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Multiple Feldspar replacement in Hercynian granites of the Montseny-Guilleries Massif (Catalan Coastal Ranges, NE Spain)

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The core of the Montseny-Guilleries Massif (Catalan Coastal Ranges) is mainly composed by late-Hercynian granitoids (leucogranites and granodiorites) intruded within Cambrian to Carnoniferous metasediments. The granites are unconformably covered by Triassic (Buntsandstein) and Paleocene red beds at the western boundary, preserving a continuous outcrop of the Permo-Triassic unconformity for about 20 km.

In the southwestern Montseny-Guilleries Massif the granites are covered by the Buntsandstein red sandstones that overlain a peneplain paleorelief called the Permo-Triassic palaeosurface. Beneath the palaeosurface the granite displays a characteristic pink colouration. This pink alteration is characterized by precipitation of minute heamatite crystals and albitization of pristine plagioclases (mostly labradorite). The secondary albite is pseudomorphic (mono- or polycrystalline), optically continuous, non-luminiscent, contains widespread microporosity and displays compositions about Ab98. These features are typical of low temperature replacive feldspars (Kastner and Siever, 1979). Albitization of plagioclases is almost total close to the Permo-Triassic palaeosurface and progressively decreases towards depth, displaying a 150-200 m thick alteration profile. The formation of this profile was controlled by fluid circulation along macro- and microfractures and crystal boundaries. Inside the plagioclase crystals fluid pathways were microfractures, twinning and cleavage planes and crystalline defects. The secondary albite holds widespread unconnected micron-size porosity often filled by Fe-oxides. The reaction front is sharp and displays an abrupt composicional change (Ab65 to Ab98) at micron scale. Porosity only appears to be connected at this reaction front surface.

The geometrical arrangement of this alterations suggest that albitization was a shallow process related with Na-rich descending fluids linked to the Permo-Triassic palaeosurface, in a similar way to albitization profiles described in the Morvan Massif (northern France) by Parcerisa et al. (2010).

In some places, the granites of the uppermost part of the albitization profile show microfracturation infilled by a K-feldspar cement post-dating albitization. The secondary albite crystals in contact or close to these fractures are replaced by K-feldspar. The degree of replacement decreases moving away from the K-feldspar cemented fractures. As the secondary albite, the replacive K-feldspars show pseudomorphism, optical continuity, lack of luminescence, widespread unconnected microporosity and compositions close to K end-member.

In the overlying Buntsandstein red sandstones K-feldspar has also been described as an early cement due to circulation of shallow marine or saline brines (Gómez-Gras, 1993). Considering that K-feldspar cementing the Buntsandstein sandstones and K-feldspar filling fractures in the Permo-Triassic paleosurface are the same, the relationship between secondary K-feldspar and albite indicates that albitization occurred prior to Buntsandstein sedimentation as a paleoalteration profile related with the Permo-Triassic landscape.

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