APR 7 to 9

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ANGLO AMERICAN

Anglo American Exploration (India) Pvt. Ltd.
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1. The Controller General,
Indian Bureau of Mines,
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NAGPUR - 440 001
Maharashtra

Attn. : Superintending Mineral Economist (Statistics)

2. The Controller of Mines (South)
Indian Bureau of Mines,
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3. The Regional Controller of Mines
Indian Bureau of Mines,
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4. Director Mines and Geology
Government of Andhra Pradesh
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5. Asst. Director of Mines & Geology
Government of Andhra Pradesh
Narayan Puram, Saibaba Temple Road
Dachepalli, GUNTUR – 522 002
Andhra Pradesh

Report for 3 R.P.s. No Mineralised detected. Co-ord.

Sub: **Final Report of Reconnaissance Work Done**
(Under Rule 3E of MCDR, 1988)

Ref: RP block GUNTUR-1: 2487 sq km in Guntur and Prakasam Districts of Andhra Pradesh

Mineral(s): **Copper, Nickel and Associated Minerals**

Dear Sir,

Please find enclosed herewith the **Final Report of Reconnaissance Work Done** over the above Reconnaissance Permit as required under Rule 3E of MCDR, 1988).

We request you that the contents of the report are kept confidential under Rule 7(viii) of MCR, 1960.

Yours faithfully,

Signature:

Name in full: S. Srinivas
Designation: Sr. Geophysicist

Place: UDAIPUR
Date: 28th August 2004

Enclosure 1: Form BB
Enclosure 2: Technical Report

CMG pl

डायरी क्रमांक / Diary No. 824
दिनांक / Date 1-9-04
बी.ए. क्षेत्र शाखा
Section Issuing Cell

1/9/04

कार्यालय / Office of the
महानियंत्रक भारतीय खान ब्यूरो,
Controller General Indian Bureau of Mines
आवक डायरी सं. / Dy. No. 144
दिनांक / Date 3-1-8-04

Report by Anglo American Exploration (India) Private Limited

Final Report of Reconnaissance Survey

(See rule 3E of MCDR, 1988)

A. INTRODUCTION -

In July and October 2002, Anglo American Exploration (India) Pvt. Ltd. (AAEIPL) executed three Reconnaissance Permits (RP) in the State of Andhra Pradesh for prospecting of Copper, Nickel and associated minerals.

As mentioned in our scheme of reconnaissance submitted in September 2002, these three RP blocks (forming a contiguous area of 8046 sq km) cover only one conceptual target. Reconnaissance operations, therefore, are being undertaken in the entire area as a single project and under one single scheme of reconnaissance. Hence this consolidated report of reconnaissance gives details of work done over all of the three RP blocks.

This final report describes the reconnaissance work accomplished in the Reconnaissance permit areas and data and information collected since the execution of licences.

B. AREA OF RECONNAISSANCE -

The three RPs held by AAEIPL form a contiguous area of 8046 sq km and cover large part of Prakasam district and smaller parts of Guntur and Nellore districts in Andhra Pradesh (Fig. 1).

Location, area held and date of execution of the RPs are tabulated below.

RP Block	Falls in Districts	Date of Execution	Original Area (sq.km.)	Area Relinquished (sq.km)	Surrendered on	Present Area (sq.km.)
Ongole-1	Prakasam & Nellore	31 July 2002	2858.00	2858.00	30 July 2004	00.00
Ongole-2	Prakasam & Guntur	19 October 2002	2701.00	2701.00	30 July 2004	00.00
Guntur-1	Guntur & Prakasam	27 July 2002	2487.00	2487.00	26 July 2004	00.00
Total			**8046.00**	**8046.00**		

C. GEOLOGY OF THE AREA -

The target area is underlain mainly by the rocks of the Nellore Schist Belt, which comprise mostly amphibolites with bands of quartzite. Several mafic and ultramafic bodies of varying dimensions (Chimakurti, Pasupugallu, Ravipadu etc.) have intruded into this part of schist belt and make up a large igneous province. Large igneous provinces in similar tectono-magmatic settings are known to host magmatic sulphide mineralisation elsewhere in the world, e.g. Voisey's Bay in Canada. This area in Andhra Pradesh was identified by Anglo American based on conceptual modelling and is considered as prospective for hosting copper-nickel sulphide mineralisation.

D. RECONNAISSANCE WORK DONE -

The following reconnaissance operations were carried out in these licence areas.

