Characteristic of the fluids involved in very low-grade metamorphic processes in the Cordillera de la Costa, Chile Central

S. Morales [1], J. Carrillo-Rosua [3], D. Morata [2], M. Belmar [2] and A. Boyce [3]

[1] Departamento de Mineralogía y Petrología. Universidad de Granada. Avda. Fuentenueva s/n. 18002 Granada. Spain. smorales@ugr.es, fjcarril@ugr.es
[2] Departamento de Geología. Universidad de Chile. Plaza Ercilla 803. Santiago. Chile. dmorata@cec.uchile.cl
[3] Isotope Geosciences Unit. SUERC. Scottish Enterprise Technology Park. G75 0QF. Scotland. UK. a.boyce@suerc.gla.ac.uk

Current researchs on very low-grade metabasites are mostly centred on the establishment of the metamorphic paragenesis and determination of mineral chemistry as a tool to quantify P-T conditions. Nevertheless, few works has been designed with the aim to characterise fluids involved in these very low-grade metamorphic processes. In this sense, a study of the fluids involved in the genesis of the very low- grade metamorphism found in Lower Cretaceous volcanic and volcaniclastic rocks from the Coastal Range of central Chile has been carried out. Volcanism was generated in extensional intra-arc basins, dominated by high subsidence rate during the subduction of the Pacific Plate under the South American Plate (e.g. Morata and Aguirre, 2003a). This study has been performed on samples coming from La Serena (≈30°00'S) and Melipilla (≈33º50'S). In both areas, volcanic and volcaniclastic rocks evidence metamorphic minerals ranging from the high-T zeolites to the prehnite-pumpellyite metamorphic facies (e.g. Morata et al., 2003), Metamorphic minerals appear as pseudomorphs of previous igneous phases or as replacement of the volcanic groundmass and/or infilling open spaces. The occasional higher size of metamorphic minerals in this last metadomaim favoured the application of fluid inclusion and isotopic techniques with the aim to investigate the chemical composition of metamorphic fluids.

The microthermometric study of fluid inclusions in prehnite and calcite shows the presence of fluids with moderate temperatures of homogenisation (<200ºC) and lightly saline (up to 25% wt. % NaCl equivalent). The REE contents of the separate minerals are smaller than those of the host volcanic rocks, with negative and positive anomalies of Eu for prehnite and epidote respectively. The study of the stable ($\delta^{13}C$: between -3 and -10‰; $\delta^{18}O$: between 5 and 25‰, and δD: between -40 and -100‰) and radiogenic isotopes ($^{87}Sr/^{86}Sr$: 0.7037-0.7100) in different mineral concentrates shows wide ranges of values that involve different types of fluids and processes. It is necessary to highlight the presence of surface fluids (with variable prevalence of seawater or of meteoric water according to different formations), variations in the fluid/rock relationship and in the oxygen fugacity and participation of C of diverse source (biogenic origin, dissolution of carbonate rocks).

In conclusion, the use of metamorphic minerals infilling open space in very low-grade metamorphic terrain seems to be a very important useful tool for the complete characterisation of metamorphic fluids in such very low P-T processes.

References

Morata, D. and Aguirre, L. (2003a). J. South. Am. Ear. Sci. 16, 459-476.

Morata, D., Aguirre, L., Belmar, M. and Morales, S. (2003b). 10º Congreso Geológico Chileno, Concepción (Chile).