Dating magma emplacement in the shallow crust

L.P. BAUMGARTNER[1]*, J. MICHEL[1], B. PUTLITZ[1],
O. MÜNTENER[1], U. SCHALTEGGER[2]
AND M. OVTCHAROVA[2]

[1]University of Lausanne, Lausanne, Switzerland
[2]University of Geneva, Geneva, Switzerland
(*correspondence: lukas.baumgartner@unil.ch)

The Miocene Paine Granite in the Torres del Paine Intrusive Complex, southern Chile, is an exceptionally well-exposed bi-modal intrusion. This permits the 3D study of the laccolith. From field relations it is clear that the granite intruded as a series of three major sheets, ballooning the overlaying Cretaceous sediments of the Cerro Toro and Punta Barossa formations. Today, the oldest pulse forms the top, while the youngest intruded at the base of the granitic laccolith. High-precision U/Pb geochronology [1], on single zircons using isotope dilution–thermal ionization mass spectrometry agree with field observations. They yielded distinct ages of 12.59 ± 0.02 Ma and 12.50 ± 0.02 Ma, respectively, for the first and last sheet of the laccolith.

Preliminary stable isotope studies of igneous and contact metamorphic rocks studies of the host rock [2] do not reveal any significant external fluid input (e.g. surface). Fluids seem to be mostly of magmatic origin. This is surprising, since metamorphic studies suggest that the intrusion occurred at a shallow depth of about 2 km. This might be due to the pre-existing metamorphic overprint of the host rocks. Nevertheless, due to its shallow emplacement depth the Paine granites provide abundant field evidence of fluid exsolution from the magma during cooling. Miariolitic cavities can be seen to ascend in the magma in small diapiric structures over distances of a few meters, or tube-like fluid-path-way features resulting in retrograde alteration of the granite. They are restricted to individual (sub-) layers in a pulse. Small dykes injected the host rocks, where they explode after approx. 50 m into a myriad of a few cm to dm thick dykes, each of which terminates in a hydrothermal vein documenting probably explosive fluid release. The fluid producing mechanisms apparently happen in a fraction of the life time of a single pulse, since they are associated with individual pulses, and hence at this time individual fluid release pulses can still not be dated. Nevertheless, high precision ages, careful field, metamorphic, and mineral growth kinetics studies can help to further bracket the timing of fluid release.

[1] Michel *et al.* (2008) *Geology* **36** (6), 459-462. [2] Putlitz *et al*. (2000) *Europ. Jour. Mineral*. **12B1**

Geochemical and microbial effects on depleted uranium metal corrosion in oxic soil

A.C. BAXTER[1], S. SHAW[2], M.N. GARDNER[1],
I.P. THOMPSON[3] AND S.A. JACKMAN[1]

[1]Department of Earth Sciences, University of Oxford, UK
[2]School of Earth and Environment, Unversity of Leeds, Leeds, UK
[3]Department of Engineering, University of Oxford, UK

Understanding the corrosion, transformation and transport pathways of Depleted Uranium (DU) in oxic soil are vital in order to assess the environmental impact of DU metal from munitions. These break-down processes are strongly influenced by the geochemistry, mineralogy and microbiology of the environment. This study aims to determine the relative influence of these factors during DU metal oxidation and transformation within the vadose zone .

Laboratory-based mirocosms experiments were conducted by emplacing DU metal coupons into oxic soil slurries. The experiments were run with two contrasting soil types (boulder clay containing mainly quartz, with minor albite, chlorite, mica, smectite and iron oxyhydroxides; and sandy soil with a 82-90% silica content). Both sterile and non-sterile experiments were conducted in order to determine the effect of soil type and the idigenous microbial population on DU metal corrosion.

Figure 1: Evidence of gas evolution at DU metal surface.

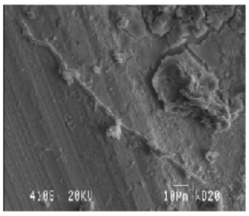

Figure 2: Fungal hyphae on DU metal surface

The microcosms with the indigenous microbial population had significant DU metal corrosion after 6 months. SEM imaging of the corroded surface showed significant corrosion pitting including evidence of gas evolution during the metal oxidation (Fig 1.). Fluorescent microscopy and SEM imaging indicates that microbial communities, both fungal and bacterial, are associated with the metal surface (Fig. 2). However, sterile microcosms showed no corrosion after 6 months, indicating that microbes have a significant effect on the rate of DU metal corrosion in soil.