

## Surface characterisation and modelling of olivine at alkaline conditions

R. JOLSTERÅ\*, L. GUNNERIUSON AND W. FORSLING

Division of Chemical Engineering, Department of Chemical Engineering and Geosciences, Luleå University of Technology, SE-97187 Luleå, Sweden  
(\*correspondence: rickard.jolstera@ltu.se)

Olivine is very susceptible to dissolution in acidic to neutral environments. However, we have found that it is possible to study the surface reactions of olivine at alkaline conditions by high precision potentiometric titrations.

Surface titrations were performed on a forsteritic olivine in the pH range 9.5-11.1. It was possible to attain a drift in pH < 0.01 unit h<sup>-1</sup>. Potentiometric and chemical analyses data also showed that the olivine dissolution was low within the studied pH range.

A linear relationship between the hydroxide adsorption capacity and the mass concentrations was established. The amount of hydroxide active surface sites were calculated from the hydroxide adsorption capacity and resulted in  $N_s = 1.88 \pm 0.16$  sites nm<sup>-2</sup>. The titration results were evaluated using the constant capacitance model (CCM). The number of available surface sites was corrected, by using data showing the change in aqueous magnesium concentrations with increasing pH.

The surface characteristics of the olivine particles were further examined using spectroscopic methods and zeta potential determinations. The chemical composition of both freshly ground olivine and samples collected and dried after performed titrations, were analysed using XPS and SEM-EDS. The results from the XPS and SEM-EDS analyses showed upon a Mg:Si atomic ratio of approximately 3:2 and 2:1, respectively. Since XPS is a more surface sensitive analysis method than SEM-EDS, the difference in ratios indicates that the mineral composition of the surface layers was modified, while the bulk of the olivine particles is still unaffected.

This modification of the surfaces may be explained as a serpentinisation of the surface layers, since serpentine has a Mg:Si ratio of 3:2 and is a established weathering product of olivine. The determinations of the zeta potential of the olivine particles showed upon an approximately constant negative charge on the surface within the studied pH range. These findings are also in agreement with a serpentinisation of the olivine surfaces.

## Mineral species controlling the solubility of Al in acid sulfate soil waters

A.M. JONES, R.N. COLLINS AND T.D. WAITE

School of Civil and Environmental Engineering, The University of New South Wales, Kensington, NSW, Australia, 2052

The identification of the mineral species controlling the solubility of Al in acid sulfate waters has presented researchers with several challenges. In many cases this is because the species formed is/are amorphous [1-2]. Additionally, the difficulty in discerning between adsorbed or structural sulfate creates added complexity [3]. Theoretical calculations often indicate the formation of a species matching the stoichiometry of jurbanite - Al(OH)SO<sub>4</sub> [4-8]. Much debate, however, exists as to the reality of jurbanite forming in natural environments, particularly in view of its apparent rare occurrence [2].

Here we describe the use of Al, S and O XANES spectroscopy in characterising the amorphous Al mineral specie (s) which form/s when acidic water derived from acid sulfate soils is discharged into a pH 6–8 buffered estuarine waterbody. In combination with theoretical data analysis and elemental composition over pH 4 - 7, the results indicate that a mixture of amorphous Al hydroxide and basaluminite forms. This finding is important as there is an approximate three-fold increase in the amount of acidity released during the formation of basaluminite and amorphous Al(OH)<sub>3</sub> compared to that released during the formation of jurbanite.

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