Early exhumation of the Beni Bousera granulites and peridotites at the northern margin of the westernmost Tethys (Rif belt, Morocco); new constraints from overlying marbles

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The West Mediterranean Alpine belts of the Rif and its northern counterpart, the Betics, are famous for the subcontinental peridotites exposed in their Internal zones (Alboran Domain), the Beni Bousera (BB) and Ronda massifs, respectively. The Beni Bousera Marbles (BBMs) here described are known for long in the northern Rif, but remained overlooked so far. Since Kornprobst (1974), these marbles have been considered as simple intercalations within the kinzigites (migmatitic granulites) envelope of the BB peridotite. Based on the integration of field mapping, structural and petrology investigations and supported by SHRIMP U-Th-Pb geochronology, we present a new interpretation of these marbles and infer geodynamic implications at the local and regional scale. The field data show that the BBMs form minor, dismembered units within a ~30 to 300 m-thick mylonitic contact zone between the kinzigites and the overlying gneisses of the Filali Unit (Filali-Beni Bousera Shear Zone, FBBSZ). They display bedding structures marked by more or less siliceous marbles and some mica-rich or conglomeratic beds. The FBBSZ includes secondary ductile thrusts that determine kinzigite horses carried NW-ward over the marbles. Within the latter, NNE-trending folds are conspicuous. Brittle, northward-dipping normal faults crosscut the FBBSZ ductile structures. An unconformable contact, either of stratigraphic or tectonic origin, onto the kinzigites can be locally observed. The petrological investigation allows us to define pebbles and/or detrital grains, including K-feldspar, quartz, garnet, and zircon in these high-grade marbles. Peak mineral assemblage consists of forsterite, Mg-Al-spinel, phlogopite, and geikielite (MgTiO3) in dolomite marbles, phlogopite, scapolite, diopside, and titanite in calcite marbles. This characterizes a peak HT-LP metamorphism at ~700-750°C, 4-8 kbar. The BBMs compare with the Triassic carbonates deposited over the crustal units of the Alpujarrides-Sebtides. The detrital cores of the zircon grains from the BBMs yield two U-Th-Pb age clusters of ~270 Ma and ~340 Ma, distinct from the 290-300 Ma age of the
zircon grains from the kinzigites (Rossetti et al., 2020), and supporting a Triassic age of the protoliths; the zircon rims yield ~21 Ma ages. The BBMs protoliths may have been deposited onto the kinzigites or carried later as extensional allochthons over a detachment in the frame of the incipient formation of the Alboran Domain continental margin, which is dated from the late Liassic-Dogger in the “Dorsale calcaire” detached units (Chalouan et al., 2008). Thus, the Beni Bousera mantle rocks would have been exhumed at shallow depth during the early rifting events responsible for the birth of the Maghrebian Tethys, i.e., as early as the Triassic-late Liassic.

**Keywords:** BBMs/ FFBSZ/ HT-LP metamorphism/ SHRIMP U-Th-Pb geochronology / hyperextended margin/ mantle rocks exhumation / Gibraltar Arc

**References :**

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