Eclogite-facies metamorphism in the Maksyutov Complex, south Ural Mountains, Russia

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The Maksyutov Complex is a mid- to late Paleozoic high- to ultrahigh-pressure (HP-UHP) subduction terrane in the southern Ural Mountains of Russia. Rare occurrences of radial fractures around quartz inclusions in garnet, omphacite, and glaucophane interpreted as pseudomorphs after coesite, and microdiamond aggregates in garnet identified by Raman spectroscopy suggest that some parts of the Maksyutov Complex were subducted to UHP conditions (>2.8 GPa for coesite and >3.0 GPa for diamond at 600°C) in the Late Devonian. Peak UHP eclogite-facies metamorphism (Grt+Omp+Ph+Coe+Rt±Ttn) took place c. 385 Ma, and were exhumed through retrograde blueschist-facies conditions (Grt+Gln+Ph+Qz±Chl±Ep) by 360 Ma. In order to better constrain the petrotectonic evolution of the Maksyutov Complex, we constructed isochemical phase equilibria diagrams (pseudosections) for several representative metabasites in the system Na2O-CaO-K2O-FeO-MgO-Al2O3-SiO2-H2O-TiO2 based on whole-rock XRF data and estimated effective bulk compositions. Both conventional Fe-Mg exchange thermometry for Grt+Cpx, and phase equilibrium modeling resulted in higher peak equilibrium temperatures than have been previously reported for the Maksyutov Complex. Isochemical phase diagrams yield minimum P-T conditions of 650-675°C and 2.4-2.6 GPa for peak assemblages from the least retrogressed eclogites, whereas Fe-Mg exchange thermometry yields a temperature of 750°C ± 25°C for a pressure of c. 2.5 GPa. Mineral chemistries in this thermodynamic model represent prograde metamorphism in the Maksyutov Complex, and conventional thermobarometry using garnet rim chemistries suggest they record peak T conditions on the retrograde exhumation path. Our modeled minimum peak pressure estimate is well below that required for coesite stability, and without further evidence of UHP metamorphic conditions, it will remain unclear if Maksyutov reached UHP depths during subduction.