Primary structures, petrography and geochemistry of Deccan flood basalts at Anantagiri Hills, Andhra Pradesh, India

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The Cretaceous age Deccan flood basalts of Anantagiri Hills in south India represented by six lava flows show formation of columnar joints as the most conspicuous feature in each basalt flow unit. These flow units, exhibiting columnar structures, enable division into three well defined zones namely: Lower Colonnade Zone (LCZ); Middle Entablature Zone (MEZ) and Upper Colonnade Zone (UCZ). The columns in UCZ are five sided; MEZ separating the UCZ and the LCZ displays four sided intersecting, fanning and fragmented columns while the underlying LEZ has four to five sided vertical columns. These basalts show a mild affinity towards basaltic andesite on the TAS (Na_2O+K_2O vs. SiO_2) diagram, while in the Al-Fe+Ti-Mg ternary plot these basalts plot in the iron rich tholeiitic field. The major and trace element signatures of these tholeiitic basalts are similar to that of the Ambenali Formation basalts, suggesting possible extension of this Formation in SE Deccan Volcanic Province. REE plots define a nearly flat pattern with mild LREE enrichment and negative Eu anomaly. Primitive mantle normalized multielement patterns show mild LREE, LILE troughs positive Ba, Nb and Pb peaks and negative K, Sr and P anomalies in similarity with plume type CFB'S. The well developed sequence of colonnade structures in the different basalt flow units in Anantagiri Hills appear to have formed due to conductive cooling initiated both from the top and bottom portions of these flows. Geochemical signatures shown by these tholeiitic basalt flows suggest that the precursor was probably generated by low degree partial melting of an enriched mantle source.

Ectomycorrhizal fungi and silicate mineral weathering: Characterising nanoscale interactions using AFM

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Ectomycorrhizal (ECM) fungi substantially affect mineral weathering [1, 2]. In order to understand the nanoscale processes occurring at the fungi-mineral interface, we have used Atomic Force Microscopy (AFM) to investigate the interactions of three *Suillus* ECM fungi, *S. bovinus*, *S. luteus* and *S. variegatus*, with sheet silicate minerals.

After 2-3 months of incubation under controlled laboratory conditions, the fungal hyphae and the mineral surface were imaged to nanometre resolution. To assess the effect of the fungi-mineral interaction on the mineral surface, a cleaning procedure was applied to biotite flakes colonised with *S. luteus*; this removed the organic material and exposed the 'reacted' mineral surface for further analysis. The cleaning protocol was also perfomed on a biotite control.

Our results show that all three *Suillus* species generate a large amount of organic material, forming typically a 1-5 nm thick coating on the mineral surface extending over many tens of microns. We have previously observed a similar 'biolayer' with *Paxillus involutus* [3]. AFM images of the cleaned biotite surface (Fig 1a), and the control biotite surface (Fig. 1b), show that both displayed a domain-like surface morphology. However, only on the fungi-colonised surface were round pits found, about 100 nm across and 5 nm in depth (Fig. 1a). These results indicate that the surface pitting is linked to the colonisation of the mineral with *S. luteus*.

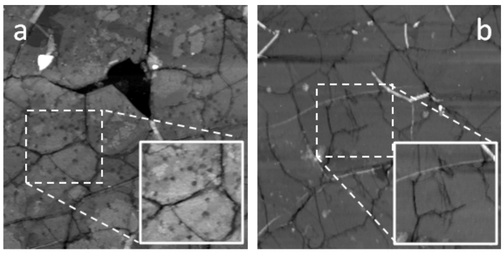

Figure 1: AFM images of a cleaned biotite surface: a) previously *Suillus luteus* colonised flake, note the pitting; b) control flake; field of view 8×8 μm, inserts 2.5×2.5 μm.

[1] Balogh-Brunstad *et al.* (2008) *GCA* **72**, 2601–2618.
[2] Landeweert *et al.* (2001) *TRENDS Ecol Evol* **16**, 248–254.
[3] Saccone *et al.* (2009) *GCA* **73**, A1140.