Size effects on colloids diffusion in granite micro fractures

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Clay colloids can be generated at the host rock (granite)/ engineered barrier (bentonite) interface of a deep geological radioactive waste repository (1). The migration of these clay particles into the rock micro-fractures could affect the migration rate of those radionuclides presenting significant sorption onto the clay.

In previous experiments simulating the bentonite/granite interface of a repository, the migration of clay particles through granite micro-fractures was observed. Furthermore, the transport of contaminants (U, Cs and Eu) sorbed onto bentonite particles was also detected (2). The study of the granite micro-fracture network structure by laser confocal microscopy revealed that particles with size lower than few μm might have entered and migrated through the rock. It is therefore very important to understand the diffusion behaviour of colloids within the rock matrix, taking into account a crucial parameter as the size.

In this work, nuclear ion beam techniques such as RBS (Rutherford Backscattering) and micro-PIXE (Microbeam-Particle Induced X-Ray emission) were used for studying the extent of colloid diffusion through granite micro-fractures as a function of the colloid size.

Gold colloids were selected as diffusants because of their suitability in natural environments; in fact, they are easily identified in geological materials (both in clay and granite), they are available in different and mono-disperse size distributions and they are stables in natural waters conditions. For these studies, granite slices were put in contact with two different gold colloid suspensions (with diameters of 40 nm and 100 nm respectively) allowing the diffusion of the particles within the rock. After the contact, the samples were analyzed by means of RBS and micro-PIXE. In all cases, a gold diffusion profile was detected inside the granite showing a clear dependence on the particle size; the lower the particle diameter, the faster diffusion process.

The fact that the diffusion of particles through granite is observed states the importance of studying colloid mediated transport of contaminants in porous rocks.

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Some textural and geochemical evidences on mixing and mingling in the genesis of Karamagara Volcanics, Saraykent-Yozgat, Central Anatolia, Turkey

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Plio-Quaternary Karamagara andesitic lava flows are exposed in Saraykent (Yozgat) region. These volcanics have a hypocrystalline-porphyrytic texture and include the clinopyroxene, hornblende and plagioclase phenocrysts. Olivine and hornblende xenocrysts have also been seen in these volcanics. Subrounded to rounded magmatic enclaves, ranging from a few mm to decimeter in size, are present in Karamagara volcanics. The enclaves are range from basaltic andesite to andesite in composition, and generally have a vitrophyric-propyrytic texture but some enclaves have the holocrystalline texture. Some distinctive mineral textures have been seen such as sieve-textured plagioclases, hornblendes with an appinitic texture and a reaction rim exhibit the disequilibrium crystallization with host magma. Enclaves and olivine xenocrysts also show the mingling process in the evolution of the volcanics.

Geochemistry of the Karamagara volcanics and enclaves reveal the magma mixing process in the evolution of these volcanics. K/Sr-Ba/Rb diagram exhibits that they are fitted on the mixing line. On the other hand, holocrystalline enclaves and hornblende xenocrysts surrounded by clinopyroxene microlithes suggest that stratification in the magma chamber were broken down, and crustal assimilation, respectively. Insights of above data, it can be suggested that the Karama_ara volcanics have the complex evolution history such as mixing, mingling and crustal assimilation processes.