HIGH RESOLUTION GEOPHYSICAL METHODS FOR GOLD EXPLORATION UNDER REGOLITH COVER, SONGVANG PROSPECT, AGNEW, WESTERN AUSTRALIA

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INTRODUCTION

The Songvang gold deposit sits on the southwestern limb of the Lawler's Anticline, in the northern part of the Norseman-Wiluna Greenstone Belt. It is a shallow, south-plunging ore shoot with an estimated reserve of 120,000 ounces. Until recently, exploration drilling in the area had only reached the start of fresh bedrock and had missed the underlying ore body. Gravity and aeromagnetic data suggested only regional structures were present, whilst electrical gradient array IP data identified a chargeable body. The IP anomaly was in an area of resistive regolith, and helped to guide drilling in to the sulphide-rich ore body at depth.

The aim of this project is to generate an understanding of the various geophysical responses from the regolith, geology and mineralisation, and to characterise the deposit. Geophysical methods used at Songvang include aeromagnetics, gravity, ground TEM, gradient array IP, dipole-dipole IP, airborne EM and the relatively new sub-audio magnetic technique (SAM). Downhole and laboratory physical property measurements have also been carried out on selected drillholes.

METHOD AND RESULTS

Ground electromagnetics was trialled to obtain conductivity with depth information. The results suggested the method was ineffective due to the depth and disseminated nature of the sulphide-rich ore body. Airborne electromagnetic data was also collected using the GEOTEM system, but produced similar results to the ground EM.

The SAM method proved useful for delineating shallow, conductive features caused by the weathering of mineralised structures, and conductive ore at high resolution. It also indirectly provided a vector to the mineralisation at depth, as an asymmetric response within the SAM total field magnetometric resistivity (TFMMR) data. Drilling results identified the SAM response as a west-dipping shear zone that connects to the main ore body at depth.

To study the effects of current channelling in the shallow sub-surface, current electrodes were rotated 90 degrees from the original survey, and this gave a radically different pattern in the near-surface conductivity. A possible channel structure within the regolith and E-W faults have been identified from this experiment. Innovative downhole SAM total field magnetometric induced polarisation (TFMMIP) was also trialled over the deposit with positive results for the first time. The downhole IP demonstrated a high level of detail and correlated strongly with increased sulphide and gold grade. This method is expected to have application for resource definition in the early stages of drilling. The SAM responses in relation to the sulphide rich ore zones are shown in Figure 1.

An integrated approach to the investigation of the various geophysical responses has enhanced the understanding of the ore body and the responses of the regolith, geology and mineralised structures. In particular, the effectiveness and application of the SAM method in comparison to other methods has been evaluated.

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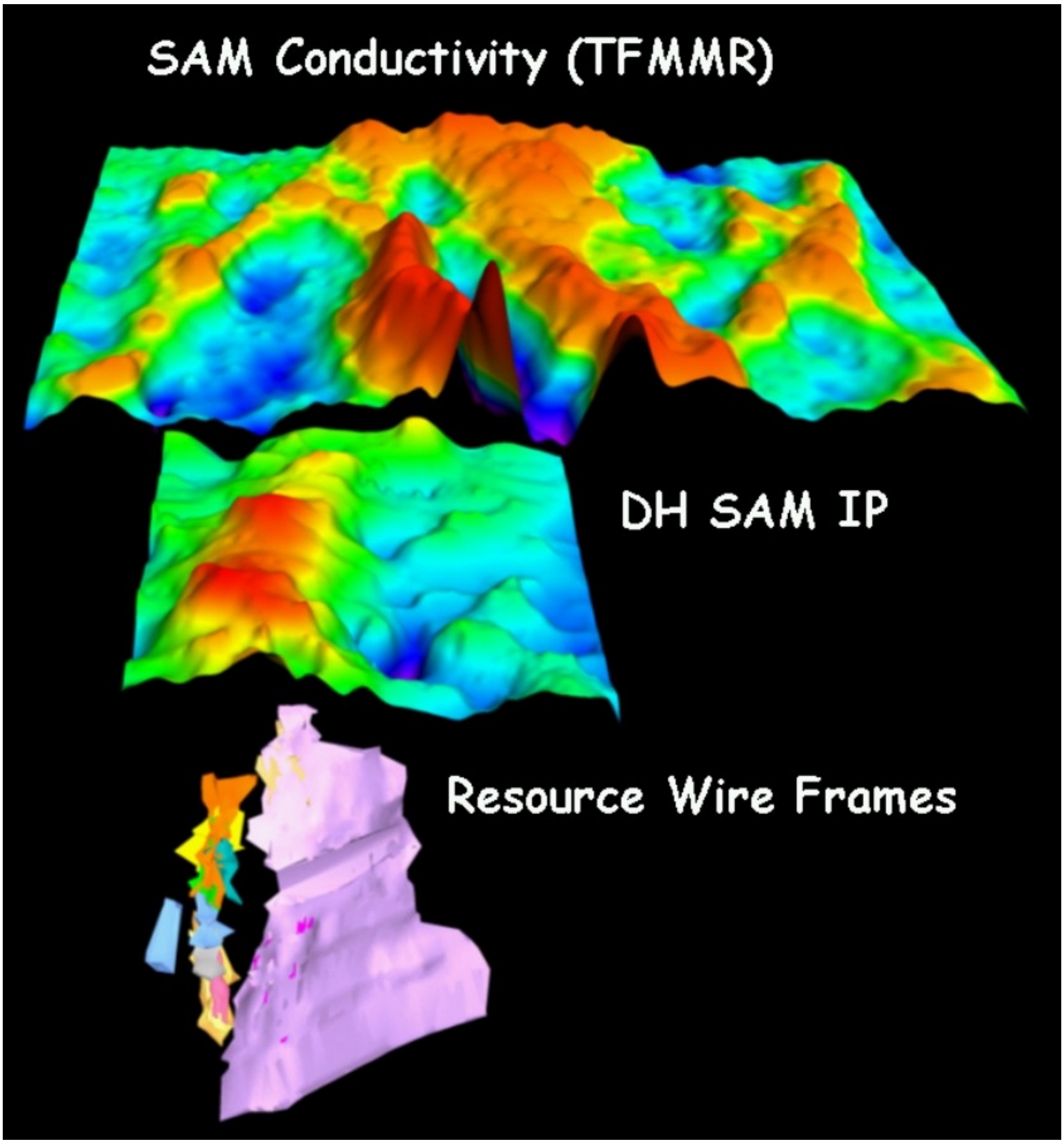

Figure 1: three dimensional perspective of the SAM results: near-surface conductivity (top), downhole IP chargeability in fresh rock (middle), and the geometry of the gold resource (bottom). View looking to the north.