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Two Paleozoic compressive events – evidence from the Fara Formation (Wadi Bani Awf, Jabal Akhdar, northern Central Oman Mountains)

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Five Neoproterozoic/Cambrian formations are exposed in the western part of the Jabal Akhdar Dome (northeastern Oman) below a Permian unconformity. The Fara Formation, which is the youngest of these five formations, is characterized by a basal clastic sequence, followed by limestone and marly-schist with a low metamorphic grade (subgreenschist to greenschist-facies). The top consists of chert, sandstone, conglomerate and felsic as well as mafic volcanic rocks. The Fara Formation has been previously identified only in Wadi Bani Awf, close to the homonymous village (Beurrier et al., 1986). Its lower and upper parts have an age of 547.23 ±0.28 Ma and 542.54 ±0.45 Ma, respectively (Bowring et al., 2007). Thus, the very top of this formation might be Cambrian in age (541 Ma or younger).

The Fara Formation has been strongly deformed by two compressive events, evident by, e.g., tight, isoclinal refolded folds, the fold axial planes (older and younger generation) are sub-perpendicular to each other. The earliest deformation (D1) has gently inclined fold axis dipping toward ENE and a moderately inclined axial surface, the later deformation is exposed with fold axis plunging to NE with about 60° and a steeply inclined axial plane dipping to NW.

The local vergence of the folds show that the older fold axial plane (D1) have formed during a NE-SW-directed compressive event, while the younger one has (D2) formed during an NW-SE-directed event. The older Neoproterozoic formations share the same deformation style of at least two distinct compressional events. Since the Permomesozoic formations above the unconformity do not display any evidence of this folding style, both deformations are time-constrained after deposition of the Fara Formation and before the Permian unconformity, and must be Paleozoic. This study reveals for the first time two Paleozoic deformation phases, recognized in the westernmost sector of the Jabal Akhdar Dome, highlighted by fold analyses and kinematic reconstruction.

Additional field work in the Saiq Plateau (40 km to the SE of Wadi Bani Awf), shows a small outcrop of gently deformed chert underlying the Permian unconformity. This chert can be correlated with the Fara Formation from a stratigraphic point of view. However, future work must confirm this tentative interpretation. Regardless whether the chert is a facies equivalent of the Fara Formation or not, the intensity of Pre-Permian deformation drastically decreases from Wadi Bani Awf to the east within some tens of kilometers. All the new field observations confirm two Pre-Permian compressional events in the western Jabal Akhdar Dome and have been referred to in previous works as the Angudan (D1) and Hercynian (D2) events.