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Mantle composition and heat flow of the southern Kola craton (Fennoscandian shield)

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Based on the chemical composition of pyropes and chrome diopsides from the Quaternary sediments from the southern Kola region, the P-T parameters of their crystallization are determined. Representing either mantle xenocrysts or constituents of mantle xenoliths, the pyropes and chrome diopsides contain valuable information on the composition of the lithospheric mantle and its thermal properties. It is established that the pyropes belong to lherzolitic (45 %), harzburgitic (30 %) and eclogitic (25 %) parageneses. Ni-thermometry on pyropes gives a range of temperatures between 650-1250 °C, corresponding to a sampling interval of ca. 75-190 km. From the distribution of the different pyrope associations and their trace element compositions, the layered structure of the Kola lithospheric mantle is inferred: a shallow horizon (75-110 km) of mainly lherzolite composition; a middle horizon (110-170 km) of harzburgite composition with abundant G10 grains; and the deepest layer (170-190 km) of lherzolite-harzburgite composition. Ca. 16 % of lherzolite-harzburgitic pyropes are derived from the stability field of diamond, i.e. from the depth of 140-190 km. The chrome diopsides fall into two genetic groups: eclogitic and peridotitic. P-T parameters of crystallization determined for peridotitic chrome diopsides using the single-grain Cr-in-Cpx barometer and enstatite-in-Cpx thermometer of Nimis & Taylor (2000) imply that most of grains fall into the graphite stability field with 20-45 kbar and 700-1150 °C. These grains apparently originated from Kola carbonatite intrusions or from non-diamondiferous ultramafic xenoliths from alkaline-ultramafic dykes of the region. Nevertheless, 15% of diopsides yield values of 55-60 kbar and 1000-1100 °C and thus have been derived from the stability field of diamond. The P-T values for chrome diopsides also imply significant regional variations in the geotherm. Within the western part of the craton, adjacent to the Kandalaksha graben, the chrome diop-

side data is consistent with the 42-44 mW/m2 model geotherm of Pollack & Chapman (1977). Importantly, in the east, far from Kandalaksha graben, the lithosphere appears to be cooler and the heat flow corresponds to the cool cratonic model geotherm of 37-38 mW/m2. While the western part of the study area is dominated by carbonatitic and non-diamondiferous alkaline magmatism, the more "cratonic" eastern Kola Peninsula seems to have greater potential for diamondiferous kimberlitic magmatism.