

## Carbonation of serpentinite mine tailing: the example of Montecastelli mine (Tuscany, Italy)

BOSCHI C.<sup>1</sup>, DINI A.<sup>1</sup>, BEDINI F.<sup>1</sup>, BANESCHI I.<sup>1</sup>,  
NATALI C.<sup>1</sup> AND DALLAI L.

<sup>1</sup>Istituto di Geoscienze e Georisorse, CNR (Pisa, Italy);  
c.boschi@igg.cnr.it

Carbonation of serpentinite or asbestos mine tailing is a passive, weathering-related process that take advantage of the thermodynamically driven natural transformation of ultramafic rocks into carbonate and thus it is cost and energy effective. The enhancement of this natural weathering is a challenge including multiple advantages: CO<sub>2</sub> capture, and remediation of asbestos tailing. Here, we present an example of natural carbonation of a small mine dump at Montecatelli (Tuscany, Italy).

At Montecatelli (Tuscany, Italy), a pluri-kilometric body of serpentinite, embedded in shales, has been deeply eroded by the Pavone River providing good exposures and sections. The central portion of the serpentinite body host a small copper ore deposit that was intermittently exploited during the XIX century, and was definitively closed in 1869. Bornite, chalcopyrite, chalcocite and pyrite veinlets and nodules, in a chlorite-serpentinite-brucite-amphibole soapy gangue, characterize narrow deformation zones crosscutting the serpentinites. Most of the low-grade Cu-ore extracted in the past was not reliable for industrial processing and directly dumped in front of the entrances of the mine, forming by the time a small mining dump. Mining activity stopped 60 years ago.

Intense natural carbonation produced crust of hydrated Mg-carbonates (hydromagnesite, nesquehonite, manasseite, pyroaurite, brugnatellite) coating the serpentinite clasts of the mining dump and the serpentinite walls of the mine tunnels.

The Montecatelli carbonated serpentinite mine tailings represent an example of rapid atmospheric CO<sub>2</sub> uptake. Their study improved our knowledge of the carbonation processes. Future quantification of the amount of carbon sequestered in geologic samples from Montecatelli would give an estimate for the sequestration capacity of ultramafic mine tailings in general and will provide a framework for the development of standard protocol for enhanced mineral sequestration at mine sites.

## The Behavior of Beryllium in Soils and Aquatic Environments

VANESSA BOSCHI<sup>1\*</sup> AND JANE K. WILLENBRING<sup>1</sup>

<sup>1</sup>University of Pennsylvania, 240 South 33rd Street  
Philadelphia, PA 19104; \*vaboschi@sas.upenn.edu

Beryllium is an important metal utilized in a diverse range of applications. Aside from its numerous industrial uses, it is as a central tool used in the field of geochronology and geomorphology. Recent work indicates <sup>9</sup>Be leached from mineral lattices during weathering processes moves through a landscape adsorbed to soil particles and in solution. As such, the flux of <sup>9</sup>Be from rivers is indicative of the weathering extent of soils within the catchment. Another isotope, cosmogenic <sup>10</sup>Be, is formed in the atmosphere and is precipitated onto the Earth's surface, adsorbing onto surface sediments. The concentration of <sup>10</sup>Be in soils and sediments scales with the residence time of sediments in a landscape. Although these applications are dissimilar, they require an understanding of the behavior of beryllium in soils and aquatic environments. A better understanding of the mobility of beryllium will help constrain its use for such geologic techniques.

In order to evaluate the interactions of beryllium with soil and aquatic related materials, we selected model organic compounds and minerals to perform distribution coefficient experiments. Model organic compounds such as graphite, cellulose, an amine compound and phenolic acid in addition to dissolved organic matter samples were selected on the basis of their chemical composition and potential ability to adsorb beryllium. Clay-sized fractions of montmorillonite, illite, kaolinite and hectorite were also selected. The retention of beryllium onto each of these compounds was evaluated over a pH range and various equilibration times to determine which conditions allowed for the greatest retention of beryllium. Preliminary results conclude that mineral compounds more efficiently adsorb beryllium relative to the selected model organic compounds. Retention of beryllium increases with increasing pH from 2 to 6. We also examined the effect of pH on the speciation and colloidal nature of beryllium. For beryllium concentrations typical of natural soil solutions, we find that the colloidal behavior of beryllium may play a significant role in its mobility within soils.