Applied forensic igneous petrogenesis: locating the source quarry for the "Black Granite" Titanic headstones in Halifax, Nova Scotia, Canada

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In Halifax, Nova Scotia, 149 victims of the 1912 sinking of the Titanic lie beneath petrologically identical "black granite" headstones. Those headstones, supplied by the White Star Line, arrived in Halifax in late 1912, but no known historical document reveals their source. They consist of a medium- to coarse-grained olivine-bearing gabbro, with cumulus phases consisting of randomly oriented euhedral plagioclase laths (An 50–70), corroded olivine (~Fo_{63}), and titano-magnetite (7.5 wt.% TiO_2) with Ti-hornblende and biotite reaction rims, and intercumulus material consisting of titanaugite (~Wo_{43} En_{42} Fs_{15}) with reaction rims of titaniferous hornblende, both of which are variably uralitized. Three types of evidence (*quantitative* – radiometric age of ca. 422 Ma, zircon U/Th ratios, olivine FeO/(FeO+MgO) ratios, clinopyroxene trace-element compositions, wholerock chemical compositions; *qualitative* – mineral assemblage, modal proportions, textural parameters, style and degree of alteration; and *circumstantial* – regional reputation, quarrying history, local logistics, regional transportation, McGrattan "paperweight") connect the Titanic headstones to the St. George Batholith in SW New Brunswick. Precise matching of any dimension stone to its source quarry is problematic, because that stone no longer resides in the quarry. Given this constraint, one of three possible conditions must obtain: (i) if the correct quarry is homogeneous on a scale larger than the quarry, all the physical, chemical, and temporal parameters of the quarry walls and floor will perfectly match those of the headstones; (ii) if the correct quarry is monotonically heterogeneous on a scale larger than the quarry, the physical and chemical parameters of the walls and floor of the quarry will bracket those of the headstones, and the ages will match precisely; or (iii) if the correct quarry is erratically heterogeneous, the physical and chemical parameters in the walls and floor of the quarry may not bracket some, or even all, of these parameters in the headstones, but the ages will still match precisely. In the case of the Titanic headstones, most quantitative parameters in the quarry fall under condition (ii) above, but some parameters (Sr, Zr, Hf, Ga, middle REEs) fall under condition (iii). No individual line of evidence, on its own, is sufficient to identify the source quarry, but the combination of the cumulative weight of all the quantitative, qualitative, and circumstantial evidence plus a process of elimination suggests that the Charles Hanson Quarry near Bocabec, SW New Brunswick, is the source for the gabbroic Titanic headstones in Halifax. More information is available at: earthsciences.dal.ca/www/titanicgranite

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