Electron back-scattered diffraction data of the Himalayan HP and UHP eclogites

Rehman H. U. (Kagoshima University)

Electron back-scattered diffraction (EBSD) maps and crystal-preferred orientation (CPO) of eclogite-facies phases (omphacite, garnet, phengite, quartz, epidote, ilmenite, and rutile) and their retrogressed products (hornblende, biotite, and titanite) are reported for understanding the rheological behavior of crustal material during the subduction- and exhumation-related deformation regimes. Two types of eclogites from the Himalayan metamorphic belt, Kaghan Valley, Pakistan, were investigated within polished thin sections. Group-I eclogites (HP) are composed of garnet, omphacite, quartz with accessory rutile, ilmenite, titanite, zircon and secondary hornblende and biotite. Group-II eclogites (UHP) are composed of omphacite, garnet, phengite, epidote, quartz/coesite, with accessory rutile, ilmenite and titanite and retrograde hornblende. Multiphase-analyzed EBSD maps from HP and UHP eclogites are characterized by relatively deformed and preferably oriented omphacite overgrown by hornblende and irregularly placed clustered garnets. Epidote, phengite and quartz are randomly oriented. Omphacite, the peak eclogite-facies phase, exhibits L-type CPO where the maximum density of [001] axes is parallel to and high density of {110} poles is normal to the lineation in HP eclogites. This type of LPO suggests intra-crystalline plasticity with [001] {110} and <110> {110} active slip systems that commonly develops in a constrictive strain regime at mantle depths. Omphacite in UHP eclogites also exhibits a similar fabric but with stronger CPO. Garnet, the second dominant phase in the eclogite-facies stage, exhibits weak and complex fabric patterns in both groups of eclogites, behaved like rigid bodies that did not deform plastically. Quartz in HP eclogites show irregular CPO but the density in UHP eclogites is stronger compared with those in HP eclogites. Rutile, although occurs as accessory, but show preferred orientations along [001], suggesting their deformation coeval to those with the omphacite. Titanite, the by product of rutile indicate different CPO than rutile, suggesting their growth in late-stages. Hornblende in both HP and UHP eclogites have a strong CPO along [001] axes aligned parallel to the lineation that indicate homotactic crystal growth by the replacement of omphacite during the early stages of retrogression.

Keywords: Himalayan metamorphic belt, UHP eclogites, Crystal deformation, Garnet, Clinopyroxene

* Corresponding Author: hafiz@sci.kagoshima-u.ac.jp