

Government of India

Ministry of Coal

MD/HPGCL

Memo No. 10937 Date 2/3/16

Dir/Tech.

Dir/Gen.

Dir/Fin.

OSD/Tech.

SE/Tech.

PA

CAMS-1427

New Delhi, the 24th February, 2016

Dir/Gen.

Diary No.....Dt.....

CE/RGTPP.

CE/Proj.

CE/PTPS-2

SE/Tech.

SPS Discuss

SPS File

1178

/CFMS

dated

2-3-16

To

The CMD,
Haryana Power Generation Corp. Ltd.
C-7, Urja Bhawan,
Sector-6,
Panchkula

Chairman - Buss

1316

W/M/H/16

8/1/3/16

Subject:- Allotment of Kalyanpur-Badalpara Coal Block located in the State of Jharkhand to M/s. Haryana Power Generation Corp. Ltd., (the "Block Allocattee") for end use power under Rule 4 of the 'Auction by Competitive Bidding of Coal Mines Rules, 2012'.

Sir,

I am directed to refer to this Ministry's letter of even number dated 31.03.2015 (copy enclosed for ready reference) and to say that the Competent Authority has approved allotment of **Kalyanpur-Badalpara** Coal Block in the State of Jharkhand to your Company for generation of Power as per details indicated below:

Name of Coal Block	Location	Estimated Geological Coal Resource (Million Tonnes)	Allottee Company	End Use Plant Project considered
Kalyanpur-Badalpara	Jharkhand	102	Haryana Power Generation Corp. Ltd.	1) 1x800 MW (exp.) unit at Deenbandhu Chhotu Ram TPP (DCRTPP), Yamunanagar 2) Surplus coal if any to meet partial requirement of 1x800 MW (exp.) unit proposed to be set up at PTPS, Panipat

2. In accordance with Rule 7 of the 'Auction by Competitive Bidding of Coal Mines Rules, 2012' the Coal Block Allottee is required to enter into an agreement namely, Coal Block Development and Production Agreement (CBDPA) with the Central Government. A copy of the model CBDPA containing the terms and conditions of allotment is enclosed. The date and time for signing the CBDPA shall be intimated in due course.

3. The Block Allottee is required to provide to the Central Government, an irrevocable and unconditional guarantee (the "Performance Security") as will be prescribed in CBDPA, within 30 days from the date of signing of CBDPA.

4. Rule 4(6)(ii) of Auction by Competitive bidding of Coal Mines, Rules, 2012 mandates that every Allottee Company or Corporation shall comply with the following terms and conditions of allotment :
- (1) The Allocatee company shall utilize the coal for captive purpose only in the specified end use for which the area containing coal has been allocated and in case of washing, the middlings shall be utilized for captive power generation only with the approval of the Central Government or agency authorized by it in this behalf.
 - (2) The Allocatee company shall be responsible for development of area containing coal as per the specified mile stones.
 - (3) The Central Government or, as the case may be, the State Government shall institute a mechanism and regular physical inspections to ensure monitoring of development of the area containing coal as per specified milestones and submitting quarterly reports to the Central Government in the Ministry of Coal or and agency authorized by it, in addition to the monitoring or inspection by the Central Government.
 - (4) The production of coal shall be as per the approved Mining Plan and the terms and conditions of the Mining Lease.
 - (5) The Mining Lease shall be in the name of the allocate company and shall remain with a Government Company and the formation of joint venture by the company with any private company shall not be permitted for development of areas containing coal allocated under this dispensation.
 - (6) The allocatee company shall file an annual return regarding utilization of coal to the Coal Controller and the agency authorized by the Central Government or as the case may be, the State Government.
 - (7) The allocatee company shall submit the Bank Guarantee as may be specified by the Central Government in this behalf.
 - (8) The reserve price shall be payable by the allocatee company as specified in the allocation letter or the agreement and in case the reserve price is yet to be determined, the allocatee company shall furnish an undertaking for paying the reserve price within the specified time, after the reserve price is determined by the Central Government, failing which the allocation shall stand cancelled.
 - (9) In case the mine is developed through Mine Developer and Operator, the selection of the Mine Developer and Operator shall be through a competitive bidding process and the allocatee company shall inform the State Government about the engagement of the Mine Developer and Operator and the terms and conditions of such engagement, as soon as it is finalized.
 - (10) The allocate company shall ensure that the criteria of bidding for engagement of Mine Developer and Operator is not linked to the notified price of the Coal India Limited.
 - (11) The Mine Developer and Operator shall maintain all records as required to be maintained and shall provide such records for inspection by the allocatee company, the State Government and the Central Government.

(12) In case area containing coal is allocated for power generation, the allocattee company shall utilize coal from the allocated area containing coal for the power plants owned by it for which Power Purchase Agreement had been signed on or before the 05th January 2011.

5. Further, in accordance with rule 4(6) (i) and (ii) of the 'Auction by Competitive Bidding of Coal Mines Amendment Rules, 2012' (Ministry of Coal Notification dated 27th December, 2012) the reserve price payable on actual production of coal and the upfront payment shall be payable by the allocattee company as specified in the allocation letter or the agreement. As the reserve price and upfront payment [as per Article-14] is yet to be determined, the allocattee company shall furnish an undertaking for paying the reserve price and upfront payment within the specified time (after the reserve price and upfront payment is determined by the Central Government), failing which the allocation shall stand cancelled.

6. You may collect Geological Report/Available Geological information / data from CMPDIL/GSI/MECL on payment basis.

7. Any violation of the above terms and conditions of allotment and as laid down in CBDPA, shall render the allotment liable for cancellation and resultantly, termination of the Coal Block Development and Production Agreement.

Yours faithfully,



(Rishan Rynthiang)

Under Secretary to the Government of India

Tel. No.2307 3936

Encl. : As stated above.

Copy to:

1. Secretary, Ministry of Power, Shram Shakti Bhawan, New Delhi.
2. Chief Secretary, Government of Haryana, 4th Floor, Haryana Civil Secretariat, Sector-1, Chandigarh.
3. Chief Secretary, Government of Jharkhand, Secretariat, Ranchi-834004
4. Chairman, Coal India Ltd., Coal Bhawan Premise No-04 MAR, Plot No-AF-III, Action Area-1A, Newtown, Rajarhat, Kolkata-700156.
5. CMD, Central Mine Planning & Design Institute Ltd., Kanke Road, Ranchi - 834031, Jharkhand.
6. Director General, Geological Survey of India, 27, J.L. Nehru Road, Kolkata-700016.
7. CMD, Mineral Exploration Corporation Ltd., Dr. Babasaheb Ambedkar Bhawan, Seminary Hills, Nagpur-440 006, Maharashtra.
8. CPAM Section
9. Guard Folder.



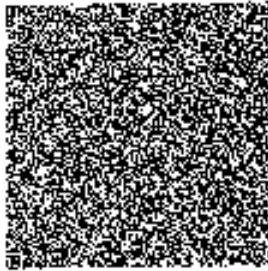
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Government of National Capital Territory of Delhi

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 Unique Doc Reference : SUBIN-DL3143651967571704385936030
 Purchased by : HARYANA POWER GENERATION CORPORATION LTD
 Description of Document : Article 5 General Agreement
 Property Description : C-7, URJA BHAWAN, SEC - 6, PANCHKULA, HARYANA, INDIA
 Consideration Price (Rs.) : 0
 (Zero)
 First Party : PRESIDENT OF INDIA THROUGH MIN OF COAL
 Second Party : HARYANA POWER GENERATION CORPORATION LTD
 Stamp Duty Paid By : PRESIDENT OF INDIA THROUGH MIN OF COAL
 Stamp Duty Amount(Rs.) : 500
 (Five Hundred onty)



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THE COAL BLOCK DEVELOPMENT AND PRODUCTION AGREEMENT BY AND BETWEEN THE PRESIDENT OF INDIA AND HARYANA POWER GENERATION CORP. LTD. (HPGCL) IN RESPECT OF KALYANPUR-BADALPARA COAL BLOCK ALLOTTED UNDER SECTION 11A OF THE MINES AND MINERALS (DEVELOPMENT AND REGULATION) ACT, 1957

This Stamp-paper forms an integral part of this deed of Allotment Agreement

रिशाभ सिंघानिया / RISHAB SINGHANIYA
 अवर सचिव / Under Secretary
 भारत सरकार / Govt. of India
 कोयला विभाग / Ministry of Coal
 एन 7, भवन - 5, शास - 6, पंचकुला
 Statutory Area : C-7 / New Delhi


एम. के. सी. रामा राव
 अध्यक्ष निवेशक
 हरियाणा बिजली उत्पादन निगम
 पंचकुला

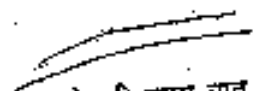
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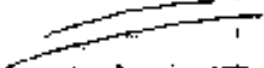

रिशाभ प्रसाद / RISHABH PRASAD
अधीन सचिव / Under Secretary
कोयला विभाग / Ministry of Coal
शांति नगर, झारखण्ड / Shanti Nagar, Jharkhand


श्री. के. वी. रामा राव
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हरियाणा विजली उत्पादन निगम
पंचकुला

Coal Block Development and Production Agreement for Katyampur-Budalpara Coal Block

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शशि भानु शर्मा / SHASHI BHANU SHARMA
अवर सचिव / Under Secretary
राज्य सरकार / Govt. of India
शक्ति विभाग / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi


सम. के. वी रामा राव
प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम
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Coal Block Development and Production Agreement for Katyampur-Nadalpura Coal Block

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रामन शिवायन / ASHWINI KISHORE
अध. सचिव / Under Secretary
भारत सरकार / GOVT. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
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प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम,
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Coal Block Development and Production Agreement for Kalhanpur-Budulpura Coal Block

COAL BLOCK DEVELOPMENT AND PRODUCTION AGREEMENT


This **COAL BLOCK DEVELOPMENT AND PRODUCTION AGREEMENT** (this "Agreement") is made this 30th day of March, 2016 ("Effective Date") at Office of Nominated Authority, Ministry of Coal, Ground floor, World Trade Tower, Barakhamba Lane, New Delhi 110001, India, by and between:

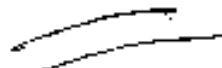
- (1) The President of India, acting through Shri Rishan Ryntathiang, Under Secretary, Ministry of Coal, Government of India (hereinafter referred to as the "Ministry of Coal" or the "Government" which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors and permitted assigns) of the **FIRST PART**; and
- (2) **Haryana Power Generation Corp. Ltd. (HPGCL)**, a company duly incorporated and existing under the laws of India with its registered office at C-7, Urja Bhawan, Sector-6, HPGCL, Panchkula, India (hereinafter referred to as the "**Block Allocatee**", which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors and permitted assigns) of the **SECOND PART**.

In this Agreement, the Government and the Block Allocatee are hereinafter collectively referred to as the "**Parties**" and individually to as a "**Party**".

WHEREAS

- A The Mines and Minerals (Development and Regulation) Act, 1957 (No. 67 of 1957) (the "Act") and The Mineral Concession Rules, 1960 made thereunder provides, *inter alia*, for the development and regulation of mines and minerals including coal and lignite.
- B Section 11A of the Act authorizes the Government to select for the purposes of granting Prospecting Licence or Mining Lease in respect of an area containing Coal (i) through auction by competitive bidding, a company or a joint venture to carry on coal mining operation in India any from either for own consumption, sale or for any other purpose in accordance with the prospecting license or mining lease, as the case may be; (ii) for allocation to a government company; and (iii) through competitive bids for tariff, a company that has been awarded a power project.
- C Section 13 (1) of the Act authorizes the Government to make rules for regulating the grant of Prospecting Licenses and Mining Leases in respect of Coal. Specifically, Section 13 (2) (d) of the Act authorizes the Government to make rules to provide for the terms and conditions of the auction by competitive bidding referred to in Recital B above.
- D Pursuant to the aforesaid, the Government has made the Auction by Competitive Bidding of Coal Mines Rules, 2012 (the "**Rules**").
- E Pursuant to Rule 4 of the Rules, the Government has selected the Block Allocatee to undertake Mining Operations in the Mining Area.



RISHAN RYNTATHIANG
अध: सचिव / Under Secretary
मंत्रालय कोयला / Govt. of India
क्षेत्रीय मंत्रालय / Ministry of Coal
शासकीय भवन / Sanshi Bhawan
नई दिल्ली / New Delhi

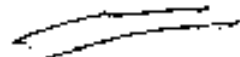

एम. के. सी रामा राव
प्रबंध निवेशक
हरियाणा बिजली उत्पादन निगम,
पंचकुला

Coal Block Development and Production Agreement for Kaiyampur-Badulpur Coal Block

- F. Rule 7 of the Rules mandates that the Government enters into an agreement with the Block Allocated. This Agreement constitutes the abovementioned agreement envisaged by Rule 7 of the Rules.

NOW THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement and other consideration, the sufficiency and adequacy of which is hereby acknowledged, the Parties agree as follows:


श्रीमान् निवेशकः / श्रीमान् निवेशकः
अधिकांशः / Under Secretary
भारत सरकार / Govt. of India
कोयला / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi


एम्. के. टी. रामा राव
प्रबंध निवेशक
हरियाणा बिजली उत्पादन निगम
पंचकुला

ARTICLE-I

DEFINITIONS

1.1 In this Agreement unless the context otherwise requires, the following words and phrases shall have the meaning assigned to them hereunder:

"Affiliate" with respect to any Party shall mean any Person which, directly or indirectly: (1) Controls such Party; or (2) Is Controlled by such Party; or (3) is Controlled by the same Person who, directly or indirectly, Controls such Party.

"Agreement" means this written Coal Block Development and Production Agreement and includes the Schedules made part of this Agreement.

"Applicable Law" shall mean any law, legislation, statute, act, by-laws, rule, regulation, ordinance, order, decree, protocol, notification, policy, by-law, administrative guideline, ruling, instruction, directive, code, requirement, consent, license, approval, permit, judgement, court order, treaty or any interpretation thereof by any Governmental Authority or Person acting under the authority of any Governmental Authority and / or of any statutory authority in India, whether in effect on the Effective Date or thereafter.

"Authorisations" shall mean any and all regulations, clearances, licenses, no objection certificates, exemptions, consents, decrees, orders, permits, waivers, privileges and approvals from and filings and registrations with any and all Governmental Authorities.

"Bank" means a nationalized bank or a bank listed in the Second schedule of the Reserve Bank of India Act, 1934, having a net worth of INR 10,000,000,000/- (Indian Rupees One Thousand Crore) or more.


"Block" or "Block Area" means, on the Effective Date, the area containing Coal as described in Schedule I and delineated on the map attached in Schedule II or any portion of the said area remaining after relinquishment or surrender from time to time pursuant to the terms hereof.

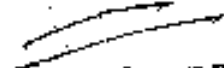
"Block Development Milestone" means the Block development milestones set forth in Schedule IV-A.

"Business Day" shall mean a day which is not a Saturday, Sunday or any other day declared as a public holiday by the Central Government.

"Change in Law" shall mean the occurrence of any of the following after the Effective Date:

- a. Enactment of any new Applicable Law of India;
- b. Modification or repeal of any existing Applicable Law of India;


श्री. र. क. राथंग / श्री. R. K. RATHANG
उप-सचिव / Under Secretary
सचिव, सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शांती, कान / Shanti, Kanwar
एन. डी. नई दिल्ली / New Delhi


श्री. वी. रामा राव
प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम
पंचकूला

Coal Block Development and Production Agreement for Kalyanspur-Badalpara Coal Block

and without prejudice to the generality of the foregoing, shall also include any enactment, modification, repeal, interpretation or application of any Applicable Law of India affecting **Block Allocatee's Taxes**

"**Coal**" includes anthracite, bituminous, lignite, peat and any other form of carbonaceous matter sold or marketed as coal and also coke.

"**Controlling**", "**Controlled by**" or "**Control**" with respect to any Person, shall mean: (1) the possession, directly or indirectly, of the power to direct or cause the direction of the management and policies of such Person whether through the ownership of voting securities, by agreement or otherwise or the power to elect more than one-half of the directors, partners or other individuals exercising similar authority with respect to such Person. *Provided however that in order to exercise "control" under this sub-paragraph (1), the controlling entity must have a voting interest of more than twenty six percent (26%) in the entity that is controlled;* (2) the possession, directly or indirectly, of a voting interest of more than fifty percent (50%) and a contractual shareholder or director veto right in management matters. "Change in Control" shall be construed accordingly.

"**Detailed Exploration Operations**" means detailed exploration operations including detailed three-dimensional delineation of a known deposit achieved through close spaced sampling, pitting, trenching and drilling etc. in a grid, including analysis of outcrops, trenches, horseholes, shafts and tunnels, so that the size, shape, structure, grade of the deposit are established with a high degree of accuracy as per Indian Standard Procedure set by the Coal Council of India and includes intensive ground geological, geophysical, geochemical, close space drilling, sampling and deposit modeling to establish the continuity, orientation and geometry of coal seams, prepare detailed seam profiles, make confident assessment of coal tonnage and quality potentiality amenable to exploitation and determine the likely mining method.

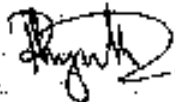
"**Development Area**" means the whole or any particular part of the Mining Area which is established for commercial development and which is delineated as such in a Mine Plan.

"**Effective Date**" shall have the meaning assigned thereto in the preamble of this Agreement.


"**Eligibility Conditions**" shall mean the eligibility conditions specified in the Act and the Rules.

"**Encumbrance**" means a mortgage, debenture, charge (legal or equitable, fixed or floating), pledge, lien, attachment, option, restriction, right of first refusal, right of pre-emption, third party right or interest, other encumbrance or security interest of any kind, or another type of preferential arrangement (including a title transfer and retention arrangement) having similar effect.

"**End Use Plant (s)**" shall have the meaning assigned thereto in Article 12 hereof.


श्रीमान् निदेशिका / श्रीमान् निदेशिका
अन्तर्गत / Under Secretary
सर्वकार / Govt. of India
कोयला / Ministry of Coal
शास्त्र / Shastri / Shastri
नई दिल्ली / New Delhi

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प्रबंध निदेशक
हरियाणा विजली उत्पादन निगम.
फरीदाबाद

Coal Block Development and Production Agreement for Kalyanpur-Badlatpara Coal Block

"End Use Plant(s) Development Milestone" means the development milestones for the End Use Plant(s) as set forth in Schedule IV-D.

"Environmental Clearance" shall have the meaning assigned therein in Article 7.2 hereof.

"Event of Force Majeure" shall mean any of the following events or circumstances or combination of the following events or circumstances which are beyond the reasonable control of the affected Party, which could not have been prevented by Good Industry Practice or by the exercise of reasonable skill and care and which or any consequences of which, have a material and adverse effect upon the performance by the affected Party of its obligations or enjoyment of its rights, under this Agreement:


- a. Flood, lightning, storm, typhoon, tornado, earthquake, landslide, subsidence, washout or epidemic or other similar acts of God;
- b. War (whether declared or undeclared), riot, civil war, blockade, insurrection, acts of public enemies or civil disturbance, including disturbances caused by "extremists" and break down of law and order, in each case, occurring in India;
- c. nuclear, chemical or biological contamination or sonic boom;
- d. collapse of buildings, fire, explosion or accident; and
- e. Strikes or lockouts or other industrial action or industrial dispute occurring in India other than those occurring in the Mining Area and other than those solely affecting the Party claiming the same as an Event of Force Majeure and attributable to such Party's policies regarding labour, compensation or employment or labour related conditions.

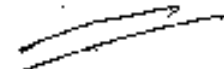
It is expressly clarified that an Event of Force Majeure affecting the/ 1 (one) or more End Use Plant(s) shall also constitute an Event of Force Majeure hereunder.

"Financing Agreements" means the agreements executed by the Block Allocatee in respect of financial assistance to be provided by the Senior Lenders by way of loans, guarantees, subscription to non-convertible debentures and other debt instruments including loan agreements, guarantees, notes, debentures, bonds, security agreements and other documents relating to the financing (including refinancing) of the Block development costs.

"Forest Clearance" shall have the meaning assigned thereto in Article 7.2 hereof.

"Geological Report" means the formal document used to report geological coal reserves. It provides details of the exploration work undertaken in a block, seam details and information on partings and dirt bands intersected and considered during resource estimation, assumptions made for structural and quality modeling along with a detailed account of the resource estimation process followed. The Geological Report normally contains description, all basic data generated during Detailed Exploration Operations and processed and interpreted data and plans. Geological Report shall be prepared in accordance with the guidelines/ norms as may be prescribed by the Government in the Ministry of Coal.


श्रीमान् सितार्थिणः / श्रीमान् SITHARTHANING
अन्तर-सचिव / Under Secretary
सर्वकार / Govt. of India
कोयला विभाग / Ministry of Coal
शास्त्र-मन्त्री / Shreshth Bhanu
नई दिल्ली / New Delhi


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हरियाणा बिजली उत्पादन निगम
पंचनूसरी

Coal Block Development and Production Agreement for Kalyanpur-Hadalpara Coal Block

"Governmental Approval" means any authorization, approval, consent, licence or permit required from any Governmental Authority.

"Governmental Authority" shall mean, in respect of a country, the government (central, state and local) or any ministry, directorate, department or political subdivision thereof and any Person exercising executive, legislative, judicial, regulatory or administrative functions of or pertaining to government or law or any other governmental entity, instrumentality, agency, authority, corporation, committee or commission under the direct or indirect control of any such government.

"Good Industry Practice" means the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected to be applied by a skilled and experienced person engaged in the international mining industry.

"Lenders Representative" means the person duly authorised by the Senior Lenders to act for and on behalf of the Senior Lenders with regard to matters arising out of or in relation to the Financing Agreement, and includes his successors, assigns and substitutes.

"Material Adverse Effect" means a material and adverse effect on the business, properties, prospects, financial position or the ability of the Block Allocatee or an event or circumstance that may result in such material and adverse effect.

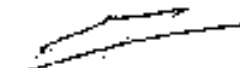
"Mining Lease" means a lease granted under the Act for the purpose of undertaking mining operations and includes a sub-lease granted for such purpose. *Provided that where the context requires, the term "Mining Lease" shall mean a lease deemed to be granted under the Coal Bearing Areas (Acquisition and Development) Act, 1957, the Coal Mines (Nationalisation) Act, 1973 or the Coking Coal Mines (Nationalisation) Act, 1972, as the case may be, for the purpose of undertaking mining operations.*

"Mine Plan" means a plan submitted by the Block Allocatee for development of the Mining Area and which has been approved by the Government in accordance with the terms of Article 10 hereof. Mine Plan shall be prepared in accordance with the guidelines/ norms as may be prescribed by the Government in the Ministry of Coal.

"Block Allocatee Taxes" shall mean the following, as now in force or as newly imposed, or as modified or increased from time to time:

- (1) All taxes, duties, cesses, imposts, fees, levies (including all Indian central and state government taxes, octroi, excise duties, customs duties, sales tax, value added tax, countervailing duties, works contract tax, service tax, building and construction workers cess and withholding taxes) imposed under Applicable Laws (whether within India or outside India) in connection with this Agreement; and
- (2) All taxes on Block Allocatee's income, profit, real and personal property; and


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New Delhi


एम. के. वी. रामा राव
प्रबंध निदेशक
हरियप्ता बिजली उत्पादन निगम,
धनशुद्धा

Coal Block Development and Production Agreement for Kalyanpur-Hudalpara Coal Block

- (3) All applicable payroll, withholding, social security, workers' compensation and employment taxes and contributions imposed under any law in connection with or measured by compensation (including wages and salaries) paid to or for the benefit of employees of Block Allocatee (including taxes, health and welfare funds, minimum wages, provident fund, employee state insurance, gratuity, pensions and annuities, disability insurance and all other similar social payments under labour laws or otherwise under Applicable Laws generally).

"**Mining Operations**" means, as the context may require, Detailed Exploration Operations and Development Activities or any combination thereof and all work related to the various phases in the mineral development process, including exploration, mineral deposit evaluation, mine construction, mine/ block development and all other activities necessary or convenient to carry out the Block Allocatee's rights and obligations under this Agreement, subject always to compliance with Applicable Law and this Agreement.

"**Monthly Payment**" shall have the meaning assigned thereto in in Clause 11.2(d).

"**Notice**" shall have the meaning assigned thereto in Article 27.6 hereof.

"**Performance Security**" shall have the meaning assigned thereto in Article 6 hereof.

"**Permitted End Use**" shall have the meaning assigned thereto in Article 12 hereof.

"**Person**" means any individual, firm, partnership, trust, joint venture, company, corporation, body corporate, sole proprietorship, unincorporated body, association, organisation, Governmental Authority or any other entity or organisation (whether or not in each case having separate legal personality).

"**Production Operations**" means a set of activities and operations involved in producing Coal such as drilling, blasting, loading and transport of the broken rock / coal, crushing, storing and dispatch of coal and drainage, pumping, lighting, haul road construction and maintenance etc.

"**Prospecting License**" means a license granted under the Act for the purpose of undertaking prospecting operations. [Provided however that where the context requires, the term "Prospecting License" shall mean a license to prospect under the Coal Bearing Areas (Acquisition and Development) Act, 1957.]

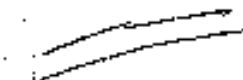
"**Prospecting Period**" shall have the meaning assigned thereto in Article 3.

"**Senior Lenders**" means the financial institutions, banks, multilateral lending agencies, trusts, funds, and agents or trustees of debenture holders, including their successors and assignees, who have agreed to guarantee or provide finance to the Block Allocatee under any of the Financing Agreements for meeting all or any part of the Block development cost.



रिश्वान रिनकथियांग / RISHWAN RYNZATHIANG
अवर सचिव / Under Secretary
कोयला विभाग / Govt. of India
कोयला विभाग / Ministry of Coal
राजधानी, दिल्ली / New Delhi

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पंचसूती

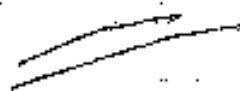
Coal Block Development and Production Agreement for Kalyanpur-Budaipora Coal Block

"**Upfront Amount**" means a non-refundable, fixed sum of money determined by the Government at the time when the Mine Plan is approved.

1.2 In this Agreement, unless the context requires otherwise:

- (1) References to a Person (or to a word importing a Person) shall be construed so as to include that Person's successors in title and assigns or transferees permitted in accordance with the terms of this Agreement and references to a Person's representatives shall be to its officers, employees, legal or other professional advisers, sub-contractors, agents, attorneys and other duly authorised representatives.
- (2) A reference to a Law shall be construed as including all Laws consolidating, amending, modifying, supplementing or replacing the Law referred to. Reference to any agreement, deed, document, instrument, rule, regulation, notification, statute or the like (including this Agreement) shall mean a reference to the same as may have been duly amended, modified or replaced. For the avoidance of doubt, a document shall be construed as amended, modified or replaced only if such amendment, modification or replacement is executed in compliance with the provisions of such document.
- (3) The singular of any defined term includes the plural and vice versa and any word or expression defined in the singular has the corresponding meaning used in the plural and vice versa.
- (4) The rule of construction, if any, that a contract should be interpreted against the parties responsible for the drafting and preparation thereof, shall not apply.
- (5) The terms include and including shall be deemed to be followed by the words 'without limitation', whether or not so followed.
- (6) Article headings in this Agreement are inserted for convenience only and shall not be used in its interpretation.


उप-सचिव, राखन कल्याण
अवर सचिव / Under Secretary
गणतन्त्र भारत / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi


एम. वी. वी. रामा राव
प्रबंध निदेशक :
हरियाणा बिजली उत्पादन निगम
पंचकुला

Coal Block Development and Production Agreement for Kalyanspur-Badampura Coal Block

ARTICLE-2


TERM

- 2.1 This Agreement shall commence on the Effective Date and shall continue for the term of the Prospecting Period, unless agreed otherwise by the Parties and unless this Agreement is terminated earlier in accordance with its terms prior thereto.



शशि भवन् सिंह / SHASHI BHAWAN SINGH
अवर सचिव / Under Secretary
राज्य सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शास्त्र, भवन / Shastri Bhawan
एन २८/१ / New Delhi

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प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम
भिवनूरुला

ARTICLE-3

PROSPECTING PERIOD

3.1 "Prospecting Period" shall be divided into two stages as follows:

1. "Exploration Period" being the period during which Detailed Exploration Operations are carried out by the Block Allocatee, the Geological Report, the Mine Plan and the drilling logs are prepared in accordance with the guidelines/ norms as may be prescribed by the Government in the Ministry of Coal, submitted to the Government and approved by the Government as set forth in Schedule IV-A hereof; and
2. "Development Period" being the period following completion of the Exploration Period during which "Development Activities" are undertaken

and for the purposes hereof, "Development Activities" consist of applying for Environmental Clearance and Forest Clearance and a Mining Lease including all other activities leading up to grant of a Mining Lease as set forth in Schedule IV-A hereof.

3.2 Subject to completion of the work programme/ milestones associated with the Exploration Period as set forth in Schedule IV-A hereof to the satisfaction of the Government, the Block Allocatee may elect to terminate this Agreement by Notice to the Government. At the time of submitting the Mine Plan as per the provisions of Schedule IV-A, the Block Allocatee shall notify the Government whether it has elected to terminate this Agreement or continue into the Development Period.

3.3 If this Agreement is terminated in accordance with Article 3.2 above, the Performance Security shall be released in favour of the Block Allocatee.

रिजल सेक्रेटरी / RISHMAL KHANDEKAR
अध. सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शाहजहाँपुर / Shastry Bhawan
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भरमकुली

ARTICLE- 4

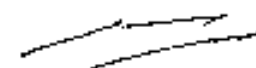
RELINQUISHMENT

- 4.1 Subject to approval of the Government, after completing Detailed Exploration Operations in the Mining Area i.e. Exploration Period, the Block Allocatee may relinquish whole or any portion of the Mining Area after making an application for the Mine Plan and submitting drilling logs and approval of Mine Plan in accordance with clause 3.1.1, but prior to obtaining of Mining Lease for such Mining Area. At the end of the Exploration Period, the Block Allocatee shall retain only that part of the Development Area which the Block Allocatee has not relinquished.
- 4.2 This Agreement shall remain enforceable only for that part of the Development Area which has been retained by the Block Allocatee pursuant to Clause 4.1.
- 4.3 Relinquishment of all or part of the Mining Area or termination of this Agreement shall not be construed as absolving the Block Allocatee of any liability undertaken or incurred by the Block Allocatee in respect of the Mining Area during the period between Effective Date and the date of such relinquishment or termination.
- 4.4 The liability of the Block Allocatee shall be limited to any liability undertaken or incurred in respect of, relating to or connected with this Agreement and any Claims arising out of or in relation to the act of negligence, misconduct, commission or omission in carrying out Mining Operations during the period between Effective Date and the date of relinquishment of the Mining Area or termination or expiry hereof, as the case may be.



श्री: अशोक कुमार, RS-ANIRNATHAN
अध. सचिव / Under Secretary
आर.डी. ब्लाक / Govt. of India
उद्योग विभाग / Ministry of Coal
एन.डी. 01, Shakti Bhawan
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प्रबंध निदेशक
इरियाला पिजली उत्पादन निगम,
भयंकूला

ARTICLE- 5

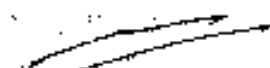
WORK PROGRAMME

- 5.1 The Block Allocatee shall commence Mining Operations immediately after Effective Date.
- 5.2 During the Prospecting Period, the Block Allocatee shall complete the work programme associated therewith as described in Schedule IV-A "Block Development Milestone" within the time period set forth therein.
- 5.3 During the Development Period, the Block Allocatee shall also complete the work programme associated therewith as described in Schedule IV-B "End use Development Milestone" within the time period set forth therein.
- 5.3 Block Allocatee shall furnish to the Government, all data gathered, including drilling logs, core samples data, copies of all findings, studies and results of the work programme described above and undertaken at any time during the term hereof within 30 (thirty) days after the same becomes available to the Block Allocatee.



श्रीमान् उपसचिवः / श्रीमान् उपसचिवः
Under Secretary
श्रीमान् उपसचिवः / Govt. of India
श्रीमान् उपसचिवः / Ministry of Coal
श्रीमान् उपसचिवः / Shashi Bhowan
श्रीमान् उपसचिवः / New Delhi

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उत्तराखण्ड विजली उत्पादन निगम
पंचकुला

ARTICLE- 6

PERFORMANCE SECURITY

6.1 Performance Security

6.1.1 The Block Allocatee shall, for the performance of its obligations hereunder during the period until grant of Mining Lease, provide to the Government, no later than 30 (thirty) days from Effective Date, an irrevocable and unconditional guarantee from a Bank payable at Delhi (the "Performance Security") in the form attached herewith as Schedule VI.

6.1.2 The Performance Security during the exploration stage may be made equal to the estimated exploration expense. The Performance Security during the development stage may be made equal to 5% (five percent) of the estimated development and construction expenditure for the block.

6.1.3 The value of the Performance Security shall be INR 150150000 (Indian Rupees Fifteen Crore One Lakh Fifty Thousand) on the date hereof. The value of the Performance Security shall be changed to such amount as notified by the Government if Block Allocatee elects to go into the Development Period pursuant to Article 3 hereof. The revised amount will be notified by the Government at the time of approval of Mine Plan. The Performance Security amount shall be changed within 30 (thirty) days of notification of revised amount by the Government.

6.2 Appropriation of Performance Security

6.2.1 The Performance Security may be appropriated by the Government upon occurrence of any of the following events (the "Appropriation Event"), to be determined by the Government in its sole discretion:

- (a) failure of the Block Allocatee to make payment of the Upfront Amount within the time specified in ARTICLE-14;
- (b) failure of the Block Allocatee to comply with the Milestones as required under ARTICLE- 5, Clause 5.2;
- (c) any Change in Control or transfer of right, title or interest in the Coal Block which is not in conformity with ARTICLE- 8;
- (d) any utilisation of coal which is not in conformity with ARTICLE-12; or
- (e) any other breach or non-compliance of any of the provisions of this Agreement including in case of the Warranties being untrue or misleading or incorrect in any manner whatsoever.

