CHG-17

JINDAL STEEL & POWER

PROJECT DIAMOND

FINAL REPORT

on

RECONNAISSANCE FOR DIAMOND, GOLD, PRECIOUS AND SEMI-PRECIOUS STONES AND ASSOCIATED MINERALS OVER 735 SQ. KM.

in

PART OF JASHPUR AND RAIGARH DISTRICTS

CHHATTISGARH

JINDAL STEEL & POWER LIMITED

2011

Chapter - 1

INTRODUCTION

Background Information:

Jindal Steel & Power Limited had submitted application for granting reconnaissance permit in parts of Jashpur & Raigarh district, Chhattisgarh on 26.06.2006. In response the Government of Chhattisgarh awarded reconnaissance permit over an area of 735 sq km covering the southern part of Jashpur District and the northern part of Raigarh District vide its office order no. 5042 F-2-82/2007/12 dated 20th November, 2007 (Annexure-I). The Reconnaissance Permit Deed was signed on 9th May, 2008 for a period of 3 years (9.5.2008-8.5.2011). The location of the RP area is shown in Fig. 1. This RP area is designated in this report as RP-I Block in order to differentiate it from the other RP blocks granted to JSPL in the Jashpur and Raigarh districts.

After completion of 2 years of reconnaissance 50% of the area (368 sq km) was surrendered to the State Government on 17th June, 2010 (Annexure-II). On completion of the 3rd year the PL application has been submitted over a total area of 20.66 sq km. The remaining area of 346.34 sq km has been surrendered to the Government of Chhattisgarh on 12th May, 2011.

The current report is the final report on the studies carried out and the findings thereof over the entire area of 735 sq km.

Objectives:

The major objectives of the programme were:

1. Identification of the host rocks for diamonds.
2. Identification for host rocks for gold, base metals and other minerals, if found.

Officers associated with the project:

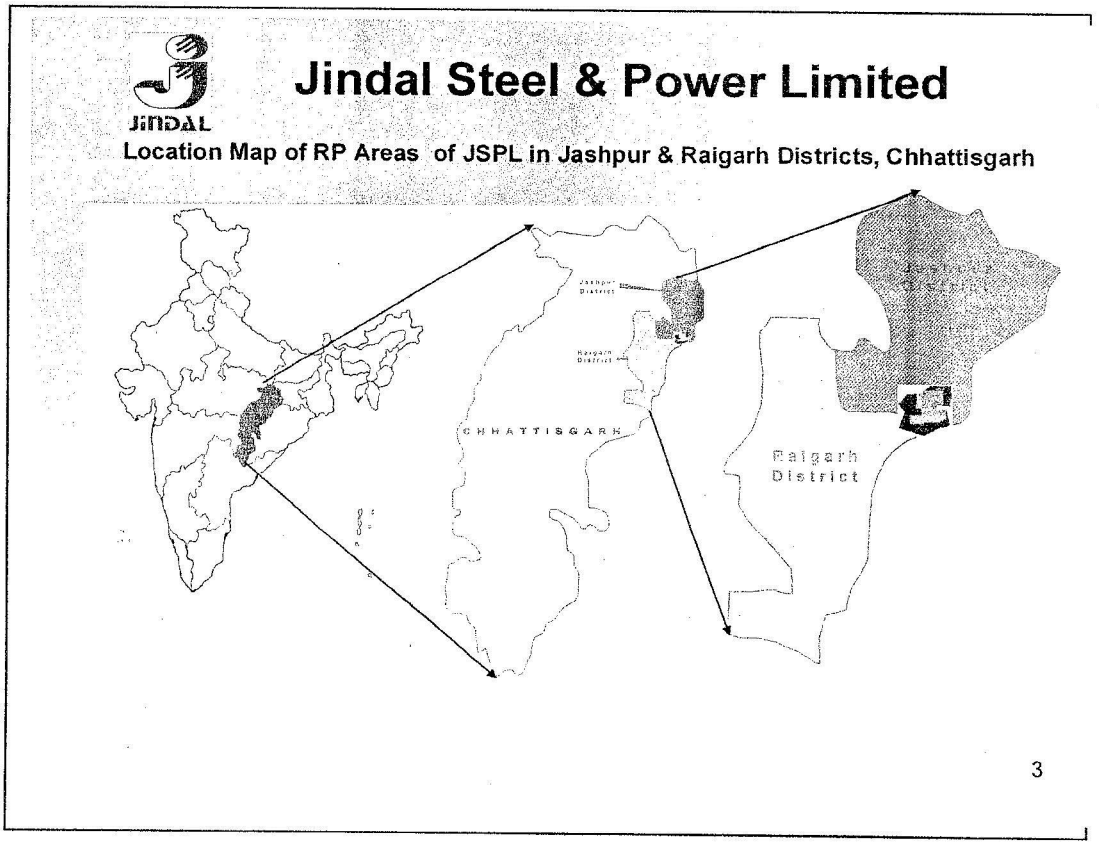
Sl. No.	Name of Officers	Designation
1	S. K. Sarkar	Advisor (Mines)
2	M. K. Soni	Supervisory Geologist

