The magnetite-stable alteration is peripheral to gold lodes in differentiated dolerites, metabasalts and metasedimentary rocks which have undergone lower to mid-greenschist facies metamorphism. The magnetite alteration is partly coincident with the well-documented chlorite and biotite alteration zones.

The magnetic susceptibilities of the magnetite-stable alteration assemblages range to 100 x 10-3 SI units. It is noted that the magnetic properties of the Kapai Slate vary considerably on a regional scale but appear to be consistently high (up to 400 x 10-3 SI units) within the Victory-Defiance gold camp.

Magnetic maxima are coincident with all three gold deposits. The amplitude of the maxima observed in low-level aeromagnetic surveys are 30, 300 and 400 nT for Orion, North Orchin and Revenge, respectively.

Detailed Ground Radiometric and Magnetic Surveys of the Leviathan and South Venus Gold Prospects, Western Australia

Allan Perry[1] & Vernon C. Wilson[2]
1. World Geoscience Corporation, 65 Brockway Rd, Floreat, W.A. 6104 (formerly of Curtin University of Technology). 2. Department of Exploration Geophysics, Curtin University of Technology, G.P.O. Box U1987, Perth, W.A. 6001.

Abstract

In Western Australia, exploration for low-grade gold mineralisation is hindered by the presence of a deep mantle of weathering. Application of geophysical techniques at two prospects near Southern Cross, South Venus and Leviathan, shows that ground magnetic surveys are useful for lithological mapping and structural interpretation, and potassium alteration associated with gold mineralisation can be mapped directly using radiometric surveys. Radiometric measurements indicate that potassium signals of up to 5%eK are associated with wallrock alteration adjacent to gold mineralisation, whereas the potassium signal from the main mineralised zone is close to 0%eK. Potassium signals associated with alteration are generally two to five times the width of the zone of gold mineralisation. Comparison of surface and drillhole radiometric sampling indicates that weathering does not seriously effect surface radiometric surveys except where transported soils cover the residual weathered profile.

Geophysics of the Big Bell Gold Deposit, Western Australia

Stephen G. Massey[1] & Peter Kowalczyk[2]
1. Placer Exploration Ltd, P.O. Box 764, Cloverdale, W.A. 6105. 2. Placer Dome Incorporated, P.O. Box 49330, Bentall Postal Station, Vancouver, British Columbia V7X 1P1, Canada

Abstract

The Big Bell gold deposit is hosted by a felsic volcanic sequence of Archaean age. The alteration mineral assemblages within the host- and wallrock units of the deposit produce measurable geophysical anomalies. The deposit and altered wallrocks which contain up to 10 vol. % sulphide are chargeable, producing induced polarisation anomalies in dipole-dipole data of up to 30 mV/V at n^53. In addition, a strong chargeability of up to 40 mV/V at n^52 is evident in the dipole-dipole data, and corresponds to a graphitic and sulphidic horizon in the immediate footwall to the deposit. This unit has been mapped with the gradient array over the entire extent of the leases, providing a useful marker at the top of the felsic volcanic sequence.

The strong potassic alteration accompanying the gold mineralisation is delineated in downhole spectral radiometric logs in which highly anomalous potassium values of up to 8 wt % are comparable with those derived by chemical analysis. The downhole logs also indicate that alteration has not enriched or depleted uranium or thorium in the ore zone. There are also ground radiometric potassium anomalies over outcropping lode rocks.

Airborne and ground magnetic anomalies adjacent to the lode are due to sources with very high magnetic susceptibility values, measured in pyrrhotite- and magnetite-altered wallrocks by downhole geophysics. The values measured in the logs are 0.14 SI units in the pyrrhotite-altered zone, and range between 0.025 and 0.5 SI units in the magnetite-altered zone.

Target generation within the remainder of the Big Bell greenstone belt has relied heavily on geophysics, with the highest ranking being given to magnetic, potassium and induced polarisation anomalies within the felsic volcanic sequence.

Magnetic Susceptibilities of Rocks Associated with Some Archaean Gold Deposits in Western Australia

Richard A. Keele
Centre for Ore Deposit and Exploration Studies, Geology Department, University of Tasmania, G.P.O. Box 252C, Hobart, TAS 7001

Abstract

Magnetic susceptibility measurements of rocks obtained from a number of Archaean mesothermal gold deposits have aided the interpretation of their geological and geophysical settings. Five deposits within the Yilgarn Craton were chosen on the basis of their magnetic host rocks: Youanmi (tholeiitic basalts), Greenfields (layered differentiated gabbro), Mount Martin (strongly sheared komatiitic sequence), Queen Margaret (serpentinised komatiitic peridotite) and Bounty (banded iron-formation). Iron-rich minerals associated with the gold ores include: weakly magnetic pyrrhotite (Greenfields and Bounty), magnetite (Mount Martin and Bounty) and non-magnetic pyrite (Youanmi and Queen Margaret).

The existence of two styles of mineralisation, whose apparent susceptibilities are either less than, or greater than, the host rocks, is a consequence of the geochemical interaction between the hydrothermal fluids and the wallrocks. This can have important implications for exploration since the target magnetic anomalies will be different in each case. Where apparent susceptibility values in the ore are greater than the host rocks, the mineralisation would be expected to be represented by a secondary positive anomaly on the flanks of a larger regional anomaly; where they are less, any local magnetic minima could be highly significant in terms of