6 FEASIBILITY STUDIES - FIELD RESULTS

6.1 Introduction

In Chapter 5, the waveforms recorded in the feasibility trials were analysed and a procedure developed for extracting the information of interest. This Chapter describes the results of extracting and mapping that information from surveys conducted over two well-known mineral deposits. The results confirmed the diagnostic value of the high definition information acquired by the SAM method.

These feasibility studies presented in this chapter were conducted at:

(i). The Orlando Au-Cu-Bi Deposit, Tennant Creek, NT.

(ii). The Flying Doctor Pb-Ag-Zn Deposit, Broken Hill, NSW.

Both sites had been surveyed with conventional geophysical survey techniques and had previously been subjected to intensive exploration activity. Consequently, the deposits were well understood from a geological perspective.

A major objective of the trials was to gain an insight into the potential of the method to provide information of diagnostic value to the explorationist. The trials were also intended to provide a means of evaluating the SAM field procedure with a view to identifying any logistical difficulties inherent in the technique.

6.2 Feasibility Study #1 - Orlando Deposit, Tennant Creek, Northern Territory

6.2.1 Location

The first SAM feasibility trial was conducted in May, 1992 over the Orlando Au-Cu-Bi Deposit. The site is located 28 km WNW of Tennant Creek, NT as shown in Figure 6-1 and lies within the Tennant Creek 1:250,000 map sheet (SE 53-14 at 19°26′51″S & 134°01′30″E). The license area is referenced to the Orlando Mine Grid which is orientated 26°30′ from true north. The magnetic declination at Orlando is 4°30′. The magnetic inclination in the area is -50.8°.

The Orlando Deposit was first discovered in 1934 and has undergone three periods of intermittent mining. Reported production between 1934 and 1952 was 47 tonnes of ore averaging 9 g/t Au. Following exploration by Peko-Mines NL in the years 1956-1958, the deposit was underground mined and in the 17 years to 1976 produced 322,000 tonnes of ore averaging 11.7 g/t Au and 1.5% Cu from depths of 100-300 m below surface. The Orlando mineral claims which now form part of the Orlando Mine block of mineral leases and claims were originally granted to Peko-Wallsend Operations Limited in 1989 and were, subsequently, acquired by Poseidon Gold Limited (PosGold) in June 1991.

An exploration program implemented by Peko defined a shallow near-surface resource. However a combination of low grade, adverse waste-to-ore ratio, metallurgical recovery difficulties and slope stability problems precluded a viable open cut operation at that time. This shallow resource and adjacent zones of north-west trending geochemical anomalism along the "Orlando Shear" have been the focus of resource drilling and a mine feasibility study by PosGold. They are now being exploited via an open cut mining operation. As a consequence, exploration within the Orlando group of tenements has been accelerated in order to thoroughly test the surrounding area for further Au-Cu mineralisation associated with magnetite / haematite ironstone bodies.