GENERAL:

This area has been covered by NRSA high altitude mag, OHR surveys (partly) and regional ground gravity surveys (by NGRI). This data has been used sometimes for identifying important zones. Some anomalies are also picked from this data. Table 1 gives the description of these anomalies.

Regional Geological Mapping

Reconnaissance work in the project started with regional geological traverses. The objectives of these traversing were to understand the geological set-up, to define prospective areas for further work and to decide on an exploration strategy to effectively screen the area.

Several regional traverses across the entire project area were made and information was collected from over 700 field stations in an effort to understand the nature of basement rocks and igneous intrusions. Most of these rock samples were sent for geochemical analysis of 53 elements.

Although large areas within the permit area are concealed under soil of varying thicknesses, some parts of the intrusions are outcropping/subcropping. Several representative rock chip samples were collected for petrographic studies and chemical analysis, which led to characterise the intrusions in terms of their type and lithology. Several major intrusions were located and their aerial extents better defined.

It also led to identifying intrusions, which could be prospective in terms of hosting Cu-Ni sulphides. Mafic/ultramafic intrusions (e.g. gabbro, norite, troctolite etc.) have a greater chance of hosting magmatic sulphide mineralisation whereas alkaline intrusions (syenites etc.) are unlikely hosts.

A regional geological map of the area showing various types of igneous intrusions is given in Fig. 2. Fig. 3 shows the rock chip locations collected in the RP area.

Based on the findings of this work, regional soil sampling and ground geophysical (mag, EM and IP) data was collected in few areas with various specifications depending on the size of the target anomaly. **This work was carried out in two phases**.

Fig. 4 shows the outlines of areas covered by different surveys (soil, magnetic and electromagnetic) with respect to intrusions and RP blocks during two phases.

2. Ground Magnetic Survey

A ground magnetic survey was done so as to locate major geological structures, see the lateral spread of the intrusions under cover and pick up magnetic anomalies related to possible mineralisation.

Initially in Phase1, detailed ground magnetic data at 400m-line spacing over 1850 sq km (~ 4000 line km of data with EW line direction) has been collected to identify geological structures/regional anomalies. Magnetic data was collected more or less continuously at 2-3m intervals along these lines.

In the Phase2, 750 line km data was collected on the individual soil anomalies (line direction was perpendicular to strike in most of the cases and line spacing varied from 50m to 200m).

The data helped in interpretation of geology and structure under cover, but no discrete magnetic anomalies were identified. Reduced-to-pole image of the ground magnetic data is shown in Fig. 5.

Portable GSM 19 V6.0 magnetometers (GEM Systems, Canada) with inbuilt geographic positioning system (GPS) were used to collect the ground magnetic data. Locally hired personnel were trained to operate the magnetometers and collect the data by walking along the planned traverse lines. Four to five magnetometers were used simultaneously and a resident geophysicist supervised the survey work and checked the quality of data being collected.

Fig.6 shows anomalies picked from airborne and phase 1 ground magnetic data. Table 2 shows the details of these anomalies.

3. Regional Geochemical Sampling

Topographically, all the intrusions excepting the one at Chimakurti are plain to gently undulating areas dissected by a number of stream/rivers. A thin soil cover, generally residual in nature, is found over most parts. During regional traversing, it was found that conventional soil sampling would be effective in most areas.

In Phase 1, conventional soil samples at 1000m x 250m grid (~ 3700 samples) were collected from an area of ~700 sq km.

In Phase 2, soil sampling total of 3665 samples was collected at various spacings (500 x 500 m offset grid, 1000 x 1000 off set grid) depending on the priority of the area.

The proposed site of sampling was reached with the help of a GPS. The topsoil was scraped and required amount of sample (approximately 160gms of -250μm fraction) was collected from a depth of 20-30cm.

Soil results identified a number of weak to moderate anomalous areas. Several single-point anomalies were also picked up based on the soil results.

Soil samples have been analysed for a large number of major and trace elements using ultra-trace analytical methods and ICP-MS / ICP-AES at ACME Laboratories, Vancouver (Canada).

Fig. 7 shows the all soil sample locations of the area. Geochemical anomalies of copper and nickel picked from soil sampling are shown in Fig. 8. Table 3 shows the top priority intrusives names from the soil geochemistry.

