magnetic technique to exploration at Yarrie was an integral part of the discovery of the Y2 deposit.

Downhole natural gamma logging is used as an in-hole stratigraphic mapping tool. In the Jimblebar area, the stratigraphy, comprising interbedded oxide BIF and silicate iron formation (shale) macrobands, is very regular. As a result, it is generally possible for gamma ray logging to identify the strata intersected in drillholes to within a several metres, even where they are complexly deformed. Hence natural gamma logging can play an important role in resolving complex structural problems. At Shay Gap-Yarrie, gamma logging does not show the stratigraphic discrimination seen in the Jimblebar area, because the stratigraphy in the Shay Gap region is not as laterally consistent. However, gamma logging is still useful for general delineation of rock types.

Density logging is used for a variety of applications, including confirmation of ore grades, bulk density estimates for resource calculation, and geotechnical studies. At Shay Gap-Yarrie, back-scattered gamma density logging is used downhole to determine the density of iron ore, an important parameter in resource calculations. Frequent calibration of the probe with known reference samples is critical.

URANIUM

Geophysical Signature of the Kintyre Uranium Deposit, Western Australia

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Abstract

Kintyre is an unconformity-related, vein-style uranium deposit estimated to contain 36,000 t of U3O8. The deposit, located 70 km south of Telfer, was discovered during heliborne follow-up of 214Bi channel anomalies detected by an airborne magnetic and radiometric survey. Ground inspection of the strongest anomaly identified outcropping secondary uranium-silicate mineralisation. Drilling beneath the mineralised outcrop intersected the Kintyre ore lens, with the best hole containing 71 m at 5.94 kg/t U3O8. Since then, six additional ore lenses have been discovered and these make up the Kintyre deposit.

A wide range of airborne, ground and borehole geophysical techniques has been applied to the evaluation of the deposit in an attempt to locate additional ore lenses and to determine a geophysical signature for use in regional exploration. Two types of geophysical signature have been determined for the deposit; that of the mineralised zones and that of the host unit.

The deposit has an anomalous 214Bi channel radiometric response coupled with elevated counts in the potassium channel. Induced polarisation surveys have shown that a distinct, high apparent resistivity and high chargeability response coincides with the Kintyre mineralisation.

The ore is hosted by a lithological package which contains variable amounts of magnetite, leading to a moderate- to high-amplitude, inhomogeneous magnetic response. A density contrast detectable by gravity surveying has been noted between the host sequence and surrounding rocks. Electrical surveys have shown that the host unit is resistive relative to the rest of the host sequence and other rocks in the area.

TITANIUM

Geophysical Signature of the Balla Balla Titaniferous Magnetite Deposit, Western Australia

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Abstract

The Balla Balla titaniferous magnetite deposit is situated about 120 km southwest of Port Hedland, in the Archaean Pilbara Craton of Western Australia. The titaniferous magnetite, and associated vanadium, occurs as layers within a mafic intrusion. A detailed gravity survey was conducted over the deposit. After band-pass filtering, residual gravity highs (about 10 gu) associated with mineralisation were defined. A ground magnetic survey was also conducted over the deposit. Positive magnetic anomalies (about 4000 nT) were interpreted to be due to more massive areas of mineralisation. Offsets between these anomalies allowed faults to be mapped. Elementary modelling of the magnetic data indicates that remanent magnetisation is responsible for a significant part of the observed magnetic anomalies. Ground electromagnetic data (VLF) and resistivity data were moderately successful in mapping the contact between the mafic intrusion and underlying granitic rocks, and confirmed the location of faults inferred from the magnetic data. Induced polarisation data show that the mineralisation is chargeable.

DIAMONDS

Geophysical Signature of the Argyle Lamproite Pipe, Western Australia

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Abstract

The Argyle lamproite diatreme is located close to the eastern margin of the Halls Creek Mobile Zone, in the East Kimberley, 120 km south of Kununurra. The pipe was discovered by the Ashton Joint Venture during reconnaissance gravel sampling of the East Kimberley in late 1979. The Argyle diatreme is intruded into Revolver Creek Formation and Carr Boyd Group Proterozoic sedimentary rocks. The diatreme is an elongate body 2 km long and oriented approximately north-south, with widths varying from 150 to 500 m. It is composed dominantly of pyroclastic rocks.

A range of geophysical techniques have been used over the Argyle pipe, partly to assist in prospect evaluation but mainly to test their suitability for locating lamproite diatremes in adjacent areas. Airborne and ground magnetic and electromagnetic methods were used with varying degrees of success and a limited borehole logging programme carried out. None of the methods produced a definitive response over the Argyle pipe. Results indicate that the Argyle pipe is, at best, weakly magnetic, mainly in the northern bowl area, and weakly conductive, making it a very difficult target to locate using geophysical exploration techniques. Severe topographic problems which affected both airborne and ground survey results compounded the inherent problem of locating a subtle geophysical response.