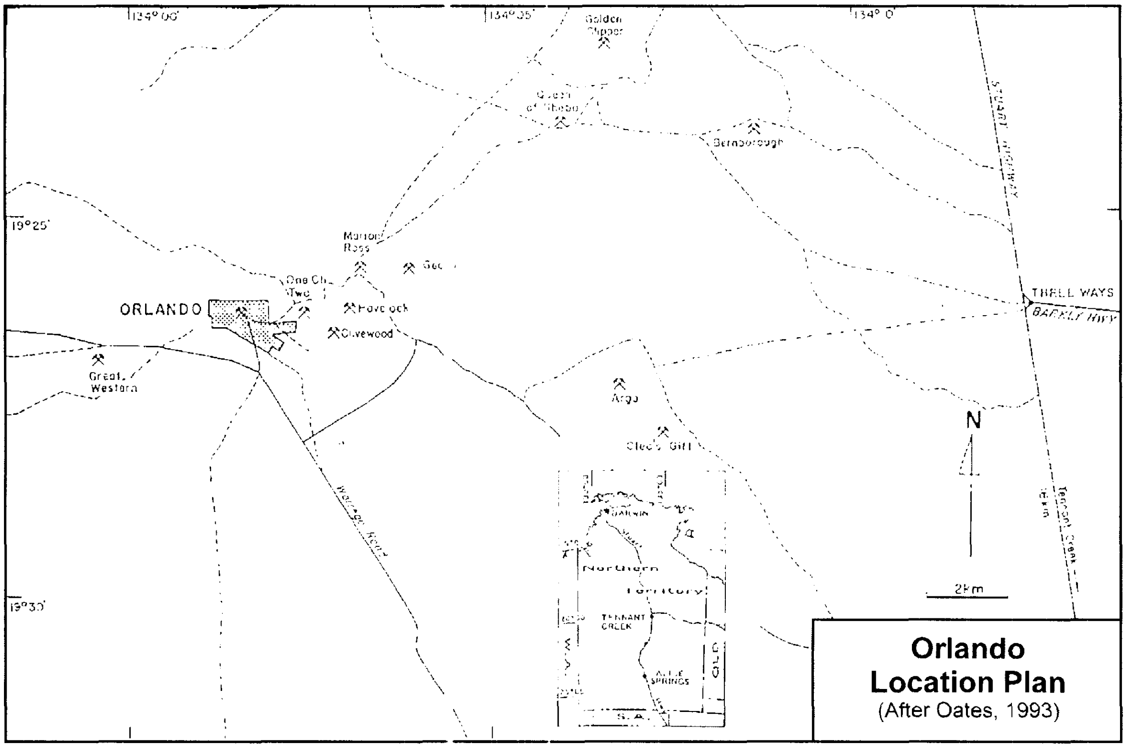

Figure 6-1. Orlando Location Plan (After Oates, 1993).

Soil cover, comprising alluvium, colluvium scree, aeolian sand and mottled clay is developed to an average depth of 3-6 m, and up to 10-15 m above the Warramunga Group sediments. Minor outcrop is preserved in the form of mesas and low lying ridges. Iron-stained pisolitic laterite material is also present. Green to dark brown calcrete occurs as isolated cover with ferricrete cover forming topographic highs. Faults within the area tend to form resistant ridges due predominantly to the presence of quartz fill. In general, the terrain is low lying hills and plateaus surrounded by broad floodplains. Ironstone blows and ridges protrude as mesas above the surrounds.

6.2.2 Geological Setting

The geology of the Orlando Mine area is described by Oates (1993). The Orlando Deposit occurs within the Lower Proterozoic Tennant Creek Inlier which extends from 17°15′S to 21°33′S and from 131°55′E to 135°47′E and covers an area of about 43,000 km^2. It can be subdivided into three geological provinces (Figure 6-2):

(i). The Central Tennant Creek Block (TCB) which hosts the economic Tennant Creek goldfield. The TCB consists of a 3,000 m thick sequence of turbiditic greywacke, siltstone, shale and interlayered felsic volcanics which comprise the Warramunga Group.

(ii). The Davenport Province - Hatches Creek Group. A pile of felsic volcanics, with and without shallow water sediments and extensive basalt flows up to 10,000 m thick which is situated to the south of the TCB and unconformably overlies the Warramunga Group Sediments.

(iii). The Tomkinson Creek Province. The TCB is overlain in the north by the Tomkinson Creek Beds which comprise clean quartz sandstones with minor siltstones, mudstones and carbonates and are about 9,000 m thick.

Isolated occurrences of gneisses have been interpreted by Whittle (1966) as basement, possibly Archean in age (Black, 1981). Within the Tennant Creek Inlier are a number of igneous intrusive bodies of which the Tennant Creek Granite (1870 - 1820 Ma) and the Warrego Granite (1700 Ma) are the most significant.

