Genesis of Fe- and Ni-rich intraplate magmas related to Ni deposits

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Intraplate magma suites associated with several important Ni deposits (Pechenga, Noril'sk, Jinchuan, Raglan) are intimately related to ferropicrite magmas sensu stricto or more voluminous but still unusually Fe- and Ni-rich tholeiitic suites. The causes of the high Ni contents in ferropicrite and related magmas, and the reasons for the common occurence of these magmas in intraplate settings, remain controversial. Ferropicrites may be generated by partial melting of exceptionally Fe-rich peridotite at moderate pressures. In this scenario high melt Ni in the presence of residual olivine is accounted for by high degrees of partial melting. Commonly observed high concentrations of incompatible elements and depletion in Al and HREE are difficult to reconcile with this scenario, as is the occurence of Fe-rich peridotitic mantle itself. The other type of explanation proposes that ferropicrites are produced by partial melting of eclogite or as the reaction products of melts derived from eclogite mantle with peridotite. In this scenario, the mantle residue of ferropicritic magmas lacks olivine, causing less compatible behaviour of Ni and allowing for high Ni concentrations in the melt. The proposed presence of residual garnet accords with Al- and HREE-depleted signatures in the melt, whereas high overall abundances of incompatible elements are consistent with participation of eclogite in the melting reactions. I propose here that the entire range of magma types reported from the localities mentioned above can be considered as members of a continuum from meimechites at one extreme and ordinary Mg-rich continental tholeiites at the other, all resulting from melting of various proportions of eclogite and peridotite in ascending mantle plumes.

Future CCD and CSH variations: Deep-sea impact of ocean acidification

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The evolutions of atmospheric CO_2 partial pressure (pCO_2) and of the carbonate compensation depth and the calcite and aragonite saturation horizons (CSH and ASH, respectively) have been studied with the coupled ocean-sediment model MBM-MEDUSA [1], over the next 50,000 years. MBM-MEDUSA includes a full description of sedimentary exchange processes, taking into account chemical carbonate erosion in a consistent way. The adopted emission scenarios were based upon logistic functions [2], considering total emissions of 500, 1000, 2000 and 4240 GtC); the adopted stabilisation scenarios were the S350, S450, S550, S650 and S750 from the IPCC [3]. While the evolutions of atmospheric pCO_2 and *p*H have got a great deal of attention so far (e.g., [4, 5]), only a few studies have considered the saturation horizons [5, 6], and, to our best knowledge, this is the first study also focusing on compensation depth variations.

Simulation experiments were started with a 50,000 year spin-up to 1750 A.D. (at steady state). This state was characterised by an atmospheric pCO_2 of 277 ppm, a CSH depth of 3350 m and a CCD of 4300 m (in the Indo-Pacific, which can be considered the most representative reservoir for the global ocean).

In all experiments, we found that CCD variations were considerably greater than CSH variations. The 500 GtC emission scenario yielded CSH and CCD maximum shoalings of 450 and 800 m, respectively, in the year 3400 A.D. about; with the 4240 GtC emission scenario, both CSH and CCD became shallower than 500 m in 2650 A.D. With the highly optimistic S350 stabilisation scenario, CSH and CCD become even shallower than with the 500 GtC emission scenario (650 m and 1000 m shoaling, respectively), although in the year 5000 A.D. only. For the close-to-CO_2-doubling scenario S550, CSH and CCD shoaled by about 1950 and 2450 m (to depths of 1400 and 1900 m, respectively). As a result, most of the sea-floor environment bathed in water that was highly corrosive to carbonate material. In the S650 and S750 scenarios experiments, the CCD becomes shallower than 500 m, leaving little space for benthic carbonate producers to survive.

[1] Munhoven (2007) *Deep-Sea Res. II* **54**, 722–746. [2] Bacastow and Dewey (1996) *Energy Convers. Mgmt.* **37**, 1079–1086. [3] *IPCC* (1994) *Climate Change 1994*, Cambridge University Press. [4] Caldeira and Wickett (2003) *Nature* **425**, 325–325. [5] Orr *et al.* (2005) *Nature* **437**, 681–686. [6] Cao and Caldeira (2008) *Geophys. Res. Lett.* **35**, L19609.