Silicon isotopic sytememathics of different weathering profiles, Deccan Traps, India

M. WILLE[1*], M. G. BABECHUK[2], M. WIDDOWSON[3], B. S. KAMBER[2] AND R. SCHOENBERG[1]

[1]Department of Geosciences, University of Tübingen, Germany (*correspondence: martin.wille@uni-tuebingen.de)
[2]Department of Geology, Trinity College Dublin, Ireland
[3]Department of Geography, Environment and Earth Sciences, University of Hull, UK

Chemical weathering of Earth's upper crust cycles most key elements in response to tectonic activity, and climatic and environmental conditions such as soil water residence times, and pH and Eh. Accordingly, different surface weathering regimes around our planet place fundamental controls upon the supply of element to the oceans and associated biosphere. Of the key major elements, Si has particular importance.

Globally, basalt is one of the most widespread and compositionally uniform rock types, accordingly continental flood basalt successions provides a useful natural laboratory for weathering fluxes. Here, we compare two weathering profiles of differing chemical maturity developed upon basalt of the Deccan Volcanic Province, India. We present new Si isotopic data in combination with major and trace element information. High rates of chemical weathering during the Paleogene led to extreme basalt alteration characterising the Bidar profile, with iron-rich lateritic horizons displaying high loss of Si compared to the unweathered protolith. By contrast, the Quaternary age Chhindwara profile displays a much lower degree of chemical alteration, with only small changes in Si concentrations during chemical weathering.

Importantly, the bulk sample Si isotopic variations are relatively small in both weathering profiles. Si isotopic variation associated with increasing kaolinisation is not observed but, crucially, increasing Fe/Al ratios are associated lighter Si isotopic values. The correlation of $\Delta^{30/28}Si_{(soil\text{-}protolith)}$ with Si/Fe with indicates that formation of iron oxides may control Si isotopic varations in both profiles. Further, lower Eh and pH conditions appear to have caused Fe^{2+} migration and iron oxide precipitation associated with Si adsorption at a restricted paleo-water table level in the Bidar profile By contrast, the entire Chindwarra profile was oxic, leading to in situ formation of iron oxides associated with Si adsorption.