Petrology, Geochemistry and Geochronology of a HP Metarodingite from the Rodope Massif, N-Greece

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In the past few years the Rodope Massif and especially the Rodope Metamorphic Province (RMP) have been the subject of a controversial debate about UHP metamorphism. Mposkos & Kostopoulos (2001) reported diamonds from metapelitic RMP-lithologies indicating unusually deep subduction of continental crust. This lithology occurs in the Kimi Complex, representing the uppermost tectonic RMP-unit. The metapelitic rocks are associated with acid to intermediate metaplutons, granulites, eclogites, amphibolithes and a suite of ultramafic rocks, represented by more or less serpentinized lherzolithes containing layers of garnet-clinopyroxenites and spinell-garnet clinopyroxenite dykes. Associated with the ultramafic complex we found a rock containing the assemblage garnet + clinopyroxen + kyanite + Mg-staurolithe + clinozoisite + Ca amphibole + pumpelleyite + rutile + zircon + apatite. The bulk composition is unusually Si-poor and Ca-, Mg- and Al-rich with 42.1 wt% SiO_2, 16.4 wt% CaO, 10.9 wt% MgO and 19.9 wt% Al_2O_3. The chondrite-normalized whole rock REE-pattern shows a strong LREE-enrichment (500 x chondrite) compared to a moderate HREE-enrichment (10 x chondrite) with a very small negative Eu-anomaly. The garnet of this sample is Mg- and Ca-rich with $Prp_{41-52}Alm_{25-30}Grs_{21-24}Sps_{0-1}$. Clinopyroxenes are essentially diopside – Ca-Tschermak-pyroxene solid solutions with very low Jd_{ss} ($Di_{78-82}Cats_{8-11}Jd_{0-5}$) reflecting the low bulk Na_2O-content of 0.7 wt%. Zoisite shows evidence of metasomatic alteration in the form of irregular zones strongly enriched in Sr with 0.8–1.1 wt% SrO. Both garnet and zoisite contain numerous kyanite inclusions. Mg-staurolithe has an X_{Mg} of 0.59–0.62 and is exclusivly present as inclusion in zoisite. Peak metamorphic conditions for the assemblage garnet + clinopyroxen + clinozoisite + kyanite + Mg staurolithe + amphibole calculated with the THERMOCALC software and the database of Holland & Powell (1999) yield 25 ±1.5 kbar and 725±50°C. Thus, both mineral assemblage and the whole rock major and trace element chemistry strongly suggests that this rock is a high pressure metamorphosed rodingite (e.g. Evans et a. 1979; Li et al. 2004; Dubinska et al. 2004). In addition, textures and compositional zoning of individual phases point to a complex history of hydrous fluid infiltration during uplift and exhumation of the metarodingite involving the formation of secondary amphibole, chlorite and pumpelleyite. An extremly high bulk Zr-content of 434 ppm along high U and Th (51 ppm Th and 22 ppm U) gives rise to numerous zircons 50–150 µm in

size, in part with strong back scattered electron (BSE) and cathodoluminescence (CL) zoning. These zircons are present as inclusions in all major matrix phases and contain inclusions of garnet, FeNi-sulfide and an unidentified K-phase. Two types of zircons can be distinguished based on BSE- and CL-zoning: (1) discontinuously zoned zircons showing cores in part with oscillatory zoning and rims without obvious CL- or BSE zoning and (2) zircons with strongly irregular patchy/cloudy CL-zoning, in rare cases with narrow unzoned rims. U-Pb ionprobe dating of the various zircon domains yields ages in the range 103±2 to 161±3 Ma and 75±1 to 107±2 Ma for the zircon cores and rims of type (1), respectively. The irregularly zoned zircons of type (2) yield ages in the range 82±2 to 88±2 Ma.

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