1.3.P07

Early cooling history of Huangzhen eclogite from Southern Dabieshan: Comparative study of U-Pb, Ar-Ar ages and garnet diffusion kinetics

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Geochronology is a classical approach used for the investigation of cooling and exhumation history of HP-UHP rocks. If one can get a group of mineral ages, which has different and known closure temperature, the cooling rate of time-temperature relation can be obtained. Diffusion kinetics is another useful method to study rock cooling. Lasaga et al. first theoretically released mathematical relationship between composition zoning and metamorphic thermal evolution, and concept of geospeedometry. This approach deals with geological process speed through an inverse method by using mineral chemical zoning which only caused by diffusion. In high-grade metamorphism garnet is the most common mineral which has diffusion zoning. It usually shows a homogeneous core and zoning rim. It is imprinted by garnet chemical homogenization during peak metamorphism, and then cation exchange and relative slow inter-grain diffusion rate compared with other surrounding minerals during depression.

We determined both geochronology of zircon U-Pb ages, mica and amphibole ^{40}Ar-^{39}Ar ages and garnet major element zoning for low T Huangzhen eclogite(T = 586-635ºC, P = 2.0-2.4 Gpa) from Southern Dabie Terrain. The zircon U-Pb weighted SIMS age is 231.6±9.7 Ma. The mica ^{40}Ar-^{39}Ar isochron age is 232.6±2.1 Ma and the lowest plateau age is 221.7±2.4 Ma. U-Pb TIMS concordant age from another eclogite zircons is from 221.3±1.4 Ma to 222.5±2.3 Ma. The retrograde amphibole ^{40}Ar-^{39}Ar isochron age is 205.9±1.0 Ma. Except for mica, which may contains excess ^{40}Ar, all the other ages represent peak or retrograde metamorphism of low T eclogite. According to chemical zoning of different size of garnets in eclogite, a sphere symmetry relaxation and an exchange diffusion model were used for kinetics calculation of two eclogite. The results show that from peak temperature to about 480ºC, the closure point of Fe, Mg exchange in garnet, the duration of 23 Ma and 17 Ma were needed for their composition modulation, respectively. The calculated cooling rates is around 7-10ºC/Ma and exhumation rate is 1.5 km/Ma. The approximate coherence of two approch indicates that the cooling history of HP-UHP rocks by using diffusion kinetics and geochronology should be comparable and complementary each other.

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Lower crustal metasomatism at Mount Sidley, West Antarctica

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Tertiary basanitic melts generated in the mantle beneath Mount Sidley Volcano, Marie Byrd Land, West Antarctica, have infiltrated and metasomatised the lower crust prior to eruption at the surface. The composition of the lower crust is represented by a suite of xenoliths that range between meta-cumulate mafic pyroxenites (Mg# 55-80) and more evolved granulites (Mg# 35-60) comprised of olivine + clinopyroxene ± plagioclase ± Fe-Ti oxides. Metasomatism has resulted in disequilibrium reactions in primary mineral phases and growth of secondary mineral phases that in many cases coexist with glass.

Metasomatism has occurred in three related styles: along mineral grain boundaries between mafic and felsic layers (percolative metasomatism); replacement of clinopyroxene by kaersutite (replacement metasomatism); and along fractures (fracture metasomatism). Percolative metasomatism is common in granulites and has resulted in: sieved textures on plagioclase with Fe-Ti oxides and glass patches trapped between primary plagioclase and calcic overgrowths; the breakdown of olivine into two phases, one Fo-rich and one Fo-poor; and crystallization of large (mm-scale) apatite crystals and Fe-Ti oxides. Replacement metasomatism is the hydrous replacement of clinopyroxene by kaersutite typically along an advancing front that includes microphenocrysts of rhonite, olivine and K-feldspar. Fracture metasomatism occurs in more primitive pyroxenites and involves the transit of oxidising fluids and/or gases along fractures resulting in the breakdown of primary olivine into Fo-rich and Fo-poor phases.

Melt phases associated with percolative and replacement metasomatism are consistent with evolution of a basanitic parental melt to more evolved compositions through fractional crystallization of plagioclase ± olivine ± clinopyroxene ± Fe-Ti oxides ± apatite and by interaction with the primary mineral assemblage. These reactions have resulted in the enrichment of the lower crust, the effects of which vary by metasomatic style, but generally results in enrichment in elements that are more compatible in the primary and secondary mineral phases, such as P, K, LILEs (Sr, Ba) and LREEs.

Here we present detailed petrographic evidence of these reactions and *in situ* analyses of primary and secondary mineral phase, including quantitative water and carbon distributions determined by FTIR spectrochemical imaging.