Provided however that in the event an Appropriation Event has occurred solely on account of an Event of Force Majeure which could not have been mitigated by the Block Allocatee through Good Industry Practice as provided in ARTICLE-17, then the Performance Security shall not be appropriated for such specific Appropriation Event.

Coal Block Development and Production Agreement for Kalyampur-Budaipara Coal Block

6.3 Manner of appropriation of the Performance Security


6.3.1 Upon occurrence of an Appropriation Event, to be determined by the Government, the Government shall have the unconditional right to appropriate the Performance Security by providing a written notice to the Block Allocatee in the following proportion:

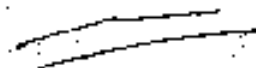
	Appropriation Event	Amount of the Performance Security to be appropriated
1.	Failure of the Block Allocatee to make payment of the Upfront Amount within the time specified in ARTICLE-14	An amount equal the Upfront Amount together with [12% per annum] simple interest on such amount starting from the date on which such amount was due and until the date of appropriation of the Performance Security.
2.	Failure of the Block Allocatee to comply with the Milestones as required under ARTICLE- 5, Clause 5.2;	Such Per cent of the Performance Security for each failure to comply with the Milestone as specified in Schedule IV-A.
3.	Any Change in Control or transfer of right, title or interest in the Coal Block which is not in conformity with ARTICLE- 8	Entire Performance Security.
4.	Any utilisation of coal which is not in conformity with ARTICLE-12	Entire Performance Security.
5.	Any other breach or non-compliance with any of the provisions of this Agreement, including in case of the Warranties being untrue or misleading or incorrect in any manner whatsoever.	Such proportion as may be determined by the Government in its sole discretion.

6.3.2 Any Appropriation Event resulting in appropriation of the entire Performance Security shall be a Termination Event for the purposes of Clause 25.2.1.

6.3.3 In the event of a part appropriation of the Performance Security, the Block Allocatee shall be required to: (i) rectify the Appropriation Event; and (ii) top-up the bank guarantee constituting the Performance Security within fifteen Business Days of receipt of a notice under this Clause, failure to do so shall be a Termination Event for the purposes of Clause 25.2.1.

6.3.4 In the event that on account of one or more Appropriation Events, an amount equal to hundred per cent of the Performance Security is appropriated in aggregate in one or more instances, the same shall be a Termination Event for the purposes of Clause 25.2.1.


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 Under Secretary
 Ministry of Coal
 Government of India
 Block Development Division
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 प्रबंध निदेशक
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 पंचकुला

ARTICLE-7

GENERAL RIGHTS AND OBLIGATIONS

7.1 Exclusivity

The rights granted to the Block Allocatee herein to conduct Mining Operations are exclusive within the Mining Area. The Government undertakes not to grant any rights to prospect for Coal in the Mining Area to any third party during the term of this Agreement.

7.2 Authorisations

a. The Block Allocatee shall obtain and maintain all Authorisations required to conduct Mining Operations. The Government undertakes, on a reasonable endeavour basis, to expeditiously provide all necessary approvals and assistance for conducting Mining Operations and as otherwise may be reasonably required by the Block Allocatee in relation to the rights granted to it under this Agreement.

b. Without prejudice to the generality of the foregoing, Government shall, on a reasonable endeavour basis, assist Block Allocatee in obtaining approvals from the necessary Governmental Authorities under:

- i. the Forest (Conservation) Act, 1980 (the "Forest Clearance"); and
- ii. the Environment (Protection) Act, 1986 (the "Environmental Clearance"),


subject always to compliance by the Block Allocatee of all Applicable Law.

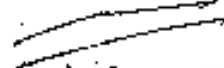
7.3 Health, Safety, Welfare, Social Security and Minimum Wages

(a) The Block Allocatee shall comply with all Applicable Laws and observe Good Industry Practice for the protection of the general health, safety, welfare, social security and minimum wages of employees engaged at the Coal Block, including employees of any contractor or sub-contractor and of all other persons having legal access to the area covered by this Agreement.

(b) Without prejudice to the generality of the foregoing, the Block Allocatee shall ensure payment of minimum wages to the employees engaged at the Coal Block and in related activity including employees of any contractor or sub-contractor.

(c) The Block Allocatee shall install and utilize such recognized modern safety devices and observe such recognized modern safety precautions as are provided and observed under Good Industry Practice. The Block Allocatee shall maintain in a safe and sound condition for the duration of this Agreement all infrastructure and


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हरियाणा बिजली उत्पादन निगम,
पंचकुला

Coal Block Development and Production Agreement for Kalvanganj-Badlipara Coal Block

equipment constructed or acquired in connection with Mining Operations and required for ongoing operations.

- (d) The Block Allocatee shall train its employees in accordance with generally accepted health and safety procedures and practices.
- (e) The Block Allocatee shall construct, maintain, and operate health programs and facilities to serve its employees which programs and facilities shall install, maintain and use modern health devices and equipment and shall practice modern health procedures and precautions in accordance with accepted international medical standards. Any Block Allocatee-supplied housing shall be built to a standard that provides suitable living environments adequate for health and well being, and which meet applicable sanitation standards

7.4 Prevention of Corruption

7.4.1 Obligations of the Block Allocatee

The Block Allocatee, its officers, directors and employees acknowledge and agree that they are subject to the anti bribery and anti-corruption provisions of Applicable Law and of the jurisdictions in which the Block Allocatee is organized or conducts business (collectively, "Anticorruption Laws"), and shall conduct their activities in India in accordance with their obligations under the Anticorruption Laws.

7.4.2 Obligations of the Government

The Government acknowledges and agrees that officials of Governmental Authorities are subject to the Anticorruption Laws and shall conduct their activities in accordance with their obligations under the Anticorruption Laws.

7.4.3 Other Applicable Norms


The Parties acknowledge and agree that this Article and all payments made by the Block Allocatee, or any of its contractors, subcontractors, officers or directors to any Governmental Authority at any level may be public information

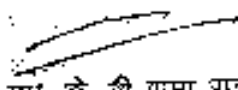
7.4.4 Understanding of the Parties

(a) The Parties to this Agreement understand that:

- (i) The offering, solicitation or acceptance of an offer, promise or gift of any pecuniary or other nature, including facilitation payments, whether directly or through intermediaries, to any private party or government official, in order that the private party or a third party act or refrain from acting in relation to the performance of official duties to achieve any favour or to otherwise obtain any business advantage; and

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शशि घोष / SHASHI GHOSH
अधीन सचिव / Under Secretary
मंत्रालय / Ministry of India
कोयला / Ministry of Coal
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पंचकुला

Coal Block Development and Production Agreement for Kalyanspur-Badhalpara Coal Block

- (ii) Any acts complicit in any act described in this Article, including incitement, aiding and abetting, conspiracy to commit or authorization of such acts, are acts inconsistent with the Applicable Law, the Anticorruption Laws and this Agreement and acts subject to appropriate criminal and other enforcement and sanctions.
- (b) The Government may prosecute such activities in accordance with the Anticorruption Laws, may seek enforcement action by the government of any foreign country where appropriate, and shall fully cooperate with any such action by a foreign government.

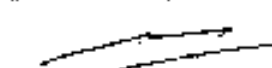
7.5 Geological and Archaeological Finds

It is expressly agreed that other than rights to mine for Coal (as may be granted under any Mining Lease pursuant hereto), geological or archaeological rights do not form part of the rights granted to the Block Allocatee under this Agreement and the Block Allocatee hereby acknowledges that except in relation to Coal (as may be granted under any Mining Lease pursuant hereto), it shall not have any mining rights or interest in the underlying minerals, metals (including gold, silver etc.), gas, oil, fossils, antiquities, structures or other remnants or things either of particular geological or archeological interest and that such rights, interest and property on or under the Mining Area shall vest in and belong to the Government or the Governmental Authority concerned. The Block Allocatee shall take all reasonable precautions to prevent its workmen or any other person from removing or damaging such interest or property and shall inform the Government forthwith of the discovery thereof and comply with such instructions as the Governmental Authority concerned may reasonably give for the removal of such property.



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Under Secretary
Ministry of Coal
Government of India
Shastri Bhawan
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श्री. रमेश चंद्रा
प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम
फचकुला

ARTICLE 8

CHANGE IN CONTROL

8.1. Change in Control of the Block Allocatee

8.1.1. Change in Control of the Block Allocatee or any transfer of the Specified End Use Plant along with the rights in relation to the Coal Block, shall only be permissible with prior intimation to the Government if:

(a) such Change in Control or transfer does not result in the Block Allocatee becoming non-compliant with any of the Eligibility Conditions or the transferee is also compliant with the applicable Eligibility Conditions, as the case may be;

(b) post such Change in Control or transfer the coal block and the End Use Plant(s) remains under Control of the same company or corporation and coal to be mined from the Mining Area (under any Mining Lease pursuant hereto) may be used for the purposes of the End Use Plant(s) only and for no other purpose; and

(c) any prior consent, approval, no-objection certificate or the like required for such Change in control or transfer under any Applicable Law has been obtained prior to submission of prior intimation.


8.1.2. In the event that any Change in Control of the Block Allocatee or any proposed transfer of the Specified End Use Plant along with the rights in relation to the Coal Block which requires prior Governmental Approval under any Applicable Laws, then such Governmental Approval shall be granted (in addition to any other requirement under Applicable Law) only if:

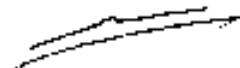
(a) the transferee of such right, title or interest of the Block Allocatee subsequent to Change of Control, as the case may be, also meets all the applicable Eligibility Conditions; or

(b) the Block Allocatee continues to meet all the applicable Eligibility Conditions.

8.2. Change in Control in case of a joint venture

8.2.1. In the event, a Block Allocatee is a joint venture company formed by two or more companies (the "JV Partners"), which has become eligible for coal Block allocation on account of its JV Partners meeting all the Eligibility Conditions or two or more Block Allocatees form a joint venture company, then:


रिशभ सिंघानिया / RISHABHSINGH
अधीन सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi


एम. के. वी. रामा राव
प्रबंध निदेशक
हरिसागर बिजली उत्पादन निगम.
पंचकुला

Coal Block Development and Production Agreement for Katyanpur-Badalpara Coal Block


(a) no change in shareholding (directly or indirectly) of the joint venture company shall be permitted, without the prior approval of the Government as may be required under Applicable Laws. Such approval shall be granted only if the new shareholder meets all the applicable Eligibility Conditions;

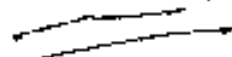
(b) in the event that, one of the JV Partners becomes ineligible or ceases to operate the Specified End Use Plant or ceases to be a JV Partner, then: (i) the joint venture company may supply coal to the remaining JV Partners subject to the condition that each such remaining JV Partners shall not be entitled to receive coal in excess of the normative requirement of coal for their Specified End Use Plant and (ii) coal extracted in excess of the limit specified in sub-clause (i) above shall be required to be supplied to CIL at the CIL Notified Price.

8.3. Consequences of default

8.3.1. In the event of any Change in Control or any transfer of right, title or interest in the Coal Block which is not in conformity with this Agreement or any Applicable Law, then in addition to any rights, remedy or consequences as may be applicable under Applicable Laws, the Government may, in its sole discretion, appropriate the Performance Security, disqualify the Block Allocatee from participating in any further auction or allotment process conducted by the Government or the Nominated Authority appointed under Coal Mines (Special Provisions) Act, 2015; terminate this Agreement; and/or terminate and withdraw the allotment as the case may be.

8.3.2. Any transfer of right, title or interest which is not in conformity with this Agreement or Applicable Laws shall be deemed to be void ab-initio.



रिश्ता निदेशक / RISHTA NIDESHAK
अवर सचिव / Under Secretary
अन्तर राज्य / Govt. of India
केन्द्र, 4 शान्त / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi

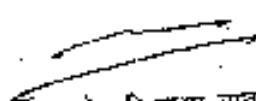

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प्रबंध निदेशक
हरिप्रसाद विजली उत्पादन निगम,
पंचकुला

ARTICLE-9

PERFORMANCE STANDARDS

- 9.1 The following general obligations shall apply relating to performance standards:
- a. Block Allocatee shall conduct all operations and activities in a prudent, diligent, and efficient manner in accordance with good and acceptable mineral exploration and mining engineering standards and practices and in accordance with modern and accepted scientific and technical principles applicable to the exploration and mining of Coal. All operations and activities under this Agreement shall be conducted so as to minimize waste or loss of natural resources, protect natural resources against unnecessary damage, and in a manner intended to minimize pollution and contamination of the environment.
 - b. Block Allocatee shall prevent and control fires and notify immediately the Governmental Authorities concerned of any fire that occurs within the Mining Area.
 - c. Block Allocatee shall not cause or allow damage to the properties of the Government and third parties located within the Mining Area.
 - d. Block Allocatee shall install and utilize such recognized modern safety devices and observe such recognized modern safety precautions as are required under Good Industry Practice.
 - e. Block Allocatee shall observe all Applicable Laws for the protection of the general health and safety of its employees and of all other persons contracted by Block Allocatee having legal access to the area covered by this Agreement.


श्रीमान् विद्युत् (SHRI MAN VEDYUT)
सचिव, भारत सरकार / Shri Man Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
श्रीवाहा / Shriwaha
नई दिल्ली / New Delhi


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प्रबंध निदेशक
इन्दियान विजली उत्पादन निगम,
पुणे/मुंबई

ARTICLE- 10

MINE PLAN

- 10.1 After undertaking Detailed Exploration Operations and within 2 (two) years of Effective Date, the Block Allocatee shall submit to the Ministry of Coal or other relevant Governmental Authority a comprehensive Mine Plan.
- 10.2 The Mine Plan shall be prepared in compliance with the guidelines for preparation of mining plans as provided by the Ministry of Coal or other relevant Governmental Authority, as the same may change from time to time and shall comply with all requirements under Applicable Law.
- 10.3 **Approval of the Mine Plan**
- (a) The Ministry of Coal or other relevant Governmental Authority may provide comments thereon to the Block Allocatee including on the basis of any failure to conform to Applicable Law or to the terms of this Agreement. The Block Allocatee shall correct any failures to conform to Applicable Law or to the terms of this Agreement. In the event the Ministry of Coal or other relevant Governmental Authority does not provide comments on the Mine Plan, the same shall not relieve the Block Allocatee of its obligation to comply with Applicable Law and the terms hereof.
- (b) The Ministry of Coal or other relevant Governmental Authority may provide Notice to the Block Allocatee requesting such revisions to the Mine Plan as it deems fit. The Block Allocatee shall meet the Ministry of Coal or other relevant Governmental Authority promptly to discuss revisions to the Mine Plan. In the event of any disagreement, the view of the Ministry of Coal or other relevant Governmental Authority shall prevail.
- 10.4 A Mine Plan approved by the Ministry of Coal or other relevant Governmental Authority shall commit the Block Allocatee to its obligations and commitments as contained in the Mine Plan.

ARTICLE- 11

SUBMISSION OF APPLICATION FOR COAL MINING LEASE

- 11.1 The Block Allocatee shall submit an application for a Mining Lease in respect of the proposed Development Area to the relevant State Government.
- 11.2 Block Allocatee agrees that the following terms may be included in any Mining Lease granted in relation to the Mining Area by the relevant State Government:
- No Change in Control shall be permitted except in accordance with Article 8.
 - The Block Allocatee shall commence Production Operations in accordance with the Block Development Milestones prescribed in Schedule IV-A.
 - The Block Allocatee shall allow the Government to access the Block Allocatee's financial and other records and transactions (relatable to any period) at any time during the normal working hours upon reasonable advance Notice, the right to copy therefrom, for the purpose of assessing the performance and compliance of the Block Allocatee with the terms of this Agreement and all Applicable Laws, rules and regulations or to aid in the enforcement of the same.
 - Monthly Payment**
 - The Block Allocatee shall pay to the State Government, over and above the statutory Royalty and Upfront Amount, a monthly payment linked to the coal production of the Block (the "Monthly Payment") Monthly Payment shall be calculated on the following basis:

[Actual production of coal in previous month in tonnes multiplied by the Reserve Price in the form of Rupees per tonne.]
 - The Reserve Price may escalate on the following basis:

[Reserve Price in the form of Rupees per tonne multiplied by the Wholesale Price Index as on April 01, of such financial year divided by the Wholesale Price Index on April 01 of the financial year in which the Reserve Price is set.]
 - Reserve Price shall be as determined by the Government at the time when the Mine Plan is approved.
 - The Monthly Payment is required to be made in the manner as specified by the State Government within 20 calendar days of expiry of each month with respect to coal extracted from the Coal Block in such calendar month.
 - All payments required to be made by the Block Allocatee shall be made net of all applicable Taxes and Royalty. In the event, Taxes and Royalty are payable,

Coal Block Development and Production Agreement for Kalyanspur-Badalpara Coal Block

the Block Allocatee shall gross-up the amount payable and make payment of the aggregate amount.

(vi) The Monthly Payment may be secured by a bank guarantee in favour of the relevant State Government to be provided upon grant of a Mining Lease. Such bank guarantee shall be equal to 5 (five) percent of the peak capacity of the Mine/ Block as per the approved Mine Plan multiplied by the Reserve Price in the form of INR per tonne. It is clarified that the Reserve Price shall also be escalated for the purpose of calculation of bank guarantee in accordance with the formula specified in clause (ii) above.

(vii) The term and events of appropriation of such bank guarantee will be prescribed by the relevant State Government.

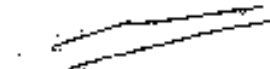
e. The provisions of this Agreement shall also be included in the Mining Lease alongwith any other terms and conditions that the Government/ State Government may desire.

11.3 Parties hereby agree that the Block Allocatee shall be deemed "selected" for the purposes of Section 11A of the Act only once it receives a Mining Lease from the relevant State Government.



श्रीमान् सचिव/SHRI MAN SACHIV
अन्तर्-सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi

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प्रबंध निदेशक
हरिभागा दिल्ली उत्पादन निगम
पंचकुला

ARTICLE-12

RESTRICTIONS ON SALE, DISPOSAL AND EXPORT OF COAL

- 12.1 Block Allocatee agrees that it shall be a provision of any Mining Lease granted in respect of the Block that the Block Allocatee may mine, remove, treat, produce and refine Coal found in the Mining Area solely for the purpose ("Permitted End Use") of usage in the 1x800 MW (exp.) unit, Deenbandhu Chhotu Ram TPP and 1x800 MW (exp.) unit, PTPS, producing facility(ies) of the Block Allocatee located at Unit-3, DCRTPP, Yamuna Nagar and Unit-9, PTPS, Panipat respectively as more fully described in Schedule V (the "End Use Plant(s)") and for no other purpose. In the event there is more than 1 (one) End use Plant, the coal produced in the Block shall be allocated to each End Use Plant in the proportion set forth in Schedule V or in any other proportion as the Block Allocatee deems fit provided all the End Use Plant(s) have been commissioned and brought into commercial operation, as per their declared capacities.

It is expressly further clarified that the Block Allocatee shall not have the right to market, sell or export Coal to any third party.

- 12.2 Any coal extracted from the Coal Block which is in excess of the requirements of coal for the Specified End Use Plant(s) shall be required to be supplied to Coal India Ltd. (CIL) at the CIL Notified Price.
- 12.3 It is clarified that for the purposes of sale of coal to CIL, the determination of grade of coal shall be based on joint analysis of coal carried out by the Block Allocatee and CIL.
- 12.4 All Taxes applicable on such sale of coal shall be payable additionally.
- 12.5 The Block Allocatee shall adhere to Good Industry Practice with respect to mining of coal and make best efforts to reduce generation of middling or washery rejects and utilise the same in any End Use Plant(s) of the Block Allocatee. In any case the middling or washery rejects generated from the Coal Block shall not exceed normative limits.
- 12.6 Any middling or washery rejects or jhama or other carbonaceous shale which cannot be used in End Use Plant(s) generated from the Coal Block may be sold by the Block Allocatee with the prior approval of the Coal Controller's Organisation and the Block Allocatee shall maintain separate records for the middling or washery rejects or jhama or other carbonaceous shale generated, utilised and sold.



भस्कर भवान् / Bhaskar Bhawan
अवर सचिव / Under Secretary
राज्य सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
भस्कर भवान् / Bhaskar Bhawan
नई दिल्ली (New Delhi)

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पंचकुला


ARTICLE-13

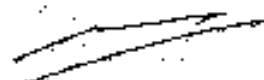
MINE CLOSURE

13.1 Mining Closure/Post-Closure Obligations

13.1.1 Closure Plan and Closure Obligations

- (a) The Block Allocatee shall prepare a closure plan as per the Guidelines for Preparation of Mine Closure Plan issued by the Ministry of Coal or other relevant Governmental Authority, as the same may change from time to time and submit the same to the Government/ relevant Governmental Authority (the "Closure Plan"). The Closure Plan shall address the anticipated environmental, social and economic impact of mining activities. The Closure Plan shall be updated through the same process by which it was prepared each time that there is a substantial change in mining activities or conditions or the guidelines for preparation of mine closure plans.


उप-सचिव / Under Secretary
राज्य सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शाही भवन / Shahi Bhawan
नई दिल्ली / New Delhi


रम. को. वी. रामा राव
प्रबंध निदेशक
हरीद्वारा बिजली उत्पादन निगम,
भंडारवाड़ा


ARTICLE-14

UPFRONT AMOUNT

14.1 The Upfront Amount shall be determined by the Government following approval of the Mine Plan.

14.2 The Upfront Amount shall be ten percent (10%) of the intrinsic value of the block. The intrinsic value of the block will be determined when the Mine Plan is approved.

14.3 The Block Allocatee shall deposit the Upfront Amount through the mode specified by the State Government concerned within 15 Business Days of the receipt of notice from the Government specifying the Upfront Amount.


निदेशन निभाधिकारी / Bhasini Bhawan
अधर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
भारती भवन / Bhasini Bhawan
नई दिल्ली / New Delhi

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पंचगुहा

ARTICLE-15

TAXES AND DUTIES

- 15.1 The Block Allocatee, its employees, agents, suppliers and sub contractors shall be subject to all applicable fiscal legislation in India.
- 15.2 Without prejudice to the generality of the foregoing, Block Allocatee shall be liable for and pay all Block Allocatee Taxes when it becomes due.



श्रीमान् पितृवर्धियन् : RISHAB RYNTAMBAHU
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला, मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
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पंचगढ़ा

ARTICLE-16

CHANGE IN LAW

- 16.1 It is expressly agreed that neither Party may make a claim on the other Party on the basis of a Change in Law including an adverse Change in Law affecting the viability of the Mining Operations.



शशि भट्टनागर / R. SHASHI BHATTNAGAR
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
राज्यी भवन / Shastri Bhawan
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प्रबंध निदेशक
हरिद्वारा पिपली उत्पादन निगम.
पंचवर्ला

ARTICLE-17

FORCE MAJEURE

17.1 Each Party shall be exempt from compliance with its obligations under this Agreement, except the obligation to pay money, and any period in which it must perform an obligation or exercise a right shall be extended, to the extent that, and for so long as, such compliance is hindered or prevented by the occurrence of an Event of Force Majeure.

17.2 A Party asserting Event of Force Majeure shall exercise commercially reasonable efforts to eliminate the event of Force Majeure and shall give prompt Notice to the other Party within a thirty (30) day period after it becomes aware of the event that constitutes the Event of Force Majeure.

17.3 **Extension of Agreement**

The term of this Agreement shall be automatically extended for the period of the Event of Force Majeure.

17.4 **Negotiation in Event of Force Majeure**


If an obligation is suspended by reason of Event of Force Majeure for more than one month continuously, the Parties shall enter into good faith negotiations to revise the terms of this Agreement to reflect the changed circumstances, provided that this Agreement shall remain in effect during the period during which the Parties are negotiating the terms of any such revision.

17.5 **Termination for Extended Force Majeure**

If an Event of Force Majeure subsists for a period of (a) [six] months continuously; (b) or [nine] months over a period of [one] year, the Government may in its discretion terminate this Agreement by issuing a termination Notice to other Party without being liable in any manner whatsoever, and upon issue of such Termination Notice, this Agreement shall, notwithstanding anything to the contrary contained herein, stand terminated. Upon such termination, the Performance Security shall be released by the Government. *Provided however* and it is clarified that the Upfront Amount if, already received by the Government on the date of such termination shall not be refunded upon termination.



शशि भोवण / SHASHI BHOWAN
अधीनस्थ / Under Secretary
उत्पादन विभाग / Govt. of India
उत्पादन विभाग / Ministry of Coal
शशि भोवण / Shashi Bhowan
नई दिल्ली / New Delhi



श्री. के. सी. रामा राय
प्रमुख निदेशक
हरिश्चन्द्र शिलाली उत्पादन-नियंत्रण
पंचसूता

ARTICLE-18

REPRESENTATIONS AND WARRANTIES

18.1 Representations and Warranties of the Block Allocatee

The Block Allocatee represents and warrants to the Government that:

- a) it is duly organised, validly existing and in good standing under the laws of India;
- b) [it is a special purpose company set up solely for the purpose of undertaking Mining Operations hereunder in accordance with the terms of this Agreement and that it will not during the subsistence of this Agreement undertake any other project or business activity;]
- c) it has full power and authority to execute and deliver this Agreement and perform its obligations under this Agreement and to carry out the transactions contemplated hereby;
- d) it has taken all necessary corporate and other action under Applicable Laws and its constitutional documents to authorise the execution, delivery and performance of this Agreement;
- e) it has the financial standing and capacity to undertake Mining Operations;
- f) this Agreement constitutes its legal, valid and binding obligation enforceable against it in accordance with the terms hereof;
- g) it is subject to civil and commercial laws of India with respect to this Agreement and it hereby expressly and irrevocably waives any immunity in any jurisdiction in respect thereof;
- h) the execution, delivery and performance of this Agreement will not conflict with, result in the breach of, constitute a default under or accelerate performance required by any of the terms of the Block Allocatee's memorandum and articles of association or any Applicable Laws or any covenant, agreement, understanding, decree or order to which it is a party or by which it or any of its properties or assets are bound or affected;
- i) there are no actions, suits, proceedings or investigations pending or to the Block Allocatee's knowledge threatened against it at law or in equity before any court or before any other judicial, quasi judicial or other authority, the outcome of which may constitute an event of default hereunder;


Coal Block Development and Production Agreement for Kalyanpur-Badajpara Coal Block

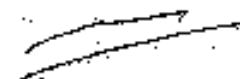
- j) it has neither violated or defaulted nor has knowledge of any violation or default with respect to any order, writ, injunction or any decree of any court or any legally binding order of any Governmental Authority which may result in Material Adverse Effect;
- k) it has complied with all Applicable Laws and has not been subject to any fines, penalties (except Additional Levy as defined in the Coal Mines (Special Provisions) Act, 2015), injunctive relief or any other civil or criminal liabilities which in the aggregate have or may have Material Adverse Effect;
- l) except as set forth in any Mining Lease, all rights and interests of the Block Allocatee in and to the Mining Area shall pass to and vest in the relevant Governmental Authority on the date of termination or expiry hereof, free and clear of all Encumbrances without any further act or deed on the part of the Block Allocatee or the Government;
- m) no representation or warranty by the Block Allocatee contained herein or in any other document furnished by it to the Government or to any Governmental Authority in relation to Authorisations contains or will contain any untrue statement of material fact or omits or will omit to state a material fact necessary to make such representation or warranty not misleading;
- n) no bribe or illegal gratification has been paid or will be paid in cash or kind by or on behalf of the Block Allocatee to any Person to procure the rights granted hereunder; and
- o) Without prejudice to any express provision contained in this Agreement, the Block Allocatee acknowledges that prior to the execution of this Agreement, the Block Allocatee has after a complete and careful examination made an independent evaluation of the Mining Area and the information provided by the Government, and has determined to its satisfaction the nature and extent of risks and hazards as are likely to arise or may be faced by the Block Allocatee in the course of performance of its obligations hereunder. The Block Allocatee also acknowledges and hereby accepts the risk of inadequacy, mistake or error in or relating to any of the matters set forth above and hereby confirms that the Government and any Governmental Authority shall not be liable for the same in any manner whatsoever to the Block Allocatee.

18.2 Representations and Warranties of the Government

The Government represents and warrants to the Block Allocatee that:

- a) the Government has full power and authority to enter into this Agreement;
- b) the Government has taken all necessary action to authorize the execution, delivery and performance of this Agreement;


शशि भोवान / SHASHI BHOWAN
अधीनस्थ / Under Secretary
कोयला विभाग / Govt. of India
कोयला विभाग / Ministry of Coal
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एन. के. शि शमा राव
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हरिद्वार विभागीय खनन निधम
भदवाड़ा

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

- c) This Agreement constitutes the Government's legal, valid and binding obligation enforceable against it in accordance with the terms hereof; and
- d) There are no suits or other legal proceedings pending or threatened against the Government in respect of the Mining Area.

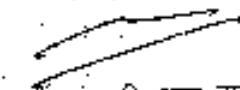
18.3 Obligation to notify change

In the event that any of the representations or warranties made/given by a Party ceases to be true or stands changed, the Party who had made such representation or given such warranty shall promptly notify the other of the same.



शशि खेवान / SHASHI KHEWAN
अधीन सचिव / Under Secretary
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एन. के. वी. सया सय
प्रबंध निवेशक
हरिद्वारा बिजली उत्पादन निगम
सदस्य

ARTICLE-19

INDEMNITIES

- 19.1 To avoid the time and expense of protracted litigation between the Parties and to allow each Party to arrange for insurance or self-insurance as deemed appropriate to address the relevant risks, the responsibility for certain Claims shall be allocated between the Parties in accordance with the further provisions of this Article.
- 19.2 Regardless of Cause, Block Allocatee Shall Be Liable For And Indemnify Government from and against any and all Claims, arising out of personal injury, illness, death, or property loss or damage suffered by any member of Block Allocatee Group.
- 19.3 Block Allocatee Shall Be Liable For And Indemnify Government from and against any and all Claims arising out of personal injury, illness, death, or property loss or damage suffered by Third Parties or any Governmental Authority, to the extent attributable to the Negligence or Gross Negligence of any member of Block Allocatee Group.
- 19.4 Government Shall Be Liable For And Indemnify Block Allocatee Group from and against any and all Claims arising out of personal injury, illness, death, or property loss or damage suffered by Third Parties or any Government Authority, to the extent attributable to the Negligence or Gross Negligence of any member of Government.


19.5 Consequential Damages

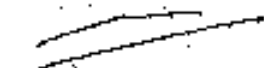
Notwithstanding any other provisions of this Agreement, in no event shall either Party be liable to the other for, and each Party shall release, defend and indemnify the other Party from and against, any indirect or consequential damages which may be suffered by such Party in connection with the performance of this Agreement, including, but not limited to, loss of profits.

19.6 Defence of Claims, Costs and Attorneys' Fees in Connection with any Claims or Litigation:

- (a) Block Allocatee shall, at its sole cost and expense, defend any and all Claims which may be brought against it or against Government for acts or omissions for which Block Allocatee indemnifies Government, including Claims brought against Block Allocatee and Government jointly and any and all suits and legal proceedings originating out of such Claims. Block Allocatee shall accept and initiate such defense within 15 (fifteen) days of written request by Government.
- (b) Government shall, at its sole cost and expense, defend any and all Claims which may be brought against Block Allocatee for acts or omissions for which Government indemnifies Block Allocatee, and any and all suits and legal proceedings originating out of such Claims, excluding Claims brought against Block Allocatee and Government jointly, which shall be governed by the provisions of Article 19.4 above.

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अवर सचिव / Under Secretary
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राजधानी कक्षा / Shashi Bhawan
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श्री राम राय
सचिव / Secretary
हरियाणा दिग्गजी उत्पादन निगम.
भुवनेश्वर

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

Government shall accept and initiate such defense within 15 (fifteen) days of written request by Block Allocatee.


- (c) Block Allocatee shall promptly pay to the Government all costs and reasonable attorneys' fees incurred by Government resulting directly from any and all loss, injury, liability and Claims for which Block Allocatee is obligated to indemnify Government.
- (d) Government shall promptly pay to the Block Allocatee all costs and reasonable attorneys' fees incurred by Block Allocatee resulting directly from any and all loss, injury, liability and Claims for which Government is obligated to indemnify Block Allocatee.
- (e) Any Party shall at all times have the right to participate, at its cost, in the defense of any such suits or legal proceedings if it is a party in interest, or is made a party defendant.


19.7 Survival

It is expressly stated herein that the provisions of this Article 19 and any other provision under this Agreement providing for an indemnity shall survive regardless of any termination of this Agreement.

For the purposes of this Article,

- (a) "**Claim(s)**" shall, unless specifically provided otherwise, mean all claims, damages (excluding punitive or exemplary damages), liabilities, losses, demands, liens, encumbrances, causes of action of any kind (including, without limitation, actions in rem or in personam), obligations, costs, judgments, interest, and awards (including, without limitation, legal counsel fees and costs of litigation if awarded as part of the judgment in favor of the Person asserting the Claim), whether created by law, contract, tort, voluntary settlement, or otherwise, arising out of, related to, or in any way connected with this Agreement.
- (b) "**Block Allocatee Group**" means Block Allocatee, Block Allocatee's subcontractors, Block Allocatee's Affiliates, and the shareholders, officers, directors, employees, agents, consultants, servants and insurers of all of the foregoing.
- (c) "**Gross Negligence**" means such an entire lack of care as to indicate a conscious indifference and reckless disregard for the safety of people and property and includes willful misconduct.
- (d) "**Negligence**" means any sole or concurrent negligent act or omission, fault (including, without limitation, pre-existing conditions), strict liability, breach of duty or warranty (statutory or otherwise), product liability, defect (whether patent, latent, or pre-existing)



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Under Secretary
Ministry of Coal
New Delhi

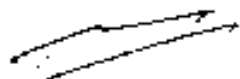

श्री. रमेश राव
उत्पादन विभाग
उत्पादन विभाग
पटना

Coal Block Development and Production Agreement for Katwanpur-Badaipara Coal Block

of any property, equipment, or materials, and shall include passive as well as active Negligence.