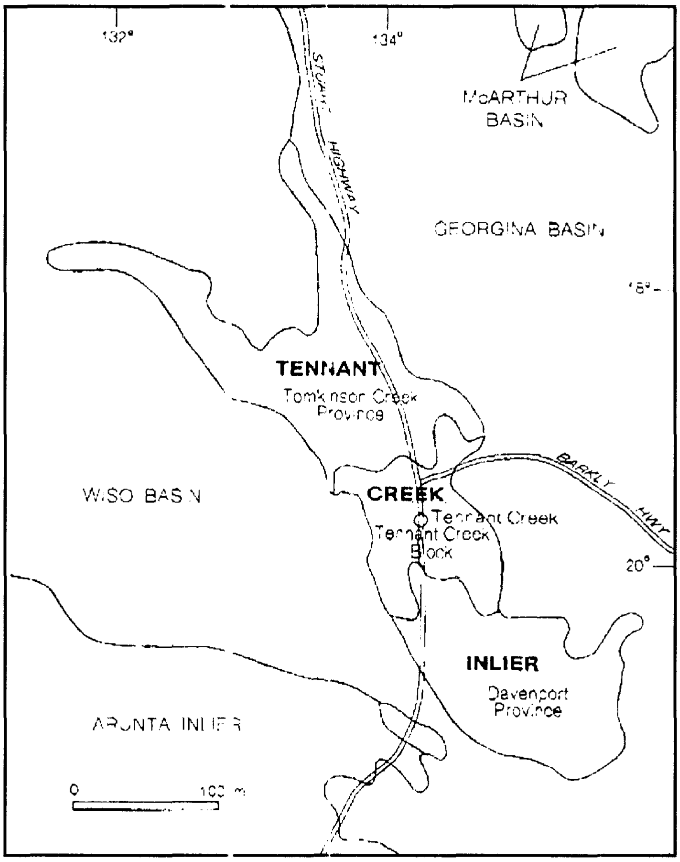

Figure 6-2. Orlando Regional Geology (After Foley *et al.*, 1995).

6.2.2.1 Form of the Mineralisation

The Orlando group of tenements are located within the Carraman Formation of the Lower Proterozoic Warramunga Group of turbiditic siltstones, shales and greywackes, which host the majority of the ironstone related Au-Cu-Bi mineral deposits in the Tennant Creek Goldfield (Lowe, 1994).

Au-Cu-Bi mineralisation is associated with magnetite-haematite ironstone bodies, within an envelope of sheared chloritic sediments (Figure 6-3). Minor Pb-Zn mineralisation is also found within this package associated with a later carbonate-talc alteration overprint. The shear zone is referred to locally as the Orlando Shear and trends 110° true north and dips a 60-80° to the south-west. The Orlando Shear is situated on the SW limb of a large synclinal structure (Lowe, 1994). Evidence of sinistral movement and reactivation has also been observed along the shear.

The magnetite-haematite ironstone bodies have an ellipsoid to pipe-like shape and commonly flatten in the direction of a regional east-west cleavage whilst chlorite rich pipes of hydrothermal alteration extend vertically below the ore bodies (Oates, 1993). A geological cross-section from Line 700 mE is shown in Figure 6-4.

