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The role of silica mobility in the origin of incipient eclogites

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Eclogite and eclogite-like rocks (referred to as eclogites *senso lato* herein) developing after (meta) gabbro are known from a number of Precambrian high-grade metamorphic terrains. Many features of the ***incipient*** eclogites, such as very localized and incomplete transformation of the country rocks, and structural association with the lower crustal shear zones, point to a major involvement of deformations and conjugate fluid flow in their origin. Examples of the incipient eclogites are Caledonian eclogite partially reworking Grenvillian granulite-facies anorthosite in the Bergen Arcs region, Norway (Austrheim, Griffin, 1985; Raimbourg et al., 2007) and early Svecofennian eclogite formed after iron-rich gabbro of early Proterozoic age at Krasnaja Guba, Belomorskii (White Sea) complex, Kola, Russia. In this work we present evidence, mostly from the latter locality, that the role played by the infiltrating fluid phase was not restricted only to catalyzing effect on mineral reactions and to introducing H_2O (and, occasionally, CO_2) to form hydrous minerals and carbonate, but, most importantly, was in dissolving significant amounts of silica liberated during eclogitization reactions. Quantitative account of the silica activity (a_{SiO_2}) based on the calculations of equilibrium conditions for the eclogite assemblages in the studied samples gives values from 0.3-0.5 thus indicating considerable silica under-saturation. Using these decreased a_{SiO_2} values results in a significantly lower pressure estimates for the eclogites than those calculated with the assumption of the presence of free quartz (a_{SiO_2}=1) in the primary eclogitic assemblages. If an assumption is made concerning composition of the fluid phase (e.g., pure H_2O, H_2O-CO_2 or H_2O-strong electrolyte), the

estimated values of a_{SiO_2} can be readily recalculated into the SiO_2 concentration in the fluid. For the Krasnaja Guba samples equilibrium H_2O activity deduced from the clinozoisite-bearing reactions is around 0.6. For the H_2O-NaCl fluid this value corresponds to a composition with X_{H2O}=0.8 at 630^{o}C/1GPa, and its silica content is about 0.2 mol/kg H_2O. Retrograde symplectites of low-Na clinopyroxene + plagioclase $\pm$ amphibole develop around omphacite-rich clinopyroxene regardless of the contacts with *qz*, which is interpreted as partly being due to the increased silica activity in the coexisting fluid phase at the retrograde stage. It is argued that this increase in silica activity may have ultimately led to re-precipitation of silica in the form of secondary quartz during exhumation of rocks.

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