

Introduction

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Palaeozoic units of the Moroccan Variscides (*sensu-stricto*) crop out in the Meseta and the “buttonholes” of the Highlands (“Hauts Plateaux”) and of the High Atlas. Hercynian folds, of varying age and intensity, affected two structural domains (Fig. 1), a western (Western Meseta) and eastern domain (Eastern Meseta). The succession of tectonic events in these two areas is based on stratigraphic arguments. The Devonian and Carboniferous period that we present in this synopsis is significant for understanding the early phases of the Hercynian orogeny and particularly for dating the precise timing of syndepositional block faulting episodes, which fundamentally shaped the Palaeozoic massifs. Effectively, the improved stratigraphical knowledge allows us to distinguish and describe specific episodes of early orogenic processes and to separate successive events from the later main deformation.

The present study combines field observations (stratigraphy, macrofaunas, sedimentary and tectonic environment) and laboratory analyses (micropaleontological studies and microfacies analyses, in particular) in order to date the multifold Moroccan Meseta structural units with the highest available accuracy. It is the logical continuation of the first volume that we published in 2020 in this journal, which concerned the Oued Cherrat and the eastern part of the massif of central Morocco (Mriat and Imouzzet-du-Kandar regions). For the general scope of the joint, interdisciplinary

DFG-CNRST Maroc project, please see the introduction chapter of that volume.

Structural units of the Meseta Paleozoic

The Moroccan Meseta is constituted by the Paleozoic Plateau and its flat lying cover between the Atlas system and Rif mountains (Fig. 1). The Middle Atlas divides this domain into two areas:

The *Western Meseta* is located approximately between the cities of Rabat, Taza, Marrakesh, and Essaouira. There are three major Palaeozoic zones (massifs), the Massif Central, Rehamna, and Jébillet, and some outcrops in the small valleys of the Atlantic coastal rivers (e.g., at the Oued Oum Er Rbia). These massifs are separated by Mesozoic and Cenozoic areas, the Khouribga and Gantour Phosphate plateau, Doukkala, and Chaouïa. Despite this cover, it is possible to establish detailed stratigraphic and structural correlations and to reconstruct a common Palaeozoic history.

The *Eastern Meseta* consists also of Palaeozoic regions and a Mesozoic-Cenozoic cover, but outcrops are smaller than those of the western part. It is composed of the Midelt area, and the areas of Zekkara, Jorf Ouezzène, Jerada Debdou, and Mekkam. The small outcrop sizes make correlations more difficult.

The Palaeozoic basement of the *Middle Atlas* is poorly exposed in small tectonic windows, for example at Immouzer-du-Kandar S of Fez (e.g., CHARRIÈRE & RÉGNAULT 1989; ABOUSSALAM et al. 2020). Reworked Neoproterozoic and Lower

Palaeozoic rocks, especially magmatic pebbles and the Devonian facies development, differ significantly from other Meseta regions, but there are some similarities with the nappes of the eastern Central Meseta.

The principle palaeogeographic configuration of the Meseta began in the upper Silurian, followed by the earliest Hercynian tectonic movements. Early Devonian sedimentation continued in most regions conformably from the Silurian (Pridoli). The transition is characterized by a strong increase of calcareous deposition related to a decreasing amount of terrigenous supply from the West African Craton in the South. This was accompanied by climatic warming due to the motion of northwest Gondwana into a warmer, southern subtropic position.

Three paleogeographic zones are distinguished in the Moroccan Meseta. A western carbonate platform zone (Western Meseta) was subdivided during the Lower and Middle Devonian into several calcareous ridges and adjacent, deeper-water troughs with shales and subordinate calcareous intercalations. Biostromes and bioherms grew along the borders of tectonically uplifted and emerged areas, and were often disturbed or even killed by ongoing tectonism. A second, transitional zone, corresponding to eastern parts of the Central Moroccan Massif, is characterized by differentiated facies in allochthonous and autochthonous series. Reef growth was rather localized. The third zone, the Eastern Meseta, shows turbiditic and pelagic sedimentation with siliciclastics derived both from distant African shields and from emerged areas (e.g., ACOTTO et al. 2019).

Content

In this volume, we will focus on the Silurian-Devonian and Carboniferous period

of four regions (Fig. 1) that have not been dealt with in the first volume:

1. The south-western part of central Morocco, the southern continuation of the Oued Cherrat-Al Attamna-Mdakra regions: Ben Ahmed area (e.g., sections of Boudouda, Dar Cheikh el Mfaddel, Zwayir, and the Oued Aricha);
2. The Rehamna massif, mainly the northern part (sections near Mechra Ben Abbou, Koudiat ed Diab, Foum el Mejez, and Sakhrat et Taïcha);
3. The Jebilet massif, in particular its eastern part (Jaidet East sections),
4. The south-western part of the Jebilet (Mzoudia region, Jebel Ardouz);
5. The Skoura region at the southern foot of the High Atlas, (sections of Taliouine, Tizin-Ouourti, and Asserhmo).