- (e) "**Regardless of Cause**" means without regard to Negligence, in whole or in part, of the Party or other Person seeking indemnity or of any other Person. Where expressly stated, Regardless of Cause also means without regard to Gross Negligence, in whole or in part, of the Party or other Person seeking indemnity or of any other Person.
- (f) "**Shall Be Liable For And Indemnify**" means the indemnifying Party shall be solely responsible for and assume all liability for and defend, release and indemnify and hold harmless the indemnified Party or other Person.
- (g) "**Third Party**" means any Person other than any member of Block Allocatee Group or Government.


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एन. के. वी. समा राय
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हरियाणा बिजली उत्पादन निगम
फरीदाबाद

ARTICLE-20

ASSIGNMENT

20.1 Restriction on assignment and charges

- a. This Agreement shall not be assigned by the Block Allocatee to any person, save and except with the prior consent in writing of the Government, which consent the Government shall be entitled to decline without assigning any reason.
- b. Subject to the provision of Article 20.5, the Block Allocatee shall not create nor permit to subsist any Encumbrance, or otherwise transfer or dispose of all or any of its rights and benefits under this Agreement without the prior consent in writing of the Government, which consent the Government shall be entitled to decline without assigning any reason.

20.2 The Performance Security issued by the Block Allocatee shall be replaced and substituted by a fresh Performance Security by the assignee.

20.3 It is clarified that notwithstanding any assignment pursuant to Article 20.1 above, the Permitted End Use as set forth in Article 12 shall remain unchanged and Coal mined from the Mining Area may be used for the purposes of the End Use Plant(s) only and for no other purpose.

20.4 If the Government does not object to the proposed assignment, within 180 (one hundred eighty) days after receipt of an application for approval with respect thereto from the Block Allocatee, the Government shall be deemed to have approved the proposed assignment.


20.5 Permitted assignment and charges

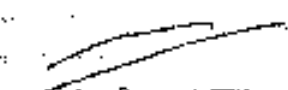
The restraints set forth in Article 20.1 shall not apply to:

- a) Liens arising by operation of law in the ordinary course of business.
- b) Assignment of rights, interest and obligations of the Block Allocatee to or in favour of the Senior Lenders, to the extent covered by and in accordance with the Substitution Agreement as security for financing provided by Senior Lenders under the Financing Agreements; and
- c) Liens and encumbrances required by any Applicable Law.

20.6 Substitution Agreement

a. The Lender's Representative on behalf of the Senior Lenders may exercise their right to substitute the Block Allocatee in accordance with the Agreement for substitution of the Block Allocatee (the "Substitution Agreement") to be entered into amongst the Block


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एनएच रोड / New Delhi


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एनएच रोड / New Delhi


Coal Block Development and Production Agreement for Katyanpur-Badolpara Coal Block

Allocatee, the Government and the Lender's Representative, on behalf of the Senior Lenders, substantially in the form set forth in Schedule III.

- b. Upon the substitution of the Block Allocatee under and in accordance with the Substitution Agreement, the nominated company substituting the Block Allocatee under this Agreement shall enjoy all rights and be responsible for all obligations of the Block Allocatee under this Agreement as if it were the Block Allocatee; provided that where the Block Allocatee is in breach of this Agreement on the date of such substitution, the Government shall by Notice grant a cure period of 120 (one hundred and twenty) days to the Block Allocatee for curing such breach.

20.7 Assignment by the Government

Notwithstanding anything to the contrary contained in this Agreement, the Government may after giving 60 (sixty) day's Notice to the Block Allocatee, assign any of its rights and benefits and/or obligations under this Agreement to an assignee who is, in the reasonable opinion of the Government, capable of fulfilling all of the Government's then outstanding obligations under this Agreement.


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श्रीमान का : Shashi Shrivastava
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हरियाणा विजली उत्पादन निगम
पंचकुला

ARTICLE-21


INSURANCE

21.1 At all times during the term hereof, the Block Allocatee will maintain, and cause its contractors and subcontractors to maintain, with financially sound and reputable insurers, insurance against such casualties and contingencies, of such types, on such terms and in such amounts (including deductibles, co-insurance and self-insurance, if adequate reserves are maintained with respect thereto) as is consistent with Good Industry Practice.

21.2 The Block Allocatee shall provide the Government with copies of all such insurance policies and the Government shall have the right to review and approve the same, such approval not to be unreasonably withheld, provided that unless the Government gives Notice to the Block Allocatee of disapproval of such insurance policies within 30 (thirty) days following receipt of all such insurance policies, the Government shall be deemed to have given its approval.

21.3 No Duty to Verify or Review

Any failure on the part of the Government to pursue or obtain the evidence of insurance required by this Agreement or failure of the Government to inform the Block Allocatee of any non-compliance with a request to provide evidence of insurance shall not constitute a waiver of any of the insurance requirements in this Agreement.


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कोयला विभाग / Govt. of India
कोयला विभाग / Ministry of Coal
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श. के. वी. रश्मा राव
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हरिद्वारम दिग्दर्शी उत्पादन निगम
पंजाब

ARTICLE-22

ACCOUNTS AND AUDIT

22.1 Audited Accounts

The Block Allocatee shall maintain books of accounts recording all its receipts, income, expenditure, payment, assets and liabilities in accordance with Good Industry Practice and Applicable Laws. The Block Allocatee shall provide 2 (two) copies of its balance sheets, cash flow statement and profit and loss account, along with a report thereon by its statutory auditors, within 180 (one hundred and eighty) days of the close of the accounting year in which they pertain.

22.2 Appointment of Auditors


The Government shall have the right, but not the obligation, to appoint at its cost from time to time and at anytime including the term of any Mining Lease granted in respect of the Mining Area, a firm (the "Additional Auditors") to audit and verify all those matters, expenses, costs, realizations and things which the statutory auditors are required to do, undertake or certify pursuant to this Agreement

22.3 Certification of Claims by Statutory Auditors

Any claim or document provided by the Block Allocatee to the Government in connection with or relating to receipts, income, payments, costs, expenses, accounts or audit, and any matter incidental thereto shall be valid and effective only if certified by its statutory auditors.



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कोयला विभाग / Ministry of Coal
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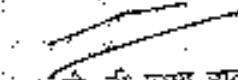
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निदेशक
भारतीय विद्युत् उत्पादन निगम
भारत

ARTICLE-23

GOVERNMENT INSPECTION

- 23.1 The Government, through its authorized representatives shall have the right to free ingress and egress within any part of the Mining Area at any time to inspect works or activities being undertaken or implemented by the Block Allocatee in order to monitor and verify compliance with the terms of this Agreement and all Applicable Laws.
- 23.2 The Government, through its authorized representatives, shall have access to the Block Allocatee's financial and other records and transactions (relatable to any period) at any time upon reasonable advance Notice, the right to copy therefrom, for the purpose of assessing the performance and compliance of the Block Allocatee with the terms of this Agreement and all Applicable Laws, rules and regulations or to aid in the enforcement of the same.
- 23.3 Authorized representatives of other Governmental Authorities may also have access to Block Allocatee's financial and other records relatable to any period at any time upon reasonable advance Notice.
- 23.4 The Government shall have the right to conduct, either directly or indirectly through any third party, a performance audit to verify compliance by the Block Allocatee, of its obligations hereunder.
- 23.5 The provision of this Article 23 shall survive termination or expiry hereof.


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एन.ए.डी.

ARTICLE-24

RELATED PARTY TRANSACTIONS

- 24.1 The Block Allocatee shall not directly or indirectly enter into any transaction or group of related transactions (including without limitation the purchase, lease, sale or exchange of properties of any kind or the rendering of any service) relating in any manner, directly or indirectly to the Block, with any Affiliate, except in the ordinary course and pursuant to the reasonable requirements of its business and upon fair and reasonable terms no less favourable to it than would be obtainable in a comparable arm's-length transaction with a Person not an Affiliate.



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भारत सरकार / Govt. of India
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भारत

ARTICLE-25

TERMINATION

25.1 Surrender

- (a) The Block Allocatee may surrender its rights under this Agreement by Notice to the Government signed by an authorized Block Allocatee representative on 60 (sixty) days' Notice under this Agreement at any time before a Mining Lease is obtained in respect of the Mining Area. Subject to Article 3, in the event of such termination, the Performance Security shall be forfeited.
- (b) Once an effective surrender is made, the Block Allocatee shall have no obligations and liabilities under this Agreement except as specifically provided herein to the contrary.
- (c) The Block Allocatee shall remain liable for all obligations accrued before the effective date of the surrender and also for the obligations that must be fulfilled after termination.

25.2 Termination by the Government

25.2.1 Termination on Certain Events


The Government may terminate this Agreement, without prejudice to any other rights that the Government may have, if any of the following events (each a "Termination Event") occur:

- (a) failure of the Block Allocatee to make payment of the Upfront Amount within the time specified in ARTICLE-14;
- (b) occurrence of any Appropriation Event resulting in appropriation of the entire Performance Security or on account of one or more Appropriation Events, an amount equal to hundred per cent of the Performance Security being appropriated in aggregate (in one or more instances) as provided in Clause 6.3;
- (c) failure of the Block Allocatee to replenish the Performance Security within a period of [15] Business Days, in the event that a part of the Performance Security has been appropriated;
- (d) non-compliance of the Block Allocatee with the Block Development Milestone (Schedule IV-A) and End Use Plant(s) Development Milestone (Schedule IV-B) for more than five instances (in aggregate and not over a specified period) as provided in Clause 5.2 and 5.3;
- (e) suspension of obligations on account of an Event of Force Majeure for a period longer than as specified in Clause 17.5;
- (f) failure to make payment of the Monthly Payment for more than three instances (in aggregate and not over a specified period) in terms of Clause 11.2(d);
- (g) failure of the Block Allocatee to provide any information requested by the Government in terms of this Agreement;

Coal Block Development and Production Agreement for Kalvampur-Badampara Coal Block

- (h) failure of the Block Allocatee to ensure continued compliance with the Eligibility Conditions;
- (i) a company other than a Government company or corporation holding more than twenty-six per cent of the paid up share capital of the Block Allocatee, either directly or through any of its subsidiary company or associate company (such expressions having meaning ascribed under the Companies Act, 2013);
- (j) in the event of any Change in Control or any transfer of right, title or interest in the Coal Block which is not in conformity with this Agreement or any Applicable Law;
- (k) the Block Allocatee dissolves, liquidates, becomes insolvent, commits an act of bankruptcy, makes an assignment for the benefit of creditors, petitions or applies to any tribunal for the appointment of a trustee or receiver for itself, or commences any proceedings concerning itself under a law concerning bankruptcy, or insolvency other than for the purposes of corporate reorganization;
- (l) any other breach of any of the provisions of this Agreement (including in case of the Warranties being untrue or misleading or incorrect in any manner whatsoever), which is not cured by the Block Allocatee within thirty Business Days of becoming aware of the same, on its own accord or upon receipt of a notice from the Nominated Authority;
- (m) In the event the [manufacturing] capacity of the End use Plant(s) is lower than 75% (seventy five percent) of the proposed [manufacturing] capacity of the End use Plant(s) as set forth in Schedule V;
In the event there is more than one End Use Plant(s), then the provisions hereof shall apply equally to all End Use Plants. Thus it will be a termination event in the event of delay of more than 6 (six) months in achieving any End Use Plant(s) Development Milestone in respect of any one or more End Use Plants or in the event any one or more End Use Plants ceases operations for a continuous period of longer than 1(one) year or in the event the [manufacturing] capacity of any one or more End use Plant(s) is lower than 75 % (seventy five percent) of the proposed [manufacturing] capacity of such End use Plant(s);
- (n) cessation of coal mining operation exceeding a period of one year continuously, or 18 months over a period of two years without occurrence of any Event of Force Majeure;
- (o) termination of the Mining Lease granted to the Block Allocatee; or
- (p) in the opinion of the Government, it is expedient in public interest to terminate this Agreement.

Provided however that a terminating Party may extend the period for cure of the relevant breach subject to mutual agreement of the Parties.


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कोयला मंत्रालय
नएला

Coal Block Development and Production Agreement for Katyanpur-Budalpara Coal Block

Upon occurrence of a Termination Event, the Nominated Authority may elect to terminate this Agreement by providing a [15] Business Days written notice to the Block Allocatee. The determination of the Nominated Authority regarding occurrence of a Termination Event shall be final and binding on the Block Allocatee.

25.2.2 Termination on Breach,

The Government may provide Notice to the Block Allocatee of a material breach of, or a failure to comply with or observe, a fundamental provision of this Agreement. If the Block Allocatee fails or neglects to (i) remedy that breach or failure within 180 (one hundred and eighty) days (or a longer period as is reasonable in the circumstances) after the Government gives a Notice requiring that the breach be remedied or the provision be complied with or observed, or (ii) challenge the Government's assertion of breach under Article 26 of this Agreement, the Government may terminate this Agreement.

25.2.3 Upon any such termination under Article 25.2.1 or Article 25.2.2, the Performance Security, if outstanding, shall be forfeited. Furthermore, the Upfront Amount if already received by the Government on the date of such termination shall not be refunded upon termination.

25.3 Termination by the Block Allocatee


The Block Allocatee shall have the right to terminate this Agreement in the event the Environmental Clearance and Forest Clearance is:

- (a) Delayed inordinately and not obtained within 7 (seven) years from the start of the Development Period due to reasons attributable to any Governmental Authority; or
- (b) Denied at any time by any Governmental Authority.

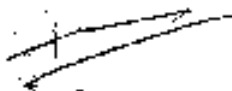
Upon such termination, the Block Allocatee shall not be refunded the Upfront Amount if received by the Government but the Performance Security shall be released.

25.4 Retention of Books and Records

No books and records of the Block Allocatee may be removed on the expiration, surrender or termination of this Agreement for a period of 8 (eight) years without the prior consent of the Government, except that the Block Allocatee may obtain copies of the books and records.


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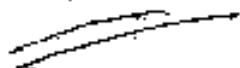

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ARTICLE-26

GOVERNING LAW AND DISPUTE RESOLUTION

- 26.1 This Agreement shall be governed by and construed in accordance with the applicable laws of India.
- 26.2 Any dispute, difference or controversy of whatever nature howsoever arising under or out of or in relation to this Agreement (including its interpretation) between the Parties, and so notified in writing by either Party to the other Party (the "Dispute") shall, in the first instance, be attempted to be resolved amicably by mutual consultations between the Parties.
- 26.3 The Parties agree to use their best efforts for resolving all Disputes arising under or in respect of this Agreement promptly, equitably and in good faith, and further agree to provide each other with reasonable access during normal business hours to all non-privileged records, information and data pertaining to any Dispute.
- 26.4 **Arbitration**
- 26.4.1 Any Dispute which is not resolved amicably within 45 (forty five) days of notification thereof, shall be finally decided by reference to arbitration by a Board of Arbitrators appointed in accordance with Article 26.4.2. Such arbitration shall be held in accordance with the Rules of Arbitration of the International Centre for Alternative Dispute Resolution, New Delhi (the "Rules"), or such other rules as may be mutually agreed by the Parties, and shall be subject to the provisions of the Arbitration and Conciliation Act, 1996. The venue of such arbitration shall be Delhi, and the language of arbitration proceedings shall be English.
- 26.4.2 There shall be a board of 3 (three) arbitrators, of whom each Party shall select 1 (one), and the third arbitrator shall be appointed by the 2 (two) arbitrators so selected, and in the event of disagreement between the two arbitrators, the appointment shall be made in accordance with the Rules.
- 26.4.3 The arbitrators shall make a reasoned award (the "Award"). Any Award made in any arbitration held pursuant to this Article 26.4.3 shall be final and binding on the Parties as from the date it is made, and the Block Allocatee and the Government agree and undertake to carry out such Award without delay.
- 26.4.4 The Block Allocatee and the Government agree that an Award may be enforced against the Block Allocatee and /or the Government, as the case may be, and their respective assets wherever situated.
- 26.4.5 This Agreement and the rights and obligations of the Parties shall remain in full force and effect, pending the Award in any arbitration proceedings hereunder.


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Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

[26.5 **Adjudication by Regulatory Authority or Commission:** In the event of constitution of a statutory Regulatory Authority or Commission with powers to adjudicate upon disputes between the Block Allocatee and the Government, all Disputes arising after such constitution shall, instead of reference to arbitration under Article 26.4, be adjudicated upon by such Regulatory Authority or Commission in accordance with the Applicable Law and all references to Dispute Resolution Procedure shall be construed accordingly. For the avoidance of doubt, the Parties hereto agree that the adjudication hereunder shall not be final and binding until an appeal against such adjudication has been decided by an appellate tribunal or High Court, as the case may be, or no such appeal has been preferred within the time specified in the Applicable Law.]

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बिड़रुआ

ARTICLE - 27

MISCELLANEOUS

27.1 Interest and Right of Set Off

Any sum which becomes payable under any of the provisions of this Agreement by 1 (one) Party to the other Party shall, if the same be not paid within the time allowed for payment thereof, shall be deemed to be a debt owed by the Party responsible for payment thereof to the Party entitled to receive the same. Such sum shall until payment thereof carry interest at [State Bank of India base rate plus 3% (three percent)] from the due date for payment thereof until the same is paid to or otherwise realised by the Party entitled to the same. Without prejudice to any other right or remedy that may be available under this Agreement or otherwise under law, the Party entitled to receive such amount shall also have the right of set off. Provided the stipulation regarding interest for delayed payments contained in this Article 27.1 shall neither be deemed nor construed to authorise any delay in payment of any amount due by a Party nor be deemed or construed to be a waiver of the underlying breach of payment obligations.

27.2 Obligations of Contractors and Subcontractors

27.2.1 Applicability of Obligations to Contractors and their Sub- contractors

- (a) Any agreement between the Block Allocatee and contractors or subcontractors shall contain appropriate terms by which the contractor or subcontractor shall acknowledge the terms of this Agreement to the extent applicable to the activities undertaken by the contractor and its subcontractors.
- (b) The Block Allocatee shall ensure that its supervision and management of its contractors and their subcontractors is sufficient to inform it of whenever the practices of its contractors or their subcontractor may place them, or the Block Allocatee, at risk of violating this Agreement.
- (c) Nothing in this Agreement shall exempt the Block Allocatee from any and all obligations under this Agreement despite the delegation of such obligations to a contractor or its subcontractors.

27.3 Waiver

- (a) Waiver by either Party of any default by the other Party in the observance and performance of any provision of or obligations under this Agreement:



शशि भवान / SHASHI BHAWAN
अवर सचिव / Under Secretary
राज्य सरकार / Govt. of India
उद्योग विभाग / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi

एन. पी. डी. सानु राव
प्रबंध निदेशक
सुविधाभा विखली उत्पादन निगम
भारत

Coal Block Development and Production Agreement for Kalyanspur-Badalpara Coal Block

- (i) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions or obligations under this Agreement,
 - (ii) shall not be effective unless it is in writing and executed by a duly authorized representative of such Party; and
 - (iii) shall not affect the validity or enforceability of this Agreement in any manner.
- (b) Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation hereunder nor time or other indulgence granted by a Party to the other Party shall be treated or deemed as waiver/breach of any terms, conditions or provisions of this Agreement.

27.4 Survival

Termination of this Agreement (a) shall not relieve the Block Allocatee or the Government of any obligations already incurred hereunder which expressly or by implication survives termination hereof, and (b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

27.5 Amendments

This Agreement and the Schedules together constitute a complete and exclusive understanding of the terms of the Agreement between the Parties on the subject hereof and no amendment or modification hereto shall be valid and effective unless agreed to by all the Parties hereto and evidenced in writing.

27.6 Notices

27.6.1 General

All Notices to be made or given by a Party hereunder (each, a "Notice") shall be in writing and delivered:


To [Government]:

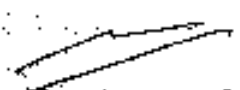
To [Block Allocatee]:

27.6.2 Change of Address

A Party may change its address by Notice to the other Party.

27.6.3 Delivery Methods


रिशन रानिथंग / RISHAN RANIATHANG
अंडर सेक्रेटरी / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शशि भवन / Shashi Bhawan
45, दिल्ली / New Delhi


एन. के. सी. राजेंद्र राव
प्रबंध निदेशक
सरिताया बिजली उत्पादन निगम,
मुंबई

Coal Block Development and Production Agreement for Kalvanpur-Badalpara Coal Block

All Notices shall be given:

- (a) By personal delivery (including courier), which shall be deemed to have been delivered on the day on which it shall have been delivered to an apparently responsible person at the address listed in Article 27.6.1;
- (b) By registered mail, charges prepaid; or
- (c) By electronic transmission, signed by the sender and marked for the attention of the person identified above, with a hard copy mailed to the address above.

27.6.4 Effective Time of Delivery

All Notices shall be effective and shall be deemed received on the date of personal delivery or delivery by registered mail at the address of the addressee established pursuant to this Agreement, if delivered during normal business hours on any day, and if not delivered during normal business hours, on the next Business Day following delivery. A Notice given by electronic transmission shall be deemed received on the next Business Day following the date of transmission.

27.7 Severability

If for any reason whatsoever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties shall negotiate in good faith with a view to agreeing upon one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable. Provided failure to agree upon any such provisions shall not be subject to dispute resolution under this Agreement or otherwise.


27.8 No Partnership

Nothing contained in this Agreement shall be construed or interpreted as constituting a partnership between the Parties. Neither Party shall have any authority to bind the other in any manner whatsoever.

27.9 Language

All Notices required to be given under this Agreement and all communications, documentation and proceedings which are in any way relevant to this Agreement shall be in writing and in English language.

27.10 Exclusion of Implied Warranties etc.


श्रीमान् श्रीशशाङ्क शशाङ्क भवः
Secretary
Ministry of Coal
Shashi Bhawan
New Delhi

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एम्. व्ही. व्ही. सभा राव
उप-निदेशक
परिधान विजली उत्पादन निगम
पुणे

Coal Block Development and Production Agreement for Kalyunpur-Badalpura Coal Block

This Agreement expressly excludes any warranty, condition or other undertaking implied at law or by custom or otherwise arising out of any other agreement between the Parties or any representation by any Party not contained in a binding legal agreement executed by the Parties.

27.11 Counterparts

This Agreement may be executed in 2 (two) counterparts, each of which when executed and delivered shall constitute an original of this Agreement but shall together constitute 1 (one) and only the Agreement.

IN WITNESS WHEREOF the Parties have executed and delivered these presents through their authorized representatives on the date first above written

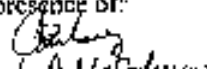
Signed, Sealed and Delivered for and on behalf of the President of India
Ministry of Coal



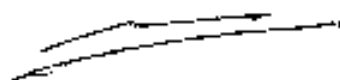
Name: Kishan Ryntathieng
Designation: Under Secretary, Ministry of Coal

किशन रीन्ताथींग / KISHAN RYNTATHIENG
अध. सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi

In the presence of:

1. 
(A. V. Prasad)
CA/PR/1


Signed, Sealed and Delivered for and on behalf of Haryana Power Generation Corp. Ltd. (HPGCL)



Name: M.K.V. Rama Rao (Emp. Code : 4243857)
Designation: Managing Director, Haryana Power Generation Corp. Ltd. (HPGCL)
Duly authorized vide resolution No. Nil dated 28.03.2016 of the Board of Directors of Haryana
Power Generation Corp. Ltd. (HPGCL).

महानिदेशक
हरियाणा विजली उत्पादन निगम,
गुरुग्राम

In the presence of:

1. 
A. K. Sood
Director/Generation
HPGCL

SCHEDULE I

Description of Mining Area

**KALYANPUR-BADALPARA BLOCK, BRAHMANI COALFIELD
(RAJMAHAL GROUP OF COALFIELDS)
JHARKHAND**

SALIENT FEATURES

1. **Block** : KALYANPUR-BADALPARA BLOCK, BRAHMANI COALFIELD (RAJMAHAL GROUP OF COALFIELDS, DIST-DUMKA, JHARKHAND
(Part of Kalyanpur-Murgadanga-Daldal block)
2. **Area** : About 6 Sq.km.
3. **Location and Communication** : The block is located to the north of Amrakonda-Murgadanga (Captive) block. The limiting coordinates of the blocks are
Latitude : 24°08'17" - 24°10'32" (approx)
Longitude: 87°32'08" - 87°32'35" (approx)
Topo Sheet No: 72P/12

The area is approachable by state highway no-6 which connects Rampurhat, Saithia of Birbhum district. From Harisingha Forest road passes through the entire length of the area. The nearest rail head is Mallapur.

4. **Status of Exploration** : Regionally Explored

Agency	No. of borehole	Meterage
GSI	7	1666.35m

5. **Structure** : Strike : N-S
Dip : 6°-12° easterly
Faults : Nine number of faults have been reported



Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

6. Sequence of Coal Seams

A total 4 coal seam zones occur in this block. Broad parameters of coal seams are as follows:

Zone/Seam	Thickness /Parting range(m)(cumulative thickness of coal seams)	Depth(m)	Remarks
Zone-III	41.35-42.70 (10.39-13.54)	12-69	Occurs in 2-7 sections. The thickness of the section ranges from <1 - 2.9m
Parting	26-34		
Zone-II	29.60-68.85 (17-64-30.55)	21-172	Occurs in 3-9 sections. The thickness of the section ranges from <1 - 17.8m
Parting	8-15		
Zone-IA	1.91-31.70 (1.91-6.00)	9-185	Occurs in 1-4 sections. The thickness of the section ranges from <1- 6m
Parting	4-25		
Zone-I	38.2-58.87 (5.89-21.75)	45-242	Occurs in 4-7 sections. The thickness of the section ranges from 0.5- 9.02


7. Quality


Seamwise Quality is given below:

Seam	M%	Ash%	Utr (kcal/kg)	Grade
III	3.3-7.2	21.2-46.7	3960-4663	D-E
II	1.9-7.2	18.1-47.6	1545-4277	D-G
IA	2.5-5.8	20.6-44.2	3179-5574	C-G
I	2.3-7	22.9-47.6	1751-5008	C-G

8. Reserves

A total of 102.35 Mt of coal resources have been reported in Kalyanpur-Badalpara block in indicated category.


 रीशान रीम्यासिंग / RISHAN ROMYASING
 अवर सचिव / Under Secretary
 भारत सरकार / Govt. of India
 कोयला विभाग / Ministry of Coal
 शास्त्री भवन / Shaastri Bhawan
 नई दिल्ली / New Delhi


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 हरियाणा विजली उत्पादन विभाग
 पंचकुला

Coal Block Development and Production Agreement for Kalyanpur-Baidalpara Coal Block

(In million tonnes)

Seam	I N D I C A T E D			Total
	Gr D	Gr E	Gr F	
III		2.89	12.09	14.98
II		26.46	15.84	42.30
IA	1.50	4.58	2.76	8.84
I	19.50	16.73	-	36.23
Total	21.00	50.66	30.69	102.35

The depth-wise reserves are as follow:


Depth (m)	Indicated Reserves (Mt)
0-300	100.62
300-500	1.73
Total	102.35

Note:

1. Salient features, Block boundary plan & lithologs are based on report on regional exploration on Banai block by MECL.
2. Block boundary shown in the plan is approximate.
3. Forest cover details are not available with CMPDL.
4. Infrastructure details are not available with CMPDL.


Bibliography

1. Final report on Regional Exploration for Coal by drilling in the Kalyanpur-Murgadanga-Daldali Block in Brahmani Southern Extension area of Rajmahal Coalfields, Dumka District, Bihar, by GSI, 1992.



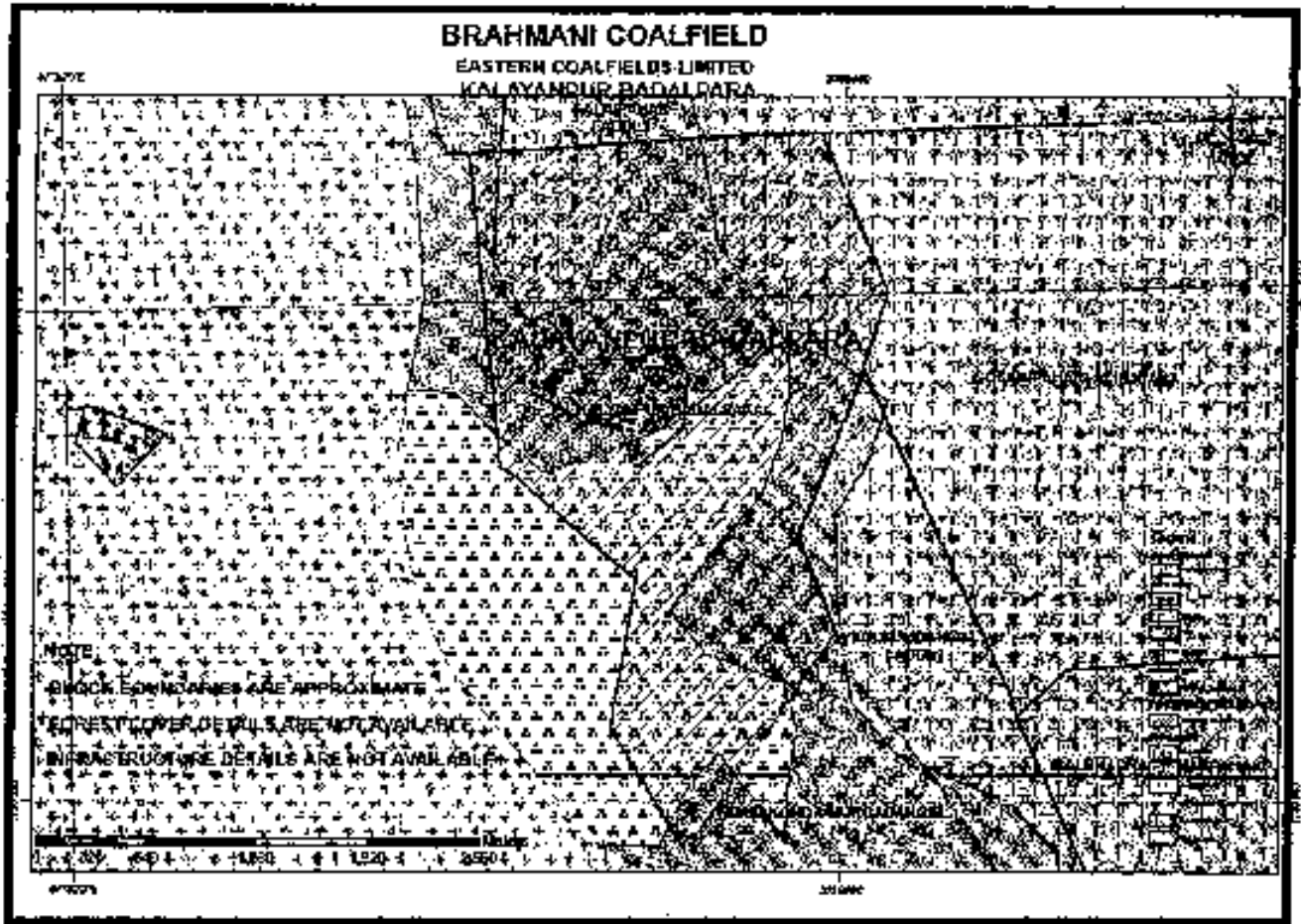
रिश्तल विवरणियन / RISHAN RIBHAYANIAN
 अन्तः सचिव / Under Secretary
 भारत सरकार / Govt. of India
 कोयला मंत्रालय / Ministry of Coal
 शास्त्री भवन / Shastri Bhawan
 नई दिल्ली / New Delhi


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 प्रमुख निदेशक
 इन्डियन बिजनेस डेवलपमेंट लिमिटेड
 बंगलुरु

SCHEDULE II

**Map of Mining Area
KALYANPUR-BADALPARA**




श्रीमान् विभागाध्यक्ष / RAJMAHARAYATATWANG
अध: सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली (New Delhi)

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अध्यक्ष निदेशक
इंडियन कोयला विजली उत्पादन निगम
पंचसूत्रा

SCHEDULE III

Substitution Agreement

THIS SUBSTITUTION AGREEMENT is entered into on this the [] day of [] 2013 at [insert location], India, by and between:

(1) The President of India, acting through the [], Ministry of Coal, Government of India (hereinafter referred to as the "Government" which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors and permitted assigns) of the **FIRST PART**;

(2) [], a company duly incorporated and existing under the laws of India with its registered office at [insert address], India (hereinafter referred to as the "Block Allocatee", which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors or permitted assigns) of the **SECOND PART**; and

(3) [], (the Financial Institution/ Bank with its registered office at [insert address] (hereinafter referred to as the "Lenders", which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors or permitted assigns) of the **THIRD PART**.

or

(3) [], (Financial Institution/Bank) having its Registered Office/Head Office at [] acting for and on behalf of the Lenders listed in Annexure I hereto (hereinafter referred as the "Lender's Representative", which expression shall, unless repugnant to or inconsistent with the context, mean and include any successors or permitted assigns) of the **THIRD PART**.

In this Agreement, the Government and the Block Allocatee and Lender or Lender's Representative are hereinafter collectively referred to as the "Parties" and individually to as a "Party".

