DE BEERS

A DIAMOND IS FOREVER

KAR-32

To,

| | |
|---|---|
| **1.** The Controller General, Attn.: Superintending Mineral Economist (Statistics)<br>Indian Bureau of Mines,<br>Indira Bhawan, Civil Lines<br>NAGPUR - 440 001<br>Ph No: 0712-2561267 | **2.** The Controller of Mines (South)<br>Indian Bureau of Mines,<br>29 Industrial Suburb<br>II nd stage, Tumkur Road<br>Yashwantpuram<br>Bangalore- 560022<br>Ph No: 080-2337 1027 |
| **3.** The Regional Controller of Mines<br>Indian Bureau of Mines,<br>Indira Bhawan, Civil Lines<br>NAGPUR - 440 001<br>Ph No: 0712-2561267 | **4.** The Director Mines and Geology<br>Dept. of Mines and Geology<br>Government of Karnataka,<br>No.49, Khanija Bhavan,<br>Race course Road,<br>Bangalore - 560001<br>Ph No: 080 - 22384134 |
| **5.**The Director General,<br>Geological Survey of India<br>27 Jawaharlal Nehru road,<br>Kolkata 700016<br>Ph No:: 91-33-22861641/65/73/72 | |

**Sub: CLOSING REPORT OF RECONNAISSANCE OPERATIONS CARRIED OUT DURING March 1st 2006 TO 26th February 2008**
(Under Rule 7 (1) (vii) of MCR, 1960)

Ref: **Reconnaissance permits for an area of 1706.53 sq. km in Chikmangalur and Chitradurga districts of Karnataka (RP# 36).**

Dear Sir,

Please find enclosed herewith the Closing Report of Reconnaissance Operations carried out during the period 01/03/2006 to 26/02/2008 over the above Reconnaissance Permit required under Rule 7(1) (VII) of the Mineral Concession Rules, 1960.

As you are aware that prospecting agencies are working in a competitive environment, we request that the contents of the report be kept **confidential under Rule** 7(1) (viii), MCR, 1960.

Please acknowledge the receipt of the report.

Yours faithfully, K V Surayanarayana Rao

Signature:
Name in full: K.V. Surayanarayana Rao
Designation: Technical Specialist - Geology
De Beers India Pvt.Ltd.

Place: Bangalore
Date: 10/4/08

De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23725252
Regd Off: Advanced Business Centre, #83, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823

DE BEERS
A DIAMOND IS FOREVER

# Closing Report on Reconnaissance Permit #36 Karnataka

Report for the period
**01/03/2006 to 26/02/2008**

## 1. Reconnaissance Permit (RP) Status

The RP area consists of 1706.53 Sq.Km covering parts of Chikmangalur and Chitradurga districts (Map 1) and was executed on 28 February 2006 at Bangalore. As per rule 7(i) (a) of MCR 1960, it is scheduled to be reduced by 50% on or before 27 February 2008, but relinquished the total area of 1547.5 sq km due to poor sample results.
1706.53

This report summarizes the exploration work carried out in the permit area in the reporting period.

## 2. Geology and Geomorphology

The Geology of the Dharwar Craton is discussed in detail by Radhakrishna and Vaidyanathan (1997) and Balasubrhmanyan (2006) and the main Geological units exposed within the RP area are summarized in (Map 2).

The oldest rocks in the RP area are the "Older granites and migmatites", which are Na-rich tonalitic sialic crust -migmatite, composed of a complex of banded gneiss and less deformed nearly massive gneiss. These rocks have been described by Radhakrishna and Vaidyanathan (1997) as "Older gneiss Complex" where as Balasubrahmanyan (2006) gave the name "Penninsular Gneisses I". The Study of SHRIMP U-Pb ages of detrital zircon in supracrustal rocks of the Sargur Group by Nutman et al. (1992) indicate an age older than 3230±5 m.y. for these rocks and the pattern and abundance of REE in these gneisses and migmatites indicates their origin could be by partial melting of mantle or crustal anatexis of amphibolites (Monard, 1983).

