New insight into reaction Iso–grades, petrography, mineral chemistry of metapelites and gem bearing marbles in Karakoram metamorphic complex (Aliabad - Karimabad), Central Hunza, NE Pakistan

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Abstract

A meta–pelitic sequence with massive meta–carbonate layers, cut by amphibolite and granite sheets is exposed in central Hunza which is bounded to the NE by Hunza plutonic Unit (HPU) at Ulter, and to the SW by the Main Karakoram thrust (MKT) near Diran peak, collectively called Karakoram Metamorphic complex (KMC). The grade of metamorphism increases from SW to NE, and this is marked by variation in mineral chemistry, and changes in mineral assemblages (facie changes) at a series of reaction isograds, which separate zones in which stable mineral pairs are: garnet–chlorite, garnet–chloritoid–biotite, garnet–staurolite–biotite, kyanite–staurolite–biotite and kyanite–sillimanite–cordierite from SW, to NE respectively. Just south of HPU (near Brongoxil and Murku) migmatites, with restites are exposed that have been produced by partial melting of pelites at high temperature (750–800 ^{o}C) with distinct leucosomes and melanosomes that ranged in thickness between 1 cm to 28 cm.

The northern part of KMC from Hasanabad to Dongdas contains dolomitic-marble belt (Hunza marbles) contains variety of gem quality corundum's and Pargasite. A reaction isograd marked by the paragenesis forsterite–diopside–calcite–dolomite occurs in these marbles beds which ranged in thickness from 0.1–300 m. The north–easterly dip of the isograds indicates that the zones are inverted. Paragenesis observed in ruby bearing marbles from Hunza is (ruby+phlogopite+muscovite±spinel±pargasite±paragonite±chlorite± margarite±amphibole±plagioclase±titanite±apatite). Petrographical studies revealed that the ruby-bearing marbles formed in the amphibolite facies (T=610 to 790 °C and P~6 kbar). A fluid inclusion study defines the conditions of gem ruby formation during the retrograde metamorphic path (620<T<670 °C and 2.6<P<3.3 kbar). Whole rock analyses of non–ruby-bearing marbles indicate that they contain enough aluminum and chromiferous elements to produce all the ruby crystals that they contain. In addition, (C, O)-isotopic analyses of carbonates from the marbles lead to the conclusion that the marbles acted as a metamorphic closed fluid system that were not infiltrated by externally-derived fluids.