Imperial porphyry from Gebel Abu Dokhan, the Red Sea Mountains, Egypt. Part II. Geochemistry

The prestigious red Imperial Porphyry was quarried from Mons Porphyrites in the Red Sea Mountains of Egypt. It was reserved for imperial use in Rome and Constantinople and widely reused in Romanesque and Renaissance times. The mineralogy and petrology of the porphyry collected at Mons Porphyrites were treated in Part I of this report. The rocks were moderately altered; greenschist facies alteration took place under essentially isochemical conditions but relatively high oxygen fugacity. The rocks retain many magmatic textures.

Whole-rock chemical analyses show that we deal with high-K to medium-K calc-alkaline andesites and dacites with a trace element spectrum typical of volcanic rocks from an Andean subduction-zone setting. Four rock samples yielded an errorchron with an age of $560 \pm 42$ Ma and an initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of $0.70283 \pm 0.00011$. Using Nd isotope data, values of $T_{\text{DM}}$ from 0.84 to 0.88 Ga and $\varepsilon_{\text{Nd}}$ from +5.1 to +5.7 were inferred. The magmas which led to formation of the Imperial Porphyry appear to be derived from a subduction-modified depleted mantle and underwent only minor contamination by older continental crust. Trace-element features, notably the high Th, U, K, Rb and Cs contents, are consistent with crust contamination. Imperial Porphyry erupted during the second Great Oxygenation Event of the Earth atmosphere.

Mineralogical observations as well as rock colour and texture, particularly the pleochroic epidote – piemontite, should allow archaeologists to reliably assign pieces of Imperial Porphyry to their Egyptian source. Major- and trace-element rock analysis or electron microprobe mineral analysis will confirm the assignment.

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