3	Vikash Kumar	Deputy Manager (Geology)
4	Jaydeep Maulik	Deputy Manager (Geology)
5	Swarup Dhara	Asstt. Manager (Geology)
6	Harish Sinha	Asstt. Manager (Geology)
7	Vishvajeet Jha	Asstt. Manager (Geology)
8	Ratul Talukdar	Asstt. Manager (Geology)
9	Suresh Kumar Verma	Surveyor

Location of the RP Area:

The RP area covers the southern part of Jashpur district and the northern part of Raigarh District, Chhattisgarh. The Surguja district lies in the north. The state of Jharkhand lies in the eastern part of the study area (Fig.1)

Fig. 1: Location map of the R. P. area



The area is covered by the Survey of India toposheet nos. 64 N/10, 11, 14 and 15.

The location of the RP area and its co-ordinates are indicated figure 2.

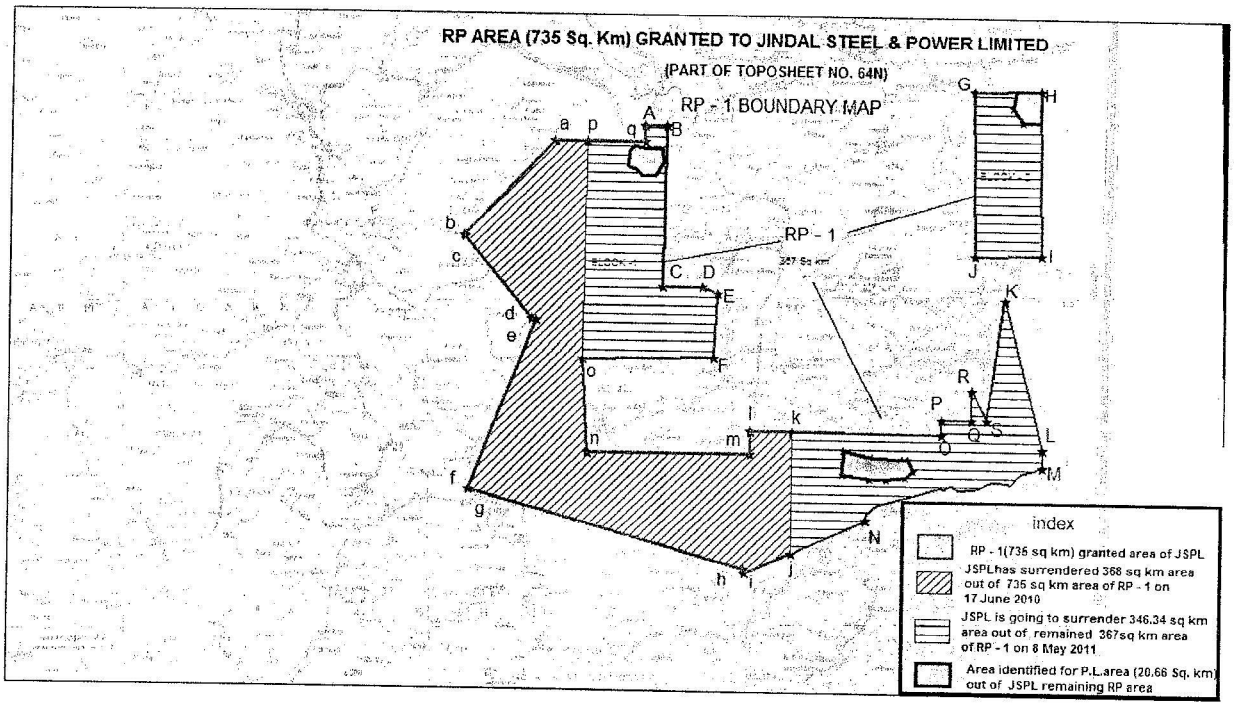


Fig. 2: RP area showing part of the area surrendered on 17th June, 2010 and rest of the area surrendered on 12th may, 2011. The blocks shown in green are the areas for which PL applications are being submitted.

The geo co-ordinates of the corner points of RP area is given in Annexure-3.

Communication:

Jashpur Nagar is the district headquarters of Jashpur district and is connected by road to Ranchi in Jharkhand and to Jharsuguda/ Raigarh/ Bilaspur in Chhattisgarh. Ranchi airport is 170 km away from Jashpur Nagar. Kunkuri and Lailunga towns are Tehsil headquarters of Jashpur and Raigarh districts respectively. Kunkuri is about 120 km away from Jharsuguda railway station. The interiors of the area are connected by metalled, non-metalled and forest roads.

Topography and climate:

On regional basis the area forms part of Chhota Nagpur Plateau. Jashpur district can be divided in to two topographic surfaces. The southern of the district, in which the present RP area is located, forms low lying lands with an average height of about 400 m above MSL.

The lowest point in the area lies at a height of 270 m along Ib River in the south eastern part while the highest point (609 m- Burha Pahar) lies in the western part of the area. By and large the area is a peneplained landscape with a few ridges and inselbergs. Small monadnocks are also observed.

