Calcite cleavage surface reactivity in sulphate-rich waters

R. ATANASSOVA[1], J. CAMA[2]*, J.M. SOLER[2], C. AYORA[2] AND I. CASANOVA[3]

[1]Geological Institute, Bulgarian Academy of Sciences, Sofia 1113, Bulgaria, EU
[2]Institute of Environmental Assessment and Water Research (IDAEA) Jordi Girona 18-26, Barcelona 08034, Catalonia, EU (*correspondence: jordi.cama@idaea.csic.es)
[3]Group of Mechanics and Nanotechnology of Engineering Materials, Univ. Politècnica de Catalunya, Barcelona 08034, Catalonia, EU

Passive treatment systems use limestone to remediate Acid Mine Drainage (AMD) waters with high metal and sulphate contents. Geological sequestration of CO_2 in rock formations containing brines rich in sulfate has also been proposed. Gypsum precipitation on dissolving calcite surfaces may occur in both types of systems.

In this study, the dissolution of the (104) calcite cleavage surface was investigated by means of ex situ VSI (Vertical Scanning Interferometry) measurements using flow-through and batch experiments at $pCO_2= 10^{-3.4}$ and (1) pH ranging from 1 to 7 in sulphate-free (HCl) and sulphate-rich solutions and (2) pH 3 in metal-free sulphate and metal-sulphate solutions. Also, solutions equilibrated with gypsum have been used.

In sulphate-free solutions, the dissolution of the calcite (104) cleavage surface follows the same trend previously reported from powder experiments (rate decreases from pH 2 to 6, becoming pH independent at pH 6-9), but the magnitude of the rates is about one order of magnitude smaller. Moreover, the calcite dissolution mechanism controlled by the formation and coalescence of rhombohedral pits that promote an overall surface retreat is observed. In the sulphate-rich solutions at highly acidic pH, the calcium released reacts with sulfate, yielding a solution that is supersaturated with respect to gypsum. The precipitation of gypsum forms a dense but porous layer of needle-like crystals that allows diffusion of products and reactants between the calcite surface and the solution.

At pH 3 and metal-free sulphate and metal-sulphate solutions, calcite (104) cleavage surface dissolution is similar than the rates at pH 3 in HCl solutions. The presence of divalent cations (Fe(II), Cu, Zn, Cd) in sulfate-rich solutions does not show a significant effect on calcite dissolution rate, regardless of gypsum precipitation.

Occurance of iron skarns in relation to A-type granites in SE Saqqez, western Iran

S.F. ATHARI[1]* AND A.A. SEPAHI[2]

[1]Department of Geology, Bu Ali Sina University, Hamadan & Young Researchers Club of Kurdistan, Iran (*correspondence: sfathari@gmail.com)
[2]Department of Geology, Bu Ali Sina University, Hamadan, Iran (sepahi@basu.ac.ir)

The study area is located in southeast of Saqqez in the north of the Kurdistan Province, western Iran. In the southeast of Saqqez, there are two contrasting granitoid complexes (G_1 and G_2). G_1 granitoids are composed of alkali feldspar granite, syenogranite and quartz alkali feldspar syenite whereas G_2 granitoids are composed of monzogranite, granodiorite and tonalite. Geochemically, G_1 granitoids are peralkaline and their characteristics resemble the A-type granites, but G_2 granitoids are subalkaline (calc-alkaline) and metaluminous and their characteristics resemble the I-type granites. According to the geochemical classification scheme of [1], G_1 granitoids are ferroan alkali and ferroan alkali-calcic whereas G_2 granitoids are magnesian and calcic. Based on field geological evidence, petrographic studies and G_1 granitoids are ferroan, it seems that iron skarns are produced in contact with Permian limestones in south of Ranga-Rizhan and southeast of Hassan Salaran villages.

Ore minerals in the Ranga-Rizhan ore body are magnetite, hematite, pyrite, goethite and chalcopyrite. Magnetite is the predominant mineral and is produced in oxidation phase of high-temperature degree. Hematite is the production of supergene processes and according to [2] hematite mineral produce during martitization process from magnetite. Pyrite is the most abundant sulfide mineral in this ore and is produced after magnetite. Goethite is produced by atmospheric water during supergene process from the Fe-bearing minerals such as pyrite. Chalcopyrite minerals are seen very small but some of them are large.

Ore minerals in the Hassan Salaran deposit are magnetite, hematite, pyrite, goethite, chalcopyrite and rutile. The mineral assemblages in this deposit is very similar to the Ranga-Rizhan deposit except for existence of rutile. Rutile is produced in oxidation phase, but in the lower temperature degree than magnetite and after it.

[1] Frost et al. (2001) *Journal of Petrology* **42**, 2033-2048. [2] Ramdhor (1980) *Pergamon Press*, 1267P.