WHEREAS

- A. The Government wishes to develop minerals in a manner to promote overall industrial development and contribute to the sustainable development of India and its communities through a process in which the production and use of non-renewable natural resources takes place in an equitable framework;
- B. By the Coal Block Development and Production Agreement dated [] entered into between Government and the Block Allocatee (hereinafter referred to as the "Coal Block Development and Production Agreement") the Block Allocatee has been granted the right to undertake Mining Operations in the Mining Area (the "Project");



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अधक सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शासक भवन / Shashi Bhanu
नई दिल्ली / New Delhi



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एन. के. वी. शर्मा राज
इसरो डिरेक्टर
हरियाणा विजिली उद्योग विभाग,
पंचकुला

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

- C. With a view to facilitate financing of the Project by the Block Allocatee, in pursuance of Article 20.6 of the Coal Block Development and Production Agreement, Government and the Block Allocatee have agreed to enter into Substitution Agreement being these presents with the Lender/s/Lenders' Representative; and
- D. As a condition to making any disbursement pursuant to the Financing Agreements, the Lender(s) has/ have required that the Substitution Agreement being these presents be entered into, and Government and the Block Allocatee have agreed to the same.

NOW THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Substitution Agreement and other consideration, the sufficiency and adequacy of which is hereby acknowledged, the Parties agree as follows:

ARTICLE I

DEFINITIONS

1.1 Definitions

In this Substitution Agreement the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereafter respectively assigned to them.

"**Agreement**" means this Substitution Agreement and includes any amendment or modification made to this Agreement in accordance with the provisions hereof.

"**Financial Assistance**" means the financial assistance agreed to be provided by the Lender(s) to the Block Allocatee for financing the the Project as set forth in the Financing Agreements.

"**Lender(s)**" means the financial institutions/banks whose name(s) and addresses are set out in Annexure I hereto.


"**Block Allocatee Event of Default**" means an event of default by the Block Allocatee under the Coal Block Development and Production Agreement as provided under Article 25.2.1 and 25.2.2 thereof.

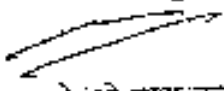
"**Selectee**" means a Person proposed by the Lender/Lender's Representative pursuant to this Agreement and approved by Government for substituting the Block Allocatee, in accordance with the provisions of this Agreement.

"**Suspension Period**" means the period during which all formalities connected with substitution of the Block Allocatee by the Selectee including handing over of Mining Area in accordance with this Agreement are completed and the substitution has become effective.

- 1.2** Capitalised terms used in this Agreement but not defined shall have the meaning assigned to them respectively in the Coal Block Development and Production Agreement.

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श्रीमान् विश्वभूषण / RISHANBUSHAN
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ARTICLE 2

SUBSTITUTION OF THE BLOCK ALLOCATEE BY THE SELECTEE

2.1 Lenders right to Substitute

Government and the Block Allocatee hereby irrevocably agree that upon occurrence of a Block Allocatee Event of Default, the Lender(s) shall, without prejudice to any other rights or remedies available to them under law/Financing Agreements and without being required to exercise or exhaust such rights or remedies, have the right to seek substitution of the Block Allocatee by Selectee for the residual term of the Coal Block Development and Production Agreement in accordance with the provisions of this Agreement. Provided upon substitution the Selectee shall be entitled to an extension of the remainder of the term of the Coal Block Development and Production Agreement by the Suspension Period.

2.2 Preliminary Notice of Termination

Government shall as soon as possible but in any case not later than 15(fifteen) days of its knowledge of the occurrence of a Block Allocatee Event of Default issue a Notice of termination to the Block Allocatee in terms of Article 25 of the Coal Block Development and Production Agreement, with a copy thereof simultaneously to the Lenders.

2.3 Suspension and Takeover of the Mining Area

The Block Allocatee irrevocably agrees that:

- (i) in the event of a Block Allocatee Event of Default other than the events covered under 25.2.1 and where such event of default is capable of remedy or cure, and said the relevant Block Allocatee Event of Default is not cured within [180 (one hundred and eighty)] days of receipt of a Notice of termination from the Government, then effective from the [181st (one hundred and eighty one)]; and
- (ii) immediately upon the occurrence of any event covered under 25.2.1,

the Coal Block Development and Production Agreement shall stand suspended without any further notice or other act of Government being required, and that Government shall have the right to enter upon and takeover the Mining Area and to take all such steps as are necessary for the substitution of the Block Allocatee by the Selectee in accordance with this Agreement. The Block Allocatee hereby irrevocably consents to the takeover of the Mining Area by Government forthwith upon suspension becoming effective.

2.4 Substitution Notice



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हरिद्वार विजली उत्पादन विभाग
पंचकूला

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

Government and the Block Allocatee hereby irrevocably agree that in the event of a suspension as described above, the Lender/Lender's Representative may, notify Government and the Block Allocatee about the intention of the Lender(s) to seek substitution of the Block Allocatee by the Selectee (the "Substitution Notice").

2.5 Criteria for selection of the Selectee.

The Lender/ Lenders' Representative shall in addition to any other criteria that it may deem fit and necessary, apply the following criteria in the selection of the Selectee:

- (i) the Selectee shall possess the networth, experience, technical capability and managerial ability to perform and discharge all the residual duties, obligations and liabilities of the Block Allocatee under the Coal Block Development and Production Agreement;
- (ii) the Selectee shall have the capability and shall unconditionally consent to assume the liability for the payment and discharge of dues, if any, of the Block Allocatee to Government under and in accordance with the Coal Block Development and Production Agreement and also payment of debt due to the Lender(s) upon terms and conditions as agreed to between the Selectee and the Lenders;
- (iii) the Selectee shall agree to mine, remove, treat, produce and refine Coal found in the Mining Area solely for the Permitted End Use in the End Use Plant(s) and for no other purpose; and
- (iv) In the event the developer of the End Use Plant(s) is not the same Person as the Block Allocatee, the Selectee shall be held by the developer of the End Use Plant(s) in the same manner as the Block Allocatee was held by the developer of the End Use Plant(s). In other words the shareholding ownership pattern between the Block Allocatee and the developer of the End Use Plant(s) shall be replicated in the shareholding ownership pattern between the Selectee and the developer of the End Use Plant(s).


ARTICLE 3

MODALITY FOR SUBSTITUTION

3.1 Modalities for Substitution.

The following modalities shall be followed for substitution of the Block Allocatee by the Selectee pursuant to this Agreement:

- (i) The Lender(s)/Lenders' Representative shall be entitled, within a period of 120 (one hundred twenty) days from the date of delivery of the Substitution Notice pursuant to the Article 2.4 to invite or procure offers either through private negotiations or public auction or process of tender or otherwise from the eligible Persons, for the



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शास्त्री भवन / Shastri Bhawan
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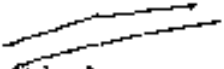
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हरिधास विजली उत्पादन विभाग
पंचकूला

Coal Block Development and Production Agreement for Kalyanpur-Budalpara Coal Block

substitution of the Block Allocatee by the Selectee and propose to Government for its approval the Selectee (the "Proposal"). The Proposal of the Lender/Lender's Representative shall contain the particulars and information in respect of the Selectee, the terms of substitution, particulars of the debt due and such data and information as would be necessary and relevant for Government to decide as to the acceptability of the Selectee. The Lender/ Lender's Representative shall provide to Government such additional information and clarification in respect of any data, particulars or information contained in the Proposal, as Government may promptly and reasonably require.

- (ii) The Proposal shall be accompanied by an unconditional undertaking of the Selectee to the effect that it shall upon acceptance by Government of the Proposal observe, comply with, perform and fulfill the residual terms, conditions and covenants of the Coal Block Development and Production Agreement as if the Selectee had been the Block Allocatee under the Coal Block Development and Production Agreement and to assume, discharge and pay the debt due on the terms and conditions agreed to by the Selectee with the Lenders. The Selectee shall also undertake to enter into such documents and writings with Government and the Lender(s) as may be necessary or required to give effect to the substitution of the Block Allocatee by the Selectee.
- (iii) Government shall convey to the Lender/ Lenders' Representative its acceptance or otherwise of the Selectee within 30 (thirty) days of (a) the date of receipt of the Proposal by Government, or (b) the date of receipt of the additional information and clarifications in respect of any data, particulars or information comprised in the Proposal, provided by the Lender/Lender's Representative to the Government, *whichever is later*.
- (iv) At any time prior to the acceptance of the Selectee by Government pursuant to this Agreement, Government may require the Lender/Lenders' Representative to satisfy it as to the eligibility of the Selectee and the decision of Government as to acceptance or rejection of any Selectee (which shall be reasonable), shall be final, conclusive and binding on the Lender(s), the Selectee and the Block Allocatee. In the event that Government fails to communicate its acceptance or otherwise or the objections if any it has to the acceptance of the Proposal/ the Selectee within a period of 30 (thirty) days prescribed in preceding sub-article (iii), Government shall be deemed to have accepted the Proposal/ the Selectee.
- (v) The rejection of the Selectee if made by Government shall be reasoned and be made after hearing the Lender/Lenders' Representative. Following the rejection of the Proposal, the Lender/Lenders' Representative shall have the right to submit a fresh Proposal, proposing another Selectee, within 30 (thirty) days of receipt of communication regarding rejection of the Selectee previously proposed. The provisions of preceding sub-article (iii) and (iv) shall apply mutatis mutandis to such fresh Proposal.


रिशन रिन्याथियास / RISHAN RINIATHIAS,
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शांति भवन / Shanti Bhawan
नई दिल्ली / New Delhi


श्री. रामा शंकर
उप निदेशक
उत्खाना विजली उत्पादन निगम,
पंचकूला

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

- (vi) If Government accepts the Proposal/fresh Proposal, Government shall take all necessary steps to substitute the Block Allocatee by the Selectee by amendment of the Coal Block Development and Production Agreement or by execution of fresh agreement or such other writing as may be required or necessary to give effect to the substitution of the Block Allocatee by the Selectee.
- (vii) The substitution of the Block Allocatee by the Selectee shall be deemed to be complete upon the Selectee executing all necessary documents and writings with or in favour of Government and the Lender(s). Upon the substitution becoming effective pursuant to this sub-article all the rights of the Block Allocatee under the Coal Block Development and Production Agreement shall cease to exist. Provided nothing contained in this sub-article shall prejudice any pending/subsisting Claims of the Block Allocatee against Government or any claim of Government against the Block Allocatee and the Selectee shall incur no liability or consequence on account of any previous breach/default and shall subject to the terms and conditions of the substitution, have a period of 90 (ninety) days to cure any breach/default subsisting on the date of substitution and required to be cured.
- (viii) The decision of the Lenders and Government in the selection of the Selectee shall be final and binding on the Block Allocatee and shall be deemed to have been made with the concurrence of the Block Allocatee. The Block Allocatee hereby expressly waives all rights to object to or challenge such selection of the Selectee on any ground whatsoever.

ARTICLE 4

GENERAL

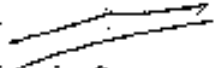
4.1 General

- (i) The Parties hereto expressly represent and warrant that they are duly empowered to sign and execute this Agreement and the Lenders Representative is duly and fully authorised by each of the Lenders to enter into this Agreement on their behalf.
- (ii) Notices under this Agreement shall be sent to the addresses first hereinabove mentioned. Any change in the address of any Party shall be duly notified by a registered post acknowledgment due and delivered to the other parties.
- (iii) This Agreement shall not be affected by the reorganisation of any Lender, the Block Allocatee or Government and the successor in interest of the Lender or Government shall have the benefit of this Agreement.

(iv) Governing Law and Dispute Resolution

- a. This Agreement shall be governed by and construed in accordance with the laws of India.


रिशभ रिनथिंग / RISHAB RYNATHIANG
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शांती भवन / Shanti Bhawan
नई दिल्ली / New Delhi


श्री. डी. राम राव
प्रबंध निदेशक
हरियाणा बिजली उत्पादन निगम,
पंचसूरी

Coal Block Development and Production Agreement for Kalwanpur-Badulpura Coal Block

- b. [dispute resolution to mirror the Financing Agreements]
- (v) The consultation, recommendation or approval of the Lenders' Representative under this Agreement shall always be taken as consultation, recommendation or approval of every concerned Lender and each such Lender shall be bound by the same.
- (vi) This Agreement shall be in addition to and shall not be in derogation of the terms of the Financing Agreements.
- (vii) It shall not be necessary for the Lender(s) or the Lenders' Representative to enforce or exhaust any other remedy available to them before invoking the provisions of this Agreement.
- (viii) No amendment, variation or modification to this Agreement shall be valid and effectual unless made in writing and executed by the duly authorised representatives of all the Parties hereto.
- (ix) All stamp duties or other imposts and charges as are applicable on this Agreement or on amendment of the Coal Block Development and Production Agreement or execution of fresh Coal Block Development and Production Agreement for the purpose of substitution as aforesaid shall be borne by and be to the account of the Block Allocatee. In the event of the Lenders making such payment for the time being, it shall be deemed to be a part of the debt due.
- (x) The Parties hereby expressly agree that for the purpose of giving full and proper effect to this Agreement, the Coal Block Development and Production Agreement and this Agreement shall be read together and construed harmoniously.

IN WITNESS WHEREOF the Parties have executed and delivered these presents through their authorized representatives on the date first above written

Signed, Sealed and Delivered for and on behalf of

[Block Allocatee]


(Signature)

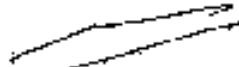
(Name)

(Designation)

In the presence of:

Signed, Sealed and Delivered for and on behalf of


रिशाभ रिशिया / RISHABH RISHI
अवर सचिव / Under Secretary
आरक्षक सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
मन्त्री भवन, [Sheela Bhasan
नई दिल्ली / New Delhi


श्री राम राव
अधीन निदेशक
इरिक्का विजली उत्पादन निगम,
पंचकूला

Page 65 of 74

Coal Block Development and Production Agreement for Katyanpara-Badalpara Coal Block

[Government]

(Signature)

(Name)

(Designation)

In the presence of:

Signed, Sealed and Delivered for and on behalf of

[Lender/ Lenders Representative]

(Signature)

(Name)

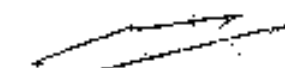
(Designation)

In the presence of:



श्रीमान् शिश्रिभयान् / SHESHRI BHAWAN
अन्ध सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Sheshri Bhawan
नई दिल्ली / New Delhi

Page 66 of 74



श्री शशि चव
अन्ध सचिव
झारखण्ड विजली उत्पादन निगम
पठारगुहा

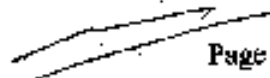
Coal Block Development and Production Agreement for Kalyanpur-Badajpara Coal Block

Annexure I

PARTICULARS OF LENDERS



रिशभ सिन्घिया / RISHABH SINGHIA
अपर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन (Shastri Bhawan)
नई दिल्ली (New Delhi)



Page 67 of 74


श. प्र. की कक्षा रात्र
प्रकाश निदेशक
हरियाणा बिजली उत्पादन निगम.
पंचकुला

Coal Block Development and Production Agreement for Kalyanpur-Badalpara Coal Block

SCHEDULE IV-A

Block Development Milestone

S. No.	Milestone	Time Limit in Months (From the date of this Agreement/ zero date)	Weightage for calculating deduction of Performance Security (in case of failure/ delay in achieving milestone)
1	Prospecting License	4	5
2	Completion of Exploration and Preparation of Geological Report (GR)	22	
Events after preparation of GR			
3	Mining Lease Application	3	7
4	Submission of Mining Plan	6	8
5	Mining Plan Approval	11	8
6	Previous Approval Application	12	6
7	Previous Approval	13	5
8	Forest Clearance Application	11	8
9	Forest Clearance	21	5
10	Environment Clearance Application	11	8
11	Environment Clearance	21	5
12	Grant of Mining Lease	24	5
13	Land Acquisition (To reach rated capacity)	36/42 (in case of forest land)	5
14	Opening of Escrow Account	37/43 (in case of forest land)	8
15	Application for Opening Permission	37/43 (in case of forest land)	2
16	Grant of Opening Permission	38/44 (in case of forest land)	2
17	Schedule of Production/ Reaching Rated Capacity	At least 90% of the annual scheduled production/ reaching rated capacity as per approved mining plan in case of	8


 निम्न निदेशक / UNDER SECRETARY
 जय सचिव / Under Secretary
 भारत सरकार / Govt. of India
 कोयला विभाग / Ministry of Coal
 शाही भवन / Shashi Bhawan
 नई दिल्ली / New Delhi

Page 68 of 74
 एम. के. सी. रंगा राव
 ज्येष्ठ निदेशक
 कोयला विभागीय उत्पादन निगम,
 भुवनेश्वर

Coal Block Development and Production Agreement for Kalvanpur-Badampara Coal Block

S. No.	Milestone	Time Limit in Months (From the date of this Agreement/ zero date)	Weightage for calculating deduction of Performance Security (in case of failure/ delay in achieving milestone)
		opencast mines and at least 80% of the annual scheduled production/ reaching rated capacity as per approved mining plan for underground mines	
18	EUP Synchronisation	As per approved Mining Plan	5

Note:

- The percentage for appropriation of Performance Security shall be calculated in proportion to the failure/ delay in compliance with the timelines mentioned for achievement of Milestones which shall be broadly based on the abovementioned Weightages.
- In case of non-compliance with the Milestones mentioned above, the Block Allocatee shall be required to rectify the same within such time as may be prescribed by the competent authority after examination on a case to case basis.
- Milestones specified in Sl. No. 16 to 18 are indicative.



रिश्भ सिन्हा / RISHAB SINGH
 अवर सचिव / Under Secretary
 कोयला विभाग / Govt. of India
 कोयला मंत्रालय / Ministry of Coal
 शांती भवन / Shanti Bhawan
 नई दिल्ली / New Delhi

ए. डी. डी. रमा राव
 उपायुक्त
 हरियाणा विद्युती उत्पादन निगम,
 रोहतक

Coal Block Development and Production Agreement for Kalyanspur-Badampara Coal Block

SCHEDULE IV-B


End Use Plant(s) Development Milestone

The End Use Plant(s) should achieve the following milestones

- 1.1 Financial Closure of the End Use Plant(s) should be done within 6 (six) months of start of Development Period².
- 1.2 Disbursal of funds from Senior Lenders should start within 6 (six) months of start of Development Period².

¹ This Article will be applicable only for surface gasification End Use Plant(s).

² Applicable for explored blocks allocated to integrated steel, power, sponge iron and cement End Use Plant(s). 6 (six) months will change to 12 (twelve) months for surface gasification.


शशांक किशन शिन्हा
अवर सचिव / Under Secretary
कोयला विभाग / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शशांक भवन / Shashi Bhawan
नई दिल्ली / New Delhi

श. के. वी. राधा राव
सहयोजक निदेशक
हथियाण्डा विजली उत्पादन निगम
भोपाळ

Coal Block Development and Production Agreement for Kalvanpur-Budalpara Coal Block

SCHEDULE V

End Use Plant(s)

Sl. No	Name of Specified End Use Plant	Address	Configuration	Capacity	Geological Reserves Allocated (In Million Tonnes)
1	1x800 MW (exp.) unit, Deenbandhu Chhou Ram TPP	Unit-3, DCRTPP, Yamuna Nagar	1x800	800 MW	102
2	1x800 MW (exp.) unit, PTPS	Unit-9, PTPS, Paripat	1x800	800 MW	

* MW stands for Mega Watt

In the event this is:

1. an existing facility, then "End Use Plant" shall mean such existing facility. To the extent that the existing facility shall have already achieved milestones set forth in Schedule IV-B, the milestones shall be deemed satisfied.
2. a new facility, then "End Use Plant" shall mean such new facility. End Use Plant Development Milestones as set forth in Schedule IV-B shall mean the milestones in respect of such new facility.
3. an expansion project of an existing facility, then "End Use Plant" shall mean the additional new expansion project. End Use Plant(s) Development Milestones as set forth in Schedule IV-B shall mean such milestones in respect of the expansion project.
4. Partially in an existing facility and partially an expansion of such existing facility, then "End Use Plant" shall mean the expended facility (existing plus expansion project taken together). Satisfaction of End Use Plant(s) Development Milestones as set forth in Schedule IV-B shall mean satisfaction of such milestones in respect of both the existing facility and the expansion project. Where the milestones in respect of the existing facility are already satisfied, then satisfaction of End Use Plant(s) Development Milestones as set forth in Schedule IV-B shall mean such milestones in respect of the expansion project.



रिशन रौतथुंग / RISHAN RAUTATHUNG
 उप-सचिव / Under Secretary
 कोयला विभाग / Govt. of India
 कानपुर / Ministry of Coal
 नया दिल्ली / New Delhi

Page 71 of 74

एक से हो रमा राव
 प्रबंध निदेशक
 हरियाणा विजली उत्पादन निगम
 पंचकुला

SCHEDULE VI

Form of Performance Security

[To be stamped in accordance with the relevant Stamp Act]

Bank Guarantee No. []

Date []

To:

Ministry of Coal

[]

India

WHEREAS

- A. [], a company incorporated and existing under the laws of India with its registered office at [] ("Block Allocatee") is required to submit a Performance Guarantee to the Ministry of Coal, in the form of an irrevocable bank guarantee for an amount of INR [] (Indian Rupees []) for the duration of [].
- B. [] having its registered office at [] (the "Bank", which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors), has at the request of the Block Allocatee, agreed to issue this irrevocable bank guarantee in favour of the Ministry of Coal.

NOW THEREFORE, the Bank hereby issues in favour of the Ministry of Coal this irrevocable and unconditional payment bank guarantee (the "Guarantee") on behalf of the Block Allocatee in the amount INR [] (Indian Rupees []).

1. The Bank for the purpose hereof unconditionally and irrevocably undertakes to pay to Ministry of Coal without any demur, reservation, caveat, protest or recourse, immediately on receipt of first written demand from Ministry of Coal, a sum or sums (by way of one or more Claims) not exceeding in the aggregate the amount of INR [] (Indian Rupees []) without Ministry of Coal needing to prove or to show to the Bank grounds or reasons for such demand for the sum specified therein and notwithstanding any dispute or difference between Ministry of Coal and Block Allocatee on any matter whatsoever.
2. The Bank acknowledges that any such demand by Ministry of Coal of the amounts payable by the Bank to Ministry of Coal shall be final, binding and conclusive evidence in respect of the amounts payable by Block Allocatee to Ministry of Coal under the Coal Block Development and Production Agreement.



निदेशानुसार / Under Secretary
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला विभाग / Ministry of Coal
मन्त्री भवन / Secy. Bhawan
नई दिल्ली, New Delhi

Page 72 of 74

ए. टी. श्री राव शिव
उप-निदेशक
इतिहास: पिचली उत्पादन निगम.
पञ्जाला

Coal Block Development and Production Agreement for Kalvanpur-Badahpura Coal Block

In witness whereof the Bank, through its authorized officer, has set its hand and stamp on this ____ day of ____ 2017] at _____

(Signature)

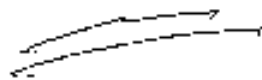
(Name and Designation)

(Bank Stamp)

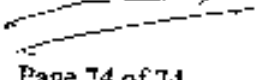
Attorney as per
Power of Attorney No. [] dated []



इरशान् किन्देशंग / IRSHANKYNESHANG
अवर सचिव / Under Secretary
भारत सरकार / Govt. of India
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi



श्री. श्री. श्री रामा राव
ज्येष्ठ निदेशक
हजिबुल्ला बिल्ली उत्पादन नियम,
कोयला



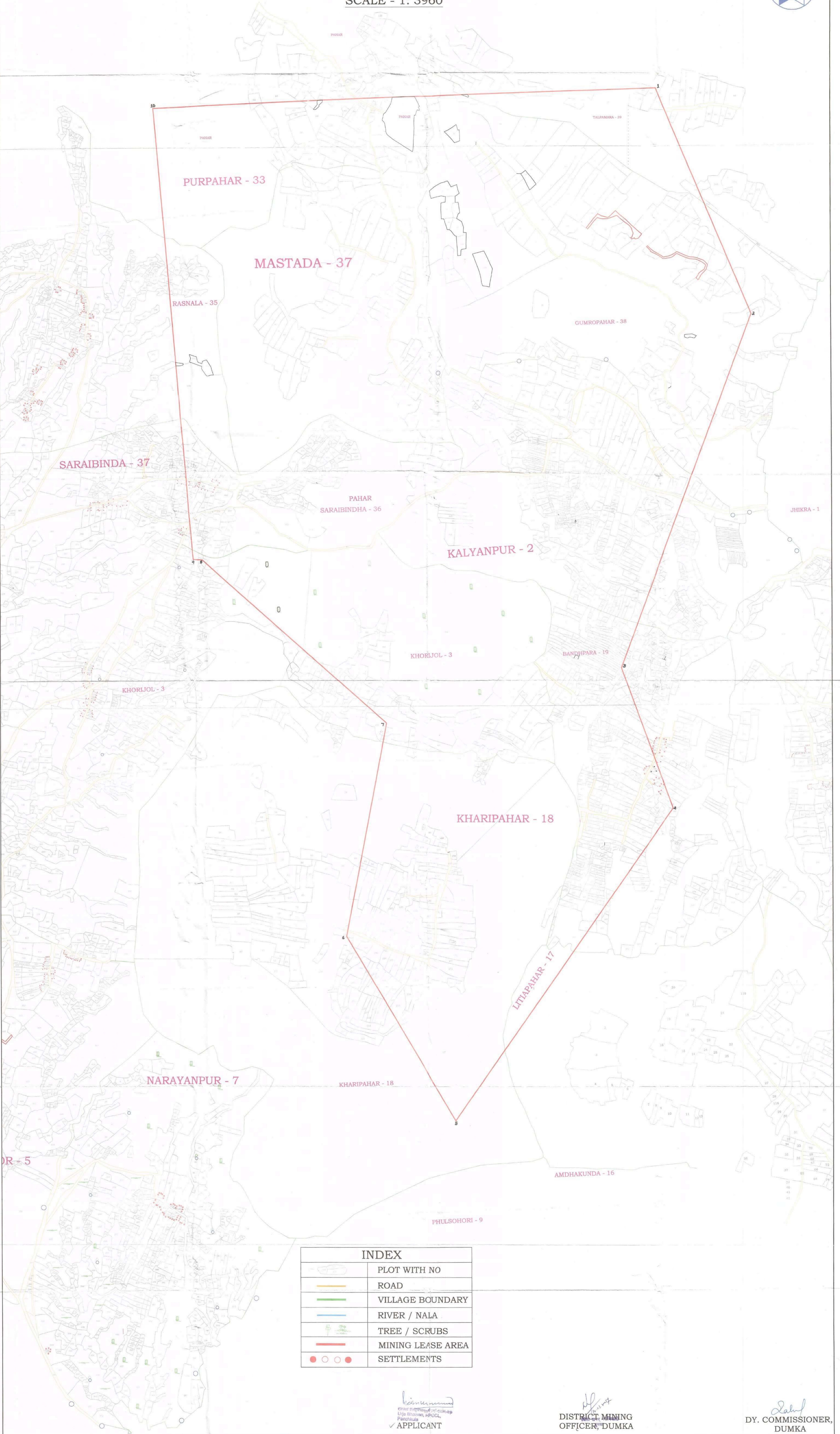
Page 74 of 74

CADASTRAL PLAN SHOWING APPLIED AREA FOR GRANT OF PROSPECTING LICENSE OF COAL OVER AN AREA OF 600 HECTARES (1482.6 ACRES) OF VILLAGES MASTADA, KALYANPUR, RASNALA, KHARIPAHAR, KHORIJOL, BANDHPARA, SARAIBINDHA, PURPAHAR, GUMROPAHAR, LITIYAPAHAR, TALPAMARA OF DUMKA DISTRICT, JHARKHAND.

APPLICANT : - HARYANA POWER GENERATION CORPORATION LIMITED

SCALE - 1 : 3960

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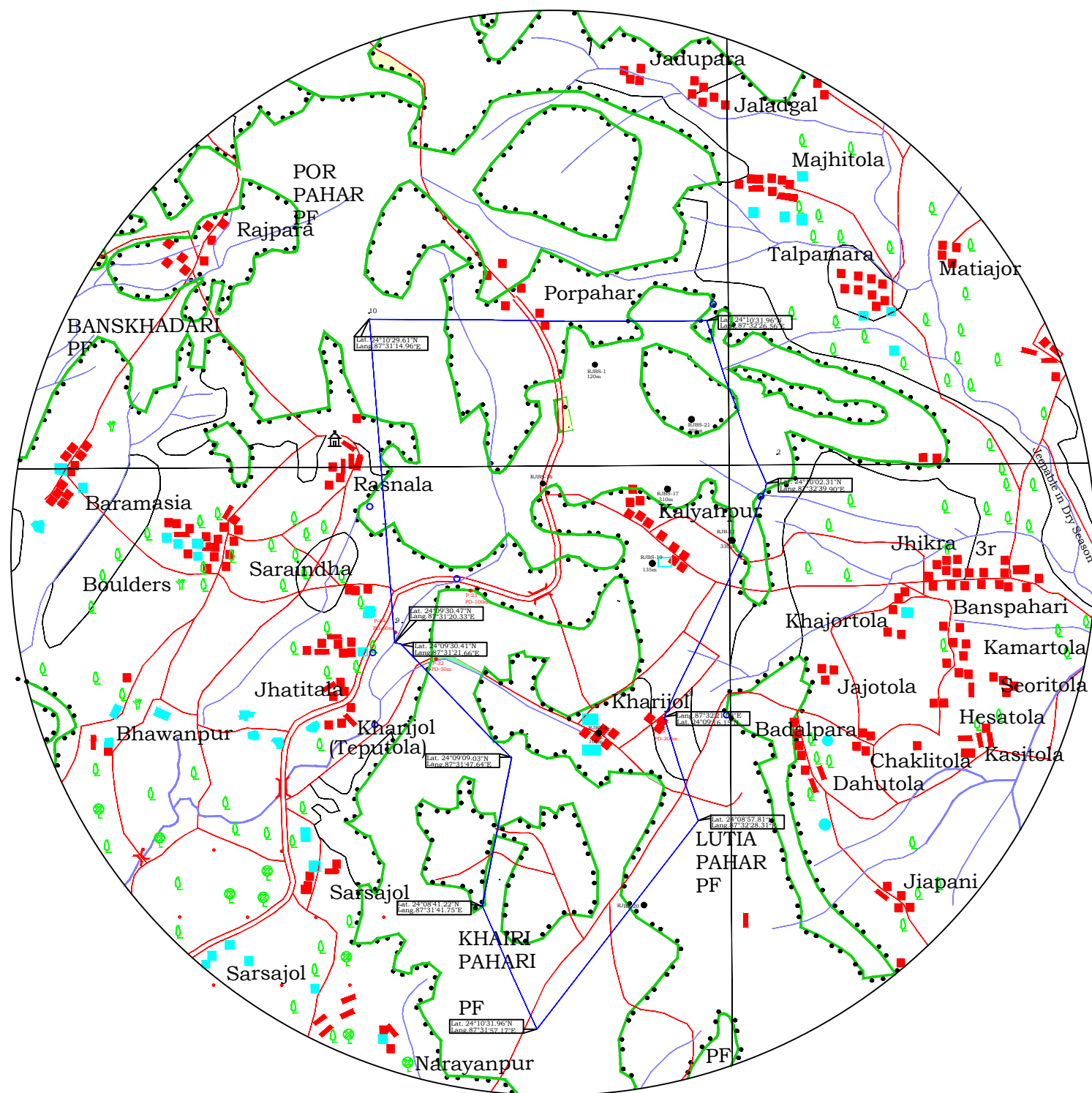
INDEX	
	PLOT WITH NO
	ROAD
	VILLAGE BOUNDARY
	RIVER / NALA
	TREE / SCRUBS
	MINING LEASE AREA
	SETTLEMENTS

[Signature]
 Chief Engineer,
 Lika Division, HRCCL,
 Ranchi
 APPLICANT

[Signature]
 DISTRICT MINING
 OFFICER, DUMKA

[Signature]
 DY. COMMISSIONER,
 DUMKA

[Handwritten notes and stamps]



Sl.No.	X	Y
1	87°32'26.56" E	24°10'31.96" N
2	87°32'39.90" E	24°10' 2.31" N
3	87°32'21.08" E	24°9'16.15" N
4	87°32'28.31" E	24°8'57.81" N
5	87°31' 57.17" E	24°8' 17.09" N
6	87°31'41.75" E	24°8' 41.22" N
7	87°31'47.64" E	24°9' 9.03" N
8	87°31'21.66" E	24°9' 30.41" N
9	87°31'20.33" E	24°9' 30.47" N
10	87°31'14.96" E	24°10' 29.61" N

INDEX	
	FOREST BOUNDARY
	ROAD
	RIVER/NALA
	BLOCK BOUNDARY
	SETTELMENTS

भारतीय भूवैज्ञानिक सर्वेक्षण
GEOLOGICAL SURVEY OF INDIA



बिहार के दुमका जिले के अन्तर्गत राजमहल कोयला क्षेत्रों के ब्राह्मणी
दक्षिणावर्ती विस्तृत अंचल के कल्याणपुर-मुरगादंगल-दलदली
ब्लक में कोयले के लिए वेधन द्वारा क्षेत्रीय अन्वेषण पर
अन्तिम प्रतिवेदन

**FINAL REPORT ON REGIONAL EXPLORATION
FOR COAL BY DRILLING IN THE KALYANPUR-
MURGADANGAL-DALDALI BLOCK IN BRAHMANI
SOUTHERN EXTENSION AREA OF RAJMAHAL
COALFIELDS, DUMKA DISTRICT, BIHAR**

1984-85 से 1989-90 फील्ड अवधि के लिए प्रगति प्रतिवेदन
Progress Report for the Field Seasons 1984-85 to 1989-90

मद संख्या : सी/72 पी/सी. डब्ल्यू/बी एच आर/84/67
Code No. : C/72P/CW/BHR/84/67

आर. बन्दोपाध्याय / R. BANDYOPADHYAY
के. के. सेन / K. K. SEN
डि. एन. बन्दोपाध्याय / D. N. BANDYOPADHYAY
एवं / AND
ए. के. दास / A. K. DAS
भूवैज्ञानिक (वरिष्ठ) / Geologists (Sr)

कोयला स्कन्ध
COAL WING
1992

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COA



Geological Survey of India

FINAL REPORT ON REGIONAL EXPLORATION FOR COAL BY
DRILLING IN THE KALYANPUR-MURGADANGAL-DALDALI BLOCK IN
BRAHMANI SOUTHERN EXTENSION AREA OF RAJMAHAL COALFIELDS,
DUMKA DISTRICT, BIHAR.

