

Combined geochronology and P-T pseudosection constrains protracted garnet growth in high-pressure eclogite

CHENG, Hao^{1*}

¹School of Ocean and Earth Science, Tongji University

Understanding convergent margin processes requires determination of the onset of subduction, the number and polarity of subduction zones, and the duration of subduction zone metamorphism. Garnet growth and intracrystalline zonation can be used to constrain the timing, duration, and kinetics of tectonometamorphic processes. An eclogite from the Huwan shear zone in the Hong'an orogen was investigated with combined pseudosection analysis and multiple geochronology. The pseudosection analysis illustrates that garnet growth is continuous and along an early near isothermal trajectory followed by a near isobaric heating path from 1.9 GPa/500 °C to 2.4 GPa/575 °C. ⁴⁰Ar/³⁹Ar dating of amphibole inclusion in garnet from the eclogite yielded age of 310 ± 5 Ma, which is consistent with the U-Pb age of 302 ± 6 Ma for the metamorphic zircons within uncertainty. Garnet from the sample was crushed to obtain separate core and rim material that produced Lu-Hf ages of 296.9 ± 3.8 Ma and 256.9 ± 3.9 Ma, the latter is consistent with its Sm-Nd age of 254.3 ± 4.6 Ma for the same aliquots. Similarly limited zircon U-Pb ages of c. 257 Ma were obtained in zircon rims with garnet inclusion. These ages were interpreted to bracket the period of garnet growth and the difference of up to ~40 Myr is best explained by protracted garnet growth. We propose that the rocks became detached from the downgoing slab and remained in the subduction zone for a long time without much change in P-T conditions until the entry of the continental crust in the subduction zone, which incorporated the rocks into the following subducted and exhumed at some time later than c. 254 Ma. The increasing observations of protracted garnet growth and long-lived subduction in various orogens worldwide demand more sophisticated geodynamic models.

Keywords: Lu-Hf, garnet, protracted metamorphism