Garnet replacement processes during the amphibolitization of eclogites

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The focus here deals with the fate of garnet from eclogite-facies terranes and microstructural features associated with exhumation and reequilibration in the amphibolite facies. EPM and LA-ICPMS trace-element maps have been acquired on four retro-eclogites (Sistan belt in E. Iran and Diego de Almagro island in S. Chile). Newly formed garnet compositions, in association with epidote, phengite, hornblende, albite and titanite, record different reactive stages between out-of-equilibrium fluid(s) and eclogite facies minerals (Grt-Omp±Phg±Gln±Czo+Qz+Rt). Late garnet-bearing textures visible along garnet grains discontinuities and surfaces reveal dissolution-transport-precipitation mechanisms along mineral-fluid interfaces. Microtextural observations and pseudosection modeling show that the formation of a late Ca-rich garnet and epidote in Diego de Almagro mafic rocks is likely controlled by local gradients in aqueous fluids during amphibolitization. MREEs and yttrium chemical patterns mark the consumption of prograde titanite, epidote and apatite due to increasing temperature. Garnet dissolution-reprecipitation processes are evidenced by the coupled distribution of HREEs, yttrium and Mn. The variable degree of coupling and decoupling between Grt-compatible and Grt-incompatible elements observed in different garnet domains may reflect heterogeneous element mobilities in the intergranular medium. Similar garnet textures can equally form by the influx of external metasomatism (Sistan) or due to chemical interaction with internal (and/or locally) derived fluids (Almagro).