(Field Seasons from 1984 - 85 to 1989 - 90)

(Code No. C/72P/CW/BER/84/67)

By

R. Bandyopadhyay ,
K. K. Sen ,
D. N. Bandyopadhyay
and
A. K. Das
Geologists (Sr.)

Diary No. 399
CE/Fuel
Date: 27/6/16

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Geological Survey of India

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i) Set it scanned & read.
ii) Set digitization of all the maps/
important documents.

ACE-III

27/6/16

Geological Survey of India

FINAL REPORT ON REGIONAL EXPLORATION FOR COAL BY DRILLING
IN THE KALYANPUR-MURGADANGAL-DALDALI BLOCK IN BRAHMANI
SOUTHERN EXTENSION AREA OF RAJMAHAL COALFIELDS, DUMKA
DISTRICT, BIHAR .

(Field Seasons from 1984 - 85 to 1989 - 90
Code No. 0/72P/CW/BHR/84/67)

By

R. Bandyopadhyay
K. K. Sen,
D. N. Bandyopadhyay
and
A. K. Das
Geologists(Sr.)

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- APPENDIX - II : Details of the coal seams with quality intersected in boreholes drilled in Kalyanpur-Murgadangal-Daldali block .
- APPENDIX - III : Reserve of coal in Kalyanpur-Murgadangal-Daldali block of Brahmani Southern extension area, Rajmahal coalfield, Dumka district, Bihar .
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Geological Survey of India

FINAL REPORT ON REGIONAL EXPLORATION FOR COAL BY DRILLING
IN THE KALYANPUR-MURGADANGAL-DALDALI BLOCK IN BRAHMANI
SOUTHERN EXTENSION AREA OF RAJMAHAL COALFIELDS, DUMKA
DISTRICT, BIHAR .

(Field Seasons from 1984 - 85 to 1989 - 90)

(Code No. C/72P/CW/BHR/84/67)

By

R. Bandyopadhyay ,
K. K. Sen ,
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A B S T R A C T

In course of regional exploration for coal in the Kalyanpur-Murgadangal-Daldali Block (extent about 12 sq.km. between latitudes $24^{\circ} 05' 45''$ N and $24^{\circ} 09' 48''$ N and longitudes $87^{\circ} 31' 30''$ E and $87^{\circ} 34' 09''$ E) of Brahmani Southern extension area, Rajmahal coalfields, Bihar. A total of 5834.0 m. drilling was done in twenty one boreholes during the field seasons from 1984-85 to 1989-90 . Besides, plane table mapping of 12 sq.km. on 1:10,000 scale was carried out in this sector. The present report incorporates the findings of this investigation .

Rock types encountered in this sector belong to Metamorphics, Talchir Formation, Barakar Formation, Dubrajpur Formation and Rajmahal Formation (from oldest to youngest). Coal seams are found to occur within the Barakar Formation only .

A number of faults traverse the area, the most conspicuous of which is the boundary fault which limits the sedimentaries in the west and an intra-formational fault within the Barakar Formation, running almost parallel to the boundary fault in the

western part of the area and defines the western limit of coal bearing Upper Barakar sediments of the area. The faults of this area are of pré-Dubrajpur age.

Sub-surface data revealed the presence of seven regionally correlatable coal seam zones (numbered I to VII in ascending order). Besides, a few local coal seams are seen to have developed in between the regional seam zones. All the seven seam zones were intersected in the southern part of the sector whereas in the northern part only three lower most seam zones (I to III) were intersected. The seam zones vary in thickness from 0.72 m. to 40.26 m. in this sector, containing non-coking, moderate to high moisture (1.6% to 7.3%), high ash (18.1% to 50.8%) coal (grade C to G). A few very thin coal seams show a better grade (grade B).

Two areas within this sector, viz. i) Kalyanpur-Badalpara and ii) Amrakonda-Murgadangal, have the prospects of multi-seam quarriable potentiality.

The net reserve of coal (Indicated category as per I.S.P.) of Kalyanpur-Murgadangal-Daldali block has been assessed to the tune of 513.56 million tonnes, upto a depth of 600 m. Out of these, the northern part has the reserve of 102.35 million tonnes and the southern part has the reserve of 411.21 million tonnes. The potentiality of the two small areas, which have quarriable prospects, is expected to be around 60 million tonnes.

Geological Survey of India

FINAL REPORT ON REGIONAL EXPLORATION FOR COAL BY DRILLING IN
KALYANPUR-MURGADANGAL-DALDALI BLOCK IN BRAHMANI SOUTHERN
EXTENSION AREA OF RAJMAHAL COALFIELDS, DUMKA DISTRICT, BIHAR.

(Field Seasons from 1984-85 to 1989-90)

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I. INTRODUCTION

Regional Exploration for coal was initiated in May, 1985, by large scale mapping and drilling, in Kalyanpur-Murgadangal-Daldali block, which lies between Ramgarh in Dumka district of Bihar in the north and coal bearing Dewanganj-Harinsingha area of Birbhum district of West Bengal in the south. The southern extension area is the southward continuation of the Brahmani main basin and is interposed between the former and the Birbhum coalfield located in the State of West Bengal. The Kalyanpur-Murgadangal-Daldali block lies in between latitudes $24^{\circ}05'45''$ E and $24^{\circ}09'48''$ N and longitudes $87^{\circ}31'30''$ E and $87^{\circ}34'09''$ E, falling in Survey of India's Toposheet No. 72P/12.

Objective of the investigation programme was to assess the coal potentiality of the area as well as to decipher the structural set up of the basin.

Drilling was commenced in the area in May, 1985, by Unit Nos. 181, and 130, and later, Unit No. 181 was replaced by Unit No. 374. A few boreholes were drilled by the Unit No. 200/214 also, during the later part of the investigation. Two scout boreholes viz. RJB-11 and 12 were drilled earlier (July, 1984) by Unit No. 200, which was later diverted from main Brahmani basin. Borehole No. RJB-12 was drilled upto a depth of 400 m. as the capacity of the drill unit was reached and later on drilling was continued in the same hole as RJB-2 by Unit No. 130.

The total drilling carried out during the period was 5834.0 m. S/Shri A.J. Chakraborty, B.C. Dutta, A. Bhowmik, Drillers and M.L. Banga, S.T.A.(D) were associated with the drilling work under the supervision of S/Shri A.K. Chowdhury, A.K. Chatterjee and Late S.K. Banerjee, Drilling Engineer (Sr.).

The initial survey work was done by a survey team consisting of S/Shri R Y. Biswas M. Datt, S.T.A.(S) and P.C.K. Banik, Surveyor. Later the survey work was carried out by S/Shri P.C.K. Banik and K.K. Dey, Surveyors. S/Shri L.K. Sardar and S.K. Das, Surveyors, were also associated with the Survey work.

Initially the investigation was being looked after by S/Shri A.K. Das and D.N. Bandyopadhyay, Geologists(Sr.), till February, 1987. Shri R. Bandyopadhyay, Geologist(Sr.), took over from them and continued till the end of the exploration work in this block. Shri A.K. Mukherjee, Geologist(Sr.), logged two boreholes(RJB-11 and 12) in the area.

Topography and Drainage :

The area forms a part of the Bihar Plateau (Santhal Parganas) with isolated hillocks rising to maximum height of 209 m. from Mean Sea Level. The hillocks are located mostly in the northern, southwestern and eastern parts of the area under operation. In the Kalyanpur-Badalpara area, the valley is surrounded by hillocks on all sides and the wide valleys are under cultivation.

Dwarka river is the main drainage of the area and flows from NW to SE direction. Minor streams and palas, a few of them perennial, generally flow from east to west, and are tributaries to the Dwarka river. However, in the Kalyanpur-Badalpara area, the palas generally flow from west to east. Besides, a number of springs have been noticed in the area.

Flora and Fauna :

Though the area receives a fair amount of rainfall, the major part of the area is barren due to 'Jhum' cultivation (shifting cultivation) practised by local inhabitants as well as due to deforestation on a large scale. Thick undergrowths of shrubs are found only along the hill slopes and hill tops. Only trees like Mahua, Jamun, Mango, Neem, Palash and Simul remain as remnants of once big forests. However, the Forest Department has recently taken up afforestation programme in this area on a massive scale.

Among the fauna, rabbits, snakes, chameleons, lizards, a few wolves, peacocks and many other types of birds deserve mention.

Climate and Rainfall

The area experiences extreme climate during the year. Summer starts from March and continues till June. Days are hot with temperature rising to about 40° C, while the nights are pleasant. Winter starts from the month of November and the peak winter is during December and January, when mercury goes down to about 5°C.

Rainy season starts from the month of July and continues generally upto middle of September, though rain starts from the third week of June. The average rainfall of the area is about 150 cm. per annum.

Accessibility :

The area can be approached by an all weather metalled road (State Highway No. 6) which connects Rampurhat, Sainthia and Seori of Birbhum district of West Bengal. From Sudaal, on Rampurhat - Seori road, a partly metalled (about 3 Km.) and partly fair weather motorable road (about 6 Km.) connects Harinsingha village, Birbhum district, West Bengal, near the border with Bihar. From Harinsingha, a fair weather jeepable forest road (not maintained properly) passes through the entire length of the area. A jeep can also move to a few villages from this road in fair weather through cart roads. The condition of this forest road during the period from July to November becomes very bad and movement along this road becomes extremely difficult. Beyond Amrakonda village, the area becomes inaccessible by road during rains.

The nearest railhead is Mollarpur on Sahibganj Loop line of Eastern Railway, which is about 12 Km. from Sudaal. Besides, one can approach the area by road service (Calcutta-Rampurhat) upto Rampurhat.

Inhabitants and Occupation :

The local people are mostly Santhals and Baharis, along with some migrating population from parts of Bihar and West Bengal.

The occupation of the local people is cultivation though a good number of them work as labourers in stone quarries and crushers, situated in the Birbhum district of West Bengal. Some are actively involved in sericulture (in small scale).

Acknowledgement :

The authors express their deep sense of gratitude to S/Shri S. Roy, S.K. Sahai and Dr. A.K. Datta, the then Directors of Coal Wing - II, under whose guidance the work was carried out. The authors are grateful to Shri G. Chandak, the then Dy. Director General, Coal Wing, who visited the Murgadangal area and took traverses. Authors are specially grateful to Lr. N.D. Mitra, Dy. Director General, Coal Wing, who visited the area on a number of occasions and gave valuable suggestions about the exploration work.

Previous Work :

The geology of the Rajmahal area had been receiving the attention of the geologists since 1821. Pioneering work was carried out by V. Ball during 1869-70 who established the geological sequence, structure and economic potentialities of this group of coal basins (1877) after delineating five separate basins namely Brahmani, Mahuagarhi, Pachwara, Chuperbhitia and Hura from south to north. Resurvey of this group of coalfields was done by Mitra (1964) who correlated the coal seams occurring in the above mentioned basins in an attempt to assess coal resource potentiality of the area. The Southern Extension area is the continuation of Brahmani basin to the south; linking it with the Birbhum coalfield of West Bengal, further south. K.K. Sen (1981-83), A.K. Das and G. Mukhopadhyay (1983-84) carried out revision geological mapping in the Southern Extension area.

Exploratory work in the Southern Extension area was started in July, 1984, with drilling of two scout borehole Nos. RJB-11 and 12. The boreholes, particularly RJB-11, intersected a number of coal horizons after which systematic exploration by large scale mapping and regional drilling was taken up in this area since May, 1985.

Present Work :

The present work includes detailed geological mapping (Plane-Table/Theodolite method) and regional exploration by drilling. Detailed geological mapping was carried out jointly by S/Shri R. Bandyopadhyay and K.K. Sen, Geologists (Sr.) during 1987-88 F.S. An area of about 12 sq.km. was covered by detailed geological mapping on 1:10,000 scale since 1987-88 F.S.

Since commencement of drilling in May, 1985, 21 boreholes (RJBS - 1 to 14, RJBS - 16 to 21 and RJB - 11) were drilled till December, 1989. Drilling Unit Nos. 130, 181/374 and 200/214 drilled all the boreholes in this area.

An attempt has been made to reinterpret the structural and geological set up in the area, to assess the coal potentiality and behaviour of the coal seam in the area.

Analysis of coal core samples was carried out by the Coal Survey Laboratory, C.F.R.I., Maniganj, Burdwan district, West Bengal.

II. GENERAL GEOLOGY

The geological formations occurring in the Kalyanpur-Murgadangal-Daldali block of Brahmani Southern Extension area, comprise Precambrian basement overlain by the Gondwana Super Group, viz., Talchir, Barakar, Dubrajpur and Rajmahal Formations. All the rock types are exposed in this area only.

The generalised stratigraphic sequence as computed from the geological mapping and exploratory drilling is given below.

Formation	Maximum Thickness (m) (as intersected in boreholes)	Lithotypes	Age
(1)	(2)	(3)	(4)
Rajmahal	36.00	Basaltic volcanic rocks with sedimentary intertrappeans- Oolitic sandstone and porcellinitic siltstone.	Lower Cretaceous.
Unconformity			
Dubrajpur	145.00	Coarse grained, hard, compact often ferruginous, sandstone, pebbly sandstone, siltstone and shale.	Lower Jurassic.
Unconformity			
Barakar	451.00	Coarse to medium grained, feldspathic sandstone, gritty and pebbly sandstone, fine grained sandstone, siltstone, fossiliferous fire-clay, grey shale, carbonaceous shale and seven coal seam zones.	Permian

(1)	(2)	(3)	(4)
Talchir	75.00	Pebbly sandstone, boulder bed, green to Khaki green splintary shale, grey to chocolate shale, medium to fine grained, greenish and occasionally micaceous sandstone.	Permian
Unconformity			
Metamorphics		Granite and granite gneiss with quartz and pegmatite veins.	Pre-Cambrian.

Metamorphics :

The metamorphics are well exposed in the western part of the area and are represented by granite, granite gneisses associated with veins of quartz and pegmatite. The contact between metamorphics and overlying Talchirs/Harakars, wherever exposed, is seen to be faulted. The dip of the fault plane varies from 50° to 55° towards east and a narrow zone of fault breccia is noticed all along the contact. The general strike of the rock units varies between NNE-SSW and NE-SW and foliation dip varies from 40° to 50° easterly.

Talchir Formation :

The Talchir rock units crop out in narrow strips in the south-western part (Ref. Plate I) and the contact between the Talchirs and the metamorphics is faulted. The Talchir Formation is represented by mottled clayey shale with dispersed pebbles and boulders of granite gneiss, quartzites, quartz etc., greenish to khaki green needle shale, mottled clay, chocolate coloured shale, grey shale and flaggy, micaceous, fine grained sandstone with greenish tinge. Occasionally very big boulders are intersected in the boreholes (RJBS-18). Chocolate coloured and grey shales are intersected only in the boreholes. An outlier of Talchir Formation (mainly needle shales) occur in the south-western part of the area near Hirapur village (Ref. Plate-I). Occasionally Talchir sandstones are silicified and ferruginous particularly near the boundary fault. The maximum thickness computed from surface and sub-surface data is about 75.00 m.

Harakar Formation :

In the western margin of the southern part of the area, where the Talchir rock units are exposed as narrow strips, the overlying

Barakar exhibits gradational contact. Elsewhere, the rock units of Barakar Formation are seen to directly overlie the metamorphics (Surface and sub-surface data) and the sandstone in contact with the metamorphics have often been silicified and ferruginated (for example in Phulshahari area (Ref. Plate). Representative rock units are pebbly and very coarse to fine grained micaceous and feldspathic sandstones, shales grey shales, carbonaceous shales, siltstones, fire-clays and coal horizons. These occupy the major part of the area. The basal Barakar units, having an average thickness of about 100.00 m. have a dominant sandstone lithology (pebbly sandstone horizons punctuated with coarse, ferruginous sandstone). Pebbles are mostly of reef and vein quartz. The basal Barakar units are exposed in the western part of the operational area and to the west of the Badalpara village (Ref. Plate) there is a lenticular bed containing ill-sorted gneissic boulders below the lower boulder beds. The lower member is characteristically devoid of any economic coal seam and contain a few pockets or lenses of fireclay. There are a number of springs and slickensided rock units in the area. In contrast to the predominant sandstone lithology of the lower member, the Upper Barakars show heterolithic assemblage of less coarse arenites and argillites. The latter includes coal seams and thin fireclay bands. There are three such prominent fireclay horizons with intervening coarse grained sandstones. Individual fireclay bands attain a maximum thickness development of about 1 m. and are under exploitation in the area.

No coal seam outcrops are present in the area. Some coal seams are exposed in the three fire-clay quarry sections, below the fire-clay horizons, to the east of Murgadangal and Badalpara villages (Ref. Plate). Quite a good number of coal seams were intersected between 5 m. and 506 m. depth horizons below surface in boreholes drilled in the Amrakonda-Murgadangal-Dalda¹i area, while in Kalyanpur-Badalpara area of the block, the coal seams were intersected between 9 m. and 317 m. depth horizons. Thickness of individual coal seam varies from 0.5 m. to 20.6 m. Seams are mostly inter-banded in nature exhibiting split section development in both strike and dip directions. Based on trend pattern of variation in thickness and profile of the seams as well as the characteristics, seams have been grouped into seven coal-seam zones numbered I to VII in ascending order (Ref. Plate V).

In the Amrakonda-Murgadangal-Daldali area, the maximum thickness of Barakar Formation is about 451.00 m. (as revealed by the borehole No. RJBS-6), whereas in the Kalyanpur-Badalpara area, the maximum thickness development of this formation is seen to be 325.00m (RJB-11 intersection).

Channelling, cross bedding bifurcating wave ripples, flaser bedding are some of the important vector structures of the sandstone units. Channelling has also affected the coal seam horizons. The floral impressions within the grey shale, fireclay and carbonaceous shale horizons include *Glossopteris*, *Schizosaura*, *Vertibraria* etc. indicating luxuriant petiolate, glossopteroid foliage. A mould of a gastropod has been found in a sandstone near Murgadangal village. The specimen has general morphological resemblance with some members of family *Microdomatidae*, particularly *Glyptospira* (Permian-Sakmarian to Kazanian). This suggests a general brackish to marine condition.

Dubrajpur Formation :

Barakar Formation is unconformably overlain by the rocks of Dubrajpur Formation, represented by coarse grained, ferruginous, pebbly sandstone (near the contact with Barakar, pebbles are mostly angular to sub-angular and made up of reef and vein quartz), coarse to medium grained, yellowish brown to pinkish brown, ferruginous sandstone (having gritty and conglomeratic layers at places), light grey siltstone, chocolate shale and mottled clay. Sandstone near the contact with overlying basaltic traps are almost quartzitic in physical appearance. The Dubrajpur rock units are found to occupy the higher grounds of the area from Lutia Pahar to Daldali area in the south (Ref. Plate I). In the northern part of the area, rocks of Dubrajpur Formation are not exposed. It occupies mainly the eastern part of the area between Lutia Pahar and Daldali village.

Typical Upper Gondwana plant fossils like *Ptilophyllum* are noticed in abundance in the silty shale units. Difficulty is experienced in delineating the boundary between Dubrajpur and underlying Barakar visually because of the similarity of lithology noticed between the rock types of these two assemblages. Pebbly horizon at the basal part of Dubrajpur Fm. indicates an unconformable relationship between the two formations. In a few boreholes, palaeosol, dark brown in colour, is noticed at the

contact of these two formations. The maximum thickness of this formation, as intersected in boreholes Nos. RJB-12/RJBS-2 is about 145 m.

Rajmahal Formation :

Dubrajpur Formation is overlapped by continuous exposure of basaltic traps/inter-trappean sedimentaries all along the northern and eastern parts of the area from north to south. These rocks belong to Rajmahal Formation. Rajmahal Formation is composed of a thick sequence of basaltic trap rocks interlayered with sedimentary beds (inter-trappeans). The trap rocks are dark coloured with greenish tinge, very fine grained, basalts. On the basis of laboratory studies (Ghose Roy, 1988) of different flows of Rajmahal Volcanics occurring in the adjacent areas, the rocks appear to be tholeiitic continental flood basalt without significant petrological variations. Minerologically, basalt is composed of augitic pyroxene (both as phenocrysts and in ground mass), minor amount of pigeonite, calcic plagioclase (phenocrysts more basic, An 54-60, while ground mass plagioclase contains An 38-40, phenocrysts show albite and carlsbad twinning and are often zoned), glass, opaque and secondary minerals like palagonite (alteration from glass). Typical basaltic textures like ophitic, subophitic, intergranular, are observed. Glomeroporphyritic texture, resulting from clustres of plagioclase and augite phenocrysts are also very common.

The intertrappean beds are represented by grey shale, coarse grained, ferruginous sandstone, often oolitic and cream coloured, porcellinitic shale. In the area around Kalichua village (Ref. plate I) two flows of trap rocks separated by inter-trappean sedimentaries are found to occur. The lower most flow (in this area) is exposed only in this part of the block. The northern most part of the block and the eastern part of this area are covered by lowermost inter-trappean sedimentaries. The latter, after overlapping the traps, have often come directly in contact with the underlying Dubrajpur and occasionally with the rock units of Barakar Formation (as evident in north-eastern part of the area mapped (Ref. Plate I). These are represented mainly by well bedded grey shale and mudstone. General strike is in NNE-SSW direction and the dip varies from 3° to 8° (easterly.). These are associated with coarse grained, highly ferruginous oolitic sandstone in the upper part. Concentric growth rings are very well preserved in the oolites. Slickensides are very common in the shale beds. Maximum thickness of the lower most trap is around 22.25 m.

as intersected in one borehole (RJBS-9). Thickness of the lowermost inter-trappean sediments is about 20.0 m. In the northernmost part of the area, north of Kalyanpur Village, brecciation is noticed in the shale beds.

III. STRUCTURE

The southern extension of the Brahmagiri basin is elongated in a NNW-SSE direction. The western contact of Talchir and Barakar Formations with metamorphic basement is marked by a conspicuous boundary fault, marked by prominent but discontinuous occurrences of fault breccia, silicified and ferruginated zones at places. The contact is offset in a few places, by cross-faults. Near Phulshahar village (Ref. Plate I) the fault plane dipping at angles of 50° to 55° in easterly and southeasterly directions is exposed.

The regional trend of the bedding in general, varies from N-S to NNW-SSE and the amount of dip, in general varies from 8° to 25° towards E and ENE directions. Deviations in the trend of bedding as well as in the amount of dip are very common, particularly near the faults. The dip of inter-trappean sediments varies from 3° to 8° southeasterly.

A number of faults traverse the area, the most conspicuous of which are the boundary fault which limit the sedimentaries in the west and an intra-formational ($F_1 - F_1$) fault within Barakar Formation, running almost parallel to the boundary fault, in the western part of the area, from north to south (Ref. Plate I). The latter defines the western margin of the coal bearing upper Barakar sediments and the basal part of the Barakar Formation is exposed to the west of the fault. The maximum thickness of the Barakars in the western side of this fault has been found to be about 215 m. (Borehole No. RJBS-12, 16 and 13), whereas in the eastern side of this fault i.e. in the down-thrown side, the Barakar sediments are found to be more than 450 m. thick. No coal seam was intersected in the boreholes drilled on upthrown side of this fault except in borehole No. RJBS - 8. A brief description of important faults encountered in this area is given below : (a) A NE-SW fault ($F_2 - F_2$), in the north of Amrakonda village, at the base of Lutia Pahar. The northern part of this fault is upthrown side as evidenced

in the borehole Nos. RJBS-8 and 20 (Ref. Plate). It has also affected the earlier mentioned intra-formational fault (F_1-F_1). Thickness of the Barakar Formation is also reduced in the upthrown side and the formation of hillock in the northern side may be due to this fault. A number of springs are noticed in the nala flowing along the trend of this fault.

(b) Another ENE-WSE trending fault (F_3-F_3) is present to the south of Amrakonda village as is evidenced by the presence of springs along the nala and shifting of sandstone body (Ref. Plate I).

(c) A fault (F_4-F_4), passing through the west of borehole Nos. RJBS-5 and 10, whose downthrown side is in the east, is projected from the borehole data, though no surface indication is present (Ref. Plate I).

(d) The fault (F_5-F_5) has been postulated from the surface and sub-surface data (RJBS-7) running in the ENE-WSW direction, off-setting the main intraformational fault (F_1-F_1). The eastern side of this fault is covered by the rocks of Dubrajpur and Rajmahal Formations.

(e) In the area, west of Badalpara village, two small faults could be traced, one in WNW-ESE (F_6-F_6) direction and the other trending along N - S direction (F_7-F_7), for which the exposure of the boulder bed (granite wash?) at the base of Barakar Formation has been restricted. Slickensides and presence of springs are noticed in this area (Ref. Plate-I).

(f) Another fault (F_8-F_8), trending WNW-ESE in this area is also suspected. The downthrown side of this fault is towards north. The basal boulder bed of Barakar Formation might have been exposed due to this fault. Shifting of metamorphic contact and presence of springs at the two ends of this fault could be seen and it passes through a valley (being used for paddy cultivation at present) (Ref. Plate I).

(g) Another fault (F_9-F_9), affecting the Talchir Formation, has been noticed in the western side of the borehole No. RJBS_10. Though there are no field evidences, there is a possibility of this fault extending towards east which is evident by the presence of a spring in the eastern side, near the contact with Dubrajpur Formation and variations of strike direction and dip amounts and direction.

A number of big springs are found to occur along the main intraformational fault (F_1-F_1), particularly in the north of Badalpara village, where big springs forming ponds, are present. Besides, numerous springs could be seen along the boundary fault.

The faults of this block, so far recognised, have not affected the Dubrajpur and Rajmahal Formations which indicates that all the faults affecting Barakar Formation are of pre-Dubrajpur age.

Large size trough cross-beddings, transverse cross-beddings, ripple marks, wave ripples (bifurcating wave ripples are also seen near Amrakonda village), evidence of channelling, flaser beddings, load casts, water escape structure, bio-turbidity, etc. are present within the Barakar sediments.

IV. COAL

Three coal seam sections are exposed in the fire-clay quarries below the clay horizons in Murgadangal and Badalpara areas (Ref. Plate) but no coal seam crops out in the area explored. However, a number of coal seams were encountered in all the boreholes except in borehole Nos. RJBS - 4, 12, 16 and 18 which were drilled through the basal part of the Barakar Formation (Ref. Plate-III). Most of the coal seams are interbanded in nature and exhibit split section development pattern both along strike and dip directions. There are also variations in thickness and lithological characters of inter-seam parting sediment. In view of such variability in facies characteristics of the coal seam sections, zone-wise correlation of seams has been made where each zone comprises a number of coal seam sections having identifiable facies development cycle.

A total of seven coal seam zones, nomenclatured I to VII (in ascending order) could be identified (see Plate V).

The thickness of coal as indicated in respect of each seam zone represents the cumulative thickness of the individual coal seams occurring within the same seam zone.

In addition to the seven coal-seam zones, there occur some thin seams of local nature, details of which have been given separately in latter part of this chapter.

From the sub-surface data, it was noticed that the thickness of Barakar Formation is much higher (more than 450 m.) in the area south of P₁-P₂ fault (north of Amrakonda village) whereas its thickness is much less (maximum upto 325.30 m.) in the area lying to the north of this fault i.e. around Kalyanpur-Badalpara villages. All the seven coal seam zones have been intersected in the southern part though the development of Zone-I is very poor in this part, compared to that in the northern part. Only three coal-seam zones (from I to III) were intersected in the northern part of the area. One interesting feature is that a seam zone (IA) which may be the split section of zone-I, has developed in this area, below seam zone II. The generalised sequences of the coal-seam zones for the southern and northern parts of the area, are given below.

(A) Southern part of the area :

Description	Composite thick- ness range (in m.)	Thickness range of total coal section(m)
Seam Zone VII	8.15 - 14.25	2.42 - 9.03
Parting	22.42 - 40.69	
Seam Zone VI	6.72 - 21.60	0.72 - 12.56
Parting	7.69 - 38.10	
Seam Zone V	5.05 - 14.10	2.13 - 9.18
Parting	7.09 - 20.08	
Seam Zone IV	28.95 - 47.32	12.71 - 25.59
Parting	7.71 - 21.60	
Seam Zone III	24.55 - 75.74	10.18 - 40.26
Parting	17.07 - 79.45	
Seam Zone II	40.01 - 69.75	7.60 - 24.41
Parting	68.75 - 70.80	
Seam Zone I	40.30 - 42.60	2.05 - 11.16

(B) Northern part of the area :

Seam Zone III	41.35 - 42.70	10.39 - 13.54
Parting	25.98 - 34.00	
Seam Zone II	29.60 - 68.85	17.64 - 30.55
Parting	8.39 - 15.39	
Seam Zone IA.	1.91 - 31.70	1.91 - 6.00
Parting	4.45 - 25.29	
Seam Zone I	58.25 - 58.87	5.89 - 21.75

Seam Zone I :

Sub-surface data reveal that this seam zone is well developed in the Murgadangal-Kalyanpur-Badalpara areas (evident from RJB-1, 6, 8, 17, 19, 21 and RJB-11 intersections). This seam zone is found to be absent in the Amrakonda and Hirapur areas (evident from RJB-3, 9, 10, 13 and 20 intersections).

In the Kalyanpur-Badalpara area, Seam Zone I occurs between 45.80 m. and 242.75 m. depth levels and comprises 4 to 7 seam sections having a cumulative thickness range from 5.89 m. to 21.75 m. Individual seam sections have a thickness range of 0.5 m. to 9.02 m. Moisture percentage varies from 2.3 to 7.0, ash percentage from 22.9 to 47.6 and the coal is of grade D to G.

In the Murgadangal area, this seam zone occurs between 291.45 m. and 400.00 m. depth levels and comprises 2 to 5 seam sections having a cumulative thickness range of 2.05 m. to 11.16 m. Individual seam sections vary in thickness from 0.69 m. to 6.19 m. The moisture percentage varies from 2.5 to 4.8 and ash percentage varies from 21.0 to 49.7 and the coal is of Grade E to G in this part of the area.

Seam Zone IA :

This seam zone is seen to have developed only in the Kalyanpur-Badalpara area (evident from Borehole Nos. RJB-1, 17, 19, 21 and RJB-11) and occurs between 9.00 m. and 184.91 m. depth levels. There are 1 to 4 constituent seam sections having a cumulative thickness from 0.87 m. to 6.00 m. The coal is of Grade C, the moisture and ash percentages vary from 2.5 to 5.8 and from 20.6 to 44.2, respectively.

Seam Zone II :

This seam zone is seen to have developed in the Kalyanpur-Badalpara area (evident from borehole Nos. RJBS-1, 17, 21 and RJB-11 intersections) as well as in the Amrakonda-Murgadangal area (evident from borehole Nos. RJBS-3, 6, 9, 11, 13 and 20 intersections). However, this seam zone is absent in Lutia Fahar area, located on the upthrown side of the main intra-formational NE-SW trending fault.

In the Kalyanpur-Badalpara area, the seam zone occurs between 21.00 m. and 172.20 m. depth levels and comprises 3 to 9 seam sections having a cumulative thickness range from 17.64 m. to 30.55 m. Individual seam sections vary in thickness from 0.51 m. to 17.80 m. The moisture percentage varies from 1.9 to 7.2 and ash percentage varies from 18.1 to 47.6. The coal is of Grade D to G.

In the Amrakonda-Murgadangal area, the seam zone occurs between 155 m. and 419.60 m. depth levels and comprises 2 to 5 seam sections having cumulative thickness range of 7.60 m. to 24.41 m. Individual coal seam sections vary in thickness from 0.65 m. to 12.31 m. The coal is of Grade C to E whose moisture percentage varies from 2.5 to 6.2 and ash percentage from 25.8 to 50.8.

Seam Zone-III :

This seam zone is developed in the Kalyanpur-Badalpara area (evident from RJBS-11 and RJBS-21 intersections) as well as in Amrakonda-Murgadangal area (evident from RJBS-2, 3, 5, 6, 9, 10, 11, 13, and 20 intersections).

In the Kalyanpur-Badalpara area, this seam zone comprises 7 seam sections having cumulative thickness range of 10.39 m. to 13.54 m. while the individual seam sections vary in thickness from 0.60 m. to 2.95 m. This seam zone occurs between 11.80 m. and 68.65 m. depth levels. Moisture and ash percentage vary from 3.3 to 7.2 and 21.2 to 46.7 respectively.

In the Amrakonda-Murgadangal-Daldali area, this seam zone occurs between 54.75 m. to 506.50 m. depth levels and comprises 6 to 13 seam sections having cumulative thickness

range of 10.18 m. to 40.26 m. The individual seam sections vary in thickness from 0.50 m. to 20.59 m. The coal is of Grade C to G whose moisture percentage varies from 1.6 to 6.8 and ash percentage varies from 18.2 to 47.7.

Seam Zone-IV :

This seam Zone is developed in the Amrakonda-Murgadangal-Daldali area (evident from RJBS-2, 3, 5, 6, 9, 10, 11, 13 and 20 intersections) between depth levels 12.50m. and 422.40 m. and comprises 3 to 9 seam sections having cumulative thickness range of 12.71 m. to 25.59 m. The individual seam sections vary in thickness from 0.50 m. to 15.72 m. The coal is of Grade C to G. The moisture percentage varies from 3.0 to 6.8 while the ash percentage varies from 28.0 to 50.0.

