targeting drillholes. A correlation between gold grades and apparent susceptibility at Bounty and Mount Martin suggests that, in some cases, susceptibility measurements can be used as a guide to ore. In deposits containing komatiitic volcanic rocks, such as Queen Margaret and Mount Martin, the susceptibility meter can be used as an effective mapping tool, particularly where facing evidence is required to interpret complex structures.

Magnetic and Electrical Signatures of the Granny Smith Gold Deposits, Western Australia

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Abstract

Gold deposits at Granny Smith occur along a shear between a granodiorite intrusion and epiclastic sedimentary units. Three ore zones, Goanna, Granny and Windich, were identified by CSR in 1987, during exploration that included ground magnetic and induced polarisation surveys. Magnetic data were useful in helping to map intrusive rocks, banded iron-formations and less magnetic sedimentary horizons, and some faults. Although magnetite is a minor alteration mineral in the granodiorite, the mineralised zones do not give identifiable magnetic responses. Dipole-dipole induced polarisation surveys also gave valuable, and complementary, mapping information. At Granny, carbonaceous shale in the hangingwall and weakly polarisable footwall granodiorite masked any induced polarisation signal that the mineralisation may have produced. Drillhole measurements showed that oxidised mineralisation is not anomalously polarisable, whereas fresh mineralisation is moderately polarisable (some pyrite accompanies gold). Despite the lack of a direct induced-polarisation anomaly from Granny, the IP surveys delineated the deeply weathered mineralised shear north of Granny, which contributed to the discovery of Goanna. Electromagnetic measurements have also been used effectively for resistivity mapping.

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Magnetic Properties and Magnetic Signatures of BIFS of the Hamersley Basin and Yilgarn Block, Western Australia

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Abstract

Magnetite-rich banded iron-formations (BIFs) exhibit characteristic magnetic properties, including strong anisotropy. Interpretation of the geological structure of BIF units from the associated magnetic anomalies is complicated by anisotropy of susceptibility and, frequently, by remanent magnetisation. The timing of remanence acquisition relative to folding exerts a crucial influence on the form of the anomalies. Neglect of susceptibility anisotropy and remanence can lead to large errors in interpreted dips and thicknesses of BIF units. The effective susceptibility of BIFs parallel to bedding exceeds the susceptibility normal to bedding, typically by a factor of 2 to 4. Bedding-parallel susceptibilities of magnetite-rich BIFs are typically 0.5 to 2.0 SI (0.05-0.16 G/Oe). Remanence directions in BIFs usually lie close to the bedding plane. Koenigsberger ratios (Q) of BIFs vary widely, but characteristic values can often be determined for individual units. Q values in the range 1 to 2 are common. The magnetisations of the haematite-rich supergene-enrichment iron ores are much lower than those of their BIF precursors.

Magnetic properties of outcropping BIFs are usually greatly modified by weathering, which substantially decreases the bulk susceptibility, the degree of anisotropy and the remanence intensity. Deeper and more intense weathering of BIFs is encouraged by faulting and can be associated with reduced magnetic response over intensely faulted zones.

The remanence of BIFs from the Hamersley Basin is carried by late diagenetic to low-grade metamorphic magnetite after primary haematite. At Wittenoom and Paraburdoo, the remanent magnetisation of Brockman Formation BIFs is pre-folding, whereas in an area of higher metamorphic grade, the Turner Syncline, the remanence of the BIFs is probably post-folding. Aeromagnetic signatures over the Turner Syncline clearly reflect anisotropy and remanence.

Anisotropy and remanence effects are also evident in observed magnetic signatures over Archaean BIFs in the Yilgarn Block. Magnetic property measurements on samples from the Mount Magnet area and elsewhere confirm the high anisotropy and strong remanent magnetisations of these rocks.

Geophysics and Iron Ore Exploration: Examples from the Jimblebar and Shay Gap-Yarrie Regions, Western Australia

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Abstract

Aeromagnetic and downhole logging data have been acquired for iron ore deposits at Jimblebar and Shay Gap-Yarrie in the Pilbara region of Western Australia. The Jimblebar deposits are from the Archaean-Early Proterozoic Hamersley Group and the Shay Gap-Yarrie deposits are from the Archaean Gorge Creek Megasequence.

Aeromagnetic data are used to assist in regional mapping and generation of exploration targets. In structurally complex areas, a very close line-spacing may be necessary to provide data of sufficient resolution. Careful processing is necessary to reduce the large dynamic range of the data, caused by highly magnetic banded iron-formation (BIF), so that subtle features may be seen. Deposits display both structural and stratigraphic controls which may be evident in aeromagnetic data. In addition, the iron enrichment process alters magnetite within the parent BIF to haematite, which may give rise to subdued responses in aeromagnetic data. The application of the aero-