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The stratigraphic, petrographic and geochemical subdivision of the upper manganese ore bed of the Hotazel Formation at Kudumane Mining Resources, Northern Cape Province.

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The Kalahari Manganese Field (KMF) is by far the world's largest land-based manganese deposit, with a resource of approximately 4 billion tons of Mn ore. The Kalahari Manganese Deposit (KMD) occurs within the KMF, covering an area of approximately 320 km^2. Stratigraphically, three manganese ore beds occur within the KMD as part of the Hotazel Formation of the Voëlwater Subgroup. The Mn ore beds are interbedded with banded iron formations (BIFs). The manganese ore beds are: (1) the lower Mn ore bed, which varies from 6 m (Black Rock area) to 45 m (Mamatwan area) thick; (2) the middle Mn ore bed which is significantly thinner (0.5-3 m in thickness); and (3) the upper Mn ore bed, which occurs approximately 20 m above the lower Mn ore bed, and attains a maximum thickness of 27 m in the Mooidraai area.

The thickness of the upper Mn ore bed has rendered it to be uneconomic in the low grade Mamatwan region of the KMD, whereas in areas like N'chwaning, this Mn ore bed is currently exploited and has been mined out in the graben-hosted Hotazel deposit. Drill core from Mooidraai, south-east of the study area, reveals that the upper Mn ore bed attains a thickness of up to 27 m in this region. Investigations are underway to try and delineate the upper Mn ore bed within the York area petrographically and mineralogically through XRD, XRF, optical microscopy (reflected-light), SEM and RAMAN spectroscopy. Based on mesoscopic descriptions of the drill core, nine zones have been identified thus far, and appear to be consistent throughout the study area. Optical microscopy and SEM analyses reveal and attest to Kleyenstüber's [1] initial findings that the manganese ores of Mamatwan–type have a microcrystalline texture and show very little to no signs of recrystallization. The two most common textures encountered in the manganese ore beds are: (1) prominent, coarse-grained ovoids; and (2) sparry carbonate lenticles. The characterization of zones identified lies solely on the observations that certain zones are mainly composed of ovoids in a lutite matrix, whereas other zones are composed of carbonate laminae which accentuate the banded appearance in these rocks, as well as zones that comprise both previous textural scenarios.

The project is also aimed at investigating the existing models of deposition like that proposed by Beukes [2] of transgressive-regressive cycles in a back-arc basin where Fe and Mn sediments were introduced by a volcanic source. Fe-rich sediments precipitated more proximal and Mn-rich sediments more distal to the volcanic source. This trend is observed in the drill core from York, where BIFs display shallow environmental features, like rip-up clasts and a granular texture which are typical of shallower high energy environments, whereas the Mn ores are more fine-grained, typical of deep marine environments.

References:

[1] Kleyenstüber A.S.E. (1984) Transactions of the Geology Society of South Africa 82:257-272

[2] Beukes N.J (1983) In: *Iron formations, facts and problems (Trendall A.F and Morris R.C., eds)*: Elsevier, Amsterdam, 131-209