

Imperial porphyry from Gebel Abu Dokhan, the Red Sea Mountains, Egypt. - DTU Orbit (08/11/2017)

Imperial porphyry from Gebel Abu Dokhan, the Red Sea Mountains, Egypt.: Part I. Mineralogy, petrology and occurrence

The prestigious red Imperial Porphyry was quarried from Mons Porphyrites in the Red Sea Mountains of Egypt. The porphyry, reserved for imperial use in Rome and Constantinople, was widely reused in Romanesque and Renaissance times, and in the Ottoman Empire. At the locality, the rocks vary from dark grey to red and are characterized by abundant, weakly aligned white to pink feldspar phenocrysts. The magmatic phenocrysts – plagioclase, hornblende, pyroxene, opaque components and apatite – are always altered. The red colour of the porphyry stems from alteration of phenocrysts and groundmass which generated Mn-epidote or piemontite (both rich in Mn^{3+}) and a hematite dusting (dominated by Fe^{3+}). Plagioclase relics consist of plagioclase (An_{2-47}) and microcline (< 5 – 6 % Ab); they recrystallized during alteration processes into a mixture of sodium feldspar with segregations of epidote group minerals, K-feldspar, and minor anorthite and calcite. Rare pyroxene retains its primary morphology but is completely altered to epidote group minerals. Primary hornblende lies along the magnesiohastingsite-edenite join but recrystallized to low-Na, low-Al^{IV} magnesiohornblende, and tremolite-actinolite. Primary oxide grains occur as exsolved ilmenite-titanomagnetite; they recrystallized to hematite or hematite-magnetite mixtures. The rocks are not pervasively recrystallized and retain a spectrum of magmatic textures. Alteration produced epidote-group minerals, notably Mn^{3+} -containing epidote and more rarely piemontite. Both are pleochroic from pink to yellow; the depth of pleochroism increases in the reddest porphyries. Other metamorphic-grade minerals include tremolite-actinolite, aluminian titanite, phlogopite, muscovite, chlorite and chalcedony. These phases indicate essentially isochemical greenschist facies conditions which took place under relatively high oxygen fugacity. Mineralogical observations, rock colour and texture, and particularly the pleochroic piemontite, should allow archaeologists to reliably assign pieces of Imperial Porphyry to their Egyptian source. Elemental and isotope geochemistry of the Imperial Porphyry is described in Part II.

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