Melt evolution in Li-F granites as revealed by quartz-hosted melt inclusions (Orlovka massif, Russia)

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Orlovka and Spokoinoye are satellite intrusions of the Khangilay massif of biotite granite. Despite their likely connection to the Khangilay at depth, the satellites are geochemically distinct. Orlovka is a strongly differentiated intrusion of Li-F granites with a layer of Li-depleted albitite underlying lepidolite-amazonite-albite granites with Nb-Ta ore deposits. Spokoinoye consists of muscovite-albite granite with W-Sn mineralisation. Bulk-rock and mineral chemistry of the intrusions were studied by Syritso and Badanina (2001). To get better constraints on melt evolution we have studied quartz-hosted melt inclusions in the full range of rocks from the earliest to the most evolved.

Melt inclusions are crystallised and composed of daughter minerals (mostly feldspars and Li-Fe micas). Inclusions were homogenised to glass by heating in cold-seal rapid–quench pressure vessels at 650-750 ºC and under 0.2 GPa pressure to prevent decrepitation. Quenched glasses were analysed by electron microprobe.

Compositions of the least-evolved melts from the three intrusions are similar and correspond to peraluminous granite. Low totals of the analyses suggest ca. 8-10 wt.% of dissolved H_2O. Melt evolution in Orlovka is characterised by strong enrichment in F (up to 1.8 wt.%) and B_2O_3 (up to 2.1 wt.%). The alumina saturation index (ASI) increases from 1.3 to 1.6. Orlovka inclusions show significant variations in molar Na/K values. These increase from 1.2 in the parental two-mica granite to 2.8 in evolved muscovite- and lepidolite-amazonite-albite granites, and drop to 0.31 in inclusions from the latest pegmatite veins. The variations of K do not correlate with Rb, which shows a continuous increase from 790 to 3600 ppm. Melts from Spokoinoye have uniform Na/K at about 1.5, ASI of 1.2 and F contents below 0.1 wt.%.

Our results show that the geochemical differences between Orlovka and Spokoinoye, as well as the spectacular layering of Orlovka originated at the magmatic stage, but cannot be explained by fractional crystallisation alone. Evolved melt inclusions in Orlovka are similar to experimental melts in equilibrium with feldspar, quartz and immiscible cryolite liquid (Gramenitskiy and Shchekina 1994), and inclusions of a dense hydrosaline melt are found in greisen at the roof of Orlovka. Thus, in Orlovka liquid immiscibility is plausible at the latest stages of evolution.

References

Syritso L.F. and Badanina E.V., (2001), *Petrol.*, **9**, 268-289.

Gramenitskiy Ye.N. and Shchekina T.I., (1994), *Geochem. Int.*, **31**(1), 52-70.

Change in seawater chemistry across the Pliensbachian-Toarcian boundary: Pre-conditioning for an Oceanic Anoxic Event ?

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Elevated rates of global extinction of benthic fauna occurred during the Pliensbachian–Toarcian boundary interval of the Lower Jurassic, a period of eustatic sea level rise preceding an Oceanic Anoxic Event (O.A.E.). The early Toarcian O.A.E. is defined by the world-wide deposition of black shales representing elevated burial rates of organic carbon. The cause of this large perturbation in the carbon cycle remains unknown.

Belemnite calcite offers the best preserved window into the geochemistry of the Mesozoic oceans due to its resistance to post-depositional alteration by burial fluids. We report records of trace element variation in belemnite calcite collected from the Yorkshire Coast, UK. The most striking feature of these records is a synchronous excursion from the background levels characterising the *margaritatus* ammonite zone to low values for Mg/Ca, Sr/Ca, Na/Ca, and K/Ca, in contrast to concurrent excursions to higher values for Li/Ca and the previously published $\delta^{18}O$ record (McArthur *et al.* 2000). The shift begins in the *spinatum* zone, 'excursion' values are sustained throughout the *tenuicostatum* zone, before returning to background values across the *tenuicostatum* – *falciferum* zone boundary. Pre and post excursion values are identical for each of the element/calcium records and $\delta^{18}O$. A secondary feature of the records is that the major excursion described above is bracketed above and below by minor inverse deviations from background levels.

The records are discussed in terms of changes in the temperature and chemistry of seawater and reveal that the Toarcian O.A.E. is likely to be the end result of a sequence of oceanographic changes occurring over a period of ~ 1.m.y. It is suggested that the *tenuicostatum* zone geochemical excursion represents a shift in seawater chemistry that reflects global oceanographic change triggered by eustatic sea level rise. This change is postulated to have caused the extinction of benthic fauna and to have pre-conditioned the oceans for the subsequent O.A.E. by the introduction of nutrients to the global continental shelves.

References

McArthur J. M., Donovan D. T., Thirlwall M. F., Fouke B. W., and Mattey D. (2000). Earth and Planetary Science Letters. 179 (2), 269 – 285.