This seam zone is found to be absent in the Kalyanpur-Badalpara area which may be attributed to erosion/non-deposition of this part of the coal bearing sediment package within the Barakar Formation.

Seam Zone V :

This seam zone is developed in the Amrakonda-Murgadangal-Daldali area (evident from RJBS-2, 3, 5, 6, 9, 10, and 11 intersections) and occurs between depth levels 14.65 m. and 365.00 m. There are 2 to 3 constituent seam sections varying in thickness (cumulative) from 2.13 m. to 9.18 m. Individual seam sections vary in thickness from 0.51 m. to 6.98 m. The coal is of Grade D to E. Moisture percentage varies from 2.6 and 7.3 and ash percentage varies from 20.8 to 48.9.

Seam Zone VI :

This seam zone is found to have developed in the Amrakonda-Murgadangal-Daldali area (evident from RJBS-12/ RJBS-2, RJBS-5, 6, 9, 10 and 11 intersections) between depth levels 5.63 m. and 343.72 m. There are 2 to 4 seam sections having a cumulative thickness range of 0.72 m. to 12.56 m. and the individual seam sections vary in thickness from 0.54 m. to 7.63 m. The coal is of Grade C to F and its moisture percentage varies from 3.4 to 6.8 while the ash percentage varies from 18.2 to 49.5.

Seam Zone-VII :

This seam zone is developed in the down-dip side of the Amrakonda-Murgadangal-Daldali area (evident from RJB-12/RJBS-2, RJBS-9 and 11 intersections) between depth levels 9.0 m. and 303.0 m. There are 2 to 5 constituent seam sections having a cumulative thickness range of 2.42 m. to 9.03 m. while the individual seam sections vary in thickness from 0.76 m. to 5.75 m. The coal is of Grade C to G. The moisture percentage varies from 3.7 to 6.8 and ash percentage varies from 24.6 to 46.9.

Local Seam :

- 1) One 1.75 m. thick coal seam was intersected at 225.80 m. depth in RJB-12/RJBS-2, drilled near Daldali village. This seam contains one dirt band and its grade varies from F(Ex-band) to G(In-band).
- 2) One 0.93 m. thick coal seam was intersected at 131.20 m. depth in borehole No. RJBS-9, drilled near Kalichua village. This seam contains dirt bands and its grade varies from E(Ex-band) to G(In-band).
- 3) Another local coal seam of 1.29 m. thickness was intersected in this borehole (RJBS-9) at 171.58 m. depth. It contains one dirt band and its ex-band grade is E.
- 4) In borehole No. RJBS-11, drilled near Amrakonda village, one 1.74 m. thick coal seam was intersected at 33.63 m. depth. It contains one dirt band and the grade is F (both ex-band and in-band).
- 5) One local coal seam varying in thickness from 0.94 m. to 1.03 m., was intersected in two boreholes (Nos. RJBS-13 and 20) drilled near Amrakonda village. In RJBS-13, the seam was intersected at 217.85 m. depth and in RJBS-20, it was intersected at 231.85 m. depth. This seam contains dirt bands and the grade varies from F (Ex-band) to D (In-band).
- 6) In borehole No. RJB-11, drilled in the east of Badalpara village, one local coal seam of 1.30 m. thickness was intersected at 315.80 m. depth. The grade of coal is F.
- 7) Another coal seam of 0.95 m. thickness was intersected at 201.10 m. depth in the borehole No. RJBS-17, drilled in the Kalyanpur-Badalpara area. The grade of coal is E.

Several local coal seams have also been intersected in borehole Nos. RJBS-19 and 21, but these seams have not been discussed as the thickness in all cases is less than 0.90 m.

From the analytical data of coal seams, it has been observed that the coal seams of this block contain high percentage of ash and moderate to high percentage of moisture. The grade of coal varies generally from E to G, and grade of majority of the seam varies from F to G. Coal seams of better grades (i.e. between B and D), though very common, are very thin and less than 0.90 m. in thickness.

The behavioural pattern of the different coal-seam zones in Kalyanpur-Murgadangel-Daldali block is shown in the isometric panel diagram (Ref. Plate VI).

Quality of Coal :

As per analytical data received from the Coal Survey Laboratory, C.F.R.I., Raniganj, Coals from all the seven seam zones contain moderate to high moisture (1.6% to 7.3%), moderate to high ash (18.1% to 50.8%), and are non-coking in character (Appendix-II). In the southern part of the area, the coal in the upper seam zones, namely IV, V, VI and VII, are inferior in 'overall' chemical profile due to the presence of several dirt bands in the coal sections. In this part, the grade of coal varies from C to G (mainly F and G) with calorific values ranging from 1724 to 5456 K. Cal./g. Coal seams intersected at greater depths are often found to be of better grades, mainly 'C'. Coal seams have deteriorated particularly in the part south of Murgadangel village.

Coals in the three seam zones (I, II and III) intersected in the northern part of the block show grade variations from C to G (mainly grade E). The Useful Heat Value varies between 1545 K. Cal./g. to 5354 K. Cal./g. On average the coals of this part of the area are generally of better grades compared to the coals of southern part.

Occasionally, coal seams of still better grade (Grade B) are also intersected in different boreholes. But in all cases, these seams are very thin and may not be of economic significance.

Coal Reserve :

Reserve of 'Indicated' category has been computed borehole-wise, seam zone-wise and depth range-wise (0.0 m. - 300 m. and 300 m. - 600 m.) as per the J. J. Standard Procedure. For calculating 'Indicated' reserve, the area of influence has been considered as 1000 m. around the boreholes and the average thickness of the seam zone was taken into consideration. For computation of 'Expand' thickness of coal seams, all non-combustible dirt bands, irrespective of thickness, were excluded and combustible dirt bands upto a thickness of 0.30 m. were included. In calculating the reserve, component seams having a thickness of 0.90 m. and above were considered.

In the southern part of the area, reserve of seam zone I, was not calculated as this seam zone is not well developed in the area and was intersected only in two boreholes (RJBS-6 and 11). In borehole No. RJBS-11, seams are very thin and are developed in two split sections, one seam section was seen to have attained a thickness of 0.90 m. The reserve of this seam zone has been calculated for the Kalyanpur-Badalpara area only.

Reserve has been calculated separately for the northern and southern parts of the Kalyanpur-Murgadangal-Daldali block (Ref. Appendix III).

The specific gravity of coal considered for tonnage computation is taken from the Revised Classification of Coal based on Useful Heat Value as adopted by Coal India Limited. Seams having ash + moisture upto 55% have been considered as coal.

Net total reserve of 513.56 million tonnes of coal has been estimated within Kalyanpur-Murgadangal-Daldali block, upto a depth range of 600 m. Out of this, the net reserve in the southern part of the block is 411.21 million tonnes and the northern part indicates a reserve of 102.35 million tonnes. The depth-wise and grade-wise break up of the reserve are given in the Appendix-III.

From the sub-surface data, it was noticed that two areas, i.e. (i) Kalyanpur-Badalpara in the northern part of the block and (ii) Anarakonda - Murgadangal in the southern part, have 'multiseam quarriable' prospects (shown in the geological map, Plate - I). Considering coal to overburden as 1 : 2 and coal

upto 100 m. depth level, a reserve of about 60 million tonnes of coal is expected from these two areas. Out of this, Kalyanpur-Badalpara area may yield 20 million tonnes and Amrakonda-Murgadangal area may yield 40 million tonnes. However, the actual quarriable potentiality can only be defined after detailed exploration.

V.. SUMMARY AND CONCLUSION

Regional exploration for coal was carried out in Kalyanpur-Murgadangal-Daldali block of Brahmani Southern Extension area of Brahmani basin, Rajmahal Coalfield and has proved the continuity of the coal bearing lower Gondwanas of Rajmahal group of coalfields in the south beyond the existing limit of Brahmani basin. It is linked with the Birbhum basin occuring further south in the district of Birbhum, West Bengal.

Contact between the metamorphics and the Talchirs/Barakars is faulted whereas the contact between the Talchirs and the Barakars is gradational. Barakar Formation is overlain unconformably by Dubrajpur formation which is in turn overlain unconformably by Rajmahal Formation.

Presence of a number of intra-formational faults within Barakars were identified, the most conspicuous of which is the fault running parallel to the boundary fault in the western part of the area and limits the coal bearing upper Barakars in the west. In the western part of this fault i.e. in the upthrown side, the Lower Barakars are exposed which were found to be barren of economic coal seams. Dubrajpur and Rajmahal Formations of this area are not affected by any of these faults. Presence of gastropod (? Glyptospira) within the Barakars, in association with wave ripples may indicate a marine connection.

Sub-surface data available from the boreholes drilled in this area, not only revealed the presence of a number of coal seams (Seam Zones I to VII) of considerable thickness for the first time in this area, but also helped in establishing persistent occurrence of seven coal-seam zones within

the Barakar Formation. The thickness of the Barakar Formation is more in the southern part of the block. The lower three zones (Zone I, II and III) are better developed in the northern part of the block.

Coals of this area contain moderate to high moisture (1.6% to 7.3%) and moderate to high ash (18.1% to 50.8%) and are non-coking in character. In the southern part of the area, the upper seam zones (from IV to VII) are inferior in overall due to presence of several dirt bands in the coal sections. As a result, coal inclusive of dirt band, is found to have ash percentage as high as 53.3. In general, the grades of coals of this block vary from C to G. In the southern part the grades are mainly F and G whereas in the northern part it is mainly E. Occasionally coal seams of better grade (Grade B) are also intersected in different borsholes. But in all cases, these seams are very thin and do not have much economic significance.

The net total reserve of 513.56 million tonnes of coal has been estimated within Kalyanpur-Murgadangal-Daldali block, upto a depth of 600 m. Out of this reserve, the southern part of the block is having a net reserve of 411.21 million tonnes of coal and in the northern part a net reserve of 102.35 million tonnes of coal has been estimated.

From the sub-surface data, it was noticed that two areas i.e. (i) Kalyanpur-Badalpara in the northern part and (ii) Amrakonda-Murgadangal in the southern part have multiseam quarriable prospects. Considering the coal-overburden ratio as 1:2 upto a depth of 100 m., these two areas are expected to yield a total reserve of 60 million tonnes of coal. Out of these, the Kalyanpur-Badalpara area may yield 20 million tonnes of coal and Amrakonda-Murgadangal area may yield 40 million tonnes of coal.

In view of the promising nature of coal prospect in Kalyanpur-Murgadangal-Daldali block, regional exploration in the eastern and northern extensions of this basin is recommended for a complete appraisal of this important coalfield.

Detailed exploration should be carried out to prove the actual quarriable potentiality of the two areas identified in this block in course of regional exploration work.

Locality Index

<u>Locality</u>	<u>Latitude</u>	<u>Longitude</u>
Amrakonda	24° 07' 49" N	87° 32' 30" E
Badalpara	24° 09' 10" N	87° 32' 20" E
Daldali	24° 06' 30" N	87° 33' 54" E
Devanganj	24° 03' 50" N	87° 35' 30" E
Dhobaghati	24° 05' 07" N	87° 33' 00" E
Harinsingha	24° 04' 45" N	87° 34' 36" E
Hirapur	24° 06' 10" N	87° 32' 45" E
Kalyanpur	24° 09' 48" N	87° 32' 30" E
Kalichua	24° 06' 50" N	87° 32' 15" E
Lutia Pahar	24° 08' 30" N	87° 32' 35" E
Mollarpur	24° 04' 45" N	87° 42' 30" E
Murgadanganal	24° 07' 15" N	87° 32' 25" E
Phulshahari	24° 07' 30" N	87° 32' 15" E
Rampurhat	24° 10' 36" N	87° 47' 12" E
Sordi	23° 54' 30" N	87° 37' 30" E
Sudsa	24° 02' 45" N	87° 37' 24" E

List of References

1. Ball, V. 1877 Geology of Rajmahal Hills, Memoir. Geol. Surv. Ind. Vol. 13, Pt. 2.
2. Bandyopadhyay, R. ...1989 Annual Prog. Report on Regional exploration for coal in Brahmani Southern Extension area, (i) Kalyanpur-Murgada-gal-Daldali and (ii) Banspaha blocks in Rajmahal C.F., Dumka district, Bihar (Unpublished)
3. Das, A.K., Mukherjee, G. and Mukherjee, A.... 1985 ... Report on regional exploration for coal in Brahmani coalfield Dumka district, Bihar (Unpublished Prog. Report for 1985-86 and 1986-87 Field Seasons)
4. Das, A.K. and 1988 ... Bandyopadhyay, D.N. Report on preliminary exploration for coal in southern extension area, Brahmani C.F. Dumka district, Bihar. (Unpublished Prog. Report of G.S.I. for the F.S. 1984-85 and 1985-86).
5. Ghose Roy, A.K. .. 1988 ... Final Report on petrology of the Rajmahal trap flows encountered in boreholes recently drilled by Coal Wing in Deocha Pachami area, Birbhum district and Panagarh-Domra area in eastern part of Raniganj C.F., West Bengal (in collaboration with Coal Wing). Prog. Report for 1986-87 F.S., G.S.I.
6. Mitra, N.D. 1965 Geology and Coal resources of Rajmahal C.F., Santhal Pargana district, Bihar. Report for 1963-64 F.S., G.S.I. (Unpublished)
7. Sen, K.K. 1984 Report on geological mapping of the Gondwana and associated rocks in Sarsajol-Daldali-Gari area, in parts of Dumka district and parts of Birbhum district, West Bengal (Unpublished Prog. Report for 1981-82 F.S.)
8. Sen, K.K. and 1987 Datta, K.K. Final Report on preliminary exploration for coal in Dewanganj-Harinsingha block, Birbhum Coalfield, Birbhum district, West Bengal (Unpublished Prog. Report for 1981-82 F.S. to 1985-86 F.S., G.S.I.)

9. Sen K.K. and 1992
Datta, R.K. Final Report on regional ex-
ploration for coal in the
Pachami Sector, Birbhum C.R.,
Birbhum district, West Bengal
(Unpublished Prog. Report for
P.S. 1984-85 to 1988-89).
10. Chaudhury, S. and ... 1991 ...
Bandyopadhyay, R. A gastropod in Barakar Forma-
tion of a part of Brahmani
coalfield near Murgadangal,
district Dumka, Bihar, Jour.
Prof. Birbal Sahni Centenary
International Conference.
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: 1/2 :

1	2	3	4
<u>Borehole No. RJBS-1(Contd.)</u>			
69.50	76.70	7.20	<u>COAL</u> .
76.70	77.10	0.40	Carb.shale .
77.10	78.30	1.20	Grey siltstone .
78.30	79.14	0.84	Shaly sandstone .
79.14	81.78	2.64	Medium to coarse grained sandstone gritty at places and sandy at bottom.
81.78	82.49	0.71	Gritty and pebbly sandstone .
82.49	82.75	0.26	Carbonaceous shale .
82.75	83.44	0.69	<u>COAL</u> .
83.44	84.60	1.16	Grey and carb.shale with lamination of coal.
84.60	85.85	1.25	<u>COAL</u> .
85.85	88.74	2.89	Medium to coarse grained Sst. gritty and pebbly at places and with a band of siltstone .
88.74	89.20	0.46	Intercalation of medium grained sandstone and shaly Sst.
89.20	93.41	4.21	Medium to coarse grained Sst.
93.41	93.66	0.25	Alteration of Sst. and sandy shale .
93.66	95.69	1.94	Medium to very coarse gr.sst. with minor shale bands.
95.69	95.72	0.12	<u>COAL</u> .
95.72	96.29	0.57	Carb.shale with a band of Sst. at top.
96.29	97.81	1.52	Alternation of shale and Sst.
97.81	98.93	1.12	<u>COAL</u> .
98.93	99.37	0.44	Carb.shale with lamination of coal .
99.37	99.73	0.40	Grey shale .
99.73	100.82	1.09	Medium grained sandstone with grits and pebbles.
100.82	101.22	0.40	Grey sandy shale .
101.22	105.00	3.78	Medium to very coarse grained Sst. with shale lamination and coal streaks at places.
105.00	106.41	1.41	Grey sandy shale with silty laminations.
106.41	108.48	2.07	Very coarse grained Sst. with a band of carb. shale at bottom .
108.48	109.52	1.04	Interlamination of sandy shale and fine grained Sst.
109.52	112.35	2.83	Very coarse gr. Sst. with laminations of sandy shale towards bottom .

1	2	3	4
<u>Borehole No. RJBS-1 (Contd.)</u>			
112.35	113.60	1.25	Interlamination of shale and sandstone.
113.60	118.90	5.30	<u>COAL</u> .
118.90	131.15	12.25	Coarse to very coarse gr. Sst., pebbly at bottom .
131.15	132.07	0.92	Fine to medium gr. Sst.
132.07	133.05	0.98	Medium to coarse gr. Sst. with thin minor grey and carb. shale .
133.05	133.43	0.38	Fine grey shale Sst.
133.43	140.29	6.86	Coarse to very coarse grained sandstone.
140.29	142.13	1.84	Interbanded/laminated shale and sandstone .
142.13	143.64	1.51	Coarse to very coarse grained massive sandstone .
143.64	144.20	0.56	Grey sandy shale .
144.20	151.42	7.22	Medium to very coarse grained sandstone with shale laminations at places and finer at bottom .
151.42	151.77	0.35	Grey sandy shale .
151.77	152.38	0.61	Intercalation of sandstone and sandy shale .
152.38	154.10	1.72	Medium to very coarse grained massive sandstone . <u>Barekar</u> <u>Talchir</u>
154.10	162.32	8.22	Pebbly to conglomeratic sandstone (pebbles are of quartz and quartzo felspathic rocks).
173.28	176.35	3.07	Hard, laminated fine grained compact Sst.
176.35	178.85	2.50	Light grey to mottled silty clay.
178.85	206.10	27.25	Metamorphics.

B. H. Closed at 206.10m.

I/4

BOREHOLE NO. RJB-12/RJBS-2

Location : Lat : 24° 06' 22" : R. L. : 92.16m.
 Long: 87° 34' 03" : Unit No.: 181
 Daldali Village : Driller : A.J. Chakraborty
 Date of Commencement : 11.8.84
 Date of Closing : 28.8.85 : S.T.A(D), M. L. Banga .
 Total depth : 532.00m : Logged by: A.K. Mukherjee,
 A.K. Das &
 D.N. Bandyopadhyay.

1	2	3	4
0.00	5.00	5.00	Sludge of sandy soil .
5.00	8.80	3.80	Fire clay (?)
8.80	13.35	4.55	Greyish white fine grained felspathic sandstone .
13.35	14.00	0.65	Grey shale . <u>Rajmahal</u>
14.00	19.15	5.15	Carbonaceous sandstone with coaly materials . <u>Dubriampur</u>
19.15	21.69	2.54	Greyish white medium to coarse grained felspathic sandstone, carb. at places.
21.69	27.00	5.31	Carbonaceous sandstone with bands of pebbly sandstone .
27.00	29.65	2.65	Greyish white medium to fine grained felspathic sandstone .
29.65	33.00	3.35	Carbonaceous sandstone .
33.00	37.70	4.70	Greyish white medium grained to coarse grained felspathic and gritty sandstone .
37.70	45.15	7.45	Grey to greenish siltstone .
45.15	47.60	2.45	Greyish white coarse grained felspathic to gritty sandstone.
47.60	48.92	1.32	Buff coloured siltstone .
48.92	50.52	1.60	Greyish white pebbly sandstone .
50.52	51.20	0.68	Buff to grey siltstone .
51.20	53.14	1.94	Greyish white gritty sandstone .
53.14	56.60	3.46	Buff coloured siltstone with a thin band of pebbly sandstone .
56.60	60.20	3.60	Greyish white pebbly sandstone .
60.20	64.80	4.60	Grey shale , sandy.
64.80	68.80	4.00	Greyish white coarse to pebbly felspathic Sst.
68.80	88.75	19.95	White pebbly Sst.
90.15	91.15	1.00	Grey shale .
91.15	95.55	4.40	Greyish white gritty Sst.
95.55	100.40	4.85	Grey sandy shale, carb. at places.

1	2	3	4
<u>Borehole No. RJB/12/RJBS-2 (Contd.)</u>			
100.40	105.55	5.15	Greyish white pabbly Sst.
105.55	106.00	0.45	Grey shale .
106.00	107.65	1.65	Greyish white medium to fine grained felspathic sandstone .
107.65	111.75	4.10	Greyish white pebbly Sst. with shale lenses.
111.75	114.55	2.80	Alternation of grey shale and fine grained sandstone .
114.55	115.20	0.65	Greyish white coarse grained felspathic sandstone .
115.20	116.40	1.20	Grey shale, sandy.
116.40	116.95	0.55	Greyish white coarse grained felspathic sandstone .
116.95	117.95	1.00	Grey shale .
117.95	120.70	2.75	Greyish white pebbly Sst. with a band of (0.30m.) medium grained felspathic sandstone at top.
120.70	123.70	3.00	Grey shale with sandy lenses.
123.70	124.05	0.35	Greyish white gritty Sst.
124.05	124.60	0.55	Grey shale, sandy .
124.60	125.05	0.45	Greyish white medium grained felspathic sandstone .
125.05	128.10	3.05	Grey shale, sandy.
128.10	130.15	2.05	Greyish white gritty sandstone with a band of (0.20m.) siltstone .
130.15	134.45	4.30	Greyish white pebbly sandstone with shale & coal lenses.
134.45	135.60	1.25	Grey shale .
135.60	139.60	4.00	Greyish white pebbly Sst.
139.60	140.00	0.40	Grey shale .
140.00	141.75	1.75	Greyish white medium grained felspathic sandstone .
141.75	143.35	1.60	Grey siltstone .
143.35	149.95	6.60	Greyish white pebbly Sst.
149.95	154.55	4.60	Grey shale with 0.08m. coal band in the middle and shaly Sst.
154.55	156.50	1.95	Greyish white medium grained felspathic sandstone .. <u>Dubralpur</u>
156.50	160.65	4.15	Grey shale (carb. at top) and a band (0.18m.) of fine grained sandstone .. <u>Borakar</u>
160.65	162.45	1.80	Greyish white medium to coarse grained felspathic sandstone .

1	2	3	4
<u>Borehole No. RJB-12/RJBS-2 (Contd.)</u>			
162.45	163.49	0.95	Grey shale .
163.40	163.55	0.15	<u>COAL</u> (C.B.)
163.55	164.20	0.65	Grey shale , sandy .
164.20	164.35	0.15	<u>COAL</u> Shaly .
164.35	166.93	2.58	Grey shale, carb. at base.
166.93	167.38	0.45	<u>COAL</u> , shaly at places.
167.38	176.52	9.14	Grey shale with a band of coarse grained sandstone .
176.52	181.05	4.53	Alternation of grey shale and greyish white medium grained gritty sandstone .
181.05	181.37	0.32	<u>COAL</u> .
181.37	182.60	1.23	Grey shale .
182.60	183.85	1.25	Greyish white medium grained felspathic sandstone .
183.85	185.95	2.10	Grey shaly sandstone .
185.95	189.00	3.05	Greyish white coarse grained felspathic & gritty Sst.
189.00	190.85	1.85	Greyish white pebbly Sst.
190.85	192.55	1.70	Grey shaly Sst.
192.55	196.60	4.05	Greyish white pebbly Sst. with a band of grey shale .
196.60	198.87	2.27	Grey shale .
198.87	201.20	2.33	Greyish white coarse grained sandstone .
201.20	203.92	2.72	Greyish white pebbly sandstone .
203.92	204.05	0.13	<u>COAL</u> .
204.05	208.02	3.97	Grey shale with a 0.10m. coal band .
208.02	209.60	2.58	Grey shaly sandstone .
209.60	217.37	7.77	Greyish white coarse grained felspathic and gritty sandstone .
217.37	218.64	1.27	Grey shale with thin bands of coal .
218.64	220.10	1.46	Greyish white gritty sandstone .
220.10	220.55	0.45	Grey shale .
220.55	223.60	3.05	Greyish white medium grained felspathic sandstone with shale laminations.
223.60	225.80	2.20	Greyish white medium to coarse grained gritty sandstone .
225.80	227.55	1.75	<u>COAL</u> .
227.55	228.70	1.15	Grey shale , sandy at top .
228.70	230.00	1.30	Carbonaceous sandstone with rock fragments.
230.00	233.20	3.20	Grey shale .

1	2	3	4
<u>Borehole No. RJB-12/RJBS-2 (Contd.)</u>			
233.20	235.35	2.15	Greyish white coarse grained gr feldspathic sandstone .
235.35	237.25	0.90	Grey shale .
236.25	238.55	2.30	Greyish white coarse to pebbly feldspathic sandstone .
238.55	243.45	4.90	Grey shale, sandy towards base.
243.45	247.29	3.84	Greyish white medium grained feldspathic sandstone with a thin grey shale band .
247.29	247.54	0.25	<u>COAL</u> .
247.54	250.80	3.26	Grey shale with a band of medium grained sandstone .
250.80	255.00	4.20	Greyish white coarse grained sandstone .
255.00	257.60	2.60	Grey shale .
257.60	261.15	3.55	White medium to coarse grained sandstone .
261.15	262.15	1.00	Grey shale .
262.15	263.25	1.10	White pebbly sandstone .
263.25	263.77	0.52	Grey shale .
263.77	263.97	0.20	<u>COAL</u> .
263.97	267.75	3.78	Greyish white pebbly sandstone .
267.75	277.35	9.60	Grey shale with a band of coarse grained sandstone .
277.35	277.55	0.20	<u>COAL</u> .
277.55	283.60	6.05	Grey shale with a (0.30m.) band of coarse grained sandstone .
283.60	287.80	4.20	Greyish white pebbly sandstone .
287.80	289.13	1.33	Grey shale .
289.13	294.25	5.12	White pebbly sandstone .
294.25	295.63	1.38	<u>COAL</u> .
295.63	296.91	1.28	Carb. shale .
296.91	297.25	0.34	<u>COAL</u> .
297.25	297.50	0.25	Grey shale .
297.50	298.42	0.92	Carb. shale .
298.42	300.14	1.72	Grey shale .
300.14	300.58	0.44	<u>COAL</u> .
300.58	301.30	0.72	Greyish white fine grained feldspathic sandstone with grey shale at bottom .
301.30	301.62	0.32	<u>COAL</u> .
301.62	301.99	0.37	Carb. shale .
301.99	302.75	0.76	<u>COAL</u> .

1	2	3	4
<u>Borehole No. RJB-12/RJBS-2 (Contd.)</u>			
302.75	303.35	0.60	Shaly sandstone.
303.35	304.12	0.77	Grey shale.
304.12	304.32	0.20	<u>COAL.</u>
304.32	305.76	1.44	Grey shale with a band of shaly sandstone .
305.76	305.90	0.14	<u>COAL.</u>
305.90	311.15	5.25	Interbanded grey shale and shaly sandstone.
311.15	317.50	6.35	Greyish white coarse grained gritty sandstone, shaly at top.
317.50	320.80	3.30	Grey shale.
320.80	323.10	2.30	White coarse grained sandstone with grey shale bands.
323.10	323.70	0.60	<u>COAL.</u>
323.70	325.50	1.80	White coarse grained sandstone with grey shale bands.
325.50	331.30	5.80	Grey shale, sandy .
331.30	335.05	3.75	Greyish white gritty sandstone.
335.05	341.22	6.17	Grey shale.
341.22	342.82	1.60	Greyish white pebbly sandstone with grey shale bands.
342.82	343.00	0.18	Carb. shale with thin coal bands.
343.00	343.72	0.72	<u>COAL.</u>
343.72	344.72	1.00	Carb. shale .
344.72	357.65	12.93	Interbanded grey shale and pebbly Sst.
357.65	358.75	1.10	<u>COAL.</u>
358.75	363.88	5.13	Interbanded grey shale and coarse grained sandstone .
363.88	365.00	1.12	<u>COAL</u> with bands .
365.00	367.25	2.25	Grey shale.
367.25	382.35	15.10	Greyish white peobly sandstone.
382.35	383.05	0.70	Grey shale .
383.05	385.08	2.03	White coarse grained sandstone.
385.08	387.20	2.12	<u>COAL.</u>
387.20	389.15	1.95	Grey shale .
389.15	393.80	4.65	White pebbly sandstone .
393.80	395.05	1.25	Grey shale .
395.05	395.50	0.45	<u>COAL.</u>
395.50	397.65	2.15	Dirty white coarse grained sandstone .

 Borehole No. RJB-12/RJBS-2 (Contd.)

397.65	401.00	3.35	<u>COAL.</u>
401.00	402.90	1.90	Dirty white coarse grained sandstone.
402.90	404.00	1.10	DO.
404.00	411.75	7.75	White coarse grained sandstone .
411.75	412.18	0.43	Carb. shale .
412.18	413.70	1.52	White coarse grained sandstone .
413.70	422.40	8.70	<u>COAL</u> with bands.
422.40	422.90	0.50	Alternation of dark grey silty shale and sandstone ,.
422.90	423.70	0.80	Dark grey to black silty shale .
423.70	425.17	1.47	Carbonaceous sandstone with grey arenaceous shale at bottom .
425.17	428.02	2.85	White coarse to pebbly sandstone with silty shale band.
428.02	428.27	0.25	Argillaceous sandstone with thin shaly coal bands at top.
428.27	428.40	0.13	<u>COAL</u> with carb.shale bands.
428.40	432.15	3.75	White gritty sandstone .
432.15	432.45	0.30	<u>CLEAN BANDED COAL</u> .
432.45	433.60	1.15	Intercalation of sandstone and shale.
433.60	438.55	4.95	White coarse to gritty sandstone .
438.55	438.85	0.30	<u>CLEAN BANDED COAL</u> .
438.85	441.12	2.27	White fine to coarse grained sandstone with grey shale bands.
441.12	441.35	0.23	<u>CLEAN BANDED COAL</u> .
441.35	444.00	2.65	White interbanded pebbly sandstone with thin black silty shale at top.
444.00	446.20	2.20	<u>COAL.</u>
446.20	448.48	2.28	Intercalation of fine grained sandstone and grey shale .
448.48	449.56	1.08	White gritty sandstone .
449.56	451.08	1.52	Grey shaly sandstone with thin laminations of coarse grained sandstone and carb. shale .
451.08	452.50	1.42	White coarse to gritty sandstone with lenses of coal .
452.50	454.40	1.90	<u>COAL</u> .
454.40	459.00	4.60	White medium grained sandstone with dark grey shaly sandstone at top .
459.00	462.90	3.90	<u>COAL.</u>
462.90	466.90	4.00	White gritty sandstone with arenaceous grey shale and carb. shale .

1	2	3	4
<u>Borehole No. RJB-12/RJBS-2 (Contd).</u>			
466.90	469.37	2.47	<u>COAL</u> with bands .
469.37	470.10	0.73	Grey shale .
470.10	479.20	9.10	<u>COAL</u> .
479.20	481.50	2.30	White coarse grained sandstone with carb.shale bands.
481.50	492.46	10.96	<u>COAL</u> with bands .
492.46	493.10	0.64	Grey shale .
493.10	496.60	3.50	<u>COAL</u> .
496.60	499.00	2.40	Alternation of sandstone and carb. siltstone .
499.00	499.90	0.90	Carb. shale .
499.90	502.55	2.65	White coarse grained sandstone with coal laminations (fractured) .
502.55	503.50	0.95	Alternation of coarse grained sandstone and carb. shale .
503.50	506.50	3.00	<u>COAL</u> .
506.50	508.20	1.70	Alternation of sandstone/carb, shale.
508.20	511.05	2.85	Carb. shale with thin coal bands.
511.05	511.65	0.60	Carb. shale .
511.65	513.70	2.05	White coarse grained sandstone, sometimes in a carb. matrix .
513.70	514.43	0.73	Carb. shale .
514.43	518.00	3.57	White coarse grained sandstone with shale bands.
518.00	518.25	0.25	<u>COAL</u> .
518.25	523.90	5.75	White coarse grained sandstone with a band of carb. sandstone at top.
523.90	524.85	0.95	Carb. shale with bands of coal .
524.85	526.85	2.00	White coarse to gritty sandstone .
526.85	527.05	0.20	Carb. shale with coal bands.
527.05	527.77	0.72	Dark grey siltstone .
527.77	532.00	4.23	White very coarse to granular sandstone with shale bands.

Borehole closed at 532.00m.

1	2	3	4
<u>Borehole No. RJBS - 3 (Contd.)</u>			
41.45	43.85	2.40	Well bedded fine grained sandstone .
43.85	44.95	1.10	<u>COAL</u> .
44.95	49.29	4.34	White fine to coarse grained sandstone with carb.shale and a siderite band.
49.29	50.80	1.51	<u>COAL</u> with bands .
50.80	52.80	2.00	Dirty white fine grained well laminated cross bedded sandstone with 0.07m. coal at bottom.
52.80	53.05	0.25	White coarse grained sandstone with coal streaks and fragments of coal .
53.05	53.40	0.35	<u>COAL</u> .
53.40	54.35	0.95	White fine grained sandstone with siderite streaks and thin bands of g gritty sandstone .
54.35	55.76	1.41	<u>COAL</u> .
55.76	56.70	0.94	Intercalation of fine grained sandstone and minor grey silty shale and coal bands .
56.70	57.90	1.20	Alternation of well laminated fine grained sandstone and grey shale .
57.90	58.28	0.38	<u>COAL</u> .
58.28	59.62	1.34	Coarse grained sandstone, Massive .
59.62	66.50	6.88	<u>COAL</u> with bands .
66.50	67.90	1.40	Well laminated interbedded sandstone with minor grey silty shale .
67.90	68.15	0.25	<u>COAL</u> with siderite bands .
68.15	74.20	6.05	Grey silty shale with lenses of fine grained sandstone .
74.20	78.90	4.70	Well laminated fine grained sandstone with 1.29m. white massive sandstone in the middle .
78.90	79.20	0.30	<u>SHALY COAL</u> .
79.20	80.78	1.58	Intercalation of sandstone and shale with argillaceous sandstone at bottom.
80.78	81.83	1.05	<u>COAL</u> with bands .
81.83	82.23	0.40	Grey shale .
82.23	84.93	2.70	<u>COAL</u> .
84.93	85.49	0.56	Grey shale .
85.49	86.48	0.99	<u>COAL</u> with bands.
86.48	87.70	1.22	Coaly shale/grey shale with coal bands .
87.70	88.32	0.62	Grey shale .

