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Geology, geochemistry and mineralogy of the Murrin Murrin Nickel Laterite Deposit

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EXECUTIVE SUMMARY

A regional and deposit scale examination was undertaken of the characteristics and factors controlling enrichment of Ni and Co within the Ni-laterite deposits at Murrin Murrin. Compilation of a 1:50000 regolith-landform map by a combined approach that incorporated aerial photographic interpretation and magnetic, radiometric and Landsat TM image analysis established the regional regolith-landform setting of the deposits within the north and south tenements at Murrin Murrin. The regolith-landform map is also available as a separate report (Wells 1999) and is available on CD as a MapInfo project.

Examination of the factors controlling Ni and No enrichment at the deposit scale was achieved by characterization of element-regolith associations for two sites, MM2 and MM3, within the north and south tenements, respectively. Regolith characteristics of the Ni-laterite profiles at the two sites were modelled using the Mining Visualization Software (MVS) system, mass balance studies cluster analysis and from determination of CIPW-Norm mineral abundances.

The mineralogy and element associations within regolith units at depth for both sites was similar because of the similar bulk chemistry (i.e. high Mg; low Si, Al and Fe) of the underlying serpentinized cumulate and because of the minimal effect of weathering at these depths. The greater effect of weathering in the upper portion (ie. near surface) of profiles highlighted differences in the chemistry of the underlying cumulate bedrock, which were expressed as relative difference in CIPW-Norm abundances of chlorite, saponite and nontronite between MM2 and MM3.

Understanding of the variations in regolith mineralogy within and between deposits may have important metallurgical implications for ore processing.

The prevailing landform processes also influence element-regolith associations within the deposit and expression of the Ni-laterite profile at the surface. Introduction of locally derived felsic sediments (high in Al, Si, Ca and Ti) at the surface of the laterite profile at MM2 confused the element-regolith associations expected in profiles formed from weathered ultramafics. The depositional landform regime that prevails at MM2 is reflected in the subdued relief and minimal outcrop of laterite, which hinders exploration in the area. The more prominent relief at MM3 is a reflection of the prevailing relict and erosional landforms of the area that provides a better exposure of the laterite profile.

Mineralization of Ni and Co at MM2 is strongly controlled by structural overprinting of underlying ortho- and mesocumulates, which is expressed as a normally displaced, intersecting fault-set. Nickel and Co occur mainly within the nontronite unit in profiles formed over variably weathered ortho- and mesocumulates along the fault planes. Probable reactivation during weathering resulted in the localised depletion of Ni and Co (and other metals) along fault shear planes. Three-dimensional modelling, using MVS, of the fault-set within the regolith at MM2 was important to understanding the distribution of Ni and Co.

Enrichment of Ni and Co at MM3 is controlled strongly by lithology; variations in cumulate lithology were well correlated to values of the Ni/Ni+Al ratio. Mineralization occurs mainly within the nontronite unit of profiles developed from ortho- and mesocumulates where the nontronite unit was thickest, presumably because leaching was minimal. Ortho- and mesocumulates have weathered to variable depths that possibly reflect local variations in porosity of the serpentinized cumulate. Regolith profiles over adcumulates were more uniformly developed but to a shallower depth. Secondary silicification associated with initial stages of adcumulate weathering probably inhibited extensive profile development by impeding drainage. This also prevented enrichment of Ni and Co over adcumulates due to silicification either diluting enrichment or impeding the mobilisation of Ni and Co within the profile.