4. Ground Electromagnetic Survey

As magmatic sulphide deposits are known to be good conductors, a time-domain ground electromagnetic survey was also attempted during phase1 program, over a cluster of soil geochemical anomalies (~125 sq km) in the central part of Pasupugallu gabbro-norite intrusion. The survey was undertaken at 200m spaced stations along 500m spaced lines.

In Phase 2, 29 line km of ground EM and 3 line km of IP data was also collected over the soil anomalous areas. But, no conductor was found on any of these areas.

Presence of two high-tension electric transmission lines affected the data quality over almost 60% of the phase1 area. It was not possible to pick up any bedrock response from this area.

A Smart EM V5.0 EM system (Electromagnetic Imaging Technology, Australia), which is capable of frequency and time domain EM surveys as well as IP surveys, was used to locate conductors. The Smart EM system has a comfortable depth penetration of 300 to 400m from the surface.

Ground EM line path locations are shown in Fig. 5.

E. PERSONS ENGAGED FOR THE WORK -

Geological mapping and geochemical sampling programmes was carried out by a number of geologists working for the company as well as consultants from abroad were used for mapping and data interpretation. Field assistants were hired locally to assist the field teams.

The company geophysicist undertook most of the ground geophysical surveys. Several field assistants, as per requirement, were hired locally to carry out the surveys.

Table 1: Airborne Geophysical anomaly descriptions

Anomaly No	Type	Description	Work done	Comments
AM 1	Aeromag	Weak mag	Soil Geochem	No encouraging result
AM 2	Aeromag	Strong Mag EW strike	Soil Geochem	No Encouraging result
AM 3	Aeromag	Strong Mag	Partly Soil geochem	Do
AM 4	Aeromag	Weak mag	Soil geochem done	Do
AM 5	Aeromag	Strong mag	Soil geochem and ground mag	Do
AM 6	Aeromag	Weak mag	Soil geochem done	Do
AM 7	Aeromag	Strong mag	Site visit (amphibolite) Soil geochem and ground mag	Do
AM 8	Aeromag	Moderate and separate magnetic zones	Field visit - BIF	No follow up
AM 9	Aeromag		Soil geochem and ground mag	No encouraging result
AM 10	Aeromag	Weak EW Mag	Partly Soil geochem	Do
AM 11	Aeromag	Weak mag	Field visit and Soil Geochem	Do
AM 12	Aeromag AEM Gravity	Weak EW Mag and western edge is coinciding with AEM	Soil Geochem	Do
AM 13	Aeromag	Weak mag	Site visit – Rock is amphibolite schist	Do
AM 14	Aeromag	Moderate mag	Only one field stop – Phyllite	Do
AM 15	Aeromag AEM	Moderate mag with coinciding AEM	Major part of the anomaly covered by soil geochem	Do
AM 16	Aeromag AEM	Weak to moderate mag with coinciding AEM		In cuddapah's – Not interested

Table 2: Anomalies from the Ground Magnetic data

Anomaly No	Type	Description	Work done	Comments
GM 1	Ground Mag	Moderate single line anomaly	Site visit (Gabbro and BIF) and soil geochem	Covered by Soil Geochem - but no encouraging results
GM 2	Ground Mag		Site visit, soil geochem and ground EM (but disturbed)	Do
GM 3	Ground Mag		Site visit, soil geochem and ground EM (but disturbed)	Do
GM 4	Ground Mag	Moderate single line anomaly		Site visit – No encouraging result
GM 5	Ground Mag		Site visit, soil geochem and ground EM	Do
GM 6	Ground Mag	Moderate single line anomaly	Site visit and soil geochem	Do
GM 7	Ground Mag		Site visit, Soil Geochem	Do
GM 8	Ground Mag		Site visit and soil geochem	Do
GM 9	Ground Mag	Moderate Single line anomaly	Site visit (amphibolite) and soil geochem	Do
GM 10	Ground Mag	Moderate Single line anomaly	Site visit (amphibolite) and soil geochem	Do
GM 11	Ground Mag		Site visit and soil geochem	Do

Table 3: Top Priority intrusives from Soil Geochemistry

Intrusion Name	Follow up method and Recommendation
Ravipadu	Ground mag and EM - No anomaly – No further work
Kellampalle1	Do
Kellampalle 2	Do
Paupugallu	Do
Intrusion 25	Do
Intrusion I	Do
Amandapalle	Do
Intrusion 25/ Intrusion H	DO
PII – 14 (soil geochem anomaly)	Ground mag, EM and IP - No anomaly – No further work