Earth Mars Analogues – Linking experimental and Martian clays

C. Sætre*, H. Dypvik, H. Hellevang, and S. C. Werner

*The Centre for Earth Evolution and Dynamics, University of Oslo, Sem Sælandsvei 24, NO-0371 Oslo, Norway (*correspondence: christian.satre@geo.uio.no)*

Clay minerals were identified on Mars a decade ago by ESA's Mars Express orbiter and more recently confirmed by in situ X-ray diffraction analysis (XRD) performed by NASA's Curiosity Rover. The occurrence of clay minerals is often associated with impact craters and probably reflects aqueous alteration of impact glass. The composition of parent material and reaction fluids, time and climate are key factors controlling the formation of clay minerals. The main goal of the present project is to gain increased understanding on factors influencing weathering and alteration of minerals and amorphous phases in various hydrous regimes. Near Infrared analysis (NIR) provides the link between phyllosilicates observed on the Martian surface and during laboratory experiments. The new information gained will help in assessing observed clay minerals on Mars and their possible mode of formation e.g. climate wise.

In the project, alteration experiments are performed in reaction bombs (PARR reactors) using starting materials of different mineralogical/petrological compositions. The samples are mixed in aqueous solutions under various CO_2, N_2 and O_2 partial pressures, at temperatures ranging from 120 to 200° C, and experimental running times between 3 and 6 weeks. Detailed chemical composition and mineral assemblage of starting materials and products are acquired by standard petrographical techniques, e.g. XRD, Scanning Electron Microscopy (SEM) and X-ray Fluorescence Spectroscopy (XRF). Geochemical modelling will provide in-depth understanding of the alteration reactions and stability fields of the minerals.

NIR spectra of the experimentally formed minerals will be acquired in cooperation with Université Paris Sud in order to improve mineral identification on the Martian surface both for spectra collected during the ongoing Mars Express mission and the upcoming robotic ExoMars ESA programme.

Preliminary results show dominant formation of smectite from basaltic glass, regardless of reaction temperature, time and CO_2/O_2 pressure. More details regarding mineral types and chemistry will be presented.