

## $(^{234}\text{U}/^{238}\text{U})$ and $(^{230}\text{Th}/^{238}\text{U})$ disequilibria in fresh and altered Kolbeinsey Ridge basalts

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Here we report measurements of U and Th isotopes for 27 young (<10 ka) mid-ocean ridge basalts (MORB) from the slow-spreading Kolbeinsey Ridge north of Iceland (67°05'–70°26'N). The basalts display both  $(^{230}\text{Th}/^{238}\text{U}) < 1$  and  $(^{230}\text{Th}/^{238}\text{U}) > 1$ , with  $(^{230}\text{Th}/^{238}\text{U})$  ranging from 0.95 to 1.30. Kolbeinsey Ridge samples lie in a narrow range of  $(^{230}\text{Th}/^{232}\text{Th})$  (1.20 – 1.32) with a correspondingly large range in  $(^{238}\text{U}/^{232}\text{Th})$  (0.94 to 1.32), producing a horizontal array on a  $(^{230}\text{Th}/^{232}\text{Th})$  vs.  $(^{238}\text{U}/^{232}\text{Th})$  'equiline' diagram. Kolbeinsey Ridge Nd, Sr, Hf, and Pb isotopic compositions are relatively depleted and show a limited range (e.g.  $\epsilon_{\text{Nd}} = +8.4 - +10.5$ ,  $^{87}\text{Sr}/^{86}\text{Sr} = 0.70272 - 0.70301$ ,  $\epsilon_{\text{Hf}} = +15.4 - +19.6$ , and  $^{208}\text{Pb}/^{206}\text{Pb} = 2.043 - 2.095$ ). We measured  $(^{234}\text{U}/^{238}\text{U}) > 1.005$  in 12 basalts, likely reflecting post-depositional contamination by chemical interaction with seawater. Our measurements further show that samples with low  $(^{230}\text{Th}/^{238}\text{U})$  have high  $(^{234}\text{U}/^{238}\text{U})$ , whereas Kolbeinsey MORB with  $(^{234}\text{U}/^{238}\text{U})$  of unity have universally high  $(^{230}\text{Th}/^{238}\text{U})$ . The correlation between  $(^{234}\text{U}/^{238}\text{U})$  and  $(^{230}\text{Th}/^{238}\text{U})$  for Kolbeinsey lavas suggests a systematic alteration process affecting both U and Th isotopes in these MORB.

## Effects of retrogression on trace element contents of metabasites, Ile de Groix, France

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The metabasites of the Ile de Groix - part of a Hercynian HP/LT metamorphic belt - constitute the remnants of subducted oceanic crust. Trace elements contents in the blueschist GR 25a and the nearby outcropping retrograde greenschist GR 25b (whole rock and minerals) were analysed by LA-ICP-MS [1] to understand the behaviour of trace elements during retrogression.

Analyses and mass balance calculation indicate that at blueschist facies conditions, garnet is the main host for HREE, while epidote contains more than 95 % of Th, U, Pb, Sr and LREE. MREE are also preferentially incorporated into epidote. Ti and Nb are concentrated in rutile and titanite, the latter being also rich in HREE. Cs, Rb and Ba are hosted in phengite. The contribution of amphiboles (glaucofan, barrosite and actinolite) and iron oxides in the trace element mass balance is negligible. During the retrogression, garnet became unstable and was partially altered to chlorite. HREE liberated from garnet alteration were mainly trapped in newly formed titanite, whereas retrograde albite contains Sr and Ba.

The comparison of whole rock compositions between blueschist and retrogressed greenschist shows that the REE and HFSE have been largely immobile, whereas the LILE contents must have changed. REE and HFSE were not able to leave the system during retrogression, since these elements are mainly hosted by epidote and titanite that remain stable under retrograde conditions. The contents of Rb, Ba, K contents and, to a lesser extent, the contents of Th and U, have decreased during the retrogression. This can be interpreted as a result of partial mobilisation of these elements during interaction with the fluid responsible for the rehydration of the rock. The isothermal decompression associated with the rehydration process has led to the breakdown of phengite and crystallisation of a second generation of phengite. During this process, a part of the LILE content was incorporated into newly formed minerals (albite and phengite II), while some amount of the LILE sequestered into the percolating fluid has left the rock.

[1] El Korh *et al.* (2009) *Journal of Petrology*, (submitted).