Paper Number: 666

The Russian Belomorian eclogite, not the Archean eclogite, but the oldest Paleoproterozoic eclogite related to continental collision

Lu, H.L.[1], Zhang, L.F[1], Wei, C.J.[1] and Guo, J.H.[2]

[1]School of Earth and Space Sciences, Peking University, Beijing 100871, China; yuhuanglu@163.com
[2]State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

---

Eclogites from the Belomorian province in Russia were once regarded as Archean in age, which is significant for plate tectonic processes. But the Archean eclogitic age is under great dispute. The Gridino ecogite, which is an important member of the Belomorian eclogite associations, is located in the southwestern part of the Paleoproterozoic Lapland–Kola collisional orogen. These eclogites occur as boudins and eclogitic dykes in TTG gneiss. Zircons selected from these eclogites show obvious core and rim zoning. Zircon rims have an age of ca 1.9 Ga, with low Th/U ratios (< 0.035), flat HREE patterns, and typical eclogite mineral inclusions such as omphacite and garnet. Calculation of zircon/garnet partition coefficients suggest that zircon rims grew contemporaneously and in near-equilibrium with the garnets under eclogite facies conditions. The high $\delta^{18}O$ values of 6.23 to 6.80‰ of zircon rims imply an origin by eclogite facies metamorphism. Whereas, zircon cores of eclogite boudins display higher Th/U ratios of 0.18-0.45, negative Eu anomalies and strong enrichment in HREE, and have an Archean age of ca 2.7 Ga. $\delta^{18}O$ values of 5.64 to 6.07‰ suggest the possibility of crystallization from slightly evolved mantle-derived magmas, which may indicate that zircon cores record the Mesoarchean–Neoarchean age of the magmatic protolith. Combined with phase equilibria modelling, a three-stage metamorphic evolution has been recognized in the Belomorian eclogite: a prograde epidote–amphibolite facies, the peak eclogite facies and a retrograde high-pressure granulite facies, implying a clockwise P–T path. The peak metamorphic P–T conditions (780–820 °C, 21–22 kbar) provide a maximum geothermal gradient of 11–12 °C/km, which is similar to the modern subduction slabs. Hence, the Russian Belomorian eclogite is not an Archean eclogite, but the oldest knon Paleoproterozoic eclogite related to continental collision, which corresponds to the assembly of the Columbia supercontinent.