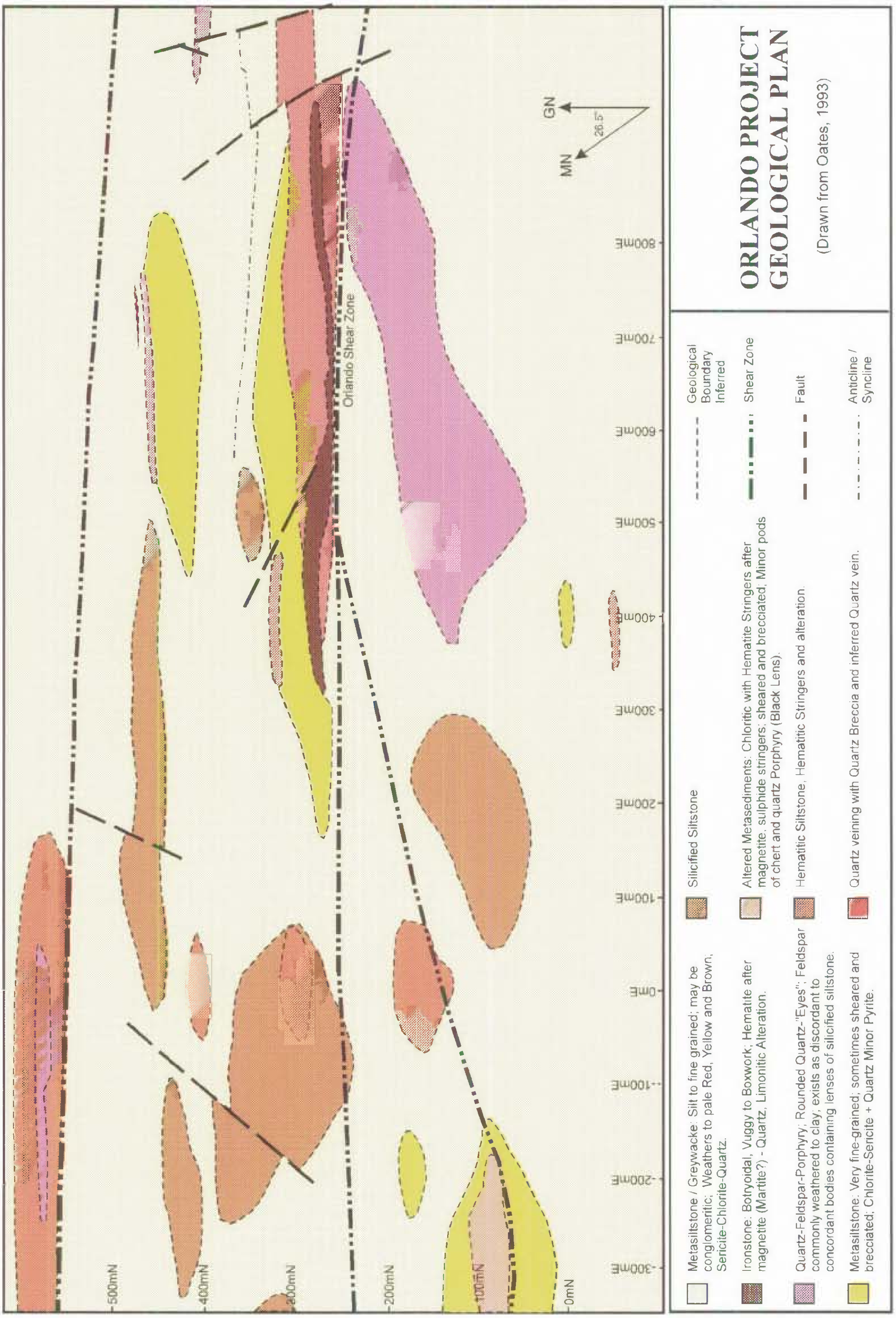

Figure 6-3. Orlando Local Geology Map (Drawn from Oates, 1993).

