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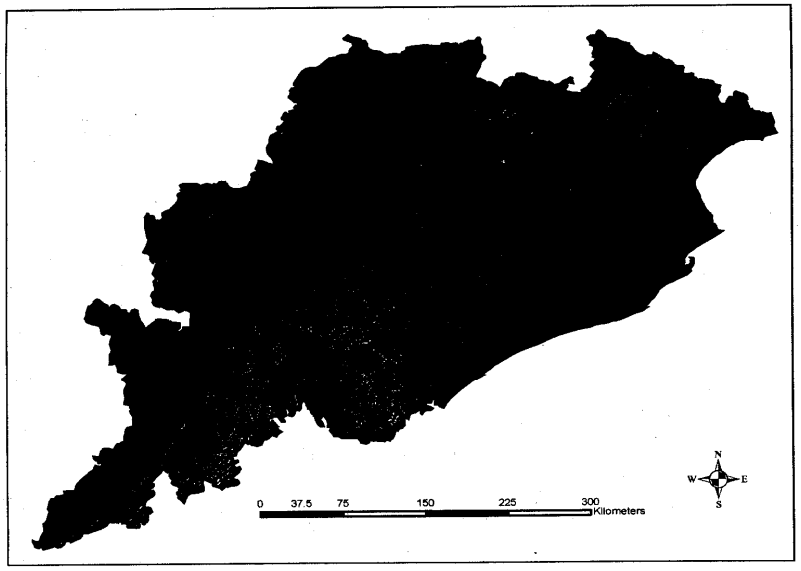
Closing Report on Reconnaissance Permit 7482/IV (GD) SM 7/2000 Orissa

Report for the period
16/02/05 to 15/08/07



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1. Reconnaissance Permit (RP) Status

The RP is 2000 km^2 in extent and was executed at Bhubaneswar on 15th February 2005. As per rule 7(i) (a) of MCR 1960, it is scheduled to be reduced by 50% on or before 14th February 2007. A total of 1380 sq km was relinquished (Map 1) on 20th July 2006. Further to this the remaining 620 Sq. Km was relinquished on 15th August 2007. This report summarizes the exploration work carried out in the total area of 2000 sq km from 16th February 2005 to 15th August 2007.

2. Geology and Geomorphology of the RP area

The Bhandara Craton is rectangular in shape and bounded by the Mahanadi Rift in NE, the Godavari Rift in SW, Narmada Rift to the NW, and the NE-SW trending Eastern Ghat Mobile Belt on the SE.

The Eastern Ghat Mobile Belt is juxtaposed with the Archean craton along a ductile thrust with a northwesterly thrust movement. This shear zone is characterized by south-easterly dipping mylonitic foliation and a down-dip stretching lineation (the L-S fabric of mylonites).

Geologically the RP area consists of the eastern margin of the Bhandara Craton with a complex lithological association of basic intrusive rocks, granitoids, supracrustal rocks and unmetamorphosed Late Proterozoic sediments in the west and the Eastern Ghat Mobile Belt in the eastern side with high grade metamorphic rocks (Map 2).

Uncertainty and unavailability of precise age data of the rocks have resulted in varied interpretations and correlations attempted by different workers. A simplified stratigraphic succession of the Bhandara Craton is presented below. The Sukma and Bengpal metamorphic rocks are possibly the oldest Mesoarchaean sequences of this region. The relationship of the precursors of the trondhjemitic gneisses (3.56 Ga) with the Sukma and Bengpal sequence is debatable from being a probable intrusive to being basement.

The Sukma supracrustal rocks consists of high grade metamorphosed orthoquartzites, carbonates and pelites in association with prominent iron formations and subordinate mafic ultramafic rocks. The Bengpal Group overlies the Sukma metamorphics with an unconformity and consists of amygdular metabasalts and andalusite-chlorite schist which are overlain by conglomerate and quartzites.

However, Ramakrishnan (1990) assigns Palaeoproterozoic ages (2.5Ga and 2.3Ga) for the Sukma metamorphics and Bengpal Group.

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The Bailadila Group overlies the Bengpal Group with an unconformity and is composed of feldspathic quartzites, chloritic phyllite and banded iron formations.

The Eastern Ghat Mobile Belt is recognised as an accreted terrain with high-grade metamorphic rocks. The major mappable units are mafic schists, quartz-feldspar-hypersthene granulites (charnockites), sillimanite-garnet-cordierite-sapphirine-schist and gneisses (metasediments locally known as khondalites) also the Calc-silicates, mafic granulites, leptynites (leucocratic quartz-feldspar-garnet gneiss), intrusions of anorthosite, gabbro, norite, dunite and serpentinite with chromite, and alkaline rocks. Most of these rock suites have been subjected to three or four deformational events and with a large number of shear zones cutting across them, and together comprise the Khariar-Angul Metapelite Complex of the Sukma Group.

