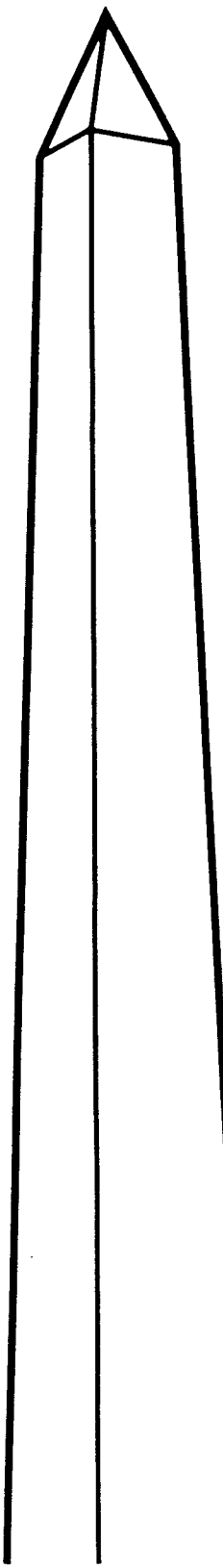
Abstracts

Volume 1 of 3

28th International Geological Congress

Washington, D.C. USA
July 9-19, 1989



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Notes on Tectonics of Morocco

Morocco presents an outstanding Triassic to Neogene structural evolution that has been recorded in the main chains of the region.

Sinistral transtensional tectonics occurred during Triassic and Jurassic times (laville, 1981) along N70°-90°E-trending basins (Gibraltar-Pays des Horst-High Atlas) while graben (pull-aparts) developed en echelon to these features (i.e., the Middle Atlas) during the relative eastward motion of the Africa Plate with respect to Europe (Figure 1).

During Cretaceous and Paleogene times, the geodynamic setting was reorganized by the opening of the North Atlanitc and the Gulf of Biscay producing by transpression a dextral inversion of the previously formed basins: Former east-west-trending negative flow structures have been inverted into positive flow structures (Figure 2). Evidences are given for instance by structural analysis (e.g., striations, folds axis) and by the greater thickness of the sedimentary cover on top of the present structural highs that are flower structures recording a pre-Miocene erosion. The inversion occurred there where the crust was stretched by the earlier tectonics, and it has been transmitted by a detachment probably located at the base of the crust or of the lithosphere.

Neogene upwelling of the asthenosphere along the Gibraltar Fracture zone, generated by the earlier transpression-related subduction, overprinted the previously formed features, producing a basin (the Alboran Sea) and a coeval accretionary wedge (the present Gibraltar Arc), which shape follows that of the internal deep basin (Figure 3). The crustal extension of the Alboran Sea is accommodated by thrusting in the Rif, and the volume balance is preserved because the crustal stretching is approximately equal to the Neogene compression of the Gibraltar Arc (the Rif for the Morocco part). Where the Rif crosses the inherited inverted basin of the Middle Atlas, the thrusts change into oblique and lateral ramps producing transpression along the N20°-40°E trend at the Northwestern margin of the Middle Atlas along the Melilla-Taza alignment. The extension in the Alboran Sea occurred along an inclined blind detachment, probably located at the lithosphere-asthenosphere or crust-mantle boundaries. The overthrusts of the Rif should be connected and detached at this decollement plane. This model predicts thrusting in the external areas and contemporaneous extension and transtension in the internal basin, which can be considered a pull-arc (Laubscher, 1988). Normal faults and overthrusts of the Neogene tectonics inherited and cut the former structures.

This kinematic evolution could present similarities with the surrounding areas of the Tyrrenian Sea.

Thanks for the useful discussions to: A. Bally, R. Catlano, R. Crane, K. Bhattacharjee, B. D. Argenio, F. Sabat, and K. Mansouri.

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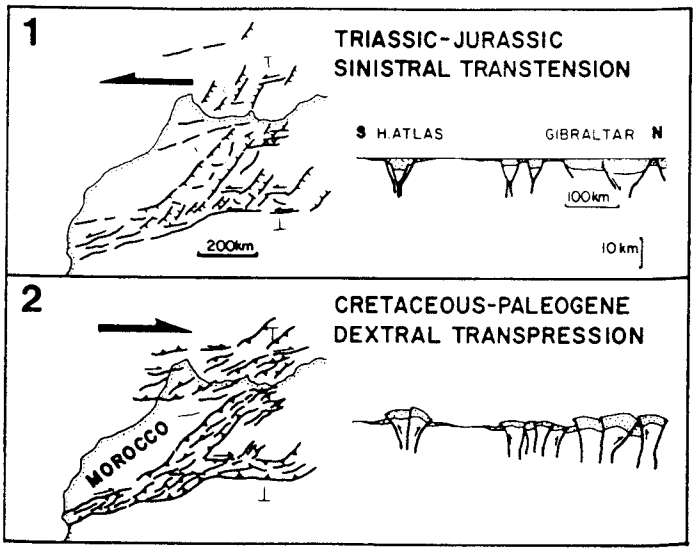

