Phanerozoic ophiolites and the modern Mediterranean Sea

by

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Eurasian ophiolites of pre-Hercynian age occur only north of the Tethys Sea. In the Mongolian geosyncline they range from Cambrian to Permian, are youngest in the centre. In the Urals they range from Cambro-Ordovician to Permian and are youngest away from the Russian platform. The same range of ages is recorded to the south and east of platforms in Central Asia. They also get younger from the Urals to the Caucasus and to western Europe.

Eurasian ophiolites of pre-Alpine age are restricted to the Tethys region and range from Triassic and Jurassic ones in Europe to Paleogene and Neogene ones in Indonesia. Jurassic ophiolites are interposed between Triassic basalts west and east of the Dinarides; Cretaceous ophiolites are interposed between Jurassic basic intrustions of northern Turkey and southern Israel.

On a global basis, pre-Hercynian ophiolites outline the margins of ancient platforms in Laurasia and circle the whole continent of Pangaea, but are absent from the interior of Gondwanaland. Pre-Alpine ophiolites encircle Pangaea on the outside of pre-Hercynian ophiolites and cross that continent to the south of Laurasia, forming a capital letter theta.

Ophiolites veer around older massifs which are then rotated in an anticlockwise direction. They are always preceded by horst and graben tectonics of deep fracturing and consequent variable water depths, are frequently associated with diatremic breccias of deeper crustal material suggestive of gas streaming, are overlain by flysch deposits, often of a deltaic environment.

This permits to construct a four-stage model of development of the Tethys. In Stage I, fractures propagating in an attenuated crust allow unsupported crustal blocks to sink. In stage II, the vacuity stage of Aubouin, distension along fractures allows rising mantle material to enter progres--sively closer to the centre of the downwarp. In stage III, the filling stage of Aubouin, doming on the flanks reaches a maximum; prograding rivers dump sediments into the downwarp and bury the horst and graben structure in thick flysch deposits. Excessive heating of the crust produces hearths of granite and concomitant acidic volcanism. In stage IV, vertical mantle movements cease and the mantle settles back into its normal stratified state. Supracrustal infill of the rebounding depression is squeezed out by folding, thrust faulting and spilling over the flanks as nappes. Whereas subsidence started from the margins of the downwarp, rebound works its way outward from the centre.

The deep portions of the modern Mediterranean Sea cannot be classed as oceans, i.e., vast bodies of water that are in effect barriers to faunal and floral migration, with developed provinciality of their own. If the Tyrrhenian Sea, the Messina Abyssal Plain of the Ionian Sea, the Hellenic Trough, the Nile Abyssal Plain and the Red Sea have dropped some 3-5 km in Plio-Quaternary times, largely along high-angle faults, the same could have happened with equal suddenness to local portions of the Tethys Sea in the past. Later reversal of that subsidence by an equivalent rate of uplift could likewise have been possible. The basaltic volcanism along high-angle fractures is evidence of distension, we are thus witnessing the vacuity stage of geosynclinal development. The modern Mediterranean Sea is thus repeating the history of the ancestral Tethys.