Late Proterozoic detached basins containing unmetamorphosed sediments overlie the Archaean rocks of the Bhandara Craton. There are two major and six minor basins in the Craton. One smaller basin, the Neogarh-Khariar (Nawapara-Kharihar) basin is located on the north of the RP and another small one the Ampani Basins is located within the RP area.

The Khariar Basin is composed of an alternating sequence of sandstones and shale and is equivalent to the Chandrapur Group of the Chhattisgarh Basin.

The Ampani Basin forms an outlier south of the Khariar Basin and is composed principally of conglomerates, sandstones, siltstones, purple shales and calcareous intercalations. The rock association resembles the Chandrapur Group of the Chhattisgarh Basin and the Tirahgarh Formation of the Indravati Basin.
Simplified stratigraphic succession of the Bhandara Craton

Chhattisgarh Supergroup	Un-metamorphosed Sediments	Upper Proterozoic
~~	Unconformity	~~~~~~~
Basic Dykes	Dolerites, Amphibolites	
~~	Unconformity	~~~~~~~
Bailadila Group	Banded Iron Formation, Phyllites with chert and local conglomerates	ca. 2.9-2.5 (Bandhopadhyay et al 1995). ca. 2.1 Ga (Ramkrishnan 1990)
~~	Unconformity	~~~~~~~
Bengpal Group	Amygdular metabasalt, andalusite schist and quartzite	ca. 2.9-3.5 (Bandhopadhyay et al 1995). 2.3 Ga (Ramkrishnan 1990)
~~	Unconformity	~~~~~~~
Sukma (Group ?) metamorphic suite	Sillimanite quartzite, cordierite anthophyllite rocks, Banded Iron Formation	ca. 2.9-3.5 (Bandhopadhyay et al 1995). ca. 2.5 Ga (Ramkrishnan 1990)
~~	Unconformity	~~~~~~~
	Basement Gneiss (TTG)?	3.56 (?): Zircons of tonalites by U-Pb method.

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The RP area is within the drainage basins of the Tel River and Hatti Nadi, tributaries of the River Mahanadi (Map 3).The western and southeastern areas of the RP comprise elevated plateaus rising to over 700m. The remaining area is a gently sloping plain falling from approximately 300 m in the west, to 200m in the northeast. The western plateau comprises sandstones of the Ampani Basin, whilst the plains are underlain by the metapelites of the Sukama Group.

3. Activity during the period (16/02/05 to 15/08/07)

3.1 Reconnaissance Sampling

A total of 170 reconnaissance stream samples were collected from the RP during this period.

Stream samples comprised 75 litres of unscreened material, collected from natural heavy mineral trapsites and field screened to –2.0mm.

Reconnaissance sample localities and information are shown in Map 4 and Table 1.

The samples were processed at De Beers heavy mineral treatment plant in Bangalore, and the concentrates were consigned to the Bangalore Mineralogical Lab, India for further processing and sorting.

3.2 Reconnaissance Sampling Results

Results were received for all the reconnaissance samples in the RP area (Map 5 and Table 2), and 87 samples reported positive with respect to kimberlitic indicator minerals. Totals of 1324 spinels, 2 garnets, and one clinopyroxene were recovered.

3.3 Follow Up Sampling

A total of twenty one follow up soil geochemical samples and five follow up stream samples were collected from the RP during the period.

Sample localities and information are shown in Map 6 and Table 3.

3.4 Follow Up Sampling results

There is no positive sign from the results of the soil geochemical samples and reported three positive samples from follow up samples (Map 7 and Table 4)

3.5 Rock Samples

A total of 15 rock samples were collected for heavy mineral extraction and whole rock geochemistry and awaited the results for heavy mineral extraction. The whole rock geochemistry of rock sample proved of its ultramafic nature. (Map 8 and Table 5).

3.6 Airborne Hyperspectral Scanner Survey

An airborne survey utilizing De Beers's proprietary Hyper Spectral Scanner was completed during March 2005 (Map 9). The system works by measuring reflectance of narrow wavelength bands of sunlight reflected from the Earth's surface. Different minerals (as well as other materials) absorb different wavelengths of light to varying degrees. The Airborne Hyperspectral scanner survey system is sensitive enough to actually distinguish some specific types of minerals by the absorption of certain wavelengths of light detected. In the search for kimberlites, the system is configured to look for the presence of magnesium-rich clay minerals, derived from the weathering of ultramafic rocks. There were 76 anomalies selected for field follow-up (Map 10)

Follow up of the survey involved field visits of anomalies and identification of the causative lithological units to conclude whether the source of the anomaly is kimberlitic or not. A total of 76 anomalies were visited (Table 6 and Map 11). Samples were collected from surface material for PIMA (Portable Infra-Red Mineral Analyses) and confirmed the causative material.

Detailed sheets of Airborne Hyper Spectral Scanner survey anomalies followed up are attached as Appendix 1.