1	2	3	4
<u>Borehole No. RJBS - 3 (Contd.)</u>			
88.32	89.76	1.44	Carbonaceous and argillaceous sandstone with black shale at bottom .
89.76	91.12	4.36	<u>COAL</u> .
94.12	94.51	0.39	Grey shale .
94.51	95.85	1.34	<u>COAL</u> with bands .
95.85	96.85	1.00	Dirty white medium to gritty and well laminated sandstone/and silty shale .
96.85	100.40	3.55	<u>COAL</u> with bands .
100.40	103.10	2.70	Dirty white coarse grained sandstone with grey silty shale .
103.10	105.33	2.23	<u>COAL</u> with bands.
105.33	105.88	0.55	Well laminated fine to medium grained sandstone with grey shale at top .
105.88	106.03	0.15	Grey fine grained argillaceous sandstone.
106.03	106.66	0.63	Dirty white coarse grained sandstone with siderite band and coal .
106.66	108.67	2.01	Dark grey to black shale and fine grained argillaceous sandstone .
108.67	109.05	0.38	<u>DULL COAL</u> with grey shale bands .
109.05	110.05	1.00	Grey siltstone .
110.05	112.00	1.95	White pebbly sandstone .
112.00	112.65	0.65	Well laminated sandstone .
112.65	114.34	1.69	Dirty white cross laminated medium to coarse grained sandstone .
114.34	114.89	0.55	Grey siltstone .
114.89	115.56	0.67	Fine to medium grained well bedded sandstone .
115.56	119.78	4.32	Grey to dirty white gritty to pebbly sandstone .
119.78	120.22	0.44	<u>COAL</u> with arenaceous black shale . .
120.22	121.88	1.66	Interlamination of grey shale and white fine grained sandstone .
121.88	122.01	0.13	<u>CLEAN BANDED COAL</u> .
122.01	123.95	1.94	Intercalation of fine grained sandstone and grey shale .
123.95	124.60	0.65	Grey siltstone .
124.60	125.85	1.25	Gritty to pebbly sandstone .
125.85	126.20	0.35	<u>CLEAN BANDED COAL</u> .
126.20	127.10	0.90	Interlaminated sandstone and grey shale .
127.10	127.55	0.45	<u>COAL</u> .

1	2	3	4
<u>Borehole No. RJBS - 3 (Contd.)</u>			
127.55	128.20	0.65	Intercalation and fine grained sandstone and grey shale/siltstone .
128.20	128.78	0.58	Carbonaceous pebbly sandstone with grey siltstone at top .
128.78	128.87	0.09	<u>COAL</u> .
128.87	129.00	0.13	Grey silty shale with siderite lamination .
129.00	129.29	0.29	<u>COAL</u> .
129.29	130.90	1.61	Dark grey to black shale often arenaceous with coal bands .
130.90	132.45	1.55	Gritty to pebbly sandstone .
132.45	133.00	0.55	<u>COAL</u> .
133.00	133.52	0.52	Intercalation of grey shale and minor sandstone .
133.52	134.44	0.92	Well laminated fine grained sandstone with minor carb.shale (core dip - 9°).
134.44	136.50	2.06	Gritty to pebbly sandstone .
136.50	137.04	0.54	Intercalation of sandstone and grey shale and clayey shale at bottom .
137.04	137.92	0.88	Dirty white fine to medium grained sandstone with wavy bands .
137.92	139.00	1.08	Well laminated fine grained sandstone with shale and siltstone .
139.00	139.60	0.60	Grey shale with coal interlaminated with siderite .
139.60	139.80	0.20	Carbonaceous sandstone .
139.80	140.68	0.88	White coarse grained sandstone .
140.68	141.18	0.50	Alteration of fine grained sandstone .
141.18	141.78	0.60	White coarse grained sandstone .
141.78	142.31	0.53	Coaly shale .
142.31	145.70	3.39	Alternate bands of white medium to coarse grained sandstone and carb. shale .
145.70	147.70	2.00	White very coarse to pebbly sandstone .
147.70	149.10	1.40	Alternation of fine grained sandstone and shale .
149.10	149.60	0.50	Silicified sandstone .
149.60	150.85	1.25	Alternation of fine grained sandstone and shale .
150.85	152.53	1.68	White coarse grained sandstone .
152.53	152.88	0.35	Carb. shale with coal bands .
152.88	153.16	0.28	<u>COAL</u> .

1	2	3	4
<u>Borehole No. RJBS - 3 (Contd.)</u>			
153.16	153.96	0.80	Carb. siltstone .
153.96	155.10	1.24	Intercalation of coarse grained sandstone and carb. shale/siltstone.
155.10	155.40	0.30	<u>Shal</u> <u>COAL</u> .
155.40	156.90	1.50	Carb. siltstone .
156.90	159.68	2.78	White coarse grained sandstone with bands of shale .
159.68	161.74	2.06	Carbonaceous sandstone .
161.74	163.06	1.32	White coarse grained sandstone with shale bands.
163.06	163.90	0.84	Carbonaceous sandstone .
163.90	166.00	2.10	<u>COAL</u> .
166.00	168.00	2.00	Alternation of sandstone and shale .
168.00	181.10	13.10	White very coarse to pebbly sandstone with bands of shale .
181.10	182.17	1.07	Black carb. shaly sandstone with minor coal bands .
182.17	187.05	4.88	White very coarse to pebbly sandstone with occasional shale bands .
187.05	187.80	0.75	Carbonaceous siltstone .
187.80	188.17	0.37	Argillaceous sandstone .
188.17	188.79	0.62	Carbonaceous siltstone with very coarse to pebbly sandstone at top .
188.79	190.15	1.36	Alternation of fine grained sandstone and shale .
190.15	190.99	0.84	Dirty white fine to pebbly sandstone .
190.99	192.14	1.15	Carb. shale with coal bands.
192.14	193.12	0.98	Carbonaceous sandstone .
193.12	196.17	3.05	White very coarse to pebbly sandstone .
196.17	203.60	7.43	<u>COAL</u> .
203.60	205.50	1.90	Alternation of shale and sandstone.
205.50	208.55	3.05	Alternate bands of carb. sandstone and shale .
208.55	212.00	3.45	Dirty white coarse grained sandstone and minor shale bands .
212.00	216.66	4.66	<u>COAL</u> .
216.66	218.88	2.22	Alternation of sandstone and shale .
218.88	219.22	0.34	<u>COAL</u> .
219.22	225.00	5.78	Alternate bands of carb. siltstone and coarse to fine grained sandstone with shale laminations .
225.00	225.74	0.74	White coarse grained sandstone .

1	2	3	4
<u>Borehole No. RJBS - 3 (Contd.)</u>			
225.74	226.00	0.26	<u>COAL</u> .
226.00	227.82	1.82	Alternate band of white coarse grained sandstone and carb. siltstone .
227.82	231.26	2.44	Intercalation of coarse grained sandstone and shale .
230.26	231.10	0.84	Carbonaceous sandstone .
231.10	232.55	1.45	White coarse grained sandstone with coal laminations .
232.55	233.65	1.10	<u>COAL</u> with bands .
233.65	252.00	18.35	Alternation of sandstone and shale .
252.00	261.25	9.25	Light grey to white very coarse to pebbly sandstone with bands of grey shale .
261.25	263.80	2.55	Light grey shaly sandstone with bands of coal & shale .
263.80	264.65	0.85	Grey sandy shale .
264.64	267.55	2.90	White medium to coarse grained sandstone shaly at top .
267.55	272.75	5.20	Greyish white gritty to pebbly sandstone .
272.75	275.60	2.85	White medium to coarse grained sandstone shaly at places, micro faulting noted .
275.60	283.68	8.08	Greyish white gritty to pebbly sandstone with lenses of coal & shale .
283.68	285.50	1.82	Grey sandy shale with a 0.12m. coal band.
285.50	286.05	0.55	Light grey shaly sandstone .
286.05	287.25	1.20	Light grey gritty to pebbly sandstone .
287.25	288.40	1.15	Grey shaly sandstone .
288.40	290.30	1.90	Greyish white gritty to pebbly sandstone.
290.30	293.75	3.45	Light grey shaly sandstone with a band of gritty to pebbly sandstone .
293.75	294.05	0.30	<u>SHALY COAL</u> .
294.05	298.30	4.25	Greyish white gritty to pebbly sandstone, shaly towards top .
298.30	298.90	0.60	Shaly sandstone with a 0.12m. brown quartzitic sandstone (affected by lamprophyre ?).
298.90	303.58	4.68	Greyish white gritty to pebbly sandstone with larger fragments of quartz.

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1	2	3	4
<u>Borehole No. - RJBS - 3 (Contd.)</u>			
303.58	303.91	0.33	Grey shaly sandstone .
303.91	304.28	0.37	<u>SHALY COAL</u> .
304.28	306.43	2.15	Grey shaly sandstone .
306.43	306.69	2.26	Grey coarse to gritty sandstone shaly at places.
308.69	308.93	0.24	<u>COAL</u> .
308.93	309.84	0.91	Light grey shaly sandstone .
309.84	310.34	0.50	Brownish hard quartzitic sandstone .
310.34	314.42	4.08	White gritty to pebbly sandstone with carb. matrix.
314.42	316.06	1.64	Medium to coarse grained micaceous sandstone .
316.06	325.70	9.64	Grey to light grey gritty to pebbly sandstone, shaly at places.
325.70	326.20	0.50	Grey fine to medium grained shaly sandstone .
326.20	367.20	41.00	Light greyish white gritty to pebbly conglomeratic sandstone with bands of shaly sandstone .

BOREHOLE CLOSED AT 367.20 m.

I/18

BOREHOLE NO. RJBS - 4

Location : Lat : 24° 05' 45" R. L. : 89.92m.
 Long: 87° 34' 15" Unit No. 130 .
 Katpahari Village . Driller:A.J. Chakraborty
 Date of Commencement : 2.9.1985 Logged by : D.N. Bandyopadhyay,
 Date of Closing : February '86 & A. K. Das .
 Total Depth : 375.90m.

From (m)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	20.85	20.85	Sludge .
20.85	24.85	4.00	Greyish white gritty sandstone, pebbly at places with grey siltstone at bottom .
24.85	25.55	0.70	Grey fine grained sandstone .
25.55	26.53	0.98	Yellow to greyish white medium to coarse grained sandstone .
26.53	49.50	22.97	Greyish white gritty to pebbly sandstone .
49.50	59.50	10.00	Grey shaly sandstone .
59.50	60.05	0.55	Greyish white fine grained sandstone with shale laminations .
60.05	68.08	8.03	Grey shale sandy with bands of fine to medium grained sandstone .
68.08	69.35	1.27	Carb.shale with thin bands of coal .
69.35	80.70	11.35	Alternate bands of grey sandy shale and fine to medium grained sandstone, core dip - 12°, core broken at places.
80.70	84.00	3.30	Dirty white coarse to very coarse grained sandstone .
84.00	85.80	1.80	Grey sandy shale .
85.80	86.50	0.70	Light grey medium grained sandstone .
86.50	90.05	3.55	Dirty white, coarse to very coarse grained sandstone .
90.05	92.55	2.05	Grey to dark grey sandy shale , carb. at places .
92.55	93.10	0.55	Grey fine to very fine grained sandstone .
93.10	94.60	1.50	Interbanded and interlaminated sandy shale and fine grained sandstone .
94.60	96.37	1.77	Dirty white coarse to very coarse grained sandstone, felspathic with few thin lenses of coal .

1	2	3	4
<u>Borehole No. RJBS - 4 (Contd.)</u>			
96.37	97.05	0.68	Carb.shale with 0.10m. shaly coal band at top, sandy towards bottom .
97.05	98.10	1.05	Inte.laminated sandy shale/fine grained sandstone .
98.10	99.90	1.80	Light grey fine to medium grained sandstone, shaly at top.
99.90	104.10	4.20	Dirty white coarse to very coarse grained sandstone, shaly at places with coal streaks.
104.10	104.95	0.85	Grey sandy shale .
104.95	106.40	1.45	Light grey fine grained sandstone, shaly at top .
106.40	109.25	2.85	Dirty white coarse to very coarse grained sandstone with interlaminated fine grained sandstone/grey sandy shale .
109.25	112.60	3.35	Alternation of grey shale and large grey medium grained sandstone.
112.60	113.70	1.10	Interlaminated light grey fine grained sandstone and grey shaly sandstone.
113.70	114.15	0.45	Dirty white medium to coarse grained sandstone.
114.15	125.70	11.55	Dirty white very coarse to extremely coarse grained sandstone with shale lamination at places.
125.70	127.95	2.25	Grey shale sandy with intercalation of shaly sandstone.
127.95	128.95	1.00	Interlamination of sandstone/shale .
128.95	132.15	3.20	Alternate bands of medium to coarse grained sandstone and shaly sandstone with grits at places.
132.15	138.55	6.40	Dirty white coarse to very coarse grained felspathic sandstone.
138.55	141.35	2.80	Grey shale, sandy with thin bands of very fine grained sandstone and carb.shale.
141.35	143.20	1.85	Light grey fine to medium grained sandstone .
143.20	143.85	0.65	Dirty white medium to coarse grained sandstone with a few streaks of carb. shale .
143.85	146.55	2.70	Dirty white very coarse grained sandstone with dark grey sandy shale at bottom .

1	2	3	4
<u>Borehole No. RJBS - 4 (Contd.)</u>			
146.55	149.00	2.45	Dirty white to large grey medium grained massive sandstone with intercalation of sandy shale at places.
149.00	149.80	0.80	Grey sandy shale .
149.80	150.60	0.80	Carb.shale with coal bands .
150.60	151.20	0.60	Dirty white coarse to very coarse grained sandstone (channel sandstone) with 0.15m. band of fine grained sandstone at bottom .
151.20	151.35	0.15	<u>SHALY COAL</u> .
151.35	152.25	0.90	Grey sandy shale .
152.25	157.80	5.50	Light grey medium grained sandstone with a few shale laminations,shaly at top.
157.80	163.00	5.20	Grey sandy shale with a few coal streaks.
163.00	164.80	1.80	Intercalation and interlamination of fine grained sandstone/sandy shale .
164.80	166.10	1.30	Light grey medium to very coarse grained sandstone with shale intercalation at places.
166.10	168.50	2.40	Grey shale, sandy at places.
168.50	168.70	0.20	<u>SHALY COAL</u> .
168.70	170.70	2.00	Dirty white coarse grained sandstone.
170.70	171.70	1.00	Grey sandy shale .
171.70	173.90	2.20	Grey siltstone (Broken).
173.90	176.30	2.40	Broken pieces of sandstone often carbonaceous .
176.30	177.30	1.00	Carb.shale .
177.30	178.30	1.00	Intercalation of sandstone and shale .
178.30	179.45	1.15	Dirty white coarse grained gritty sandstone .
179.45	180.45	1.00	Carb.shale .
180.45	182.45	2.00	Carbonaceous sandstone .
182.45	183.75	1.30	Dirty white medium grained sandstone .
183.75	184.20	0.45	Carb.shale with coal bands.
184.20	188.35	4.15	Coarse grained sandstone gritty at places with streaks of coal .
188.35	191.05	2.70	Carb. shale .

1	2	3	4
Borehole No. RJBS - 4 (Contd.)			
191.05	193.45	2.40	Dirty white-medium grained sandstone with minor shale bands.
193.45	195.70	2.25	Carb. shale with minor coal bands.
195.70	198.95	3.25	Steel grey carb. sandstone with shaly coal bands.
198.95	199.70	0.75	Grey shale.
199.70	203.30	3.60	Carb. shale with 0.10m. coal band.
203.30	205.00	1.70	Dirty white coarse grained sandstone with shale band.
205.00	210.90	5.90	Carbonaceous sandstone.
210.90	214.50	3.60	Carb. shale.
214.50	216.45	1.95	Carbonaceous sandstone with a thin band of coarse grained sandstone.
216.45	218.30	1.85	Carb. shale with thin coal bands.
218.30	221.00	2.70	Dirty white coarse grained sandstone with intercalation of grey shale.
221.00	223.55	2.55	Dark grey sandy shale.
223.55	224.60	1.05	White coarse grained sandstone.
224.60	228.60	4.00	Carb. shale with bands of carbonaceous sandstone.
228.60	242.70	4.10	Alternate bands of carb. shale and carb. sandstone.
242.70	242.85	0.15	SHALY COAL.
242.85	243.85	1.00	Carbonaceous sandstone.
243.85	246.70	4.85	Dirty white coarse grained sandstone.
248.70	249.70	1.00	Dark grey shale.
249.70	252.15	2.45	White coarse grained sandstone.
252.15	255.80	3.65	Alternate bands of carb. shale and carbonaceous sandstone.
255.80	262.90	7.10	Dirty white coarse to gritty sandstone.
262.90	269.95	7.05	Carb. sandstone mixed with dark grey shale, fractured core dip 60° - 70°.
269.95	272.35	2.40	Dirty white clayey siltstone.
272.35	273.95	1.60	Crushed carb. shale.
273.95	276.30	2.35	Carbonaceous sandstone and shale mixed up.

1	2	3	4
<u>Borehole No. RJBS - 4 (Contd.)</u>			
276.30	287.85	11.55	Light grey medium to coarse grained sandstone, carb. along fracture planes, bedding sheared along fractures.
287.85	291.85	4.00	Light grey fine grained sandstone with carb. sandstone bands.
291.85	294.85	3.00	Light grey coarse to very coarse grained sandstone.
294.85	300.00	5.15	Dirty white carbonaceous sandstone.
300.00	313.75	13.75	Dirty white very coarse to coarse grained sandstone .
313.75	319.00	5.25	Carbonaceous sandstone with grits.
319.00	320.55	1.55	Grey siltstone .
320.55	326.25	5.70	Dirty white coarse to medium grained sandstone .
326.25	327.25	1.00	Light grey fine grained sandstone silty at base .
327.25	328.25	1.00	Light grey to purplish clayey siltstone .
328.25	329.25	1.00	Intercalation of purple brown clay siltstone & fine grained sandstone .
329.25	343.85	14.60	Dirty white medium grained sandstone massive, coarse at places soft and friable and clayey at bottom.
343.85	350.85	7.00	Light grey friable med to fine grained clayey sandstone .
350.85	353.25	2.40	Grey fine grained sandstone with shale bands .
353.25	355.55	2.30	Grey fine to medium grained sandstone fracture plane has developed.
355.55	375.90	20.35	--- do ---

BOREHOLE CLOSED AT 375.90m.

1/23

BOREHOLE NO. RJBS - 5

Location : Lat : 24° 06' 24" R. L. : 103.60m.
 Long: 87° 33' 15" Driller : A. B. Bhowmik
 South of Kalichua Logged by: D.N. Bandyopadhyay
 Date of Commencement : September '85 A. K. & Das
 Date of Closing : 20.12.85 Unit : 181 .
 Total Depth : 305.00m.

From (m)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	5.50	5.50	Sludge of brownish clay.
5.50	5.63	0.13	Carb. shale .
5.63	6.25	0.62	<u>COAL, SHALY at top & bottom.</u>
6.25	7.00	0.75	Grey sandy shale with plant fossil & a band of shaly sandstone .
7.00	7.10	0.10	<u>SHALY COAL, broken .</u>
7.10	8.10	1.00	Grey sandy shale .
8.10	9.05	0.95	Light greyish white coarse to very coarse grained gritty sandstone.
9.05	9.70	0.65	Light grey shaly sandstone .
9.70	10.50	0.80	Grey shale, sandy at places.
10.50	13.30	2.80	Very coarse to gritty sandstone with minor bands of finer sandstone and shale .
13.30	14.50	1.20	Grey sandy shale .
14.50	14.57	0.07	<u>COAL</u> . . .
14.57	14.76	0.19	Grey shale with shaly sandstone at top, lenses of coal at bottom .
14.76	15.30	0.54	<u>COAL</u> .
15.30	24.42	9.12	Grey sandy shale with minor bands of shaly sandstone with 0.10m. calcite nodule/siderite .
24.42	25.83	1.41	<u>COAL</u> .
25.83	28.45	2.52	Grey sandy shale and shaly sandstone mixed.
28.45	28.92	0.47	<u>COAL</u> with shale bands .
28.92	30.17	1.25	Carb. shale with a 0.15m. shaly coal band .
30.17	31.50	1.33	<u>COAL</u> with shale bands .
31.50	32.50	1.00	Grey shaly sandstone .
32.50	34.65	2.15	Light grey to white fine grained felspathic sandstone with lenses of coal, gritty at places .

1	2	3	4
<u>Borehole No. RJBS - 5 (Contd.)</u>			
34.65	35.95	1.30	Alternate band of sandy shale and shaly sandstone .
35.95	40.80	4.85	Dirty white coarse grained sandstone .
40.80	42.50	1.70	Intercalation of shaly sandstone/ grey shale.
42.50	44.70	2.20	Grey sandy shale with 0.10m. greyish brown compact sandstone.
44.70	46.65	1.90	Light grey fine to medium grained sandstone .
46.65	47.56	0.91	Dirty white coarse to very coarse grained sandstone.
47.56	48.50	0.94	<u>COAL</u> with 0.03m. shale band .
48.50	51.90	3.40	Grey sandy, carbonaceous at places interlaminated with sandstone at top.
51.90	52.29	0.39	<u>COAL</u> .
52.29	53.60	1.31	Light grey fine to medium grained sandstone shaly at top .
53.60	54.38	0.78	Grey sandy shale, carbonaceous at bottom .
54.38	54.71	0.33	<u>COAL</u> .
54.71	55.77	1.06	Grey shale, sandy, coaly at places .
55.77	56.87	1.10	<u>COAL</u> , shaly towards bottom .
56.87	57.93	0.96	Carb. shale/grey shale with 0.04m. fine grained sandstone at bottom .
57.93	58.21	0.28	Carb. shale .
58.21	58.60	0.39	<u>COAL</u> .
58.60	59.56	0.96	Grey shale, carbonaceous at places .
59.56	60.45	0.89	<u>COAL</u> .
60.45	67.50	7.05	Light grey medium to coarse grained massive sandstone with 0.06m. coal at top .
67.50	69.36	1.86	<u>COAL</u> .
69.36	69.79	0.43	Grey sandy shale .
69.79	70.14	0.35	<u>COAL, SHALY</u> .
70.14	74.11	3.97	Grey sandy shale interlaminated with sandstone .
74.11	74.40	0.29	<u>COAL</u> .
74.40	74.81	0.41	Carb. shale .
74.81	75.85	1.04	<u>COAL, SHALY</u> at places .
75.85	76.52	0.67	Light grey fine to medium grained sandstone .

1	2	3	4
<u>Borehole No. RJBS - 5 (Contd.)</u>			
76.52	77.62	1.10	Light grey coarse to very coarse grained felspathic sandstone with minor carb. shale bands .
77.62	78.67	1.06	Light grey fine to medium grained sandstone .
78.67	79.09	0.42	<u>COAL, SHALY</u> .
79.09	79.57	0.45	Intercalation of shale/sandstone.
79.57	79.67	0.10	Dark grey carb. shale.
79.67	80.05	0.38	<u>COAL, SHALY at places</u> .
80.05	80.79	0.74	Carb. shale .
80.79	81.23	0.44	<u>COAL</u> .
81.23	81.60	0.37	Grey shale , carb. at places .
81.60	82.06	0.46	Light grey fine grained shaly sandstone.
82.06	82.90	0.84	<u>COAL</u> with carb. shale band .
82.90	84.58	1.68	Dirty white very coarse grained felspathic sandstone, finer towards bottom .
84.58	85.03	0.45	<u>COAL</u> .
85.03	86.05	1.02	Light grey medium grained sandstone .
86.05	86.60	0.55	<u>COAL</u> .
86.60	87.30	0.70	Grey shale carbonaceous at top .
87.30	94.88	7.58	<u>COAL</u> with bands .
94.88	95.88	1.00	Intercalation of shale and sandstone .
95.88	96.46	0.58	Carb. shale with coal bands .
96.46	96.85	0.39	Interlamination of shale and sandstone.
96.85	100.80	3.95	Dirty white coarse grained sandstone .
100.80	101.14	0.34	<u>COAL</u> .
101.14	102.60	1.46	White medium to coarse grained sandstone with minor shale band .
102.60	103.00	0.40	<u>COAL</u> .
103.00	104.76	1.76	White coarse grained sandstone .
104.76	105.99	1.23	<u>COAL</u> .
105.99	108.50	2.51	Dirty white coarse grained sandstone.
108.50	108.83	0.33	Carb. shale .
108.83	109.29	0.46	<u>COAL</u> .
109.29	109.83	0.54	Carb. shale .
109.83	110.18	0.35	<u>COAL</u> .

1	2	3	4
<u>Borehole No. RJBS - 5 (Contd.)</u>			
110.18	111.18	1.00	White medium to coarse grained sandstone.
111.18	112.29	1.11	Carb. shale with coal band .
112.29	1.2.57	0.28	<u>COAL</u> .
112.57	113.00	0.43	Carb. shale .
113.00	117.00	4.00	White coarse grained sandstone .
117.00	119.10	2.10	<u>COAL</u> .
119.10	120.50	1.40	White medium grained sandstone .
120.50	121.30	0.80	<u>COAL</u> .
121.30	122.90	1.60	White coarse grained sandstone .
122.90	124.35	1.45	<u>COAL with bands</u> .
124.35	130.35	6.00	White coarse grained sandstone .
130.35	131.90	1.55	<u>COAL</u> .
131.90	137.75	5.85	Dirty white coarse grained sandstone .
137.75	138.35	0.60	<u>COAL</u> .
138.35	140.62	2.27	White medium to coarse grained sandstone .
140.62	141.25	0.63	<u>COAL</u> .
141.25	145.59	4.34	White coarse to very coarse grained sandstone .
145.59	149.75	4.16	<u>COAL</u> .
149.75	151.00	1.25	Dirty white coarse grained sandstone .
151.00	155.90	4.90	<u>COAL with bands</u> .
155.90	156.60	0.70	Medium grained sandstone and shale .
156.60	169.15	12.55	Milk white very coarse to pebbly hard felspathic sandstone with grey shale band .
169.15	170.50	1.35	Alternation of sandstone and dark grey shale .
170.50	173.45	2.95	White very coarse to pebbly sandstone with coal streaks .
173.45	173.95	0.50	Black siltstone .
173.95	174.75	0.80	Alternation of shale and fine grained sandstone .
174.75	180.45	5.70	White coarse to pebbly sandstone .
180.45	182.20	1.75	Grey siltstone .
182.20	211.60	29.40	White medium grained sandstone .
211.60	215.60	4.00	White coarse to gritty sandstone .

Borehole No. RJBS - 5 (Contd.)

215.60	217.80	2.20	Alternate bands of white coarse grained sandstone/black siltstone .
217.80	218.40	0.60	Carb. shale .
218.40	219.00	0.60	Intercalation of coarse grained sandstone/grey shale .
219.00	219.85	0.85	Grey siltstone .
219.85	223.26	3.41	Intercalation of coarse grained sandstone and grey shale .
223.26	224.10	0.84	White fine grained sandstone .
224.10	224.80	0.70	Dirty white coarse grained sandstone
224.80	227.15	2.35	Alternation of fine grained sandstone and grey shale .
227.15	227.50	0.35	Carb. shale .
227.50	228.40	0.90	White medium grained sandstone with intercalation of shale .
228.40	229.40	1.00	Grey shale .
229.40	243.90	14.50	Green fine to medium grained micaceous sandstone .
243.90	249.50	5.60	Green siltstone .
249.50	256.15	6.65	Tree fine grained micaceous sandstone .
256.15	272.55	16.40	Greenish black micaceous siltstone .
272.55	290.10	17.55	Green to greenish black shale .
290.10	292.20	2.10	Black shale with sandstone fragments.
292.20	297.40	5.20	Dark grey to black shale .
297.40	305.00	7.60	Metamorphics .

BOREHOLE CLOSED AT 305.00m.

1	2	3	4
<u>Borehole No. RJBS - 6 (Contd.)</u>			
54.65	55.50	0.85	Greyish white shaly sandstone .
55.50	58.15	2.65	<u>COAL</u> .
58.15	59.05	0.90	Grey shale with thin bands of coal .
59.05	59.70	0.65	<u>COAL</u> .
59.70	60.75	1.05	Grey shale with a band of medium grey sandstone.
60.75	61.28	0.53	Dirty white coarse to gritty felspathic sandstone .
61.28	61.83	0.55	<u>COAL</u> .
61.83	62.75	0.92	Light grey shaly sandstone .
62.75	75.30	12.55	<u>COAL</u> .
75.30	76.30	1.00	Light grey shaly sandstone .
76.30	76.80	0.50	<u>COAL</u> .
76.80	77.70	0.90	Greyish white medium grained sandstone .
77.70	82.83	5.13	Grey shale .
82.83	86.10	3.27	Greyish white fine to medium grained sandstone .
86.10	89.00	2.90	Grey shale with 0.05m. coal at bottom.
89.00	90.03	1.03	Greyish white fine to medium grained sandstone .
90.03	91.98	1.95	Dirty white coarse gritty felspathic sandstone with grey shale at top.
91.98	92.48	0.50	<u>SHALY COAL</u> .
92.48	92.65	0.17	Grey shale .
92.65	98.24	5.59	<u>COAL, shaly at places</u> .
98.24	98.65	0.41	Grey shale .
98.65	99.60	0.90	Grey shaly sandstone .
99.60	100.72	1.12	Grey shale .
100.72	101.17	0.45	<u>COAL, SHALY at places</u> .
101.17	103.29	2.12	Greyish white medium to coarse grained sandstone.
103.29	103.74	0.45	<u>COAL</u> .
103.74	105.45	1.71	Light grey to greyish white medium grained sandstone with bands of grey shale at places .
105.45	105.92	0.47	<u>COAL</u> .
105.92	106.65	0.73	Grey shale with a 0.15m coal band in the middle .
106.65	113.85	7.20	<u>COAL</u> with shale bands at places .

1	2	3	4
<u>Borehole No. RJBS - 6 (Contd.)</u>			
113.85	116.65	2.80	Light grey fine to medium grained sandstone with grey shale bands at places .
116.65	117.20	0.55	<u>COAL</u> .
117.20	121.90	4.70	Greyish white medium to coarse grained felspathic sandstone .
121.90	122.50	0.60	<u>SHALY COAL</u> .
122.50	124.02	1.52	Greyish white fine to medium grained sandstone .
124.02	125.32	1.30	<u>COAL</u> , shaly at top .
125.32	125.64	0.32	Carbonaceous sandstone .
125.64	126.43	0.79	<u>SHALY COAL</u> .
126.43	127.22	0.79	Dirty white medium grained sandstone . with shaly bands .
127.22	127.53	0.31	<u>COAL</u> .
127.53	128.35	0.82	Interbanded shale/sandstone .
128.35	129.45	1.10	Carbonaceous shale .
129.45	131.70	2.25	Greyish white medium grained sandstone .
131.70	131.75	0.05	Grey shale .
131.75	133.47	1.72	<u>COAL</u> .
133.47	136.75	3.28	Carbonaceous sandstone .
136.75	139.65	2.90	<u>COAL</u> with bands .
139.65	142.15	2.50	Carbonaceous sandstone .
142.15	142.85	0.70	Carbonaceous shale .
142.85	147.20	4.35	Dirty white coarse grained sandstone .
147.20	148.17	0.97	<u>COAL</u> .
148.17	148.20	0.03	Grey shale .
148.20	152.50	4.30	White coarse grained sandstone with grey shale band .
152.50	154.60	2.10	<u>COAL</u> .
154.60	159.75	5.15	White coarse to very coarse grained felspathic sandstone with grey shale bands .
159.75	159.83	0.08	Grey shale .
159.83	163.50	3.67	<u>COAL</u> .
163.50	164.25	0.75	Carbonaceous siltstone .
164.25	164.65	0.40	<u>COAL</u> .
164.65	165.00	0.35	Carb. Shale .
165.00	166.62	1.62	<u>COAL</u> .

1	2	3	4
<u>Borehole No. RJB3 - 6 (Contd.)</u>			
166.62	183.55	16.93	White very coarse to pebbly feldspathic sandstone .
183.55	183.69	0.14	Grey shale .
183.69	190.00	12.31	<u>COAL</u> , shaly at top .
196.00	212.60	16.60	White very coarse to pebbly feldspathic sandstone with occasional shale bands.
212.60	224.70	12.10	<u>COAL</u> with bands .
224.70	225.90	1.20	Grey siltstone .
225.90	230.10	4.20	White coarse grained sandstone .
230.10	258.50	28.40	White very coarse to pebbly sandstone with grey shale bands .
258.50	259.70	1.20	Dirty white fine grained sandstone .
259.70	260.03	0.33	<u>SHALY COAL</u> .
260.03	264.20	4.17	Dirty white fine to medium grained sandstone with minor dark grey silty shale .
264.20	266.20	2.00	Black carbonaceous sandstone .
266.20	268.40	2.20	White gritty to pebbly sandstone .
268.40	274.80	6.40	White medium to fine grained sandstone with minor change of pebbly part .
274.80	275.85	1.05	Dirty grey to black shale .
275.85	277.35	1.50	Intercolation of fine grained sandstone/grey shale .
277.35	280.50	3.15	Dirty white gritty to pebbly sandstone .
280.50	281.00	0.50	Dirty grey silty shale .
281.00	285.45	4.45	Dirty white medium grained sandstone .
285.45	286.35	0.90	Dark grey silty shale .
286.35	286.90	0.55	White medium grained sandstone .
286.90	287.90	1.00	Well laminated fine grained sandstone.
287.90	288.90	1.00	Black carb. shale, minor shaly coal band at top .
288.90	291.45	2.55	Dirty white coarse to gritty sandstone.
291.45	297.60	6.15	<u>COAL/SHALY COAL</u> .
297.60	300.50	2.90	Dirty grey coarse to gritty sandstone with grey shale bands .
300.50	302.00	1.50	White fine grained sandstone .
302.00	304.40	2.40	White coarse to gritty sandstone .