The area is characteristic of sub-tropical region. In Jashpur and adjoining uplands the maximum summer temperature is 40° C. while the winter temperature drops down to 0°c in January. The average annual rainfall in the area is about 150 cm most of which falls in the months of July to September.

Drainage:

Ib and Maini Rivers are most important water channels in the area, draining from north to south. Both have their source in Khuria highlands in the north. The Maini River joins with Ib River at south of Kunkuri. The Chief tributaries of Ib in RP area are Siri, Sonajori, Kokiya nala and Khudung streams.

Although the drainage is by and large dendritic but the imprints of lineaments are also observed where the streams take sudden swing.

Previous work:

The area forms interior tribal land and is highly dissected and covered by thick forest. Only government agencies like Geological Survey of India and Directorate of Geology & Mining, M.P. (now Chhattisgarh) have carried out geological mapping and mineral exploration. In the light of the recent changes in National Mineral Policy private entrepreneurs have shown keen interest in the area and also carried out surveys.

Blanford (1870) was one of the earliest workers of this area who had recorded some coal occurrences in the country between Bilaspur and Ranchi. Ball (1881) published gold assay values of samples collected from erstwhile Jashpur State. Hira Lal (1888-89; Op.cit. Dey, 1983) published first geological account of this area. Maclaren (1904) also described certain occurrences of gold from Jashpur state. Dey (1983) possibly made first systematic study of Jashpur district, published a geological map and discussed gold, beryl, bauxite and laterite occurrences in details. Geological survey of India carried out prospecting for kimberlite in parts of topo sheets 64 N/1, 5, 6, 9 and 10 (Hemraj et al, 1999). Mishra and Saha (2000) and Swain et al (1997) from GSI also carried out prospecting for kimberlite in Jashpur-Surguja-Raigarh areas.

CHAPTER -- 3

GEOLOGICAL SET UP

Regional geology:

Regionally the rock assemblage of this part of the subcontinent is made up of what is called as Chhota Nagpur gneisses and metasediments of Archaean-Proterozoic age. The area forms part of Singhbhum craton. In the absence of sufficient geochronological data, the rocks have tentatively been called as unclassified crystallines of Archaean-Proterozoic age.

