Quantifying chemical weathering at the biotite-mycorrhiza interface

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Up to 80 and 92% of plant families and species respectively exhibit mycorrhizal symbionts with their root system [1]. In return for 20-30% of the carbon fixed via photosynthesis, the mycorrhizal networks transfer a large array of elements to the plants [2]. Mycorrhiza are believed to be responsible for recycling up to 12 % of the terrestrial carbon stock per year and therefore they are major agents of weathering at the Earth's surface. Similar to most soil microorganisms, mycorrhiza bind strongly to mineral surfaces and weathering is thought to be maximal at the microbe-mineral interface. However, so far, the fluxes of elements across this interface and the weathering kinetics due to these interactions are virtually unquantified.

We designed an experiment that replicated the fundamental functionning of the plant-mycorrhiza symbiosis (*Pinus sylvestris* and *Paxillus involtus*, respectively) and their interactions with mineral surfaces under unsatured hydric conditions typically found in soils. From a biotite flake incubated for 3 months, four ultrathin sections of the mycorrhiza-biotite interface were retrieved along an individual hyphae (~ 800 µm in lenght) using a Focus Ion Beam. Si, O, Al, Fe, Mg, and K depth profiles across the interface were quantified at the nanometer resolution by Scanning Transmission Electron Microscopy. In addition, the time-resolved growth of *Paxillus involutus* across the surface of biotite flakes were monitored with a confocal laser scanning microscope. These combined datasets enabled us to derive first estimates of the uptake rates of K, Fe, Mg and Al at the mycorrhiza-mineral interface and to propose a conceptual model for plant-micorrhiza driven weathering under close- to-natural conditions.

[1] Wang & Qiu (2006) *Mycorrhiza* **16**, 299-363. [2] Read *et al.*(2004) *Can. J. Bot*. **82**, 1243-1263.

A century long record of Amazonian Miocene seasonal climate.

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The *Pebas* Formation, an extensive sedimentary sequence that is partially exposed along many contemporary river banks in central Amazonia, provides evidence for a Miocene tropical wetland environment [1]. The Amazon offers enormous potential for the study of the Miocene global palaeoclimate and it has been identified as a target region for detailed Miocene palaeoclimate research [2].

At present few details are known, but stable isotope data from fossil bivalves show seasonal cycles in river water [3], while data from fossil wood points to reduced seasonality [4]. Here we present new stable isotope data ($\delta^{13}C$ and $\delta^{18}O$) of shell carbonate from the largest terrestrial gastropod known to science: *Pebasiconcha immanis* [5]. This animal reached an apparent age of 100 years and provides unique insights into Amazonian Miocene climate.

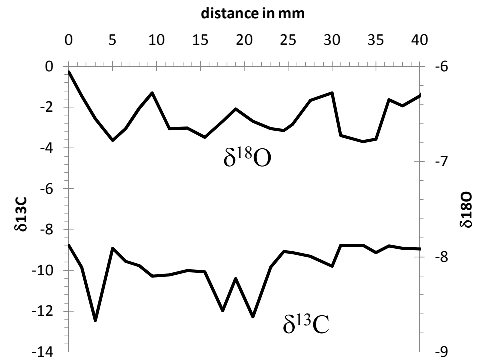

Figure 1: Selection of preliminary $\delta^{18}O$ and $\delta^{13}C$ data, in total 4 seasonal cycles are shown.

Values of $\delta^{18}O$ vary between -6 and -7‰, reflecting dry and wet seasons respectively. Minimum values of $\delta^{13}C$ -12‰ are expected for a diet derived from typical dense tropical rainforest, with shifts to less depleted values reflecting changing in vegetation and/or variation in the animal's feeding behaviour (e.g. canopy effect).

[1] Wesselingh *et al.* (2006) *Scripta Geol.* **133**, 291-322. [2] Lunt *et al.* (2008) *Earth. Planet. Sci. Lett.* **271**, 53-62. [3] Kaandorp *et al.* (2005) *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **221**, 1-6. [4] Pons & De Franceschi (2007) *Bull. Geosci.* **82**, 343-354. [5] Wesselingh & Gittenberger (1999) *The Veiliger* **42**, 67-71.