3.7 Airborne Geophysical Survey

An Airborne Magnetic and Time Domain Electromagnetic survey was carried out over the RP area .The results were processed and interpreted. Based on the response, a total of 14 anomalies (Aero Magnetic- 5 and Aero Electro Magnetic-9) were identified (Map 12) and they are followed up with ground geophysical surveys.

3.8 Ground Geophysical Survey

3.8.1 Ground Electromagnetic Survey

Seven EM anomalies were followed up with ground frequency domain EM survey using GEM-2 (Table 7 and Map 13), covering a total of 62.3 line kilometres.

Detailed sheets of EM anomalies followed up with ground survey are attached as Appendix-2.

3.8.2 Ground Magnetic Survey

Twelve magnetic anomalies were followed up with ground magnetic survey using a Proton precision magnetometer (Map 14 and Table 8), covering a total of 795 line kilometres.

Detailed sheets of Magnetic anomalies followed up with ground survey are attached as Appendix 3 .

3.8.3 Ground Gravity Survey

Three anomalies were followed up with ground Gravity survey using CG-5 gravimeter (Table 9), covering a total of 21.6 line kilometres.

Detailed sheets of gravity anomalies followed up with ground survey are attached as Appendix 4.

3.9 Drilling

A total of 881.58 meters in 34 holes were drilled to test the geophysical anomalies and Airborne Hyper Spectral anomalies (Map 15 and Table 10).

Detailed sheets of borehole logs are attached as Appendix 5.

4. Occurrence

One of the anomalies 551/146/X0165 proved to be a lamproite (Map 16 and table 11). Detailed work carried out on the anomaly is attached to this report as Appendix 6

5. Interpretation

The potential for the area to have an economically viable and mine able diamond bearing body is low (Fig 1 – 10). Hence this RP area is relinquished (Map 1).

6. Personnel

Name	Designation	Education
K.V.Suryanarayana Rao	Project Manager	M.Sc. Tech-Applied Geology
Krishna Pande	Staff Geologist	M.Sc.Tech.– Applied Geology
Chandan kumar	Staff Geologist	M.Sc. – Applied Geology
K.V.Praveen Kumar	Staff Geologist	M.Tech-Remote Sensing
Prashant Laharia	Geologist (on contract)	M.Sc Tech Geology
Sukhbinder Sharma	Geologist (on contract)	M.Sc Geology
Sudipta Sarkar	Geologist (on contract)	M.Sc. Tech-Geology
Rekha K.R.	Kimberlitic Mineral Analyst	M.Sc Geology
Shobha N.	Kimberlitic Mineral Analyst	M.Sc. Geology

Sanjay Deogiri	IT Manager	B.Sc. Electronics, MCSE
Rina David	SHE Officer	Graduate
Girish Menon	Security Adviser	Grade 12
Gajanana Naik	Treatment Plant Supervisor	Gráduate
R.Shrinivasalu	Field Assistant	Grade 10
Venu Kumar	Field Driver	Grade 12
A.Channaiah	Field Driver	Grade 10
Rajanna	Field Driver(on contract)	Grade 10

Labourers were employed on a daily basis from local towns and villages to help with the field work.

7. Training

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 training completed during reporting period.

All Earth scientists, field assistants and field drivers attended a training program on Crisis Management to deal emergency situation related to safety and security in the field.

An HIV/AIDS awareness programme was conducted for the entire field based staff.

The drivers attended a training course on Defensive Driving and Road Safety conducted by the Automobile Association of Southern India.

All field drivers attended training on vehicle maintenance conducted by Mahindra & Mahindra.
Earth Scientists attended training on new mineral classification scheme.

All field geologists attended a training program on First Aid conducted by International SOS.

Earth scientists attended a programme on Arc SDE and Arc GIS to hone their skills in Database management.

Earth Scientists also attended a programme on Datamine solutions which will enable them to effectively organize data from drilling programmes.

A brief introductory lecture on basic geology was given to field drivers and field assistants.

Earth Scientists attended a programme on XSIMS database management.

Earth Scientist completed a sort time assignment for drilling and petrology training in Canada and South Africa.

8. Expenditure

Total expenditure of Rs. 47,829,688 has been incurred for the Reconnaissance Permit to date. The expenditure was incurred as follows:

Capital expenditure: Rs. 3,638,870

Revenue expenditure: Rs. 44,190,818

9. References

Bandyopadhyay, B. K. Roy A. Jain A. K. 1995: Structure and Tectonics of a part of the Central Indian Shield: In Continental crust of north-western and central India. Sinha Roy S, Gupta K. R. (Eds) Geol Soc India, Mem 31, 433-468.

Ramakrishnan M 1990, Crustal development in southern Bastar, Central Indian Craton. In Precambrian of central India Geol, Surv, India Spl Publ. No 28 44-66.

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