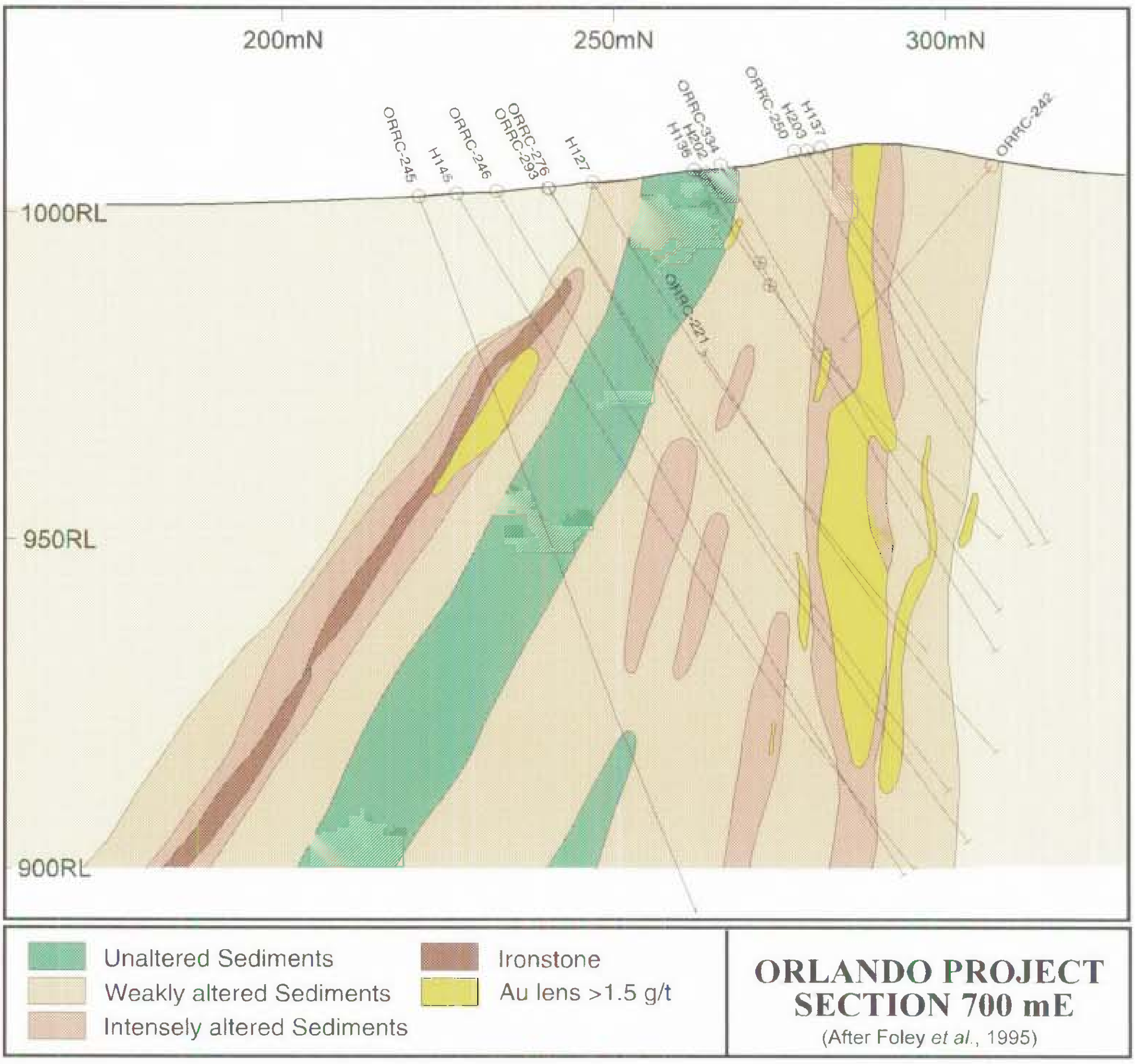

Figure 6-4. Orlando Geological Section - Line 700 mE (After Foley *et al.*, 1995).

6.2.3 Prior Geophysics

The Geophysics of the Orlando deposit is described by Foley *et al.* (1995) and much of the following discussion has been drawn from that paper. Surveys relevant to this report are described below.

6.2.3.1 Magnetics

A ground magnetics survey was conducted over Orlando in 1937 by the Aerial, Geological and Geophysical Survey of Northern Australia (McNeil, 1966). At the time, the survey was considered a major advance in exploration in the area as it located two significant magnetic anomalies directly over the Orlando deposit (see Figure 6-5).

