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The Ore Genesis of Okanjande Graphite Deposit, Central Zone, Damara Belt, Namibia

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Okanjande is a flake-type graphite deposit hosted by amphibolite-grade banded, porphyroblastic, and migmatitic feldspathic quartzites of the Nosib Group, of the Pan-African Damara Belt, Namibia. The Central Zone is a high-temperature, low-pressure zone characteristic of sillimanite-cordierite metamorphic assemblages, numerous granitic plutons, and fold structures

Petrographic studies showed that quartzites are composed of quartz, K-feldspar, plagioclase, muscovite, biotite, chlorite, jarosite, sillimanite, rutile, pyrite, pyrrhotite, chalcocopyrite, sphalerite, and molybdenite. Graphite forms isolated, well-crystallised, disseminated needle-like and platy flakes. Sillimanite is present as spherical to elongated and shear-like porphyroblasts.

$\delta^{13}\text{C}$ graphite from quartzites ranges from -13.36% to -21.58%, falling within the range of -10% to -40% for organic matter in the Proterozoic. On the other hand, $\delta^{13}\text{C}$ graphite from carbonate rocks yielded two different ranges of -4.54% to -7.01% and -11.8% & -22.68%, inferring values from devolatilization of carbonate minerals and carbonaceous materials as well as from the carbon isotopic exchange between graphite and calcite.

$\delta^{34}\text{S}$ compositions from pyrite, pyrrhotite, and chalcocopyrite have values in the range of -4.4% to 3.7%, indicating a magmatic source of sulphur at Okanjande.

Graphite morphology studies from XRD indicated that graphite at Okanjande is well crystallised and matured (Lc (002) 233Å - 544Å; Graphitization Degree of 33Å - 133Å). The metamorphic temperatures calculated from $\delta^{13}\text{C}$ graphite (414°-684°C) and Graphitization Degree (459°-709°C) of graphite are in agreement with the range for Amphibolite facies (450°-700°C) as well as the previously estimated temperature of the Central Zone (432° to ±700°C). Our results support a syngenetic model for graphite formation at Okanjande.