Meseta and Anti-Atlas domains (Morocco): which relationships during the Paleozoic?

Hassan Ouanaimi*
Ecole Normale Supérieure, Université Cadi Ayyad, Marrakech, Morocco
*E-mail: houanaimi@gmail.com

Moroccan geologists currently label "Meseta Domain" or shortly, "Meseta" the Paleozoic terrains strongly deformed and intruded with granites before the Triassic. These terrains form typically a segment of the Hercynian or Variscan Belt south of the Iberian segment, and they sharply contrast with the Anti-Atlas Paleozoic terrains much less deformed and devoid of any intrusive granite. The Meseta crashed again the Anti-Atlas during the Late Carboniferous-Early Permian and no noticeable relative displacement occurred afterward. However, which were the relationships of these two domains during the Paleozoic? Current opinions are diverging about this topic. Many specialists of the European Hercynian Belt do not consider the Moroccan segment and then do not discuss the Meseta paleopositions. In the figures showing their restoration of the Paleozoic geological setting, North Africa may include the Meseta in its present-day position or may be cut sharply along the West African Craton (WAC), suggesting that Meseta has been one of the Cadomian or Avalonian fragments drifted away from Gondwana, similar to those of Iberia and North-West Europe. In contrast, the most popular opinion among the "Moroccan geologists" favors a permanent reciprocal proximity of these domains and envision the pre-Variscan Meseta as a distal, strongly extended and fragmented margin of the WAC, more external that the Anti-Atlas proximal margin. Here we focus on the southern border of the Meseta along the Anti-Atlas (Fig. 1). This critical zone crops out in several massifs mostly included in the Mesozoic-Cenozoic High Atlas intracontinental mountain range: Western High Atlas Paleozoic Massif, in contact with the Ouzellarh salient of the Anti-Atlas domain; Tizi nTichka, Skoura, Ait Tamlil, Tineghir massifs of the Central High Atlas area; Mougueur, Boudahar and Tamlelt massifs of the Eastern High Atlas.

From the Cambrian to the Carboniferous, the south Meseta border experienced sedimentary, magmatic and tectonic events that contrast with the coeval developments in the Anti-Atlas. We may emphasize the following points:

- a northward increase of subsidence associated with a more important magmatism during the Cambrian rifting, particularly in the western regions;
- the development of red bed subaerial deposits in the Meseta-Atlas domain alone during the lowermost Ordovician, contrasting with the frequent gap in the Anti-Atlas and associated with the onset of the Rheic Ocean rifting;
- the more distal character of the Middle and Upper Ordovician sedimentation toward the Meseta domain;
- the extension of the Hirnantian amalgamated sandstones and of the glacial erosion from the Anti-Atlas to the Meseta;
- a very located Upper Ordovician thermal event in the Tamlelt inlier;
- the common, Silurian-Devonian extensional tectonics in both the Meseta and Anti-Atlas with the occurrence of Lower Devonian red beds in the west and turbiditic series in the east;
- the common effects of the platform dislocation during the Late Devonian-Early Carboniferous.

None of these observations could suggest any displacements at the plate tectonics scale between Meseta and Anti-Atlas. The recent geological achievements in the area indeed reinforce the arguments in support of an essential continuity between Meseta and Anti-Atlas, i.e., between the distal and proximal passive margin of the Saharan platform, respectively. The varied Meseta blocks moved away from the Anti-Atlas due to the successive rifting/extension events, but they were never separated from the Anti-Atlas by an ocean. This has been confirmed by some paleomagnetic results, despite the problem of the widespread Permian remagnetization.