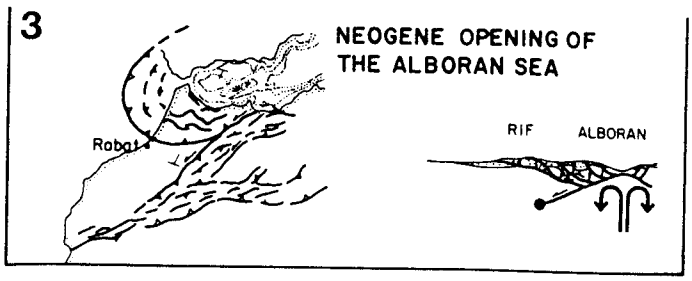

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Metallogeny of Bulgaria

The territory of Bulgaria covers parts of two continental lithospheric plates which had been in collisional relationships since the Mid-Mesozoic - the Moesian Platform and the Rhodope Massif (grosso modo). A small wedge of specific crust, related to the Black Sea rift, extends in the eastern part of the country (Fig. 1).

The development of the Moesian Platform may be reliably traced since the Early Paleozoic, Its active southern margin comprises fragments of: Early Paleozoic allochthonous complexes, a Late Paleozoic magmatic arc, Mesozoic and Cenozoic flysch troughs and a new magmatic arc with elements of back-arc rifting and back-arc thrusting, results of progressive collision and deformation of the arc. The magmatic rocks of the Late Paleozoic and Meso-Cenozoic (Late Cretaceous) arcs belong to the Ca-alkaline and K-subalkaline series typical of the Mediterranean petrochemical province.

The Rhodope Massif is a zone of Early to Late Alpine (pre-Upper Cretaceous) tectonic collage of six exotic accretionary blocks welded together and to the active southern periphery of the Moesian Platform (Fig. 1). The blocks are heterogenous and show specific rock sequences and mineral deposits.

In the beginning of the Tertiary the exotic blocks of the Rhodope Massif, already accreted to the margin of the Moesian Platform, were re-worked and fossilized by the Late Cretaceous magmatic arc known in Bulgarian literature as Srednogorie zone. Culminating collision resulted in a back-arc thrust belt in Stara Planina (the Balkan). To the south, mainly in the area of the Rhodope blocks, a series of Tertiary grabens formed. They are infilled by volcano-terrigenous molasse and abundant subaeral Ca-alkaline and K-subalkaline volcanic rocks.

The post-acretionary (post-Early Cretaceous) metallogeny, related to the Alpine magmatic arc and the later collisional events, generated the most important metallogenic regions in Bulgaria as parts of three planetary metallogenic units (Fig. 2).

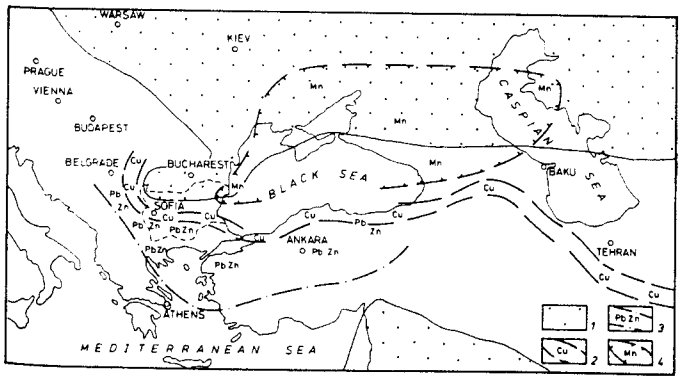

Figure 1—Sketch of the lithospheric plates in Bulgaria, their relationships and metallogenic content since the Paleozoic. 1, Moesian Platform with weekly deformed Mesozoic sedimentary cover; 2, southern margin of the platform active during the Phanerozoic and particularly during the Middle-Late Paleozoic and the Mesozoic; 3, outcrops of pre-Mesozoic sequences in the southern margin of the platform; 4-9, Middle Alpine accretionary (exotic) blocks; 4, Serbo-Macedonian; 5, West Rhodope; 6, East Rhodope; 7, Central Sredna Gora; 8, Sakar-Stradza; 9, East thracian; 10, West Black Sea rift; 11, Flexure, thrusts and nappes (simplified after the 1:1,000,000 Geologica and 1:500,000 Tectonic Map of Bulgaria); 12, faults