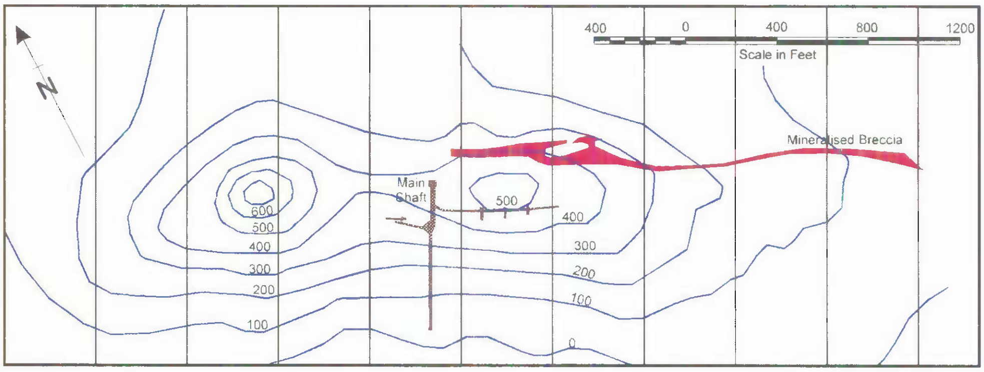

Figure 6-5. Contours of the vertical component of the magnetic field in gammas (nT). Orlando Mine area (Drawn From McNeil, 1966).

The results of a recent aeromagnetic survey encompassing the Orlando area are shown in Figure 6-6. The prospect is centred on *a "discrete elongate-ovicular magnetic high, 400 nT in amplitude and situated along a contact between Warramunga Group Sediments and a westerly extension of the Tennant Creek Granite, referred to locally as the Red Bluff Granite"* (Foley *et al.*, 1995). The magnetic anomaly is structurally controlled and appears to be ironstone related. The strike of the anomaly is 315° true over a distance of about 700 m.

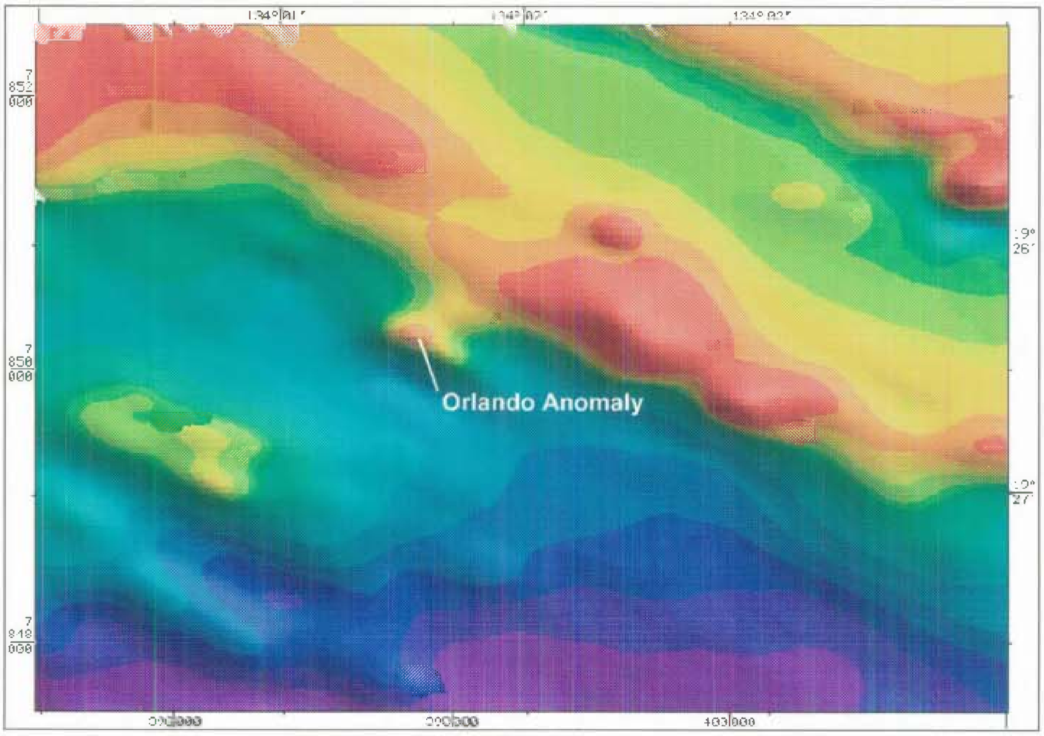

Figure 6-6. Orlando Aeromagnetic Data (After Foley *et al.*, 1995).