Turning now to the orogenic period, the contrasting deformation of these domains implies a low coupling between them during the collision event. This resulted from the activity of a fault zone, labeled the South Meseta (fault) Zone (SMZ), bounded to the north by the South Meseta Fault (SMF), and to the south by the Mesetan Front that shows south-directed thrust faults at least locally (Tineghir). The SMZ is remarkably wide in the east (Tamelet), but becomes narrow and narrow to the west and vanishes against the Ouzellarh salient. In the Western High Atlas Paleozoic Massif, it only corresponds to the Tizi n'Test Fault (TNTF). The sub-meridian synmetamorphic foliations of the Meseta-Atlas domain end obliquely on the TNTF, suggesting a dextral-reverse shear along the fault during the Variscan compression. To the east of the Tizi n'Test, the TNTF branches into several faults across the Ouzellarh Precambrian salient transgressed by the Upper Visean deposits. This would correspond to the inverted margin of the Meseta Carboniferous basin. Further to the east, the Ait Tamlil and Skoura inliers expose fairly well the transition from the Meseta to Anti-Atlas domains: the Ait Tamlil Meseta thrust nappes emplace in a Carboniferous basin whose beds overlie parautochthonous pre-Visean series that belong to the unconformable Paleozoic cover of the Anti-Atlas. So, before the Variscan collision, this would correspond to the classical setting of a foreland basin extending along its southern borderland. The Variscan compression resulted in south-verging folds and duplications in the pre-Visean and Visean-Namurian series of the Tineghir area. Further to the east, Carboniferous terrains are lacking in the Tamlelt massif, whose northern part depends of the Meseta whereas the southern part exhibits a weak, Anti-Atlas type deformation with south-verging folds and E-W dextral strike-slip faults. A similar type of structure has been recently recognized in the Mougueur inlier.

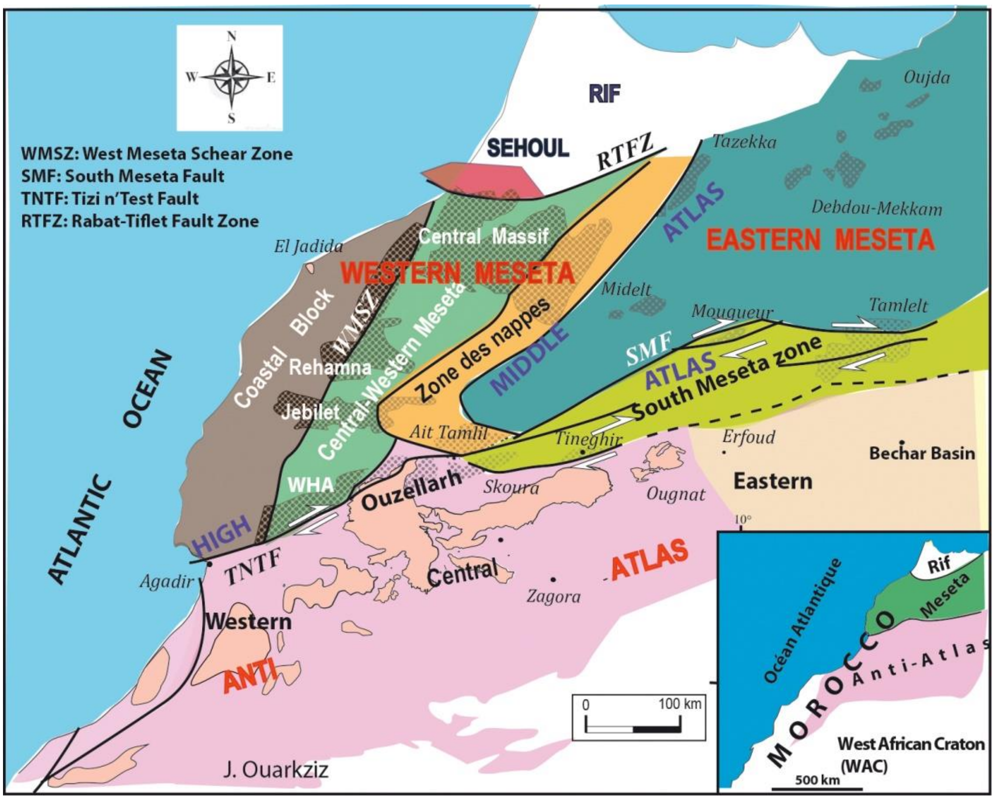

Fig. 1: The Meseta Variscan orogen and its relationships with the Anti-Atlas foreland belt in its present-day setting (after Hoepffner et al., 2017, modified).

References

Most of the references used in this review are listed in Géologues, 194 (Morocco Special Issue, sept. 2017), published by the *Société Géologique de France*, and available at http://www.geosoc.fr/numero-actuel-

geologues.html. We particularly relied on the paper by Hoepffner C., Ouanaimi H., Michard A. (2017), included in this Special Issue