Hydrothermal synthesis of lentil shaped $ThSiO_4$ nanoparticles

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We synthesized thorite ($ThSiO_4$) by a hydrothermal route for which we have adapted the protocol used by Fuchs and Hoekstra [1]. All samples were investigated by XRD and show the successful formation of $ThSiO_4$, molecular composition was confirmed by EDX. IR as well as DTA measurements suggest the well known phenomenon of the presence of H_2O in the crystal lattice in some samples. Complete new insight was obtained through SEM investigations, which reveal a rather unusual morphology of the synthesized $ThSiO_4$. Particles are uniform in size, lentil shaped and are 150 – 400 nm along the longest dimension. After heating up to 1000°C the shape and size of the particles remains merely unchanged.

The size of the nanoparticles, as well as their consistency can be influenced by synthesis temperature, concentration and pH-value. Therefore, particle growth most probably follows kinetically controlled mechanisms. However, further investigations and comparison to calculated data are essential. With the synthesis of $ThSiO_4$ being successfully accomplished, work on substituting Th for U is in progress, currently we are investigating the potential of UF_4 as a precursor for this matter.

[1] L.H. Fuchs, H.R. Hoekstra (1959) *Am. Min.* **44**, 1057-1063.

Recycling of juvenile supracrustal rocks in Mesozoic batholiths: Implications for crustal growth

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The Mesozoic batholiths of the circum-Pacific region represent voluminous production of granitic crust; however, the proportion of these granitic batholiths that are re-worked, continental crust, versus young, recycled supracrustal rock (volcanogenic sedimentary rocks or ocean crust), remains uncertain.

Oxygen isotopes are particularly well suited to detect recycling of young rocks that have been hydrothermally altered at Earth's surface before being buried and re-melted. Moreover, because such rocks may be recycled before significant ingrowth occurs in radiogenic isotope systems, $\delta^{18}O$ and radiogenic systems can be decoupled.

Oxygen isotope studies of zircon in the Sierra Nevada batholith (SNB), California [1], show the highest $\delta^{18}O$ values (typically >7.0‰) in the Early Cretaceous western SNB, and the largest range of values, 5.3–8.7‰. $\delta^{18}O$ is commonly anti-correlated with radiogenic systems, indicating a significant (up to 20%) component of juvenile rocks in early arc magmas. In contrast, eastern SNB magmas, including the Late Cretaceous Sierra Crest magmatic centers, are typically lower $\delta^{18}O$ (<6.5‰) and vary by less than 1‰; radiogenic systems suggest greater input of age rock, likely lithospheric mantle [2], and not North American continental crust. The overall pattern of lower and more uniform $\delta^{18}O$ with time shows increasinly efficient magmatic recycling of pre-existing wallrock and hybridization with mantle derived magmas that averaged out $\delta^{18}O$ heterogeneity in the Sierran arc.

Thus, the contribution of juvenile supracrustal rocks to Mesozoic batholiths appears more significant that previously thought. Moreover, when accreted terranes are recycled in convergent margin arcs, an intermediate refinement step facilitates the conversion of juvenile arc terranes to granitoid crust. Recent work in other Mesozoic batholiths shows similar reworking of such rocks, suggesting the process is common operative, and an important step in the conversion oceanic arcs to continental crust.

[1] Lackey *et al.* (2008) *J. Petrol* **49**, 1397–1426. [2] Coleman *et al.* (1997) *I. Geol Rev.* **39**, 768–787.