

The Paleoproterozoic Amitsoq Graphite Deposit, South Greenland

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The Amitsoq graphite deposit of South Greenland's Nanortalik region is one of the richest graphite deposits worldwide, with a JORC-resource estimate of more than 23 Mt at 20.41% graphitic carbon. The Amitsoq deposit was mined in the early 20th century, yet the origin of the graphite is presently unknown. The ore is hosted by two main bodies, the UGL and LGL, of which the LGL is the thickest (up to 20 m) and richest (typically 20-24% graphite). The orebodies display a simple planar geometry, dipping 30° westward measured from the surface outcrops on the eastern flanks of the Amitsoq Island. A remarkable feature of the LGL and UGL is their consistent grades across the orebodies. The ore is a graphitic-sulphidic schist in which graphite is present as elongate millimetric flakes, often piled in stacks, and as cryptocrystalline agglomerates. Graphite flakes are interleaved with biotite and pyrrhotite and are variably folded. The deposit likely formed in the context of the ca. 1.8 Ga Ketilidian orogeny, during the Paleoproterozoic, which is a geological period in which the vast majority of the world's richest graphite deposits formed. The amphibolite facies psammite hosting the ore is thought to represent part of the fore-arc of the northward-dipping Ketilidian subduction zone and was formed by the erosion of the nearby Julianehåb batholith. Shortly after the orogeny, the area was intruded by several granitoid plutons. The combination of these factors brought the area to experience HT-LP metamorphism with local anatexis. The texture of the ore indicates that graphite is either pre- or syn-kinematic with respect to the metamorphic events that occurred in the area. $\delta^{13}\text{C}$ analysis of graphite yields an average of -33‰ vs. PDB, indicating a biotic carbon source for the carbonic fluids involved in graphite precipitation.