Weathering of Bronze Age potsherds in a Mediterranean climate (Cres Island, Croatia)

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The aim of this study was to study the causes of well preserved status of potsherds in bronze age hill forts on Cres island (Northern Adriatic Sea) exposed to Mediterranean climate and their buried equivalents in colluvial deposits. The island of Cres has a long history of settlement and hosts some very important Mesolithic, Neolithic and Bronze age sites. Due to erosion large areas are bare karst lacking soil cover and prehistoric potsherds can be found in stonewalls of hill forts or caves.

The potsherds were analyzed by microscopy methods as well as geochemistry to study the weathering process in both exposed and buried potsherds. The colluvial soil containing potsherds was dated at Beta Analytic AMS facility (Beta-199264) and a calibrated ^{14}C date ranging from 2030 to 1870 BC was obtained. Under the optical microscope, the potsherds are texturally homogeneous and display inclusions of similar type, abundance, and grain size.

The enrichment of Ca in exposed potsherd rims is accompanied by depletion of light REE's and enrichment of heavy REE's.

The results show that potsherds exposed to the Mediterranean climate for four thousand years have an improved durability due to calcite re-crystallization and notable change in the chemical composition of potsherd rims which have to be considered when using bulk geochemistry for provenance studies.

Constraining the role of anoxygenic phototrophic Fe(II)-oxidizing bacteria in the deposition of BIFs

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Banded Iron Formations (BIFs) are Precambrian sedimentary deposits of alternating iron oxide and silica mineral layers. Their presence in the rock record ca.3.8-2.2 Ga makes them particularly intriguing formations for the debate over when oxygen became dominant on Earth. The mechanism(s) of BIF deposition is still unclear and suggestions include both abiotic and biotic processes. We are interested in constraining one of these proposed mechanisms; the direct biological oxidation of Fe(II) via anoxygenic Fe(II)-oxidizing photoautotrophs.

In order to find the limitations of photoferrotrophic BIF deposition, we take a holistic approach, investigating the oxidation of Fe(II) by modern Fe(II)-oxidizing phototrophs, the precipitation of Fe(III) (hydr)oxides, and the fate of the cell-mineral aggregates in the water column and at the basin floor.

Specifically, physiology experiments with Fe(II)-oxidizing phototrophs under various conditions of light intensity, pH, Fe(II) concentration and temperature allow us to determine the environmental limits of such organisms. We carry out precipitation experiments to characterize the sedimentation rates, aggregate size and composition in order to resolve the effect of reactions in the water column. Finally, we simulate the diagenetic fate of these aggregates on the basin floor by placing them in gold capsules under temperature and pressure conditions relevant for the Transvaal Supergroup BIFs of South Africa. Recently, we have developed a tank simulating the Archean ocean in which the strains grow in continuous culture and collect the aggregates formed under various geochemical conditions.

We aim to model the extent of and limitations to photoferrotrophs in BIF deposition. This information will help constrain whether biotic processes were dominant in the Archean ocean and will offer insight to the evolution of the early biogeosphere.