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EBSD characterization of pre-Cambrian deformations in conglomerate pebbles (Sierra de la Demanda, Northern Spain)

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Pre-Cambrian and unconformable earliest Cambrian rocks from the Sierra de la Demanda (N Spain) exhibit field and microstructural relationships that attest to orogenic events recorded by concealed basement rocks. Neoproterozoic foliated slates ("Anguiano Schists") crop out under up to 300 m thick, unfoliated quartz-rich conglomerates ("Anguiano Conglomerates") and quartzites which are stratigraphically ca. 600 m below the oldest, paleontologically dated, pre-trilobitic Cambrian layers (likely older than 520 Ma). The Anguiano Conglomerates contain mm to cm grainsized well-rounded pebbles of various types including monocrystalline quartz, detrital zircon and tourmaline-bearing sandstones, black cherts and metamorphic poly-crystalline quartz aggregates. The undeformed matrix is made of much smaller (diagenetically overgrown) monocrystaline quartz grains and minor amounts of accesory zircon, tourmaline and mica. Black chert pebbles exhibit microstructural evidence of brittle deformation (microfaults and thin veins of syntaxial fibrous quartz). These and the fine-grained sandstone pebbles can also exhibit ductile deformations (microfolds with thickened hinges and axial planar continuous foliations), too. Polycrystalline quartz pebbles exhibit a variety of microstructures that resulted from syn-metamorphic ductile deformations. These are recognisable under the petrographic microscope and include continuous foliations, quartz shape fabrics, various types of subgrain or recrystallized new grain microtextures, and lattice preferred orientations (LPOs).

Conventional characterization of quartz fabrics (after oriented structural sections) is challenged in conglomerate pebble thin sections by the difficulty of unraveling in them the complete structural reference framework provided by foliation (whose trace can be unraveled) and lineation orientation (which cannot be directly identified). Quartz in various metamorphic polycrystalline pebbles was studied with the Electron Back-Scatter Diffraction (EBSD) technique. The identification of quartz c-axis point maxima or girdles and their geometrical relationships with respect to <a>-axis arrangements and pebble foliation traces enabled us to identify the operation of basal and prism-<a> and occasionally prism-[c] intracrystalline slip systems. This points to upper-greenschists and amphibolite facies syn-metamorphic deformations. By contrast, black chert and sandstone pebbles and matrix quartz aggregates lack any LPO.

The source area of the conglomerates was likely a pre-Cambrian basement that contained penetratively deformed low- to medium-grade metamorphic rocks. Radiometric dating of this metamorphism has not been accomplished so far though it is known that inherited Precambrian sources in the Iberian Peninsula relate notably to Neoproterozoic (Pan-African and Cadomian) orogens, and to a lesser extent to Paleoproterozoic (1.8-2.1 Ga) or Neoarchean (2.4-2.8 Ga) ones. Neoproterozoic (Cadomian) metamorphism of this grade has only been recognized in SW Iberia. If the fabrics here studied were Cadomian, they might be related to the arc-related igneous suites that have been detected or inferred in other realms of the northern Iberian Massif.