



Experimental studies on TTGs the Nuvvuagittuq Complex, Quebec, Canada: Implications for early crustal recycling and Archaean granitoids

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Partial-melting experiments were conducted (at 900-1100C and 0.5-3.0 GPa) on two greenstones from the Nuvvuagittuq Complex, Quebec, Canada and on a 3.66 Ga tonalite that encloses the mafic rocks of the Complex. The mafic Nuvvuagittuq rocks represent the oldest crust on the Earth. We performed experiments on the mafic rocks to first determine the phase equilibria and second, to assess whether they could be the source for the younger tonalities associated with them. At 1.5-3.0 GPa and 950-1100C, the experimentally produced melts are compositionally similar to Archaean TTGs. We found the degree of melting needed to produce these melts is high, greater than 30 percent, and so the relative concentrations of most incompatible elements in the melts are similar to those of their mafic parent rocks. These greenstones have compositional affinities with modern subduction zone magmas. Thus, arc-like mafic rocks appear to have been selectively involved in TTG formation, implying the involvement of crustal recycling in TTG genesis. The results of experiments on the tonalite suggest either equilibrium of its original magma with a garnet pyroxenite residue at 1050C and 3.0 GPa, or compositional control by the plagioclase-pyroxene cotectic at greater 900C and 1.0 GPa. The latter option is more consistent with the compositional trends of Archaean TTGs in general. In either case, a high degree of inheritance is involved implying a role for early crustal recycling.