Promising Rocks for CO_2 Capture & Storage

The main types of CO_2 Capture and Storage (CCS) are: (i) *mineral carbonation*, (ii) *geological storage*, and (iii) *ocean storage*. Mineral carbonation can be carried out either *in situ*, by injecting CO_2 into specific geological formations (Matter and Kelemen, 2009; Gislason et al., 2010; Gislason and Oelkers, 2014), or *ex situ* in a chemical processing plant, after mining and pre-treating the rock material (Gerdemann et al., 2007; Oelkers et al., 2008; Pronost et al., 2011). The goal of the CO2NOR Project is to propose an efficient method (*ball milling*) for enhancing the *ex situ* carbonation of ophiolitic rocks.

The purpose of mineral carbonation is to create stable carbonate minerals such as magnesite ($MgCO_3$), calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$), by reacting CO_2 with natural metal oxides (Oelkers et al., 2008; Matter and Kelemen, 2009; Kelemen et al., 2011). These metal oxides are principally the oxides of divalent cations Mg^{2+}, Ca^{2+} and Fe^{2+} that are found in the crystal structure of many mineral phases. Silicate minerals with the highest potential for CO_2 mineralization are olivine, pyroxene, serpentine and plagioclase. Substantial quantities of all the above mineral phases occur in the *ultramafic* and *mafic* rocks of ophiolite complexes. The main carbonation reactions of ophiolitic rocks are summarized below:

$$Mg_2SiO_4 + 2CO_2 \rightarrow 2MgCO_3 + SiO_2 \quad (1)$$

FORSTERITE MAGNESITE SILICA

$$MgSiO_3 + CO_2 \rightarrow MgCO_3 + SiO_2 \quad (2)$$

ENSTATITE MAGNESITE SILICA

$$Mg_3Si_2O_5(OH)_4 + 3CO_2 \rightarrow 3MgCO_3 + 2SiO_2 + 2H_2O \quad (3)$$

SERPENTINE MAGNESITE SILICA

$$CaAl_2Si_2O_8 + CO_2 + 2H_2O \rightarrow CaCO_3 + Al_2Si_2O_5(OH)_4 \quad (4)$$

ANORTHITE CALCITE KAOLINITE

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