Recycling deep cratonic lithosphere and generation of intraplate magmatism

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Recycling continental lithosphere via foundering is suggested to be an important geodynamic process but is difficult to document (Sobolev *et al*., 2005). Here we show that Early Cretaceous alkaline picrites and high-magnesium basalts from the North China craton provide evidence for such recycling. These mantle-derived lavas contain both xenocrystic and magmatic olivines. The former have high Fo_{92-93} and low CaO (<0.10%) and suggest derivation from the Archean mantle lithosphere. More importnatly, these lavas contain unusual reversely zoned clinopyroxenes. Compositions of their low Mg cores and high Mg mantles are consistent with crystallization from eclogite- and peridotite-derived melts, respectively. The cores are high in Na_2O (up to 2.4%) and frequently contain ilmenite exsolution lamellae, whereas the mantles are low in Na_2O (<0.92%) and lamellae-free. These lines of evidence suggest that the cores formed at a significantly greater depth (≥2.5 GPa) than the surrounding mantles (≥1.5 GPa). The whole-rock compositions of the basalts also contain chemical evidence (high Ni/Cr, Fe/Mn, Sr/Y La_N/Yb_N, and Th/U ratios and low Lu/Hf ratio) for their derivation from an olivine-free source and incorporation of melts derived from foundered eclogitic lower continental crust. Together with our previous studies of the late Jurassic high-Mg intermediate to felsic lavas from western Liaoning in the northeastern North China craton (Gao *et al*., 2004), these findings indicate that thinning of the North China craton was caused by recycling of the lower lithosphere (mantle and lower crust), and demonstrate that continental lithosphere recycling is a viable means of producing mantle heterogeneity.

References

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The building-up exercise of a thermodynamic data set on ISA-actinide system

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Isosaccharinic acid (ISA) is one of the most important degradation products of cellulose expected in the hyperalkaline conditions defined by cementitious environments. Despite the high affinity shown by this ligand toward actinides complexation, the number and reliability of available experimental studies is still limited (Hummel *et al*., 2005). Due to the potential effect of these complexes in the performance assessment exercises, this work aims at providing a comprehensive and coherent thermodynamic data set on the ISA-actinide system. For this purpose, the thermodynamic data available in the literature have been complemented with further modelling exercises and estimations based on ionic radii correlations among actinides.

Under slightly reducing conditions and absence of carbonate and calcium, $M(OH)_xISA_y$ ternary complexes (M= Th, U(IV), Np(IV), Pu(IV)) are expected to dominate aqueous speciation. The available publications show a moderate agreement among the stability constants of these complexes, although their structure is still ill-defined and some authors propose complexation reactions where the alcohol groups of ISA are partly deprotonated. Under hyperalkaline conditions and the presence of calcium, the species $CaM(OH)_4ISA_2(aq)$ has been described for Th and may dominate aqueous speciation of further tetravalent actinides.

The limited number of experimental studies assessing the complexation of An(V) and An(VI) with ISA indicates the possible formation of $An(V)O_2(OH)_x(ISA)_y$- and $An(VI)O_2(OH)_x(ISA)_y$-like complexes.

This work has allowed to obtain a complete set of stability constants for complexes of ISA with tetravalent actinides under alkaline to hyperalkaline conditions. Similarly, stoichiometries and stability constants for An(V)-ISA and An(VI)-ISA complexes have been proposed, although further experimental efforts would be advisable to gain confidence on these complexes.

Reference

W. Hummel *et al.* (OECD-NEA TDB), *Chemical Thermodynamics of Compounds and Complexes of U, Np, Pu, Am, Tc, Se, Ni and Zr with Selected Organic Ligands*, Elsevier, 2005