Ediacaran Rosetta Gabbro from northernmost Arabian-Nubian Shield, south Jordan: Geochemistry and Petrogenesis

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The Rosetta Gabbro of S. Jordan is a distinctive igneous rock that reflects rapid crystallization of plagioclase from hydrous mafic magma. It is characterized by rosettas, consisting of spherical clots, up to 40 mm in diameter, with amphibole cores from which plagioclase euhedra radiate. It intrudes the Aqaba complex granitoids (630 ~ 610 Ma) as a small (ca 200x200 m) outcrop.

This gabbro is Ol/Qz tholeiite with the following chemical characteristics [SiO_2 = 46.2–47.8; Al_2O_3 = 16.4–17.7; TiO_2 = 1.70-2.82; Na_2O = 1.27-2.83; K_2O=0.82-1.63 wt. %; Mg# 58-63;ΣREE=38-82 ppm; La/Yb ~ 6 to 8. Eu/Eu*=1.05-1. 2]. Amphiboles are found as: 1) large , 3-5 mm in size, brown titanian tschermakite $(K_{0.08},Na_{0.44})(Na_{0.25},Ca_{1.75})$ $(Mn_{0.03},Fe^{3+}{}_{1.02},$ $Mg_{2.64},$ $Fe^{2+}{}_{0.59},Ti_{0.27},Al_{0.44})(Al_{1.86},Si_{6.14})$ O_{22} $(OH)_{1.95}$ and magnesiohastingsite of the calcic amphibole group; and 2) yellowish-light green tschermakite $(K_{0.01},Na_{0.54})(Ca_{1.06}$ $Fe^{2+}{}_{0.88},$ $Mn_{0.06})$ $(,Fe^{2+}{}_{1.11},$ $Mg_{3.41},Ti_{0.04},Al_{0.44})$ $(Al_{0.87},Si_{7.13})$ O_{22} $(OH)_{1.95}$ to barroisite of the sodic-calcic amphiboles that dominate the cores of the rosettas and found mostly replacing type one. Tabular plagioclase (An_{64-79}) up to 10 mm in size.Trace elements vary considerably in amph and plag (LA-ICP-MS). The REE in amphiboles show an order of magnitude variation with a concave-downward pattern and a positive Eu anomaly (Eu/Eu* =0.6 – 2), though far less pronounced compared to the (Eu/Eu* = 5 – 25) of plagioclase. The 3D dandelion-like texture is broadly similar to “Chrysanthemum Stone”, but we can find no description of similar textures in igneous rocks; therefore we think it must represent unusual magmatic conditions. Formation of rosettas is thought to reflect loss of magmatic water resulting in rapid growth of plagioclase around amphiboles. This implies magmatic evolution in the shallow crust, but this conflicts with inferences from amph.-plag pairs indicating equilibrium at 6.87 ± 1.04 kbar and 844 ± 67 °C, consistent with formation at mid crustal levels, ~20 km deep.