

Abstracts

Geology and Geophysics of Western Australia

Geology and Mineralisation of Western Australia

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Abstract

The evolution of Western Australian terrains spans over 4000 million years. During this time, a wide variety of mineral deposits have formed. The ca 2700 to 2500 Ma granitoid-greenstone terrains of the Yilgarn Craton are the most intensely mineralised with world-class nickel and gold deposits, as well as mineralised pegmatites. The Pilbara Craton is less well mineralised but is overlain by the Late Archaean to Palaeoproterozoic Hamersley Basin which contains world-class iron ore deposits. Proterozoic orogens and basins contain sporadic and locally important gold, copper, copper-nickel, lead-zinc, and uranium mineralisation. Diamondiferous lamproites and kimberlites have intruded within, and adjacent to, the Kimberley Craton since the Proterozoic. These include one of the world's largest diamond deposits at Argyle. The Canning Basin hosts late Paleozoic carbonate-hosted zinc-lead mineralisation. Since the Mesozoic, heavy-mineral sands have been deposited, mainly in the Perth Basin, and lateritic weathering has resulted in world-class bauxite deposits. This deep weathering has also resulted in supergene enrichment of gold, nickel, rare earth elements and uranium.

Airborne Geophysics in Western Australia

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Abstract

Aeromagnetics became recognised as a valuable aid to exploration in Western Australia during the 'nickel boom' of the 1960s. The now commonplace term 'high-resolution aeromagnetics' evolved during the 1980s, mainly to meet demands of a resurgent gold exploration industry which required a greater understanding of geological structure and rock type than was possible with conventional field mapping. High-resolution aeromagnetic surveys are typically flown at a line spacing of 200 m, a terrain clearance of 60 m and with a magnetometer sampling interval of 7 m. Imaging of the data provides a greater range of options for highlighting subtle structural features than conventional contours. Image maps may be interpreted using skills of photogeology and satellite-image interpretation and have been a major factor in bridging the communication gap between geophysicists and geologists.

The effectiveness of radiometric data in Western Australia, collected simultaneously on virtually all high-resolution

aeromagnetic surveys, has been constrained by lack of outcrop and transported soils. In appropriate areas the method is successful at mapping different types of felsic igneous, sedimentary and metasedimentary rocks, and also in identifying hydrothermal alteration zones displaying potassic enrichment.

Problems of high surface conductivity have, in the past, limited the application of airborne time-domain electromagnetic surveys. The new generation of digital systems (e.g., QUESTEM) has improved depths of penetration through the real-time removal of unwanted noise. Airborne time-domain electromagnetics is no longer only an anomaly detector, but a three-dimensional regional conductivity mapping tool which, when integrated with magnetic data, enables the targeting of bedrock conductors to be controlled by interpreted geology.

Role of Geophysics in Exploration for MVT Lead-Zinc Deposits on the Lennard Shelf, Western Australia

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Abstract

The exploration strategy in the search for Mississippi Valley-type (MVT) mineralisation on the Lennard Shelf has been modelled on the approach commonly used in exploration for similar mineralisation in North America. Regional areas of interest are defined using a combination of geology, geochemistry and geophysics, then systematically grid-drilled. Several MVT lead-zinc deposits have been discovered on the Lennard Shelf through the application of this strategy.

Mississippi Valley-type lead-zinc deposits are difficult geophysical targets. Their geophysical characteristics have been studied on the Lennard Shelf to provide a guide for more cost-effective exploration both on the Lennard Shelf and elsewhere. On a regional scale, gravity and aeromagnetic surveys, used in conjunction with geochemistry, effectively focus exploration into favourable structural and lithological settings. Detailed gravity and seismic surveys delineate areas of the host carbonates in regions of shallow cover.

Several known Mississippi Valley-type deposits and prospects on the Lennard Shelf are associated with extensive marcasite haloes and associated induced polarisation anomalies. In areas of shallow cover, the induced polarisation method can be used to cost effectively define prospective areas by mapping mineralised systems on a semi-regional scale. These areas can then be tested using grid drilling.