These oldest gneisses comprise the basement to the Sargur Group of rocks. Various opinions are expressed regarding their stratigraphy and environment (Swami Nath and Ramakrishnan, 1981; Radhakrishna and Naqvi, 1986) .The group is composed of intensely metamorphosed, deformed rocks, representing incomplete sequences of shelf-facies sediments with intercalated mafic rocks and iron formations. Zircon from the banded chromite-fuchsite quartzite near Arsikere gave an age of 3232±10 to 2942 m.y. (by Nutman et al. 1992).

The basement gneiss to the Dharwar Supergroup herein labeled as Penninsular Gneissic Complex ("Penninsula Gneisses II" by Balasubrahmanyan) has been dated by Rb/Sr, Pb/Pb techniques to be 3150 m.y. and 3000 m.y. in the Chickmangalur and Chitradurga areas (Balasubhramanyan, 2006).

De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23726252
Regd Off: Advanced Business Centre, #83, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823

However, Taylor et al. (1988) assigns this Peninsular Gneiss event at 3000 m.y. and the higher initial strontium ratio indicates them to be the reworked older crustal material.

Dharwar supracrustal rocks are considered as platformal and volcanic sediments deposited in sialic basins and geosynclines (Chadwick et al., 1978- Balasubrahmanyan, 2006). They comprise clastic and chemical sediments developed with volcanism and several cycles of sedimentation during the time interval of 2900-2600 m.y. (Radhakrishna and Vaidyanadhan, 1997).

Two main divisions of the Dharwar Supergroup are recognized.

The older group is an igneous suite named as 'Bababudan Group'. The litho units show that sedimentation started at severe hydrodynamic condition and under conditions of intense chemical weathering. A lower sedimentary cycle with a basal oligomict conglomerate at its base and basic volcanics at the top is followed above by numerous quartzite horizons with several differentiated gabbro sills and a subsequent differentiated mafic to felsic volcanic complex comprising basalt, andesite, dacite and rhyolite. At the top of the sequence, dolomite, ironstone and exhalative magnesian schist indicate transition from chemical sediments to volcaniclastics.

Overlying this is a more extensive group of schistose rocks, largely sedimentary in character known as the 'Chitradurga Group'. This group is largely made up of sediments starting with a mixed pebble (polymictic) conglomerate followed by a limestone-manganese-iron formation, phyllite and extensive development of greywacke, in the deeper parts of the basin. However there are differing views on stratigraphy and structure for the Chitradurga Group of rocks (Naqvi, 1973 and Mukhopadhyay et al, 1981).

Stratigraphically above the Chitradurga Schist Belt there is a N-S trending, narrow belt of younger potassic granites (the 'Closepet' granite) dividing the greenstone terrain into an eastern and western block and is located at the site of differing crustal thickness.

Two groups of granite intrusions are observed; an early silica-poor porphyritic granite and later silica-rich anatectic group of grey and pink granites.The earlier phase is inferred to be due to mixing lines at the magmatic stage whereas the later phase is thought to be due to partial melting of Peninsular Gneiss (Jayananda et al. 1993). The oldest dyke suite cutting the granites is 2500 to 2400 m.y. aged, suggesting the granites to be ~2600 m.y. (Balasubrahmanyan, 2006) in age.

De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23725252
Regd Off: Advanced Business Centre, #83, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823

