Properties of fly-ash synthetic zeolite NaP1 for soil remediation

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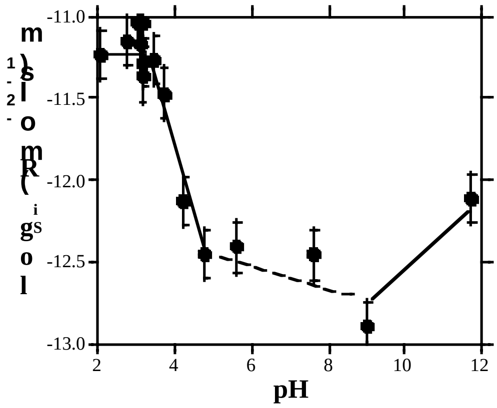
Zeolitic material NaP1, synthesized from fly ash by conventional and microwave-assisted hydrothermal alkaline activation experiments (Querol et al., 1997), has been proposed as candidate to ground-water remediation by mixing the zeolitic material with contaminated soil (Moreno et al., 2001). Knowledge of its stability at different pH and cation exchange properties is necessary.

The kinetics of Nap1 dissolution at pH range of 2-11 and the cation-exchange properties are being studied at 25 ºC by means of flow-through and batch experiments, respectively. Dissolution rate dependence is depicted in the figure below. At very acidic conditions the dissolution rate appears to be pH independent, while increasing pH it becomes pH dependent. Near the neutral region to pH 9 the dissolution rate might decrease (dotted line) and increases at basic pH by increasing pH. NaP1 affinity for cation exchange has been examined for the binary systems Na-K, Na-Ba, Na-Ca and Na-Zn from exchange isotherms, yielding preliminary K^{GT} values of 0.2, 1.64, 0.09 and 0.13, respectively.



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Thermal disequilibrium in the lower crust: evidence from the Bergen Arcs, Norway

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The coupling of fluids with deformation is commonly considered to play a central role in promoting the transformation from granulite to eclogite. This relationship has been clearly shown in the Bergen Arcs, Norway, where Caledonian (~450Ma) hydrous shear zones transformed Proterozoic granulites to eclogite (~700°C, ~15kbar). Recent Rb-Sr dates from phlogopite in undeformed mafic lenses surrounded by Caledonian eclogite were shown to preserve Proterozoic ages. Because the temperature of eclogite formation was assumed to reflect the ambient thermal regime, this unexpected result was inferred to indicate a Rb-Sr biotite closure temperature of ~700°C under dry and static conditions.

We question this assumption, particularly in settings where subduction and exhumation rates are fast. The inert nature of argon is such that the ^{40}Ar-^{39}Ar, rather than the Rb-Sr, system is more likely to conform to an infinite reservoir model when applied to closure temperatures. Consequently, a ^{40}Ar-^{39}Ar study was performed on phlogopite from the same undeformed lenses examined in the Rb-Sr study. The ^{40}Ar-^{39}Ar and Rb-Sr dates are similar, suggesting that the Rb-Sr system in biotite did not behave anomalously. In addition, the larger grains preserve older ages and large boudins preserve older ages than smaller boudins, which is consistent with isotopic diffusive behaviour.

Because the Rb-Sr and ^{40}Ar-^{39}Ar systems were not reset during the Caledonian, we believe that the temperatures of 700°C recorded in the shear zones reflect the local fluid temperature rather than the ambient thermal regime of the surrounding rocks. In addition to the important role of fluid in catalysing transformation, heat advection by the fluid localises thermal effects; where the duration of fluid infiltration is short, advection and conduction of heat from the shear zones into the country rock would be negligible.

An inferred non-equilibrium temperature difference between shear zones and surrounding country rocks can be explained in several ways (e.g., heat advection by fluids or melt), depending on the tectonic environment. The thermal evolution of a terrane depends on two principal factors, locally transient thermal perturbations and the regional thermal regime. By applying diffusion theory the duration of geological processes in the Bergen Arcs must have been fast (≤30Ma). Thus, temperatures recorded in shear zones need not reflect the ambient thermal regime.