Si-in-rutile observed in eclogites from Dabie-Sulu orogen: Another evidence of UHPM

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Rutile, an important accessory minaral in ultrahigh pressure metamorphic (UHPM) rocks, served as the blackbox in aircrafts, can provide much geochemical information. Trace elements of rutile in eclogites from Shuanghe, Yanwo, Maowu (Dabie orogen), Donghai (Sulu orogen) and the main hole of Chinese Continental Scientific Drilling Project are analysed by LA-ICP-MS. We observed that silicon content of rutile is higher (0.1-0.4 wt%, average value 0.23 wt%), whereas other rock-forming element contents are usually not as high as silicon, such as Al (120 ppm), Mg (190 ppm), Ca (122 ppm), Na (22 ppm), K (6 ppm), Fe (0.29 wt%). We assume that the silicon exists exactly in the lattice of rutile rather than microinclusions. Although isobars of ^{29}Si such as CO and N_2 may interfere the silicon signal, the result indicates that rutile contains much silicon exhibited as the higher signal-to-background ratios (1.2).

A semi-quantitative silicon in metamorphic rutile can be regarded as a geochemical anomaly, because ionic radius and coordination of Si^{4+} (0.26 Å, IV) are different from Ti^{4+} (0.61 Å, Ⅵ). High pressure may enhance SiO_2 solubility in rutile implied by the experiment [1]. And silicon-bearing rutile ($(Ti_{0.82}Si_{0.18})O_2$) has been discovered in chromitite from the Luobusa ophiolite (regarded as a window of mantle materials) in Tibet. It is seemed that the ionic radius of Si^{4+} increases under high pressure. Also we can observe the coordination number of Si^{4+} converts from 4 to 6 or 7 to form a tighter structure under high pressure [2]. Therefore, high pressure in subduction zone facilitates incorporation of Si into rutile.

Silicon is the second abundant element in silicate Earth, but its geochemical behavior remains unclear especially under high pressure. We assume that most of the silicon in rutile is 6-fold coordination, similar to stishovite, which could imply the form of silicon in deep Earth. Si-in-rutile can be used to limit the depth of continental materials subduction.

[1] Escudero & Langenhorst (2012) *AM* **97**,524-531. [2] Luo *et al*. (2004) *AM* **89**, 455-461.