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Progressive coaxial Variscan deformation in the Centro-Iberian Zone (Portugal): Serra do Moradal-Fajao complex syncline

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The Serra do Moradal-Fajão syncline is a major NNW-SSE Variscan structure developed in the SW sector of the Centro-Iberian Zone, one of the main geodynamical structures of the Iberian Variscides. This tight syncline with a 1.5 km wavelength, could be followed for more than 80 km and represents one of the most important regional structures. Its complex structure has been possible to characterize, not only due to excellent outcrop condition (mostly induced by the competent behaviour of the Lower Ordovician Armorican Quartzite Formation), but also to the detailed lithostratigraphic control of the Ordovician-Silurian lithologies. These units are present in a homogeneous regional distribution, unconformably overlain the Cambrian Beiras Group.

Concerning the Variscan structures, their geometry and kinematics show that they could be ascribed to progressive deformation induced by the first and main D1 tectonic event. During this event, a complex NNW-SSE aggregation of fold and thrust arrays have been developed. At the macroscale, this pattern is mainly characterized by the Serra de Moradal-Fajão syncline. Both limbs of this major D1 Variscan fold, which present a slightly ENE facing, have been disrupted by convergent thrust systems, leading to the superposition of the Cambrian Beiras metasediments on top of the Ordovician-Silurian succession. Concerning its SW limb, a major single overthrust has been developed, the Vilar Barroco-Fajão one, although in some very localized sectors, some minor thrusts could be emphasized; as they present a ENE facing, they are interpreted as duplex style forethrusts in relation to the main overthrust. Regarding the NE limb, a different behaviour is found. Indeed, in this sector, an imbricated thrust system has been mapped; due to their WSW facing it should be considered as backthrusts.

Concerning the temporal relations between the previously described structures, although in some rare cases backthrusts cut forethrusts, the scarcity of interference structures turns difficult the subdivision of the main tectonic Variscan phase in sub-events of regional meaning. Indeed, the described geometries and kinematics could be the result of progressive deformation in a coaxial regime. This coaxial deformation is also consistent with the mesoscopic Variscan structures of the Serra de Moradal-Fajão syncline. In fact, not only the geometry of the minor folds are similar to the major syncline, but also the coeval S1 cleavage presents an axial plane behaviour, emphasized by the regularity of the intersection L1 lineation, which is subparallel to the fold axes.

Both the folds and the thrusts are distorted at the cartographic scale by ductile shear zones: N-S to NNE-SSW dextral and WNW-ESE to E-W sinistral. As these structures could be interpreted as conjugate shears induced by a stress field fully compatible with the D1 Variscan tectonic event they are considered as lateral ramps of the main thrust system.

Some of the previous planar anisotropies are reactivated in a brittle regime during the late-Variscan orogenic cycle: mainly the N-S to NNE-SSW behaves as sinistral strike-slip faults. Alpine reactivation by NNW-SSE compression (Cebola reverse fault of the Central Cordillera system) induces also sinistral strike-slip on NE-SW and dextral strike-slip on ENE-WSW previous Variscan faults.