

Rey (2013) proposes a similarity between the GAB and areas of Mars studied by various rovers and suggests the Australian outback could be an analogue for Mars. While there is a superficial similarity in mineral assemblages, looking at major- and trace-element behaviour shows the two areas are quite different. On Earth, weathering proceeds through dissolution of minerals to either dispersion of soluble elements or concentration of the less soluble. This is manifest in GAB weathering profiles by loss of Na, K, Mg, etc. from weathered profiles but retention of Fe and other trace elements such as Th in iron-stones. Dickson & Scott (1997) found weathering of basalt led to soils with depleted K and enriched Th, whereas U concentrations were static. The aerial gamma-ray map of Australia (Minty *et al.* 2010) shows that a large fraction of Australia has a Th-rich signature as a consequence of this process. In marked contrast, satellite gamma-ray surveying of Mars shows that K and Th remain in close association, and there is no evidence of widespread dissociation of these two elements (Taylor *et al.* 2006). The moon shows a similar correlation of K and Th to Mars although with a quite different ratio (360 compared to 5500), but the dispersion of values about the correlation is similar.

Other indications of the low water/rock ratio of Martian alteration can be seen in the common mixture of calcium and magnesium sulphates in some areas. The calcium sulphates have low solubility, whereas magnesium sulphates are extremely soluble. A mixture of these salts is difficult to achieve even under laboratory conditions, as calcium sulphates will precipitate long before magnesium sulphates that can form dense brines and be transported from the original deposition site by gravity-induced flow. This is the mechanism by which the many gypsum lakes in Australia form, and similar processes would be expected on Mars if surface evaporation were to occur. The admixture of two salts of widely varying solubility is an indication of *in situ* formation and lack of sufficient water to induce transport.

In reality the only place on Earth which could be an analogue for Mars are the cold and dry, “Dry Valleys of Antarctica” (Salvatore *et al.* 2013). Most of the geochemistry of Earth is dominated by abundant water and an oxygenated atmosphere leading to transport and concentration. In contrast, the data indicate that on Mars there are local, *in situ* reactions with low water-rock ratios and a puzzling oxidising environment possibly related to the effect of high-energy cosmic radiation over long time periods.