Effects of mineral type and grain size on EM fungal-mineral interactions

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Ectomycorrhizal Weathering

Ectomycorrhizas (EM) are symbiotic fungal-root associations most prevalent in Boreal coniferous forests. EM fungi play a key role in weathering as they are supplied with large amounts of organic carbon from their host trees. The fungi release large amounts of organic chelators and dominate soil microbial biomass.

Here we report new research to determine (a) EM responses to a range of minerals and, (b) the effect of grain size, and interactions between grain size and mineralogy, in controlling EM fungal colonisation of minerals. This study, for the first time, sought to minimise confounding effects of major changes in air and water-filled porosity that accompany different grain sizes, by using a standard mixture of three grain sizes (<53μm, 53-90μm and 500-1180μm), in which test minerals (apatite, biotite and quartz) and grain size could be independently varied. The minerals were placed in wells in axenic microcosms containing pine seedlings mycorrhizal with *Paxillus involutus*.

Results and Discussion

The pine shoots were pulse-labelled with $^{14}CO_2$ and the allocation of ^{14}C into the wells colonised by *P. involutus,* growing from the roots, was used to measure fungal-mineral interaction intensity. Fungal ^{14}C allocation increased in the order quartz <microcline <granite <gabbro <basalt <limestone <olivine. In the study with three minerals, fungal ^{14}C allocation increased in the order quartz <biotite <apatite. The fungus was responsive to grain size, but the effect was mineral and context-dependent, sometimes being different in mixed grain sizes to single sizes. The results confirm that an EM fungus will focus a significant proportion of the organic carbon it receives from its host plants into growth and interaction with mineral grains, these responses being determined by size and mineralogy of the grains. This specificity of EM fungus-mineral interactions has important implications for studies of weathering in forest soils-indicating that microsites at the scale of individual grains of particular mineralogy may experience intense colonisation and organic acid secretion [1] by EM fungi.

[1] Schmalenberger *et al*. (2009) *GCA*, this volume.

Passive concentration of REE during skarn formation: Example from the Quérigut Massif (Pyrenees, France)

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Skarn formation is generally interpreted as resulting from large chemical mass transfers between sedimentary host-rocks and magmatic intrusions. The occurrence of metasomatic fronts in metacarbonate rocks, associated to large chemical mass-transfers, has been suggested to explain the formation of calc-silicate minerals (e.g.: Cpx, Grt, Wo) in limestone with large SiO_2 input from the intrusive rocks [1, 2, 3, 4,]. Recently, Durand *et al.* [5] proposed another efficient process to explain skarn formation (mineralogical and geochemical evolutions) in metacarbonate xenoliths enclosed inside a granodiorite from the Quérigut Massif (Pyrenees, France): a calcite loss process associated with a passive concentration of chemical elements not related to calcite.

The aim of this study is to understand the REE behaviour during the metacarbonate formation. REE patterns were measured in a metacarbonate xenolith along a profile towards the granodiorite. Bulk-rock analyses indicate that REE contents increase toward the contact zone without any fractionation between LREE and HREE. The REE content evolution can also be modelled by a simple process of calcite loss from the carbonate protolith (up to 90% loss of the initial calcite content for the exoskarn at the vicinity of the contact) inducing a passive concentration of REE. Concerning REE patterns on minerals, we observe that the REE content of the bulk-rock is only dependant of calcite and others new calc-silicate minerals amounts (after mass-balance calculations). These new results reinforce the previous observations explaining the exoskarn formation without large inputs of exotic elements from the granodiorite [see 5]. Moreover, these new observations lead us to explain the enrichment of REE and of some other trace elements in the metacarbonate xenoliths of the Quérigut Massif by a process of calcite loss and passive concentration. This new interpretation of skarn formation would have strong implications in ore formation and economic geology.

[1] Ferry (1982) *Contr. Mineral. Petrol*. **8**, 59-72. [2] Nabelek & Labotka (1993) *Earth Planet. Sci. Lett*. **1198**, 539-559. [3] Gerdes & Valley (1994) *J. Metam. Geol*. **12**, 589-608. [4] Buick & Cartwright (2002) *Contr. Mineral. Petrol*. **143**, 733-749. [5] Durand *et al.* (in press) *Contr. Mineral. Petrol*. DOI: 10.1007/s00410-008-0362-5.