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The Regional Geological Setting of the Haib Porphyry-Copper Deposit, southern Namibia



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A recent joint mapping program between the Geological Survey of Namibia and the Council for Geoscience has produced a new 1:50 000 scale map of the region surrounding the Paleoproterozoic Haib porphyry-Cu deposit [1]. The regional mapping program has covered ~25 000km² and has focused on the Precambrian basement rocks along the southern Namibia border, providing regional stratigraphic and tectonic context to the Haib deposit within the greater Namaqua Metamorphic Province (NMP). The Palaeoproterozoic Richtersveld Magmatic Arc (RMA) forms a ~200km wide crustal block in the western parts of the NMP. The RMA consists of rafts of Orange River Group (ORG) volcanics intruded by the voluminous, coeval Vioolsdrif Suite calc-alkaline granitoids (1905-1865 Ma, [1, 2]) during the greenschist-facies Orange River Orogeny (D₁). In the eastern parts of the RMA (Pella Domain), the ORG and Vioolsdrif Suite rocks and D₁ structures are strongly overprinted by the Mesoproterozoic ductile, amphibolite-facies D₂ Namaqua Orogeny. The Vioolsdrif Domain in the west of the RMA hosts the Haib and Lorelei Cu deposits and is virtually unaffected by D₂ but is cross-cut by a swarm of steep, NW-trending, late-Namaqua D₄ shear zones. The high strain zones preferentially follow the ORG volcanic belts and anastomose around more rigid ovoid-shaped, blocks of Vioolsdrif Suite granite [1]. The anastomosing D₄ shears coalesce into a wide zone north of the Haib deposit and appear to truncate the mineralised zone. The ORG in the Vioolsdrif Domain has been subdivided into the De Hoop and Haib Subgroups and the Rosyntjieberg Formation. The recent mapping, dating and geochemical studies suggest the subgroups are equivalent in composition and age, and the separation is purely geographic [1, 3, 4]. Blignault's [2] subdivision of the Haib Subgroup into the Tsams and Nous Formations on the basis of the proportion of felsic to intermediate and mafic lavas seems artificial, with both units containing roughly equal proportions of felsic and mafic lavas. Grumbley [5] recently dated the mineralised and unmineralised host rocks in the vicinity of the Haib deposit obtaining ages of between 1874 and 1855 Ma. These ages overlap with the regional dating of more than 20 samples of the ORG and Vioolsdrif Suite across the Pella and Vioolsdrif Domains [1, 4].

Most varieties of porphyry copper alteration zones have been observed at Haib. However, due to subsidence and erosion, much of the outer alteration zones have been removed. As a result of progressive cooling during hydrothermal events, upper zones of late alterations and mineralization progressively collapse inward and downwards over zones of initial mineralization, penetrating deepest along continuous veins and fractures making the situation of demarcating alteration zones more complex. This may be a reason why sericitic alteration is associated with other alteration zones, such as the potassic alteration, at the Haib deposit. Greenschist facies metamorphism further complicated the situation in the area by introducing metamorphic chlorite in addition to hydrothermal chlorite, which are difficult to distinguish. Furthermore, an abundance of pyrite in the area generated acid during oxidation, which subsequently reacted with feldspars to produce sericite. Hydrothermal alteration at the Haib deposit occurred during the emplacement of the Vioolsdrif Intrusive Suite (~1900-1850 Ma).

References:

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