



Geomorphological stability of Permo-Triassic albitized profiles - case study of the Montseny-Guilleries High (NE Iberia)

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Massif paleoalteration profiles (≥ 200 m) occur in the upper parts of the Montseny-Guilleries High (NE Catalan Coastal Ranges). The profiles consist of hard albitized-chloritized-hematized facies in the lower part and softer kaolinized-hematized facies in the upper part of the section. Preliminary paleomagnetic data show Triassic ages for both, the albitized and the kaolinized parts, and point to a surficial formation altered under oxidising conditions. Similar paleoalteration profiles have already been described and dated to Triassic ages elsewhere in Europe [Schmitt, 1992; Ricordel et al., 2007; Parcerisa et al., 2009].

These Permian-Triassic alterations are following a succession of different mineral transformations from the top to the base of the profile:

1) Red facies are defined by an increase in the amount and size of haematite crystals leading to the red colour of the rocks. The increase on haematite content is pervasively affecting the whole rock and is accompanied by the kaolinitization of the feldspars.

2) Pink facies: here, the granite shows an uniform pink colouration, which is mainly due to the albitization of the primary Ca-bearing plagioclases, accompanied by a precipitation of minute haematite, sericite, and calcite crystals inside the albite. Additionally primary biotite is fully chloritized. The pink granites are much more resistant to the present-day weathering than the "unaltered" facies at the base of the profile.

3) Spotted facies is characterized by a partial alteration of the rock, which caused a pink-screened aspect to the rock. The alteration developed along the fractures and is less well developed or absent in the non-fractured zones. In the pink-screened facies, the plagioclases are partially albitized and contain numerous hematite inclusions. Biotites are usually almost entirely chloritized.

4) Unaltered facies: These granites are coloured white to greyish, containing plagioclase and K-feldspar that do not show any trace of albitization. Biotites are not or weakly chloritized. However, these "unaltered" (or primary) granites are strongly weathered into granite boulders embedded in grus by the present-day climatic conditions.

The maturest paleoprofiles occur at the northern part of the Catalan Coastal Ranges (i.e. the Montseny-Guilleries High) where the Variscan basement remained exposed during Triassic times. Towards the South the profiles progressively disappear and Triassic sediments acquire their maximum thickness here.

The alteration profiles are related with the Permo-Triassic paleosurface still outcropping on wide areas [Gómez-Gras and Ferrer, 1999]. They are partially covered by Triassic fluvial sandstones (Buntsandstein facies) in the South [Gómez-Gras, 1993] and by Palaeocene alluvial conglomerates in the West [Anadón et al., 1979]. The Triassic paleosurface shows a remarkable stability successively outcropping during Mesozoic and Tertiary times, the pre-Tertiary exhumation and even the present day weathering affected very little these albitized profiles.

The hardness and thus preservation of the Triassic paleosurface is mainly related to the albitization. The albitized granites are entirely lacking anorthitic plagioclase, which is much more sensitive to chemo-mechanical weathering. Development of albite and additional chloritization of the primary biotite crystals render the rocks much more resistant to weathering and erosion.

This stability is particularly well expressed in case of the Montseny-Guilleries High, which is limited by a high fault scarp at the south-eastern margin. The albitized top of the scarp shows remarkably hard fresh rocks, whereas the base of the scarp (formed of primary, non-albitized facies) is deeply weathered into gruss. This is causing much smother landscape reliefs in the valleys and thalwegs. Since a long time the remarkable persistence of the Triassic paleosurface expressed in the Paleozoic massifs has been highlighted by geomorphologists. Only recently

we could draw the link of the paleosurface preservation to its albitisation [Battiau-Queney, 1996; Widdowson, 1997].

Anadón, P., Colombo, F., Esteban, M., Marzo, M., Robles, S., Santanach, P., Solé-Sugrañes, L., 1979. Evolución tectonoestratigráfica de los Catalánides. *Acta Geológica Hispánica*, 14: 242-270.

Battiau-Queney Y., 1996, A tentative classification of paleoweathering formations based on geomorphological criteria. *Geomorphology*, 16, p. 87-102.

Gómez-Gras, D., 1993. El Permotrias de la Cordillera Costero Catalana: facies y petrología sedimentaria (Parte I). *Boletín Geológico y Minero*, 104(2): 115-161.

Gómez-Gras, D., Ferrer, C., 1999. Caracterización petrológica de perfiles de meteorización antiguos desarrollados en granitos tardihercínicos de la Cordillera Costero Catalana. *Revista de la Sociedad Geológica de España*, 12(2): 281-299.

Parcerisa, D., Thiry, M., Schmitt, J.M., 2009. Albitisation related to the Triassic unconformity in igneous rocks of the Morvan Massif (France). *International Journal of Earth Sciences (Geol Rundsch)*. DOI 10.1007/s00531-008-0405-1

Ricordel, C., Parcerisa, D., Thiry, M., Moreau, M.G., Gómez-Gras, D., 2007. Triassic magnetic overprints related to albitization in granites from the Morvan massif (France). *Palaeogeography, Palaeoclimatology, Palaeoecology*, 251: 268-282.

Schmitt J.M., 1992, Triassic albitization in southern France : an unusual mineralogical record from a major continental paleosurface. in : Mineralogical and geochemical records of paleoweathering, IGCP 317, Schmitt J.M., Gall Q., (eds), E.N.S.M.P. Mém. Sc. de la Terre, 18, p. 115-132.

Widdowson M., 1997, The geomorphological and geological importance of palaeosurfaces. in: Widdowson M. (ed.), Palaeosurfaces: recognition, reconstruction and palaeoenvironmental interpretation. *Geol. Soc. Special Publ.*, 120, p. 1-12.