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Petrology of eclogites from the Orobashy area, Aktyuz region, northern Kyrgyz Tien-Shan

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The Aktyuz region is located in the Zaili Range of the Northern Kyrgyz Tien-Shan. Here, eclogites have been reported from two areas, i.e. Aktyuz area and Orobashy area (Orozbaev et al., 2010). Lens-shaped serpentinite bodies of varying size occur in the Orobashy area along NNE-SSW trending faults located within Kapchygai and Kokbulak migmatites. The largest serpentinite body contains 20 cm to 30 m across blocks of eclogites, garnet amphibolites, garnetites and gneisses. Eclogite, garnetite and garnet amphibolite blocks are massive, and range from 40 cm to 10 m in diameter. The marginal parts of the eclogite and garnetite blocks are amphibolitized. Both blocks and serpentinite matrix are intruded by granitic dykes.

Eclogites consist mainly of garnet, clinopyroxene, amphibole, clinozoisite and rutile with minor plagioclase, epidote, quartz, chlorite, biotite, paragonite, phengite, ilmenite, titanite, apatite and zircon. Garnets and clinopyroxene show coexisting texture and thus define the peak metamorphic assemblage. Garnets contain inclusions of amphibole (tschermakite, pargasite), quartz, epidote, rutile, ilmenite, apatite, plagioclase, biotite and rare paragonite and phengite. Garnets show a prograde zoning and they have compositions of 36.1-61.3 mol% of almandine, 13.3-21.9 mol% of grossular, 10.8-43.4 mol% of pyrope and 0.1-4.9 mol% of spessartine. Clinopyroxenes are Na-rich diopside in composition and their jadeite content varies from 0 to 19 mol%. The symplectite of Amp+Qtz and/or Amp+Pl is developed after clinopyroxene suggesting decompressional decomposition. Amphiboles occur as inclusions in garnet and clinopyroxene, and also in the matrix. Amphibole in the matrix is Mg-hornblende and contains inclusions of garnet, clinopyroxene (Jd9-12), rutile and quartz. Amphiboles in garnets are tschermakite and pargasite, whereas those in clinopyroxene are Mg-hornblende. Amphiboles in symplectites and in the veins are also classified as Mg-hornblende. Clinopyroxene, garnet and amphibole are cross cut by veins. Feldspars in the eclogites are plagioclase (An4-50) and K-feldspar. Paragonite occurs only as inclusions in garnets. Phengite occurs in the matrix and as rare inclusions in garnet. Epidote occurs as inclusions in garnets, clinopyroxenes and in the veins. Occasionally, clinozoisite develops in the matrix of some eclogites. Veins are mainly composed of plagioclase, epidote, amphibole and apatite.

The texture and the mineral chemistry of the Orobashy eclogites suggest three metamorphic stages i.e., prograde, peak and decompression stages. The mineral inclusions in garnet such as amphibole (tschermakite and pargasite), quartz, plagioclase (An13-50), epidote, biotite, paragonite, phengite, rutile, ilmenite and apatite may suggest mineral assemblage of the amphibolite facies conditions for the prograde stage. The coexistence of garnet and Na-rich diopside together with rutile and quartz in the matrix suggests the peak metamorphic assemblage. The garnet-clinopyroxene geothermometer of Ravna (2000) and Nakamura (2009) yielded $T = 590-710$ C at 13 kb, minimum pressure based on Jd=19 content in clinopyroxene. The symplectite of Amp+Qtz and Amp+Pl suggest decompression stage for the eclogites. Hbl-Pl geothermometer (Holland & Blundy, 1994) yielded 610-670 °C for this stage, and the minimum Jd content (>5) may suggest about 5 kbar for pressure conditions.

There are three different types of metamorphic events for the HP rocks of the Aktyuz Formation. Here, for the Orobashy eclogites single metamorphic event is recognized, which is HT metamorphism from amphibolite facies up to eclogite facies conditions and then decompression again to amphibolite facies conditions. Exhumation of the Orobashy eclogites to relatively shallow crustal levels was accompanied by re-equilibration under HT amphibolite facies conditions, probably during a period of continental collision, correlative to the third metamorphic event in the Aktyuz area.

Keywords: Orobashy, Aktyuz, eclogite, Tien-Shan, Kyrgyzstan