REE deposits in China

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Rare earths are relatively abundant in the Earth's crust, but discovered minable concentrations are less common than for most other ores. China, the United States, Russia, India, Malaysia and Brazil constitute the largest percentage of the world's rare earth economic resources. The REE deposits in China are mainly related with carbonatite-alkaline complexes, weathered granite and placer (Fig. 1). The Bayan Obo is largest LREE deposit in the world, and its reserves are more than 13500 Mt. LREE deposits in carbonatite-alkaline complexes from Panxi region (West China) and Miaoya (Central China) are also large. The weathered granite-type REE deposits in South China are characterized by REE, especially HREE adsorption in clay minerals. The origin of Bayan Obo deposit is disputed, including carbonatite magmas, sediment, and carbonatite-derived fluid mixing sediment [1]. Studies suggested that the anomaly high REE compositions in mantle source and mineral fractional crystals and carbonate cumulate processes are key cases for the REE deposit formation related with carbonatite-alkaline rocks [1, 2]. The weathered REE deposits in South China were formed by leaching granites, and REE adsorbed by clay minerals. The precondition requires the granites contain abundant REE minerals. But how the granite can produce the primary REE minerals is not clear. Granite is quite normal rock in world, but not all of them can supply sufficient REE for mineralization. It is necessary to study the primary granite magma type REE deposits.

[1] Xu et al. (2008) *Lithos* **106**, 12-24. [2] Xu et al. (2010), *Lithos* **118**, 145-155.

Re-Os geochronology of black shale from the Barents Sea: Refining the Triassic time scale

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Stage boundaries in the currently accepted Triassic time scale differ by as much as 8 Ma from those in a proposed "alternate" Triassic time scale [1]. Re-Os isochron ages combined with biostratigraphy for black shales from Kong Karls Land, Spitsbergen, and Svalis Dome in the Barents Sea help resolve these differences.

Drill core samples of black shales of the upper Ladinian Botneheia Formation next to the Kong Karls Land (easternmost Svalbard archipelago) [2], inferred to be near the Ladinian-Carnian boundary, yield a precise Model 1 Re-Os isochron age of 239.2 ± 0.4 Ma. Another section from 8 meters deeper in the same drill core yields a less precise but nominally younger age of 237.1 ± 2.3 Ma, though the two ages overlap within uncertainty. The black shale section from a nearby drill core [2], inferred to be the Carnian Tschermakfjellet Formation, yields a Model 1 age of 228.9 ± 1.4 Ma. In a previous study at Svalis Dome in the Barents Sea [3], a Re-Os isochron age of 239.3 ± 2.7 Ma was determined for the Botneheia Formation, shown by palynology to be uppermost Anisian. Together these results suggest a very short duration for the Ladinian Stage (a few million years), and support the "Alternate Time Scale for the Triassic" proposed by Ogg et al. [1], where the Ladinian Stage is from 240.5 to 236.8 Ma.

Our results affirm the utility of the Re-Os chronometer for dating black shales and correlating paleogeographically separated regions in absolute time.

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[1] Ogg et al. (2008) *The concise geological time scale*. Cambridge University Press, 177 pp. [2] Riis et al. (2008) *Polar Research* **27**: 318-338. [3] Xu et al. (2009) *EPSL* **288**: 581-587.