Intracratonic carboniferous granites in the Paleoproterozoic crust of Lithuania: New SHRIMP U-Pb zircon ages

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Employing a Sensitive High-Resolution Ion Microprobe at Korea Basic Science Institute, we found Carboniferous granite previously unknown in the Paleoproterozoic crust of western Lithuania. The granite sample was recovered from a deep drill hole, Girkaliai-2, which is situated 3 km to the east of the Baltic Sea, within the Telsiai deformation zone. In the drill core, the analyzed granite forms a 10-cm wide dyke intruding the Paleoproterozoic charnockitic rocks. It is medium to fine-grained and consists of K-feldspar, plagioclase, biotite, and quartz. Accessory phases include monazite, zircon and opaque minerals. The contact between the granite and the host charnockite is straight and sharp. Two groups of zircon grains have been recognized in the granite. Zircons of major group are prismatic in shape and show concentric and oscillatory zoning characteristic of magmatic growth. Their U/Pb ratios are 0.81-2.15, and the U contents are 57-156 ppm. A weighted mean $^{206}Pb/^{238}U$ age of 349.1±5.7 Ma (MSWD=3.2) was obtained from 12 spots. The second group of zircons yielded concordant U-Pb ages of 2042, 1880, 1846, 1726, 1630, and 1455 Ma. These grains represent xenocrysts entrapped from various country rocks during the granite emplacement. Our U-Pb zircon ages demonstrate that the Paleoproterozoic crust in western Lithuania has been affected by Early Carboniferous magmatism. The Girkaliai granitic dyke is similar to the 355 Ma diabase dykes in the eastern Baltic offshore [1], and the ca. 350 Ma alkaline-carbonatite intrusions in Poland such as Elk, Pisz and Tajno. Thus, all of these Carboniferous ages are attributed to the intracratonic magmatism associated with Paleozoic rifting in the East European craton [2]. This is a contribution to the project 'Precambrian rock provinces and active tectonic boundaries across the Baltic Sea and in adjacent areas' of the Visby Programme (the Swedish Institute).

[1] Motuza *et al*. (1994) *Geologija* **16**, 16–20. [2] Wiszniewska *et al*. (2010) *Abst. Vol. of Goldschmidt Conf.*

Microbial sulphur isotope fractionation in a Mars analogue environment at Rio Tinto, SW Spain

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Sulphur isotopes are likely to be a key in future tool for the detection of past or present life on Mars, where abundant sulphate minerals are present. To investigate the link between the activity of sulphate reducing microorganisms and sulphur isotope fractionation, we incubated sediment from a modern hyper-acidic, Fe-rich subareal environment at Rio Tinto, SW Spain. This site has been frequently used as a geochemical analogue of Mars.

Sediments were sampled from the upper part of the Rio Tinto (Marismilla) as wel as the estuary (Moguer). Laboratory incubation were carried out at 30°C using an artificial input solution with sulphate in excess and following techniques developed by Stam *et al*. [1]. The experiments were performed with an input solution at pH 7 and pH 3 and electron donors were provided by the natural substrate. Duplicate reactors were incubated for a total of 10 weeks. Initial data indicate moderate sulphate reduction rates of between 5 and 90 nmol cm^{-3} h^{-1} in Marismilla and between 5 and 45 nmol cm^{-3} h^{-1} in Moguer, independently of pH. Outflow solutions showed pH close to 7, regardless of inflow pH of 7 or 3, suggesting buffering within the sediment. Sulphur isotope fractionation was extreme in the Moguer estuary, extending beyond the maximun of 47‰ as predicted by the standard Rees model [2] of microbial sulphur isotope fractionation, suggesting that additional fractionation is possible [3] or indicating multiple cycles of reduction and oxidation of sulphate within the reactors. And inverse correlation between sulphate reducing rates and isotope fractionation was observed.

[1] Stam, M.C. *et al*. (2010) *Chemical Geology* **278**, 23–30. [2] Rees, C.E. (1973) *GCA* **37**, 1141–1161. [3] Brunner, B. Bernasconi, S.M. (2005) *GCA* **69**, 4759–4771.