Nature, origin and causes of Jurassic felsic igneous activity in the Victory Glacier area (Eastern Graham Land)

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Geochemical signatures of felsic igneous rocks (biotite granites and rhyolite dykes) from the Victory Glacier area (eastern Graham Land, Antarctic Peninsula) are mutually indistinguishable, corresponding to high-K calc-alkaline, subaluminous to slightly peraluminous rocks. The NMORB-normalized spiderplots show strong LILE/HFSE enrichment typical of magmas generated at active continental margins or having originated by anatexis of mature continental crust. Characteristic are also fractionated chondrite-normalized REE patterns with deep negative Eu anomalies. The Sr–Nd isotopic signatures are those of fairly evolved crust ($^{87}Sr/^{86}Sr_{175}$ = 0.7084–0.7107, ε^{175}_{Nd} = -4.4 to -4.8). Taken together, the felsic rocks most likely originated from highly differentiated magmas derived by low-P (residue lacking Grt), low-T (Mnz and Zrn saturation temperatures ~770 °C) anatexis of metapsammites or orthogneisses. The widespread crustal anatexis took place within attenuated crust, as a part of the Chon Aike silicic large igneous province [1] magmatism.

New U–Pb Zrn dating shows that the Jurassic magmatic flare-up was rather short-lived (Toarcian–Aalenian). The two recognized Bt granite generations (~185/~166 Ma) both pre- and post-dated the rhyolitic volcanism (~174–179 Ma).

Field relationships indicate that the rhyolite dykes were emplaced in a biaxial extension deformation regime. The appropriate tectonic setting was either rifting accompanying mantle-plume-assisted Gondwana break-up [2] or extension behind the emerging Antarctic Peninsula arc [3]. The two scenarios do not have to be mutually exclusive, though [1, 4].

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A physiochemical analysis of the mechanisms for transport and retention of Technetium (^{99}Tc) in unsaturated Hanford sediments

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The transport of technetium (^{99}Tc) is of interest due to the potential for human exposure and impact on ecosystems. Technetium has been released to the environment predominantly through nuclear fuel processing; as a result, further spreading of ^{99}Tc is a concern at DOE sites across the US. Specifically, technetium is a contaminant of concern at the Hanford Site in southeastern Washington, due to the magnitude of material that was disposed. The current body of work conducted on ^{99}Tc has provided a wealth of information regarding the redox relationships, sorption, solubility, and stability of the mineral phases [1], however little work has been conducted on the transport of technetium under vadose zone conditions.

The current conceptual model for technetium transport in the Hanford deep vadose zone is driven by two dominant hypotheses. The first component, proposes technetium movement is dominated by anisotropy and capillary forces; with the mobile technetium spreading laterally across higher conductivity saturated zones and being resisted by low saturation high conductivity zones. Within these regions technetium transport is considered highly dependent on the unsaturated hydraulic conductivity and capillary pressure. Thus, understanding saturation dependent technetium transport is critical for estimating the vertical fluxes of technetium and predictive modelling. The second premise assumes that technetium is in the form of the oxic pertechnetate species. Using an integrated testing approach we examined the mechanisms for physical and chemical retention and transport of technetium in unsaturated sediments. By employing transport and breakthrough curve analysis as well as pore water and sequential extractions, we evaluated transport behaviour, technetium mineral association, and technetium leachability with regard to pore size distribution.

[1] Artinger *et al*. 2003; Beals and Hayes, 1995; Cui and Eriksen, 1996b; Gu and Schulz, 1991; Jaisi *et al*. 2009; Keith-Roach *et al*. 2003; Kumar *et al*. 2007.