Research concept and perspectives

We were pleased to cooperate in the field and in the later analyses of faunas with leading specialists of fossil groups and with highly experienced Moroccan experts on the Palaeozoic. This led to a high number of co-authors and other persons that all deserved our thanks for the good collaboration, which now extends for almost a decade (see acknowledgements). This cooperation enabled us to cover a wide range of fields, such as lithostratigraphy, event stratigraphy, clastic sedimentology, carbonate microfacies, palaeogeography, structural geology, and the taxonomy, biostratigraphy, and palaeobiogeography of numerous fossil groups, especially of conodonts, ammonoids, nautiloids, brachiopods, trilobites, foraminifers, corals, stromatoporids, and gastropods. Therefore, this volume addresses a wide readership. There are many new data that are relevant far beyond the scholars of the Meseta Palaeozoic, for the broad international

community of Devonian and Carboniferous workers.

If you read the individual chapters, you will realize that we always took care of the research history of all treated regions. This does not only honor the past research efforts but we prefer to put old data into a modern perspective and to exploit their significance for revisions and refinements, in context –

sometimes in contrast - with the new results. All chapters are work in progress. New results led to new questions and allowed us to clearly name the open problems, where more field work and analyses are required. Therefore, we are convinced that this work will initiate and stimulate further research on the fascinating Devonian and Lower Carboniferous of the Meseta.

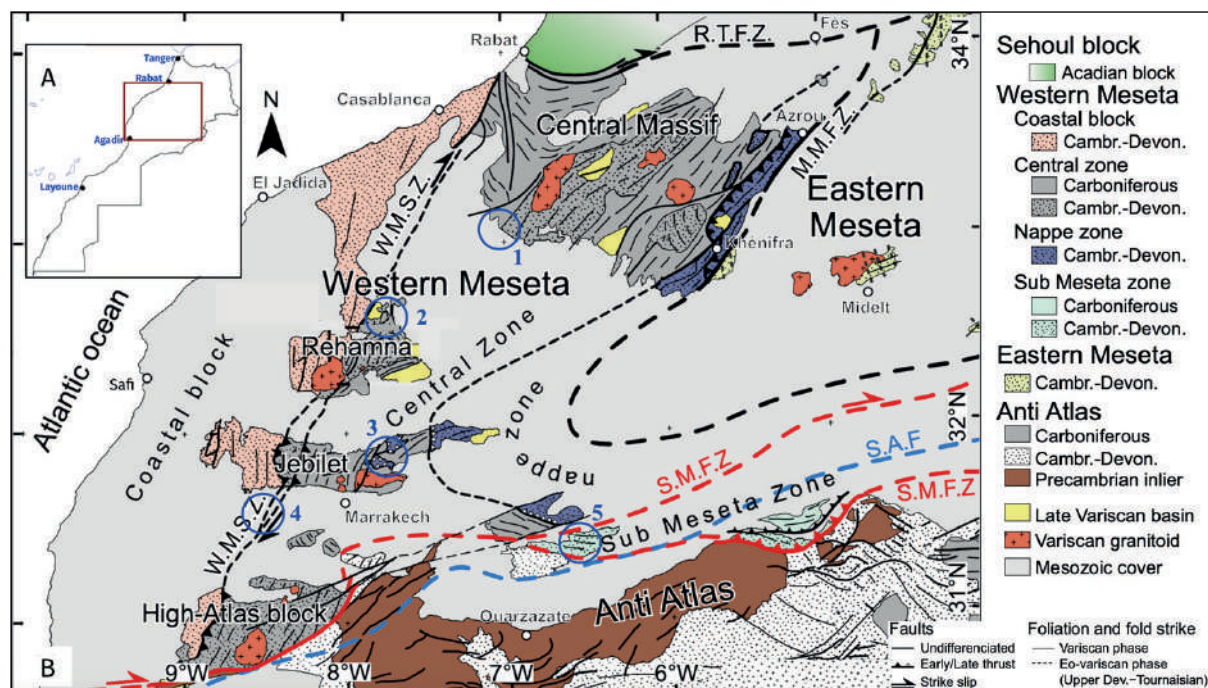


Fig. 1: A. General map of Morocco showing the Western Meseta position (red frame); B. The Meseta Domain and adjacent Anti-Atlas foreland; structural map of the Hercynian Meseta Domain, from MICHARD et al. (2008, fig. 3.16), modified after PIQUE & MICHARD (1989), OUANAÏMI & PETIT (1992), HOEPFFNER et al. (2005), BAIDDER et al. (2008), SOULAIMANI & BURKHARD (2008), MICHARD et al. (2010), and TAHIRI et al. (2010). White: Mesozoic–Cenozoic cover, MMFZ: Middle Meseta Fault Zone, WMFZ: Western Meseta Shear Zone, SMFZ: South Meseta Fault Zone; SAF: South Atlas Fault, RTFZ: Rabat-Tiflet Fault Zone. Studied areas: 1. Ben Ahmed region; 2. Northern Rehamna; 3. Eastern Jebilet; 4. Mzoudia; 5. Skoura.

Repository

Geomuseum Münster:

- Corals GMM B2C.57.1-13
- Bryozoa GMM B5A.4.1
- Brachiopoda GMM B5B.16.1-13
- Gastropoda GMM B6B.11.1-9
- Pelecypoda GMM B6A.37.1-4
- Cephalopoda GMM B6C.54.1-214
- Trilobita GMM B7A.12.1-12
- Conodonts GMM B4C.2.1-207

Fish remains GMM A1C.5.1-2

Forschungsinstitut Senckenberg, Frankfurt a.M.

Brachiopoda SMF 102133-102136

If not stated otherwise, all thin-sections and additional non-figured (currently un-numbered) specimens will be deposited in the Geomuseum Münster.

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