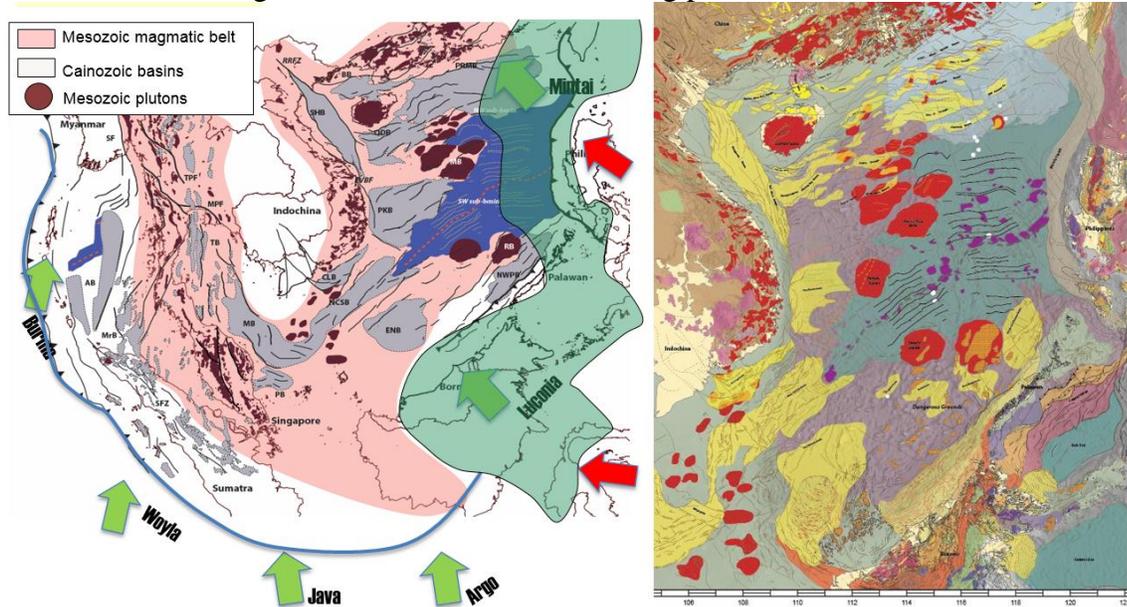
Collapse and Rifting in the South China Sea

Manuel Pubellier^{1,2}, Matthias Delescluse², Dimitri Savva², Dieter Franke³, Florian Meresse², Jean-Luc Auxietre⁴, Mario Aurelio⁵, Nicolas Chamot-Rooke, Ugo Nanni², Lung Sang Chan⁶

¹CNRS, UMR-8538, 16 rue P&M Curie, 75005, Paris, ²Ecole Normale Supérieure ENS, 24 Rue Lhomond, 75231 Paris cedex 5, ³Federal Institute for Geosciences and Natural Resources BGR, Stilleweg 2, 30655 Hannover, ⁴TOTAL/EP/GSR/PN/BTF, 2 Place Jean Millier, 92078 Paris La Défense cedex, ⁵NIGS, University of the Philippines, Diliman, Quezon City 1101, Philippines, ⁶The University of Hong Kong, Dept of Earth Sciences, Hong Kong

The South China Sea margin underwent extensional processes for an abnormally long time. For this reason and also because the tectonic events recorded in the sediments are diachronous, the rifting has been much debated. The former margin was situated during Mesozoic times on the upper plate of a subduction zone. It later evolved as a collapsed continental basin on the edge of the Yenshanian Andean-type orogeny which has been since then considerably eroded, exposing only granites and relicts of Cretaceous molasse basins. The continental crust rifted from the Paleocene to the Mid Oligocene in the eastern part, and the rifting continued until the Middle Miocene in the SW, in an environment of marginal basin opened in the midst of the lower plate.