To the east of the area the assemblage is bounded by Singhbhum craton with well known Iron Ore Series. In the north Mahakoshal Group of rocks are exposed along Son River in Sidhi District of M. P. and in the south Gondwana Supergroup of rocks of Mahanadi basin are recorded.

Geology of the Reconnaissance Permit area:

General:

In the RP area Chhota Nagpur Gneisses form the most predominant group. The metasedimentary rocks, gneisses, schists and metavolcanic rocks are the oldest rocks in the area and occur as enclaves within non-foliated to weakly foliated granites. These enclaves are recorded in the form of practically east-west trending bands. Due to large scale granitisation of the metasedimentary rocks foliated gneisses are also observed associated with the metasediments and show same structural trends as that of the metasediments.

Late phase (around 700 to 900 Ma old) granite/granodiorite/leucogranite plutons are abundant in the area and are characterized by exfoliation domes and inselbergs. They are devoid of structural foliation. However, the evidences of crystalplasitc deformation are observed in the form of mineral lineation. Plate No. 1 shows general geological set up of the study area.

Dykes and quartz veins which are older than the granite plutons and also which are younger than the granite plutons are recorded in the area. The older dykes and quartz

veins are characterized by some degree of metamorphism and foliation. The younger dykes and quartz veins have a fresh look and are massive in nature.

Major rivers like Maini and Ib support thick alluvial soil and gravel beds and show two terraces along which alluvial/gravel deposits are recorded.

Stratigraphy:

Geological map of the area, as prepared by Geological Survey of India in their District Resource Map (Fig. 5) and the lithostratigraphic succession of the rocks of Jashpur district is presented in the Table No. 1.

CHAPTER- 5

REGIONAL PROSPECTING FOR DIAMOND, GOLD, BASE METALS AND OTHER METALS

In accordance with the terms of award of RP, the area was to be searched for diamondiferous kimberlites and other host rocks and also Quaternary gravel for diamond. In addition the search for gold, base metals, other metals and precious and semi-precious minerals was also envisaged in the study.

The approach and results of prospecting for kimberlite and other metals and minerals is discussed in the following chapters.

PROSPECTING FOR KIMBERLITE:

While opening the area for prospecting for kimberlite by private entrepreneurs, the Govt. of Chhattisgarh had identified a number of blocks essentially for prospecting for kimberlite and diamond. The block under study forms part of Block D-4.

In view of the old records of occurrence of diamond in Ib River of Chhattisgarh and Shankh River of Jharkhand, the primary emphasis was laid on prospecting for diamonds.

Philosophy and approach for diamondiferous kimberlite prospecting:

In the domains of the geology and mineral exploration, the approach to kimberlite study and diamond prospecting have possibly been studied in much more details than any other single rock type. The spurt in diamond exploration, particularly in 1970s and onwards, has led to extreme sophistication of techniques, data management and interpretation to meet the goals. However, since most of the private companies are involved in this business, a lot of data remains un-accessible to the outside world. In spite of that a lot of literature is now available for making reasonable approach for kimberlite search.

Preliminary selection of the prospecting area is done on the basis of the philosophy that the emplacement of kimberlites takes place in cratonic areas which have cratonized about 2000 m.y. back (Kennedy, 1964). In a broader sense cratons include Archaean cores as well as Paleo to Meso-Proterozoic mobile belt. Janse (1992) further subdivided the cratons in to three categories on the basis of the latest thermal event Fig. 8).

1. Archon: Basement rocks are of Archaean age and the minimum age of last thermal event is 2500 m.y.
2. Proton: Basement rocks are of Early to mid-Proterozoic age (2500 – 1600 m. y.) and the minimum age of the last thermal event is 1600 m.y.
3. Tecton: Basement rocks are of Late Proterozoic age (1600 – 800 m.y) and the minimum age of the last thermal event is 800 m. y.

Fig. 9 shows the distribution of cratons, protons and tectons of Indian sub-continent. The area around Jashpur and adjoining part of Jharkhand (Simdega and Gumla districts) form part of a proton/tecton in view of the fact some of the thermal events of this area are around 800-900 m.y. old.