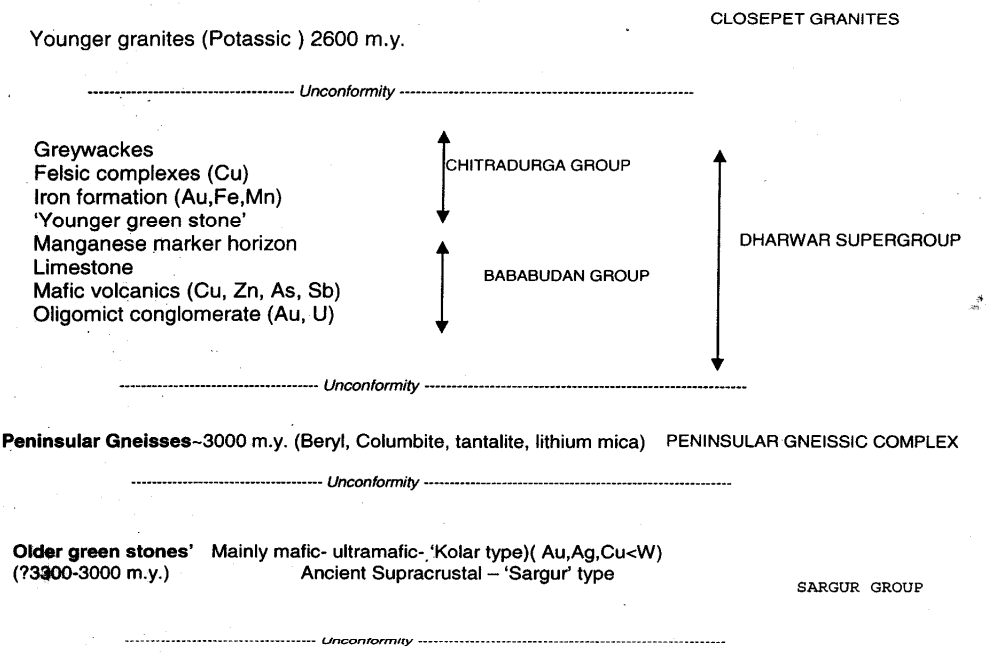


Figure 1.Karnataka Granite-greenstone stratigraphy – (after Swami Nath and Ramakrishnan, 1981)

A generalized stratigraphic sequence is shown in the above Figure.

Geomorphologically, the RP area covers the catchment of Vedawati river (tributaries of the Tungbhadra River) which flow northward within the RP area (Map 3).

De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23725252
Regd Off: Advanced Business Centre, #83, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823

## 3 Activity during the reporting period (01/03/2006 to 26/02/2008)

### 3.1 Pre-field operations

Purchase of topo sheets (on 1:50000 scale) for the license area from the Survey of India and converting them into digital form.

Study of Land Sat TM data and production of digital images.

Mobilisation of field equipment.

### 3.2 Reconnaissance Sampling

A total of 277 reconnaissance samples were collected in the RP area (Map 4).

Stream samples comprised 75 liters of unscreened material, collected from natural heavy mineral trap sites and field screened to –2.0 mm (Table 1).

The samples were sent to the DeBeers Sample Treatment Centre in Bangalore and the concentrates were consigned to the Bangalore Mineralogical Lab, India for sorting

### 3.3 Reconnaissance Sampling Result

Results were received for all recce samples (Map 5 and Table 2). 164 samples reported positive with respect to kimberlitic indicator minerals, and total of 2,599 spinals and 1 ilmenite were reported. No Garnet or clinopyroxenes were recovered.

### 3.4 Mineral Chemistry

The RP area is dominated by spinals as the ilmenites recovered are very less. The spinel chemistry is difficult to interpret, as their origin can not be denied from the older ultramafics in the Penninsualr Gneissic Complex. However some spinals do appear to show a higher probability of deriving from kimberlites, and samples which are positive in visual and probe were the areas over which follow up work was focused.

Mineral Chemistry plots are shown in Figures 1 – 10.

### 3.5 Follow-up Sampling

Four rock samples and five follow up stream samples were collected from the positive grain areas ( Table 3)

### 3.6 Follow-up Sampling Result

Results were received for all stream samples (Table 4). Three samples reported positive with respect to kimberlitic indicator minerals, and total of 5 spinals were reported. No Garnet or clinopyroxenes were recovered. The four rock samples were analyzed and found to be unrelated

### 3.3 Ground Geophysical survey

A mega block was surveyed as ground follow up of spinal anomaly from Recce samples with ground magnetic geophysical survey at 100 m line spacing using the instruments GSM 19W and 19T.

A total of 109.06 line kilometers were covered (Map 6).

A small block was surveyed as ground follow up of spinel anomaly generated from follow up samples, with ground gravity geophysical survey at 50 m line spacing and 50 m station spacing using the instruments CG-5.

A total of 5.5 line kilometers were covered (Map 7).

The surveys have not yielded any positive results.

### 4. Personnel

De Beers maintains high operating standards including safety and environmental awareness. To this end, training is an integral part of career development with the organization. The following is a short summary of trainings completed to date.

All Geologists attended a training programme on Data Mine software.

All staffs attended a training programme on First Aid.