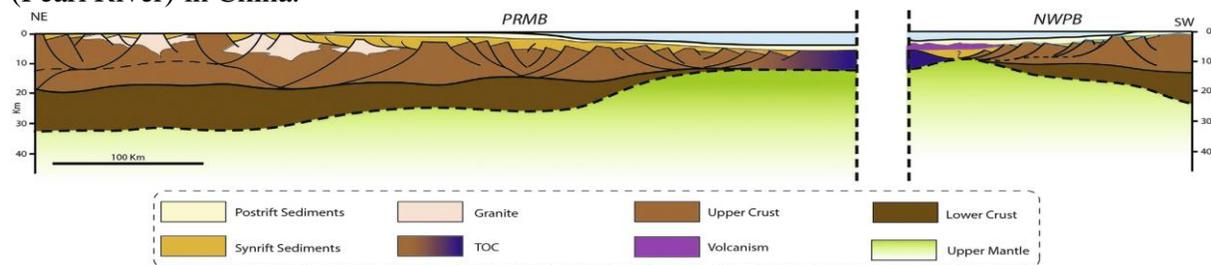
Actually, the former Sundaland promontory which was surrounded by a large subduction zone, shows early stages of extension marked by the presence of molasse type deposits although rifting is clearly documented since the Early Eocene only. It is suspected that the Molasse deposits have suffered ductile deformation along low angle faults. During the rifting *sensu stricto*, the upper crust was extremely stretched for a large time span (Early Eocene to Middle Miocene) and was sustained near sea level during the entire duration of the rifting process.



Left: Sundaland and possible block accretion prior to basins opening (Modified from Pubellier and Morley, 2014, Pubellier et al., 2014., Right: Extract of Structural Map of the South China Sea (CGMW in press)

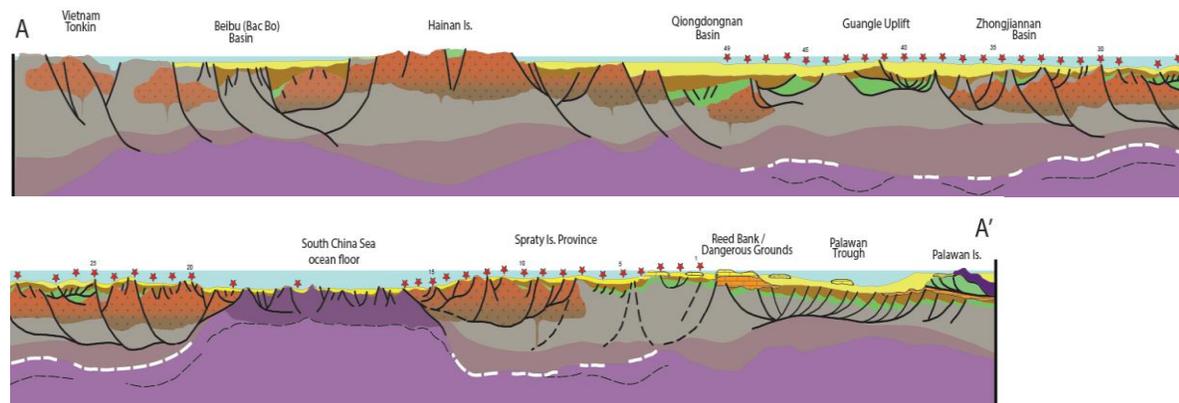
The large Jurassic and Cretaceous granitic

bodies conditioned the location of the extension via large detachments and normal faults; so that the present day morphology of the sea floor still reflects the location of the granites on which large reefal platforms developed. In other cases earlier broad folds attributed either to Triassic/Early Jurassic or to Mid Cretaceous compression condition the detachments and show large roll-over structures. Some of these features, difficult to observe in the field are preserved in the San Shui (Pearl River) in China.



Simplified section of the Central South China Sea (Savva et al., 2014),

Some sub-basins of the South China Sea are marked by extremely stretched crust (Phu Khanh, West Natuna, NW Palawan, Tainan) where upper mantle may be in contact with the sediments. Therefore we distinguish between an early extensional process which started during the Late Cretaceous and possibly Paleocene during which the basement and the Mesozoic granitoids were exhumed, and an Early Eocene to Middle Miocene rifting which thinned the crust to 12km-thick over a large area by a boudinage process.



Cross section controlled by seismic (CGMW in press), based on the OBS (Pichot et al., 2014) and MCS data (unpublished)

In this system, the reefs are often preserved on top of the boudins. The extension continued long after the beginning of the spreading and continued even after the regional MMU (varying from 15 to 12Ma). Extensional areas are found even in the oceanic crust with low angle normal faults. This structural configuration, together with the long-lived rifting stage represent an offshore Basin& Range onto which many small basins could develop in a sub-continental/shallow marine

environment accessible by quartz-rich clastic input originated from the erosion of the granitic province formed during the early subduction stage of the South China Sea region.