6.2.3.2 Gradient Array Induced Polarisation (IP)

A gradient array Induced Polarisation (IP) survey was completed over the mineral claims in mid-1992, with the aim of defining the known Orlando orebodies and other potential shallow resources as well as to aid structural mapping. The survey was carried out in complex resistivity mode using a transmitter frequency of 0.125 Hz. Data were collected along 50 m spaced lines utilising a 25 m potential electrode separation and a current electrode separation of 1200 m. The apparent resistivity and phase difference data are presented in Figure 6-7.

Apparent Resistivity

The main Orlando Shear is clearly manifest in the apparent resistivity data being bounded by the resistive Warramunga Sediments to the north and the conductive Tennant Creek Granite to the South. A secondary shear branches off the Orlando Shear to the south-west of the survey area. However, its signature is much more subtle.

This subtlety is perhaps a function of the shear not being associated with a lithological contact and is thus characterised by less physical contrast. Two major flexures are evident along the shear at 500 mE and 1000 mE. The former occurs at the intersection of the two shears, whilst the latter is coincident with two sub-parallel faults which cut across the main shear. The open pit resource currently being exploited occurs between these two flexures.

South of the Orlando Shear, the data suggests that the weathered material overlying the Tennant Creek Granite is relatively conductive, in contrast to the typically resistive response often associated with granitic units themselves, but typical of weathered overburden. According to Foley *et al.* (1995), the conductive response may also be associated with a broad alteration halo on the hanging wall of the shear. The resistive unit to the north of the Orlando shear is more variable which is consistent with the more complex geology mapped in the area. This unit is bounded to the north by another shear (the 350 mN shear), which is also evident in the data.

