REGOLITH TERRAIN ANALYSIS FOR IRON ORE EXPLORATION ITHE HAMERSLEY PROVINCE, WESTERN AUSTRALIA

FINAL REPORT

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SUMMARY

This report presents the findings of our study of the processes responsible for the genesis, transport, deposition and preservation to the hematite-rich, low-phosphorous sediments ("lump" ore) commonly distributed throughout the study areas.

Mineralisation
A weathered mantle comprising an upper hematite-rich zone overlying a lower goethitic zone was developed throughout the region. The mineralisation process was driven by the disequilibrium between meteorically derived groundwater and substrate, in the weathering zone. Mineralisation proceeded by incongruent dissolution of BIF, with silica being removed in solution, and iron precipitating as goethite prior to dehydration to hematite. Weathering zones were also developed in bedded mineralisation, where present. BIF texture is preserved in weathered/mineralised BIF. Shales weathered to pisoliths, clays and microcrystalline goethite.

Climate
Weathering occurred in the humid climatic condition which prevailed for an extensive period of time prior to the mid-Miocene. Until this time, landscape stability was maintained by rates of weathering exceeding rates of erosion of weathered material. Change of climate from humid to arid in mid- to Late Miocene times suppressed vegetation cover and destabilised the weathered mantle.

Erosion and Deposition
The weathered mantle was eroded from the uplands, and transported to lower lying areas. Sediments were deposited at sites of gradient reduction and flow expansion, burying weathered zones in the floors and sides of valleys. Primary sediment deposits typically comprise mature lower sections of hematite-rich gravels overlain by immature mixtures of goethite, hematite and BIF, recording an inversion of the weathering stratigraphy. Some sediments have been subject to erosion and local re-distribution by valley fluvial systems.

Subcrop
The basement unconformity preserves significant elements of the Tertiary landscape, although weathered zones have been eroded from some areas. Structural and erosional lows in the resultant surface have the demonstrated capacity to retain commercial deposits of mature detritus. Alluvial fan, sheetflood and fluvial facies have been recognised in subcrop.

Preservation
Mature detritus deposits are preserved where they were cemented, or were by-passed by later, erosive systems. By-passing was controlled by factors intrinsic to sedimentation, including excess of sediment supply, choking and causing avulsion of channel systems.

Implications for Exploration
The preservation of weathered zones underlying modern range front spurs and re-etrants, demonstrates that the morphology of the study areas typically follows the Tertiary landscape.

Scoured sediment traps are likely to be situated at the mouths of the Tertiary drainage systems. The presence of structural traps may be inferred from outcrop expression of faults and folds. Where conditions favouring preservation apply, traps may preserve commercial deposits of mature detritus.