

About the tectonic setting of the Moroccan Permian Basins

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In Northwest Africa, the Palaeozoic sequences present evidences of a deformation that was conspicuous in Morocco, north of the present High Atlas and in northwestern Algeria (including the inner Rif and Kabylia in their Palaeozoic location), and very mild in the Moroccan Anti-Atlas and Algerian Ougarta pre-Saharan domains [6]. This deformation occurred during the second half of the Palaeozoic, contemporaneously with the Hercynian orogeny of western Europe. Obviously, the Hercynian chain of Europe extends in Northwest Africa and it is beyond any doubt that the Hercynian segments of Morocco and Algeria correspond to the external belts of the European chain, characterised by the absence of any high-pressure metamorphism, ophiolitic remnants, etc. However, the turbiditic character of Devonian series in eastern Morocco, northwest Algeria, inner Rif and Kabylia, their early deformation (Late Devonian–Early Carboniferous) and the homogeneous style of this deformation account for a distinction between eastern, more ‘internal’, and western, more ‘external’ zones in the Hercynian belt of Northwest Africa (Fig. 1A). On the whole, the main structural lineaments active during the Hercynian orogeny were NNE–SSW and ENE–WSW oriented (Fig. 1A) [5].

The deformed Hercynian structures of Morocco are unconformably covered by continental red beds that contain volcanic flows. In the past, these rocks have been referred to as ‘post-Hercynian Permian–Triassic’. On the basis of palaeontological evidences and lithostratigraphic studies, they are now attributed according to the case either to Stephanian (in very restricted areas), Permian or Triassic.

Throughout northern Morocco, the Permian is only represented by Lower Permian (Autunian) coarse sedimentary rocks described as post-orogenic sequences resulting from the destruction of the Hercynian moun-

tains, associated to felsic volcanic flows and deposited in faulted basins. The Triassic sedimentary rocks, which are mainly fine sandstones and siltstones, especially in the upper part of the series, represent the Late (and uppermost Middle in northeastern Morocco) Triassic. At their upper part they contain mafic, tholeiitic flows of Latest Triassic–Earliest Liassic age. These Late Triassic sedimentary rocks were deposited in grabens developed in an extensive setting during the Central Atlantic intracontinental rifting [4]. Everywhere (Fig. 1B), the border faults of the Late Triassic basins were rejuvenated Hercynian lineaments (e.g., [3]).

It is important to notice that we do not have here any sedimentary or magmatic record of the long period (about 28 Ma) comprised between the end of the Early Permian and the end of the Middle Triassic. Now, this period is crucial, since it represents the time span between the end of the Hercynian compression and the beginning of the Atlantic extension.

The change in the geodynamic regime is suggested by the evolution from the Late Hercynian calc-alkaline, Early Permian [2] magmas to Triassic tholeiitic lavas [1], perhaps through alkaline dykes [8]. However, up to now, no study was available devoted to the structural changes that led from a Late Hercynian, still compressive regime, to a post-Hercynian, extensive regime. The main interest of the paper by Saidi et al. [7] is to present new and valuable data concerning this period and to shed some light upon the coeval structural evolution of Hercynian Morocco. With the authors, we note: (i) the general compressive regime acting during the Early Permian, marked by the persistence of a horizontal compression – at that time the Hercynian shortening is not achieved –; (ii) the successive reactivations of inherited Hercynian faults in response to the variation of the main shortening direction during the Permian, itself due to a clockwise

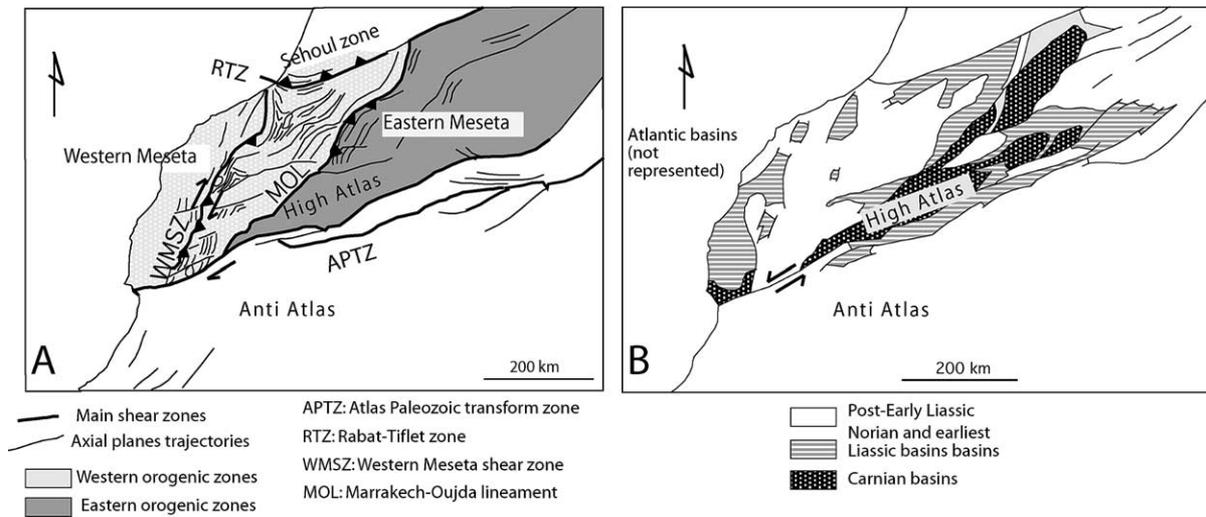


Figure 1. A. The main structural Hercynian zones in Morocco, from [6], modified. B. The Late Triassic and Earliest Liassic basins in Morocco, from [6], modified.

rotation of the regional σ_1 ; (iii) the development during Late Triassic times of a generalised multidirectional extension, σ_1 being vertical, obviously related

to the Central Atlantic rifting. From this period onwards, the general evolution of Northwest Africa is no longer influenced by any horizontal shortening.

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