The Geochemistry of London

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The population of the Greater London area is expected to grow from 8.2 million in 2013 to >9 million in 2020. London sits on complicated Quaternary superficial deposits including gravels and sands of the Thames and older deposits such as the London Clay, which overlie the chalk basement, the major aquifer of SE England. The superficial deposits include a legacy of pre- and post-industrial hazardous waste and there is also local chemical contamination in groundwater.

As geochemists we must identify and provide workable solutions to removing legacy pollutants and more importantly industrial infrastructure and agricultural development of the UK and worldwide must increasingly be underpinned by solid baseline data in order to provide solutions to environmental issues.

BGS has undertaken a systematic high-density geochemical soil survey of the Greater London Area the "London Earth" project aiming to give insight into the environmental impacts of urbanisation and industrialisation as well as to characterise the geochemical baseline of the Europe's most populous city. We must communicate to councils, developers and the general public of any environmental or health risks. It is urgent that as geochemists we assess these baselines and monitor the subsurface using new sensor networks.

Experimental partitioning behavior of MORB in subduction zones at 2 and 3 GPa

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Arc volcanic rocks show a typical geochemical signature of fluid-mobile trace element enrichments such as LILE (K, Rb, Cs, Ba). It is assumed that there is an apparent correlation between the structure and composition of the subducting oceanic lithosphere and the composition of subduction zone magmas. The slab components contributing most to the metasomatism of the wedge peridotite are the hydrated igneous oceanic crust and the sediment layer overlying it with notably high trace element concentrations. The mobility of these elements depends on both the nature and composition of the transfer agent and the phase assemblage of the residue.

To investigate the major and trace element budget within subduction zones, we conducted piston cylinder experiments at 2 and 3 GPa and 700 to 1200°C on a K-free, water-saturated and trace element-doped basaltic (pristine) MOR composition. Mobile phases are collected by the employment of diamond traps and subsequently analysed by the cryogenic LA-ICP-MS technique [1] to quantify major and trace element compositions of fluids and melts.

For K-free MORB compositions we find that the solidus lies between 800 and 850°C at 2 and 3 GPa, subsolidus phase assemblages consist mainly of the hydrous phases amphibole and epidote. Garnet, clinopyroxene and rutile, a typical eclogitic phase assemblage, is stable at higher, supersolidus temperatures. We present new results on the trace element partitioning behavior between liquids and mineral phases. In agreement with previous studies, we find that garnet is strongly controlling Heavy REE, while rutile and titanite (2 GPa, 700°C) hold back HFSE ($D^{solid/fluid} \geq 10$). Additionally we find staurolite being stable at 3 GPa and 700°C that incorporates HFSE as well as Th. Epidote is an abundant phase at PT-conditions where we suggest an aqueous fluid being released from the dehydrating slab, it strongly incorporates Light REE, Th and to a lesser extent U ($D^{solid/fluid} \geq 100$). These new experimental results are utilized in forward modelling to quantify element mobility in subduction zones.

[1] Kessel K. *et al.*. (2004) *Am. Mineralogist*, **89**, 1078-1086.

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