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# Atmospheric $CO_2$ uptake throughout bio-enhanced brucite-water reaction at Montecastelli serpentinites (Italy)

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In the last several years, interactions between microorganisms and minerals have intrigued and catched the interest of the scientific community. Montecastelli serpentinites (Tuscany, Italy) are characterized by $CO_2$-mineral carbonation, an important process which leads to spontaneous formation of carbonate phases uptaking atmospheric $CO_2$. In the studied areas carbonate precipitates, mainly hydrated Mg-carbonates, are present in form of crusts, coating and spherules on exposed rock surfaces, and filling rock fractures. Petrographic and mineralogical observations revealed that Tuscan brucite-rich serpentinites hosts preserve their original chemical compositions with typical mesh-textured serpentine ($\pm$ brucite) after olivine, magnetite-rich mesh rims and relicts of primary spinel. Representative hydrated carbonate samples have been collected in three different areas and analyzed to investigate the role of biological activity and its influence in the serpentine-hydrated Mg-carbonates reaction.
The different types of whitish precipitates have been selected under binocular microscope for XRD analyses performed at the Dipartimento di Scienze della Terra (University of Pisa, Italy): their mineralogical composition consists of mainly hydromagnesite and variable amount of other metastable carbonate phases (i.e. nesquehonite, manasseite, pyroaurite, brugnatellite and aragonite). Moreover, the crystallinity analysis of whitish crust and spherules have been carried out by detailed and quantitative XRD analyses to testify a possible biologically controlled growth, inasmuch as the crystal structure of biominerals could be affected by many lattice defects (i.e. dislocations, twinning, etc.) and this observation cause low crystallinity of the mineral. The presence of microbial cells and relicts of organic matter has already been detected by confocal laser scanning microscopy (CLSM) combined with Raman spectromicroscopy in a previous study (Bedini et al., 2013).
The presence of active microbial communities in or at the serpentinites surface could promote and/or enhance the key reaction through which serpentine, reacting with the carbon dioxide, becomes hydrated Mg-carbonates.
This novel study aims to provide a contribution to the identification of the biominerals that could be a valid proof between $CO_2$-mineral sequestration and microbial activity interactions.
This innovative research is designed to provide a plan in future at industrial scale to reduce and capture the greenhouse gas content by Earth's atmosphere, thanks to the precipitation of carbonate biominerals.

Keywords: serpentinite, carbonation, biominerals.

Bedini F., Boschi C., Ménez B., Perchiazzi N., Natali C., Zanchetta G. (2013) Interaction between Geosphere and Biosphere in $CO_2$-mineral sequestration environment. FIST GEOITALIA 2013- XI Forum di Scienze della Terra (Pisa, Italy).