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K-feldspar albitization in the Hecho Group turbidites (south-central Pyrenean Basin, Spain) and fluid-rock exchange models

D. Garcia (1), M.A. Caja (2), R. Marfil (2), E. Remacha (3), H. Mansurbeg (4), S. Morad (4) and A. Amorosi (6)

(1) Centre SPIN, Ecole Nationale Supérieure des Mines de St.Etienne, France (garcia@emse.fr), (2) Departamento de Petrología y Geoquímica, Universidad Complutense de Madrid, Spain (miguelangel.caja@ub.edu, marfil@geo.ucm.es), (3) Departament de Geología, Universitat Autónoma de Barcelona, Spain (eduard.remacha@uab.es), (4) Department of Earth Sciences, Uppsala University, Uppsala, Sweden (sadoon.morad@geo.uu.se, howri.mansurbeg@geo.uu.se), (5) Department of Earth Sciences, University of Bologna, Bologna, Italy (amorosi@geomin.unibo.it)

The Eocene turbidites of the south-central Pyrenees foreland basin, known as the Hecho Group, provide excellent exposures of slope facies associations in a well-constrained sequence stratigraphic frame. Geochemical and petrographic evidence suggest that the spatial and temporal changes in detrital composition of the group in the Ainsa sub-basin can be attributed to shifts in provenance, depositional facies and diagenetic changes. While early diagenetic alterations, primarily dolomitisation, are largely bounded to marine flooding surfaces, deep-burial diagenesis of the sand beds has presumably involved large scale fluid circulation along contact zones such as the boundaries between the successive tectono-stratigraphic units (TSU). We discuss the characteristic features (occurrence, extent, secondary products) of diagenetic albitization of detrital K-feldspar in the Hecho group sandstones based on petrographical and geochemical data, and the relevant circulation scenarii that could account for these diagenetic alterations based on reaction-transport modelling.

Sandstones of the Hecho group range from arenites in the lowermost exposed unit (TSU2) to calclithites or hybrid arenites towards the top (TSU3 to 5). Evidence for extensive K-feldspar albitization include ghost textures (inclusion-bearing megacrysts), complete lack of K-feldspar in some sand beds, and inert-element signatures (notably

LREE, Th evidence for monazite in heavy minerals) indicating a similar provenance for K-feldspar free and K-feldspar rich beds from the same TSU. K-feldspar is almost absent from the deformed lower unit (TSU2), massively removed in the margins (basinward dipping) of TSU3 and TSU4, while being preserved in their central (flat) parts, and completely preserved in the upper unit (TSU5). At variance with reported descriptions of diagenetic albitization, the detrital plagioclase remained unaltered, while the nearby K-feldspar was replaced by calcite and secondary albite.

The extent of K-feldspar albitization and the lack of associated K-enrichment in interbedded shale preclude diagenesis in closed system. Alternatively, albitization could be driven by (1) downwards migration of connate waters against a temperature gradient, and (2) invasion by deep saline solutions from underlying units. Both scenarii account qualitatively for K-feldspar replacement, but reaction-transport simulations that take into account the spectrum of sand facies generate in the second scenario a pattern of chemical variability that fits much better the rock record.

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