Office and Treatment plant staffs attended training programme on Emergency preparedness

Selected staff members also attended a programme on use of Personal Protective Equipments (PPE) in their relative fields.

| Name | Designation | Education |
|---|---|---|
| K.V.Suryanarayana. Rao | Technical Specialist-Geology | M.Sc. (Tech) – Applied Geology |
| Krishna Pande | Project Geologist | M.Sc. – Applied Geology |

| | | |
|---|---|---|
| Gargi Mishra | Geologist | M.Sc. – Applied Geology |
| Unnikrishnan | Geologist | M.Sc. – Applied Geology |
| Anand Kumar | Geophysicist | M.Sc (Tech.) Geophysics |
| Sukhbinder Sharma | Geologist (on contract) | M.Sc Geology |
| Shivshankar | Kimberlitic Mineral Analyst | M.Sc Geology |
| Manjunath | Kimberlitic Mineral Analyst | M.Sc. Geology |
| Sanjay Deogiri | ICT Manager | B.Sc. Electronics, MCSE |
| Jai Prakash | SHE Officer | Post-Graduate |
| K. Narayanan | FSLO | Graduate |
| Gajanana Naik | Treatment Plant Supervisor | Graduate |
| R.Shrinivaslu | Field Assistant | Grade 12 |
| Venu Kumar | Field Driver | Grade 12 |
| Channaiah | Field Driver | Grade 10 |
| B S Dinesh | Field Driver | Grade 10 |
| Gajanana Naik | Treatment Plant Supervisor | Graduate |
| R.Shrinivaslu | Field Assistant | Grade 12 |
| Venu Kumar | Field Driver | Grade 12 |

## 5. Expenditure

Total expenditure of Rs. 30, 035, 126 /- has been incurred for exploration in the reconnaissance permit area during the total period.

## 6. References

1. Chadwick, B., Ramakrishnan, M., Viswanatha, M.N. and Srinivasa murthy, V. (1978). Structural Studies in the Archean Sargur and Dharwar supracrustal rocks of the Karnataka craton. J. Geol. Soc. India, V. 19, pp.531-549.
2. Jayananda, M., Martin, H. and MAhabaleswar, B. (1993). The mechanism of recycling of the Archean continental crust: examples of the closepet granites, Southern India. Geol. Soc. India, Memo. No. 25, pp.119-134.
3. Monard, J.R. (1983). Evolution of sialic terrains in the vicinity of the Holenarsipur Schist belt, Hassan districts, Karnataka, India. Geol. Soc. India, Memo. No. 4, pp. 343-364.
4. Mukhopadhyay, D., Baral, M. C. and Ghosh, D. (1981). A Tectono-stratigraphic model of the Chitradurga schist belt, Karnataka. J. Geol. Soc. India, V. 22, pp. 22-31.
5. Naqvi, S.M. (1973). Geological structure and aeromagnetic and gravity anomalies in the Central part of the Chitradurga Schist Belt, Mysore, India. Geol. Soc. Amer. Bull. 84, pp. 1721-1732.

De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23725252
Regd Off: Advanced Business Centre, #33, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823

DE BEERS

A DIAMOND IS FOREVER


6. Nutman, A. P., Chadwick, B., Ramakrishnan, M. and Vishwanath, M. N. (1992). SHRIMP U/Pb ages of detrial zircon in Sargur supracrustal rocks in western Karnataka, Southern India. J. Geol. Soc. India. V. 39, pp. 367-374.
7. Taylor, P. N., Chadwick, B. and Friend, C.R.L. (1988). New age data on the geological evolution of southern India. J. Geol. Soc. India, V.31, pp. 155-157.
8. Geology and Tectonics of India: An overview-M.N.BALASUBRAHMANYAN
9. Geology and Evolution of the Indian plate- S.M. NAQVI.
10. Geology of Karnataka-B.P.RADHAKRISHNA: R.VAIDYANADHAN



K.V.Surayanarayana Rao
Technical Specialist - Geology
De Beers India Private Ltd



De Beers India Private Limited
An ISO 14001 Certified Company
Exploration Office: 36/A, Peenya Industrial Area, 2nd Phase, Bangalore – 560058
Tel no.: + 91 80 23726252
Regd Off: Advanced Business Centre, #83, Maker Chambers VI, Nariman Point, Mumbai-400021
Tel No.: +91 22 22822927, Fax no.: +91 22 22832823