A new geological/geophysical framework for SE Asia

KARSTEN M. STORETVEDT

Institute of Geophysics
University of Bergen
Allegt. 70, N-5007 Bergen, Norway

Triggered by the great confusion pertaining to global geology today a completely new system of Earth evolution has recently been launched (Storetvedt, 1997). The new theory envisages that the Earth originally had a relatively thick pan-global sialic (continental type) crust, but that subsequent planetary cooling has rendered this surface layer chemically unstable, gradually replacing it by the much thinner basaltic crust of the deep oceans. The suggested internal mass reconstitution is consistent with modern seismic mantle tomography which shows that there exists a significant compositional difference between sub-oceanic and sub-continental mantles. On this new basis global tectonics becomes intimately linked to Earth's rotation, and, based on the classical physical principles of rotating planetary bodies Earth history becomes a chain of interrelated phenomena. Plate tectonic principles have no place in the new geological worldview.

By the end of the Cretaceous the present mosaic of variegated continental blocks and intervening oceanic basins was largely in place, and with the concomitant build-up of upper mantle low velocity layers the scene was set for a tectonic revolution on Earth. The time of the Alpine climax (late Cretaceous-early Tertiary) was a time of acceleration in Earth's rate of rotation (eastward) which triggered the classical inertia effects: a general westward wrenching of crust and topmost mantle (the 'lithosphere') within which the northern paleo-hemisphere was twisted clockwise and the southern paleo-hemisphere anti-clockwise. At that time the palaeoequator passed along the southern rim of the Mediterranean, continuing eastward just south of Sumatra/Java.

The counterclockwise rotation (and associated wrench deformation) of the southern Upper Cretaceous-Lower Tertiary palaeo-hemisphere produced extensive and curved tectonic lineaments across the Indian Ocean. It is envisaged that the broad 'N-S' striking shear belt along the Central Indian Basin (a major paradox for plate tectonics) came into existence through this global 'lithospheric' wrenching. The greater mid-ocean left lateral shearing also produced considerable under-thrusting (of the thin Indian Ocean crust) beneath the Indonesian Archipelago.

In the northern palaeo-hemisphere the corresponding phase of global westward wrenching brought about considerable shearing within the attenuated crust of Eastern Asia, producing the penetrative NE-SW structural grain along the NW Pacific margin. Continued loss of continental crust to the mantle, presumably through sub-crustal eclogitization processes, has had its most significant development along the prevailing deep faults, producing the narrow and deep NE-SW trending sedimentary basins as well as the horsts and half-graben structures characterizing the South China Sea. Further, the predominantly NE-SW shearing would be prone to produce rifting perpendicular to this structural grain, and therefore the NW-SE trending embayments/basins of Eastern Asia (Malay Basin, South Mekong Basin etc.) can be explained by crustal thinning ('oceanization') along such perpendicular fracture zones.

In addition to the more direct tectonic effects provided by global wrench deformation in Alpine time a 70 degrees of Neogene anticlockwise rotation of Australia and surrounding insular regions added considerable structural complications to SE Asia. The interacting regional stress fields led the way to a significant counterclockwise rotation of Borneo giving rise to major bending of the extensive Rajang Group (NW Borneo). Within localised transtensive regimes upper mantle material (ophiolites) were squeezed to the surface as

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 25, No. 6, November-December 1999

solid state intrusions, but the overall transpressive conditions led to significant regional tectonization and structural tightening of pre-existing strata not least in NW Sabah. The linear pattern of major oil and gas fields in SE Asia, and their close association with deep fracture zones, reiterates the discussion to which extent petroleum has a non-biological origin. The implications for hydrocarbon exploration may be significant.