STREAM SEDIMENT SAMPLING

By and large the stream sediment sampling and looking for kimberlite indicator minerals in the samples is one of the most time tested methods in kimberlite prospecting. The kimberlitic magma, in the process of its ascent from mantle, picks up certain minerals which are crystallized at the same depth.

After the emplacement of the kimberlite to the surface and its subsequent erosion, diamonds and other minerals (which have crystallized at the same depth as that of diamond) get carried away in the stream. Since the incidence of the diamonds is very low in the stream sediment samples, and its detection in stream sediments is rather difficult, the emphasis is being laid on detection of minerals which are cogenetic with diamond and available in far more abundance. Picro-ilmenite, high-chromium-chromite, chrome-diopside and high chromium pyrope (along with other minerals) are such minerals and are looked in to in the process of sample grain study.

Stream sediment sample collection methodology in field:

Stream sediment samples were collected by parties, each party comprising two geologists. About 30 kg. of sample was collected from suitable traps for heavy minerals such as bush traps, pot holes, cracks in the bed rock of the channel, channel and meander bars, boulder traps etc. Such high energy environments are found to be suitable sites for trap of kimberlite indicator minerals. The samples were collected in HDPE bags, properly numbered and sample locations were plotted on the toposheets with the help of GSP data and also ground truth.

Grid based stream sediment sampling:

To cover entire RP area of 735 sq km in parts of toposheets Nos. 64 N/10, 11, 14 and 15, the area was divided in to 3 km x 3 km (9 sq km) grid and stream sediment samples were collected from each grid (Plate No. 2). The disposition of grids is indicated in the following figure. However, it sometimes so happened that there was no stream in that grid. In that case if the area was covered up stream or down stream of that grid, the sample was collected. The samples were collected by taking 5 mm sieve, large polythene

sheet, spade and other sample collection equipment and only -5 mm sample was collected in the field.

It has been our experience that extensive cultivation has taken place in a large number of the 1st, 2nd and 3rd streams of the area by ploughing through the river bed. So in some cases it has not been possible to collect samples in such cases. Out of the total target of 287 regional stream sediment samples, 280 samples have been collected so far (Plate No. 3) and all the samples have been studied under microscope. A total of 81 'follow-up' samples have been collected at closer intervals at some selected locations out of which 64 samples have been studied under microscope. The toposheet-wise details of sample collection and mineral study are as follows:

		TOTAL SAMPLES COLLECTED		MICROSCOPIC STUDY	
	Toposheet No.	Regular samples	Follow up samples	Regular samples	Follow up samples
1.	64 N/10	49	59	49	59
2.	64 N/11	80	4	80	4
3.	64 N/14	27	10	27	10
4.	64 N/15	124	8	124	8
TOTAL		**280**	**81**	**280**	**81**

The coordinates of samples are indicated in Annexure-I and the locations of the stream sediment samples are indicated in figure 12 and Plate No. 2.

CHAPTER –7

CONCLUSIONS

The programme on reconnaissance for diamond, gold and other metals/minerals in R.P. Block encompassed satellite image studies, geological traverses and stream sediment and bed rock sample collection to carry out holistic survey for diamonds, gold, base metals and other minerals.

Since the area has record of diamond findings, emphasis was laid on extensive surveys for location of kimberlite pipe and delineation of diamondiferous gravel beds along streams. Study of IRS imageries was collated with the finding of results of grid based stream sediment sampling of the area.

In the process of stereo-microscopic studies some samples showed presence of interesting garnet and chromite grains. Their microprobe analysis of mineral grains indicated interesting areas around Bangaon, Tumla-Bhelwaa and Kendhapani villages. The current data set on microprobe analysis is insufficient to arrive at tangible results and further detailed studies are required in these areas. Accordingly, PL applications have been submitted for these areas.

Although some small auriferous veins have been recorded near village Harra Dand and some gravel workings also exist for gold, the surface shows do not suggest that the quartz veins are worth prospecting in details for gold. Also gravel deposits are not extensive and rich in placer gold. The RP area does not appear to be promising for gold exploration.