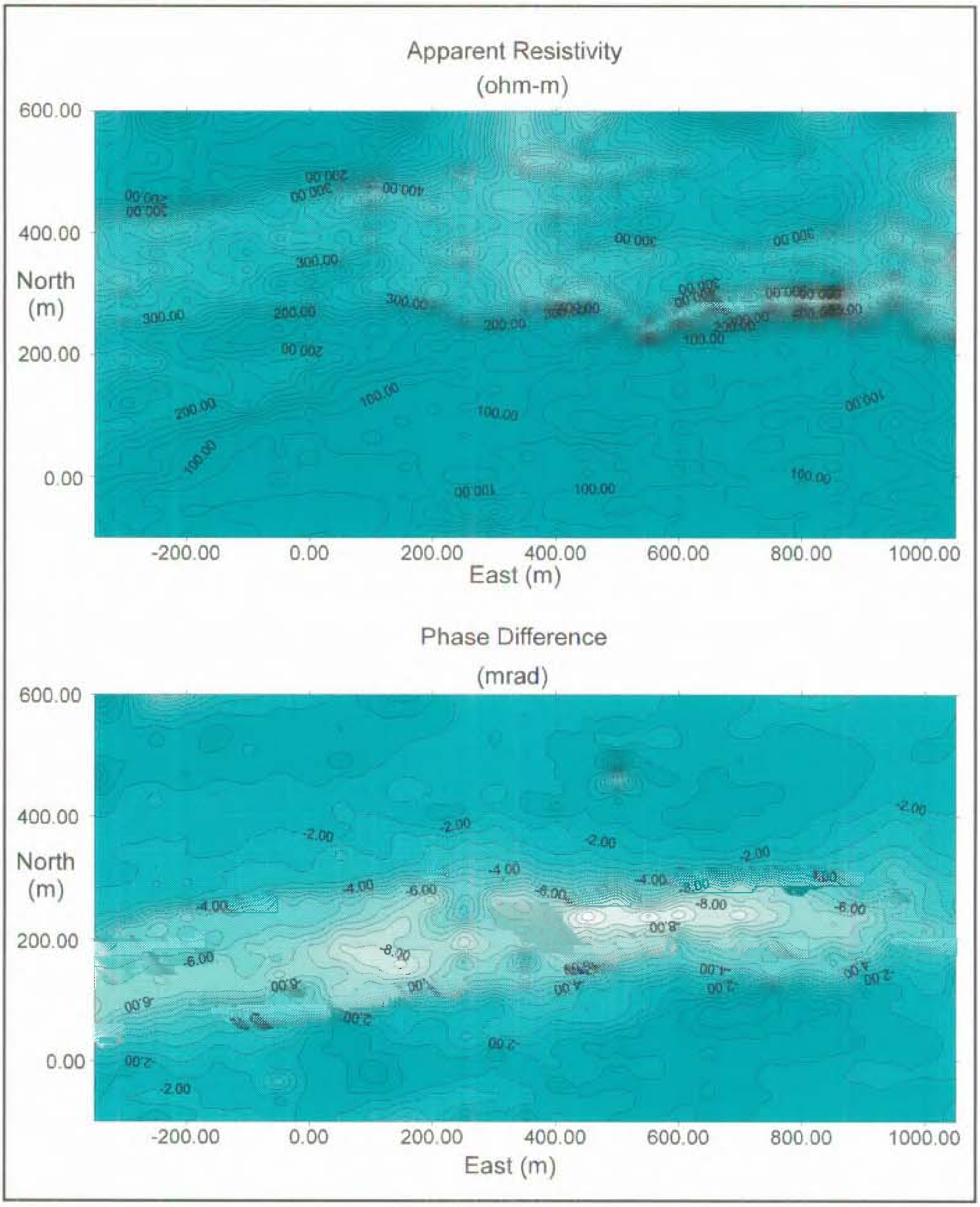

Figure 6-7. Gradient Array IP contours (After Foley *et al.*, 1995).

Phase Difference

The phase response data is characterised by a 250 m wide anomalous zone trending essentially grid east-west. The zone terminates near 1000 mE, but is open to the west. The eastern termination correlates with a major flexure in the apparent resistivity data at about 1000 mE which is related to a pair of sub-parallel cross cutting faults, although a weakly anomalous "finger" continues to the east. The eastern limit of the phase response is also consistent with the eastern limit of the ground magnetic response. The bulk of the phase response coincides with the mapped Orlando Shear between 950 mE and 300 mE at which point a change of strike direction is evident and is coincident with the "secondary", south westerly trending shear.

Foley *et al.* (*ibid.*) describe two main anomalous zones. The first is located between the two flexures along the Orlando Shear from 350 mE to 950 mE and is coincident with the current resource. A smaller zone from 0 mE to 200 mE is situated to the SW of the intersection of the two main shears and is coincident with the main magnetic response. The width of the anomalous zone is interpreted by Smith (1992) as being related to a halo of disseminated chalcopyrite, pyrite, and bismuthinite associated with enveloping altered metasediments around the main ironstone hosts.

It is clear from the data that the sources of the apparent resistivity and phase responses are not entirely the same. The apparent resistivity is clearly mapping lithological contrast, whilst the induced polarisation response appears to directly map mineralisation associated with the shear and associated alteration.

6.2.4 SAM Field Procedure

Two 700 m square grids were surveyed at Orlando and were named Grid 1 and Grid 2. Grid 1 extended from -350 mE to 350 mE and from -100 mN to 600 mN. Grid 2 adjoined Grid 1 on its eastern boundary, extending from 350 mE to 1050 mE. The layout of the surveyed grids is shown in Figure 6-8. The current electrodes were separated by 1100 m and emplaced along strike from the mineralisation. Current electrodes for Grid 1 (C1 and C2) were positioned at -550 mE, 250 mN and 550 mE, 250 mN. The Grid 2 electrodes (C3 and C4) were located at 150 mE, 250 mN and 1250 mE, 250 mN. In both cases, the wire feeding the electrodes was laid out in a "U" shape to the north of the survey areas as shown in Figure 6-8. The wire was positioned with the aid of chain and compass and was maintained at a distance of 200 m from the survey area. Traverses were surveyed along north-south orientated lines spaced 10 m apart. The current output achieved was 5.0 A for Grid 1 and 7.2 A for Grid 2.