1	2	3	4
<u>Borehole No. RJBS - 6 (Contd.)</u>			
304.40	307.25	2.85	Interlaminated sandstone/shale.
307.25	309.00	1.75	Dirty white gritty to pebbly sandstone.
309.00	311.05	2.05	Light grey fine grained well laminated sandstone .
311.05	313.25	2.20	Dirty white coarse grained sandstone .
313.25	314.11	0.86	<u>COAL</u> .
314.11	314.20	0.09	Grey shale .
314.20	315.20	1.00	Well laminated fine grained sandstone.
315.20	320.80	5.60	White gritty to pebbly sandstone .
320.80	322.80	2.00	Well laminated fine grained sandstone.
322.80	327.90	5.10	Thick bedded pebbly sandstone with minor shale band .
327.90	328.71	0.81	<u>COAL</u> .
328.71	330.31	1.60	Grey shale .
330.31	331.00	0.69	<u>COAL</u> .
331.00	331.40	0.40	Fine grained, dirty white sandstone .
331.40	334.05	2.65	<u>COAL</u> .
334.05	335.75	1.70	Dirty white coarse to gritty sandstone, pebbly at bottom .
335.75	337.75	2.00	Well laminate fine grained sandstone .
337.75	341.15	3.40	White coarse to pebbly sandstone .
341.15	341.50	0.35	<u>SHAL</u> <u>COAL</u> .
341.50	342.60	1.10	Carbonaceous sandstone .
342.60	344.30	1.70	Carb. sandstone with clasts.
344.30	345.30	1.00	Dirty white fine to medium grained sandstone .
345.30	350.15	4.85	White coarse to gritty sandstone .
350.15	351.75	1.60	Dirty white medium to coarse sandstone.
351.75	354.00	2.25	Interbanded fine grained sandstone/shale .
354.00	355.55	1.55	White coarse grained sandstone .
355.55	356.30	0.75	Dark grey silty shale .
356.30	361.85	5.55	Dirty white medium grained sandstone.
361.85	362.85	1.00	Carbonaceous sandstone with clasts .

I/33

1	2	3	4
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Borehole No. RJBS - 6 (Contd.)

362.85	386.05	23.20	White thick bedded coarse to gritty sand tone .
386.05	390.40	4.35	Dark grey silty clay .
390.40	396.20	5.80	White hard coarse grained sandstone with minor faults .
396.20	444.65	48.45	White coarse grained hard sandstone .
444.65	447.70	3.05	Alternate carbonaceous shale/sandstone .
447.70	451.00	3.30	White coarse grained sandstone with grey shale bands .

BOREHOLE CLOSED AT 451.00m.



I/34

BOREHOLE NO. RJBS - 7

Location : Lat : 24° 06' 15" R. L. : 109.92m.

Long: 87° 33' 37" Unit No.: 181

SE of Kalichua Village. Driller: A. B. Bhowmik .

Date of Commencement : 1.5.86 Logged by: D.N. Bandyopadhyay

Date of Closing : 5.7.86 &
A. K. Das

Total depth : 260.00m.

From (-)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	5.50	5.50	Sludge of loose sand.
5.50	7.30	1.80	Argillaceous sandstone .
7.30	8.20	0.90	Pink sandy shale .
8.20	14.60	6.40	Variiegated colour gritty to pebbly sandstone with minor shale bands.
14.60	15.70	1.10	Grey shale with clusts.
15.70	20.35	4.65	Dirty white medium to coarse grained sandstone with thin grey shale band.
20.35	21.12	0.77	Greyish black sandy shale .
21.12	26.71	5.59	Light yellow medium to coarse grained sandstone with thin dark grey shale .
26.71	27.36	0.65	Gre: sandy shale .
27.36	36.10	8.84	Dirty white medium to coarse grained sandstone with bands of carb.siltstone .
36.10	37.50	1.40	Carb. shale .
37.50	38.50	1.00	Intercalation of fine grained sandstone/ dark grey shale .
38.50	40.35	1.85	Carbonaceous arenaceous shale .
40.35	40.90	0.55	<u>COAL</u> .
40.90	41.50	0.60	Carb. shale .
41.50	43.40	1.90	Carb. sandstone .
43.40	44.25	0.85	<u>COAL</u> .
44.25	48.26	4.01	Alternation of medium grained sandstone and grey shale .
48.26	53.63	5.37	Dirty white coarse to gritty sandstone with clusts .
53.63	64.34	10.71	White coarse to gritty sandstone with bands of carb. shale .
64.34	65.24	0.90	Dirty white fine to medium grained sandstone .

1	2	3	4
<u>Borehole No. RJBS - 7 (Contd.)</u>			
65.24	67.70	2.46	Alternation of fine grained sandstone/ grey shale .
67.70	69.20	1.50	Dirty white coarse grained sandstone with grey shale bands .
69.20	70.20	1.00	White fine grained sandstone .
70.20	74.20	4.00	Dirty white coarse gritty sandstone with coal laminations .
74.20	75.55	1.35	Dark grey sandy shale with coal bands.
75.55	78.68	3.13	Dirty white medium grained sandstone with greyish black siltstone bands .
78.68	82.48	3.80	Carb. shale, early at bottom .
82.48	85.03	2.55	Dirty white fine to medium grained sandstone with carb. sandy shale .
85.03	85.64	0.61	Carb. sandy shale .
85.64	86.57	0.93	Alternation of fine grained sandstone and grey shaly .
86.57	88.90	2.33	Black carb. siltstone .
88.90	96.87	7.97	White coarse to gritty sandstone with intercalation of dark grey shale .
96.87	98.60	1.73	Greyish black sandy shale .
98.60	99.02	0.42	Alternation of fine grained sandstone and dark grey shale .
99.02	101.16	2.14	Dirty white medium grained hard sandstone .
101.16	102.45	1.29	Carb sandstone with 0.08m. hard silicified sandstone at top.
102.45	104.77	2.32	Alternate bands of fine grained sandstone, dark grey shale .
104.77	108.60	3.83	Dirty white medium grained sandstone with bands of shale .
108.60	108.90	0.30	<u>SHALY COAL</u> .
108.90	110.90	2.00	Dark grey sandy shale, carb. at places with thin coal bands .
110.90	115.75	4.85	Dirty white coarse to gritty sandstone, cross bedded .
115.75	117.56	1.81	Dirty white argillaceous sandstone fractured at bottom .
117.56	122.00	3.44	Dirty white medium grained hard sand- stone, fractured with thin coal band. ---- Fault (?) .
122.00	123.50	1.50	Dirty white coarse to gritty sandstone with clasts .

1	2	3	4
<u>Borehole No. RJBS - 7 (Contd.)</u>			
123.50	125.30	1.80	<u>COAL</u> .
125.30	131.10	2.80	Blac sandy shale .
123.10	129.90	1.80	Alternation of fine grained sandstone and shale .
129.90	132.90	3.00	Dirty white coarse to gritty sandstone with coal laminations .
132.90	135.65	2.75	Alternation of fine grained sandstone and shale .
135.65	138.55	2.90	Dirty white coarse to gritty sandstone .
138.55	139.25	0.70	<u>COAL</u> .
139.25	140.65	1.40	Dark grey sandy shale .
140.65	146.60	5.95	Dirty white coarse grained sandstone with laminations of coal and shale .
146.60	146.85	0.25	<u>COAL</u> .
146.85	148.85	2.00	Dark grey sandy shale .
148.85	150.85	2.00	Carb. shale .
150.85	151.61	0.76	Grey sandy shale .
151.61	151.96	0.35	<u>COAL</u> .
151.96	152.45	0.49	Dark grey sandy shale, with coal band .
152.45	154.65	2.20	Dirty white coarse grained sandstone with dark grey shale .
154.65	155.15	0.50	<u>COAL</u> .
155.15	156.90	1.75	Alternation of medium grained sandstone and grey shale , Core dip - 50° .
156.90	157.75	0.85	Sandy shale .
157.75	162.35	4.60	Dirty white massive coarse to gritty sandstone with 0.50m. fine grained bedded sandstone at top .
162.35	163.00	0.65	Dark grey sandy shale with 0.30m. coal at bottom .
163.00	176.40	13.40	Light grey to brownish grey fine to medium grained sandstone and occasional shale bands, core broken at top. ---- Fault (?) .
176.40	177.90	1.50	Grey sandy shale to shaly sandstone .

1	2	3	4
<u>Borehole No. RJBS - 7 (Contd.)</u>			
177.90	188.20	10.30	Brownish grey to grey medium to coarse grained sandstone with sandy shale .
188.20	189.70	1.50	Alternation of fine grained sandstone and shale (Core dip - 50°).
189.70	198.45	8.75	Grey fine grained sandstone, bedded at places (Core dip - 60°).
198.45	206.00	7.55	Light grey medium grained sandstone with shale laminations showing micro faults .
206.00	219.55	13.55	Light grey medium grained sandstone with shale, micro fault noticed .
219.55	223.60	4.05	Alternate band of fine grained sandstone and coarse to medium grained sandstone with micro ripple (Core dip - 50°) .
223.60	232.00	8.40	Light grey fine grained sandstone and siltstone .
232.00	233.50	1.50	Alternate bands of dirty white sandstone and grey shale .
233.50	260.00	26.50	Broken pieces of light grey siltstone .

BOREHOLE CLOSED AT 260.00m.

1	2	3	4
<u>Borehole No. RJBS - 8 (Contd.)</u>			
72.32	72.72	0.40	Carb. shale .
72.72	73.45	0.73	<u>COAL</u> .
73.45	74.05	0.60	Dirty white fine grained sandstone, with grey shale band .
74.05	74.39	0.34	Black shale .
74.39	79.25	4.86	White coarse to gritty feldspathic sandstone with thin coal band .
79.25	79.69	0.44	<u>COAL</u> .
79.69	82.10	2.41	Alternate bands of fine grained sandstone/grey shale .
82.10	82.30	0.20	<u>COAL</u> .
82.30	87.95	0.65	Dark grey coarse to pebbly hard sandstone with bands of siltstone .
87.95	88.17	0.22	<u>COAL</u> .
88.17	92.35	4.18	Dirty white coarse to pebbly hard sandstone with a band of fine grained sandstone .
92.35	92.90	0.55	<u>COAL</u> with band .
92.90	93.10	0.20	Black sandy shale .
93.10	102.76	9.66	White coarse to pebbly hard feldspathic sandstone with minor shale band .
102.76	103.20	0.44	<u>COAL</u> with band .
103.20	103.35	0.15	Grey shale .
103.35	103.26	0.91	<u>COAL</u> .
104.26	104.34	0.08	Carb. shale .
104.34	104.67	0.33	<u>COAL</u> .
104.67	105.00	0.33	Grey shale .
105.00	105.20	0.20	Alternate bands of carb. shale and fine grained sandstone .
105.20	105.48	0.28	White coarse grained sandstone with coal band at top (0.1/200). .
105.48	106.85	1.25	<u>COAL</u> with bands .
106.85	107.85	1.00	Carb. shale .
107.85	110.30	2.45	Alternate bands of fine to medium grained sandstone/grey shale and siltstone .
110.30	111.30	1.00	Grey shale with a band of fine grained sandstone .
111.30	116.13	4.83	Dirty white coarse to pebbly hard sandstone with grey shale inter- calation .

1	2	3	4
<u>Borehole No. RJBS - 8 (Contd.)</u>			
116.13	116.94	0.81	Dark grey shale .
116.94	125.40	8.46	white coarse to pebbly sandstone with dark grey shale .
125.40	125.65	0.25	<u>COAL</u> .
125.65	134.90	9.25	White medium to coarse grained sandstone, pebbly at places with grey shale .
134.90	135.57	0.67	Grey shale/carb. shale .
135.57	147.07	11.50	White coarse to pebbly feldspathic sandstone with grey shale at top.
147.07	147.39	0.32	Grey sandy shale with 0.08m. coarse sandstone at bottom .
147.39	147.82	0.43	<u>COAL with band</u> .
147.82	156.10	8.28	White very coarse to pebbly feldspathic sandstone .
156.10	158.15	2.05	Light grey massive conglomeratic sandstone .
158.15	166.70	8.55	Dirty white medium to coarse grained massive sandstone with a few grits at places. ----- <u>Barakar</u> Talchir
166.70	168.75	2.05	Light grey with a pale bluish tint massive compact siltstone .
168.75	171.90	3.15	Alternate bands of coarse grained sandstone/siltstone .
171.90	194.10	22.20	Greyish white massive conglomeratic sandstone (pebbles of metamorphic rocks).
194.10	211.50	17.40	Alternations of coarse sandstone and greenish & purplish siltstone (Core dip - 12° - 15°).
211.50	215.60	4.10	Bouldery conglomerate (Boulders of metamorphic rocks, hornblende gneiss, granitic rocks).

BOREHOLE CLOSED AT 215.60m.

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
48.05	50.00	1.95	Greyish, coarse grained sandstone with clasts of coal and white sandstone bands .
50.00	51.50	1.50	Grey argillaceous sandstone with clasts .
51.50	56.30	4.80	Greenish grey, coarse grained sandstone with clasts and kaolinised feldspar; sometimes very coarse grained to gritty .
56.30	58.12	1.82	Mottled clay .
58.12	63.55	5.43	Mottled to white, gritty to coarse grained sometimes pebbly sandstone .
63.55	65.02	1.47	Mottled sandy clay .
65.02	69.00	3.98	Mottled, medium to coarse grained sandstone, occasionally gritty.
69.00	71.15	2.15	Mottled sandy shale to arenaceous grey to pinkish shale with intercalations of fine grained sandstone .
71.15	73.90	2.75	Hard and compact, fine grained to medium grained, occasionally gritty to very coarse grained, feldspathic sandstone with lamellae of greenish shale .
73.90	74.90	1.00	Brownish, sandy shale with rock fragments .
74.90	79.10	4.20	Fine grained to coarse grained to very coarse grained feldspathic dirty white, sometimes hummitic and ferruginous sandstone with thin bands of brownish shale .
79.10	80.35	1.25	Arenaceous shale with brownish and chocolate coloured bands, greyish sandstone at the bottom .
80.35	80.80	0.45	Dirty white, coarse grained, feldspathic sandstone with minor bands of shale .
80.80	81.05	0.25	Greyish green sandy shale .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
81.05	90.00	8.95	Coarse grained to very coarse grained fragile, laminotic sandstone with violet and brownish shale bands .
90.00	90.95	0.95	Brownish shale .
90.95	99.20	4.25	Fine grained to medium grained middle part very coarse grained grey sandstone, with rock fragments cross-banded .
95.20	96.40	1.20	Violet coloured, sandy shale with bands of fine grained laminotic sandstone .
96.40	99.80	3.40	Medium grained to coarse grained lower part pebbly, greyish white to brownish sandstone, with brownish and chocolate shale bands. Pebbles are of quartzite and sandstone .
99.80	100.15	0.35	Alternation of chocolate shale and medium grained to fine grained white sandstone .
100.15	100.95	0.80	Brownish sandy shale .
100.95	102.75	1.80	Fine grained to medium grained, brownish white to violet sandstone and lower part coarser and feldspathic.
102.75	103.15	0.40	Brownish sandy shale .
103.15	106.15	3.00	Coarse grained to Very coarse grained (upper part medium grained) violet to brownish sandstone, few pebbles of sandstone and clay are present in the lower part .
106.15	106.90	0.75	Chocolate coloured arenaceous shale .
106.90	113.60	6.70	Fine grained to very fine grained to very coarse grained at the middle to medium grained variegated coloured sandstone with brownish lamellae of shale . <u>Dubrajpur</u> <u>Barakar</u>
113.60	116.10	2.50	Fine grained to medium grained greyish, sometimes, brownish white feldspathic, hard and compact sandstone with thin lamellae of grey sandy shale, cross-banded .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
116.10	116.40	0.30	Grey arenaceous shale . .
116.40	117.00	0.60	Medium grained to fine grained, feldspathic sandstone with bands of grey shale cross banded .
117.00	118.20	1.20	Grey arenaceous shale .
118.20	118.72	0.52	Fine grained to medium grained greyish sandstone .
118.72	119.40	0.68	Grey shale with siltstone band .
119.40	123.10	3.70	Medium grained to coarse grained feldspathic, dirty white sandstone .
123.10	124.40	1.30	Grey sandy shale with 13cm. coal band in the middle part .
124.40	124.70	0.30	<u>Coal</u> with a shale band .
124.70	125.00	0.30	Grey sandy shale .
125.00	125.30	0.30	Medium grained, dirty white, feldspathic sandstone .
125.30	125.70	0.40	Grey shale .
125.70	125.80	0.10	<u>Coal</u> .
125.80	125.90	0.10	Grey shale . .
125.90	126.00	0.10	<u>Coal</u> .
126.00	131.20	5.20	Medium grained to coarse grained greyish white, feldspathic sandstone, micaceous with band of shale .
131.20	132.13	9.93	<u>Coal</u> with shale bands .
132.13	132.25	0.12	Carb. shale .
132.25	132.75	0.50	Feldspathic, medium grained dirty white sandstone with pyrite .
132.75	133.75	1.00	Grey arenaceous shale, with small pellets of clay at the lower part.
133.75	134.20	0.45	<u>Coal</u> , broken cores .
134.20	135.25	1.05	Alternate bands of dark grey shale and fine grained dirty white sandstone .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
135.25	135.45	0.20	<u>Coal</u> .
135.45	135.75	0.30	Fine grained greyish white, sandstone .
135.75	136.10	0.65	Grey arenaceous shale .
136.40	137.40	1.00 grey sandy shale and fine grained dirty white sandstone with a 5 cm. coal band at the bottom .
137.40	138.00	0.60	Grey sandy shale .
138.00	140.50	2.50	Alternate grey sandy shale and fine grained dirty white feldspathic
140.50	143.15	2.65	Dark grey to greyish white medium grained to coarse grained sandstone.
143.15	143.40	0.25	Grey shale .
143.40	145.08	1.68	<u>Coal</u> with shale band .
145.08	146.38	1.30	Dark grey, carb. sandstone .
146.38	146.95	0.57	Grey shale .
146.95	150.45	3.50	<u>Coal</u> with shale bands .
150.45	152.05	1.60	Dark grey, carb. sandstone .
152.05	153.60	1.55	<u>Coal</u> .
153.60	163.30	9.70	White coarse grained, to gritty, sandstone, fragile, upper part is finer grained .
163.30	163.50	0.20	<u>Coal</u> with sandstone band .
163.50	164.60	1.10	Alternate fine grained dirty white sandstone and grey arenaceous shale .
164.60	164.89	0.29	Grey shale .
164.89	165.31	0.42	<u>Coal</u> .
165.31	165.50	0.19	Medium grained, dirty white sandstone .
165.50	166.10	0.60	Grey shale .
166.10	166.45	0.35	<u>Coal</u> .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
166.45	166.85	0.40	Grey shale with coal lamellae .
166.85	169.35	2.50	Alternate bands of grey shale and fine grained dirty white sandstone .
169.35	169.70	0.35	Medium grained dirty white sandstone .
169.70	170.15	0.45	Grey sandy shale .
170.15	170.75	0.65	White, coarse grained sandstone .
170.75	170.85	0.10	Grey shale .
170.85	170.94	0.99	<u>Coal</u> .
170.94	171.58	0.64	Carb. shale .
171.58	172.87	1.29	<u>Coal</u> with shale bands .
172.87	175.05	2.18	Alternate grey shale and fine grained dirty white sandstone .
175.05	176.05	1.00	Dirty white, medium grained sandstone .
176.05	177.75	1.70	Grey arenaceous shale .
177.75	177.95	0.20	<u>Coal</u> .
177.95	178.40	0.45	Brownish, fine grained sandstone .
178.40	178.95	0.55	Coarse grained white, feldspathic sandstone .
178.95	179.70	0.75	Grey shale .
179.70	180.00	0.30	White, medium grained sandstone .
180.00	180.30	0.30	Carb. shale .
180.30	185.47	5.17	<u>Coal</u> with shale bands .
185.47	186.80	1.33	Grey shale with streaks of coal .
186.80	188.05	1.25	Carb. shale .
188.05	190.05	2.00	Grey shale .
190.05	190.85	0.80	Dirty white, medium grained feldspathic sandstone with coal streaks .
190.85	191.95	1.10	Dark grey shale .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
191.95	192.84	0.89	<u>Coal</u> .
192.84	195.60	2.76	Dark grey shale with coal bands .
195.60	196.95	1.35	<u>Coal</u> .
196.95	198.33	1.38	Dark grey shale .
198.33	201.90	3.57	<u>Coal</u> with shale bands .
201.90	203.20	1.30	Grey arenaceous shale .
203.20	203.60	0.40	<u>Coal</u> .
203.60	205.80	2.20	Grey arenaceous shale .
205.80	206.55	0.75	Fine grained, dirty white sandstone .
206.55	209.55	3.00	Grey arenaceous shale .
209.55	211.40	1.85	Coarse grained to medium grained (towards bottom), dirty white, felds-sandstone with lamellae of grey arenaceous shale .
211.40	213.00	1.60	Alternate bands of fine grained dirty white, feldspathic sandstone and grey arenaceous shale .
213.00	218.15	5.15	Grey arenaceous shale .
218.15	218.65	0.50	Alternate bands of grey arenaceous shale and fine grained, dirty white, sandstone .
218.65	218.95	0.30	Fine grained, feldspathic, dirty white sandstone .
218.95	220.00	1.05	Grey shale .
220.00	221.25	1.25	<u>Coal</u> .
221.25	224.05	2.80	Grey shale .
224.05	225.00	0.95	<u>Coal</u> .
225.00	225.05	0.05	Grey shale .
225.05	225.90	0.85	Fine grained, dirty white, feldspathic sandstone .
225.90	227.12	1.22	Dark grey shale .
227.12	234.10	6.98	<u>Coal</u> , with shale bands .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
234.10	245.25	11.15	Fine grained to medium grained feldspathic, dirty white, sandstone massive with occasional conaly bands and grey shale band .
245.25	247.65	2.40	Grey arenaceous shale .
247.65	250.35	2.75	medium grained to fine grained feldspathic sandstone dirty white .
250.35	253.70	3.35	<u>Coal</u> .
253.70	254.75	1.05	Grey shale, carb. thin at top .
254.75	257.45	2.70	Coarse grained, dirty white, feldspathic, micaceous sandstone .
257.45	258.00	0.55	Grey arenaceous shale .
258.00	258.70	0.70	Fine grained to medium grained, dirty white, feldspathic sandstone with laminations of grey shale .
258.70	258.95	0.25	Grey arenaceous shale .
258.95	259.30	0.35	Carb. shale .
259.30	259.60	0.30	<u>Coal</u> .
259.60	260.45	0.85	Dirty white, coarse grained sandstone .
260.45	260.75	0.30	Carb. shale .
260.75	262.37	1.62	<u>Coal</u> .
262.37	263.25	0.88	Carb. shale .
263.25	265.10	1.85	Fine grained to medium grained, feldspathic sandstone lower part very coarse grained perforated .
265.10	265.45	0.35	Grey arenaceous shale .
265.45	265.85	0.40	Alternate laminations of grey shale and fine grained feldspathic sandstone with nodules of pyrite.
265.85	266.25	0.40	<u>Coal</u> .
266.25	266.50	0.25	Fine grained greyish sandstone with lamellae of grey shale .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
266.50	266.85	0.35	Grey arenaceous shale .
266.85	268.30	1.45	Fine grained greyish white , fel spathic sandstone with lamellae of grey shale .
268.30	268.93	0.63	Carb. shale .
268.93	271.40	2.47	<u>Coal</u> , with bands .
271.40	272.72	1.32	Grey arenaceous shale .
272.72	273.85	1.13	<u>Coal</u> .
273.85	274.75	0.90	Coarse grained, feldspathic, massive sandstone .
274.75	275.00	0.25	<u>Coal</u> .
275.00	276.20	1.20	Greyish sandy shale and fine grained, greyish sandstone alternations..
276.20	276.90	0.70	<u>Coal</u> .
276.90	278.20	1.30	Fine grained, poorly laminated greyish white sandstone .
278.20	278.28	0.08	Grey sandy shale .
278.28	294.00	15.72	<u>Coal</u> with band .
294.00	295.80	1.80	Fine grained to medium grained dirty white, sandstone with grey shale laminations .
295.80	296.50	0.70	<u>Coal</u> .
296.50	297.60	1.10	Grey siltstone .
297.60	298.60	1.00	Grey arenaceous shale .
298.60	300.25	1.65	Alternations of grey shale and grey siltstone .
300.25	302.60	2.35	Grey siltstone with few bands of grey shale .
302.60	305.55	1.95	Greyish white, fine grained massive sandstone, hard and com- pact .
305.55	306.80	1.25	Grey siltstone .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
306.80	307.55	0.75	Grey arenaceous shale .
307.55	311.30	3.75	Dirty white, fine grained to medium grained feldspathic sandstone with thin band of grey shale .
311.30	311.60	0.30	Grey arenaceous shale .
311.60	313.15	1.55	Siltstone to very fine grained feldspathic dirty white
313.15	313.85	0.70	<u>Coal</u> .
313.85	315.14	1.29	Fine grained, dirty white, sandstone with a band of grey shale at the top .
315.14	315.50	0.36	Grey shale .
315.50	316.15	0.65	<u>Coal</u> .
316.15	316.49	0.34	Grey shale.
316.49	318.20	1.71	<u>Coal</u> .
318.20	318.78	0.58	Grey shale .
318.78	319.77	0.99	<u>Coal</u> .
319.77	320.15	0.38	Grey shale .
320.15	321.40	1.25	<u>Coal</u> .
321.40	321.75	0.35	Fine grained to medium grained, feldspathic sandstone with a grey shale band at the top .
321.75	322.15	0.40	Grey shale .
322.15	322.65	0.50	Carb. shale .
322.65	323.30	0.65	<u>Coal</u> .
323.30	325.10	1.80	Fine grained dark grey to dirty white sandstone with few bands of coarse grained sandstone .
325.10	330.85	5.75	Coarse grained, to gritty (towards bottom), feldspathic sandstone, pyrite nodules present, lower portion perforated in appearance .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
330.85	331.30	0.45	Grey arenaceous shale .
331.30	333.10	1.80	Grey siltstone .
333.10	333.60	0.50	Carb. shale .
333.60	354.19	20.59	<u>Coal</u> , with bands .
354.19	355.71	1.52	Grey arenaceous shale .
355.71	364.40	8.69	<u>Coal</u> with band .
364.40	365.04	0.64	Alternate bands of grey shale and fine grained dirty white sandstone.
365.04	365.79	0.75	Grey shale .
365.79	369.30	3.51	Coarse grained to very coarse grained, dirty white, sandstone with stringer of coal .
369.30	370.71	1.41	<u>Coal</u> .
370.71	371.30	0.59	Grey shale .
371.30	374.05	2.75	Dirty white, to greyish, coarse grained to medium grained sandstone .
374.05	374.65	0.60	Grey shale .
374.65	375.50	0.85	Coarse grained, dirty white, feldspathic sandstone .
375.50	376.30	0.30	Grey shale .
376.30	376.70	0.40	Coarse grained, feldspathic, dirty white, sandstone with stringer of coaly materials .
376.70	378.91	2.21	<u>Coal</u> with band .
378.91	379.31	0.40	Grey shale .
379.31	380.07	0.76	<u>Coal</u> with band .
380.07	382.50	2.43	Grey shale .
382.50	393.00	10.50	Very coarse grained to gritty, dirty white, feldspathic sandstone with small pebbles of quartzite at places, top part is fine grained .

1	2	3	4
<u>Borehole No. RJBS - 9 (Contd.)</u>			
393.00	394.40	1.40	Grey arenaceous shale .
394.40	395.80	1.40	Fine grained to very fine grained laminated sandstone .
395.80	398.40	2.60	Grey arenaceous shale .
398.40	400.40	2.00	Medium grained to coarse grained feldspathic, greyish, loose and fragile sandstone .
400.40	400.70	0.30	<u>Coal</u> .
400.70	402.18	1.48	Grey arenaceous shale .
402.18	402.93	0.75	Medium grained greyish white, feldspathic sandstone .
402.93	404.55	1.62	Grey arenaceous shale .
404.55	411.62	7.07	Coarse grained, dirty white feldspathic, fragile sandstone with bands of grey shale, top part is fine grained .
411.62	412.00	0.38	Grey shale .
412.00	419.60	7.60	<u>Coal</u> with bands .
419.60	421.83	2.23	Grey arenaceous shale .
421.83	428.00	6.17	Dirty white, medium grained to coarse grained sandstone with laminations of grey shale and reworked pebbles of grey shale .

BOREHOLE CLOSED AT 428.00m.

I/53

BOREHOLE NO. RJBS - 10

Location : Lat . 24° 06' 49" R. L. : 94.134 m.
 Long : 87° 32' 57" Unit No: 181
 Date of Commencement: 4.11.87 . Driller: A. B. Bhowmik .
 Date of Closing : 13.2.88 Logged by: R. Bandyopadhyay .
 Total depth : 345.00m.

From (m)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	4.00	4.00	Sludge of fine grained to medium grained, white and fire clay .
4.00	7.13	3.13	Medium grained to coarse grained dirty white, with few brownish bands sandstone (Lower portion mottled).
7.13	8.35	1.22	Siltstone with fire clay bands .
8.35	8.72	0.37	Coarse grained argillaceous, dirty white fragile sandstone .
8.72	11.58	2.86	Dark grey shale .
11.58	14.42	2.84	Fine grained dirty white sandstone middle part silicified, with carbonised plant remains.
14.42	16.05	1.63	Very coarse grained, dirty white, feldspathic sandstone with coaly matters .
16.05	16.33	0.28	Grey arenaceous shale .
16.33	16.50	0.17	<u>Coal</u> .
16.50	17.66	1.16	Greyish clay.
17.66	21.21	3.55	<u>Coal</u> with shale bands .
21.21	21.76	0.55	Grey shale .
21.76	21.95	0.19	<u>Coal</u> .
21.95	22.40	0.40	Grey shale .
22.40	23.25	0.85	Siltstone, grey .
23.25	23.50	0.25	Grey shale .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
23.50	23.74	0.24	Greyish fine grained, to medium grained carb. sandstone .
23.74	26.72	2.98	Grey shale .
26.72	28.08	1.36	<u>Coal</u> with shale bands .
28.08	29.30	1.22	Grey shale , lower part sandy .
29.30	31.10	1.80	Grey, medium grained to coarse grained sandstone .
31.10	32.30	1.20	Grey shale .
32.30	32.86	0.56	Medium grained dirty white sandstone .
32.86	33.37	0.51	Grey shale .
33.37	33.96	0.59	Greyish, fine grained sandstone.
33.96	34.47	0.51	Grey shale .
34.47	34.98	0.51	<u>Coal</u> .
34.98	37.05	2.07	Grey shale with 0.36m. coal band in the middle .
37.05	37.56	0.51	<u>Coal</u> .
37.56	38.41	0.85	Dark grey shale with 0.20m. coal band in the middle .
38.41	39.52	1.11	<u>Coal</u> .
39.52	41.04	1.52	Grey shale with a 0.30m coal band in the lower part .
41.04	41.40	0.36	Fine grained, dirty white sandstone with thin laminations of grey shale .
41.40	43.15	1.75	Grey shale .
43.15	43.43	0.28	Fine grained, dirty white, sandstone .
43.43	43.71	0.28	Grey shale .
43.71	46.95	3.24	Intercalations of grey shale and fine grained sandstone .
46.95	50.08	3.13	Medium grained, to coarse grained (lower part very coarse grained) dirty white, feldspathic sandstone few pyrite nodules present .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
50.08	51.40	1.32	Grey shale .
51.40	55.29	3.39	Fine grained to medium grained grey, sandstone with bands and lamellae of grey shale .
55.29	55.99	0.70	<u>Coal</u> .
55.99	58.06	2.07	Grey shale, lower part carb. with pyrite .
58.06	58.66	0.60	<u>Coal</u> .
58.66	60.03	1.37	Intercalations of fine grained sandstone and grey shale .
60.03	61.37	1.34	Grey shale .
61.37	65.10	3.73	<u>Coal</u> with bands .
65.10	71.07	5.97	Medium grained to coarse grained, feldspathic, sandstone .
71.07	71.68	0.61	Grey arenaceous shale .
71.68	72.76	1.08	Medium grained to very coarse grained laminated sandstone lower part pebbly .
72.76	75.34	2.58	<u>Coal</u> with bands .
75.34	77.93	2.59	Grey arenaceous shale .
77.93	79.72	1.79	<u>Coal</u> with bands .
79.72	80.17	0.45	Medium grained to coarse grained grey, well laminated sandstone .
80.17	80.53	0.36	Dark grey shale .
80.53	82.68	2.15	Very Coarse grained, feldspathic sandstone, lower part pebbly .
82.68	83.15	0.47	Siltstone with pyrite nodules .
83.15	83.70	0.55	<u>Coal</u> .
83.70	84.40	0.70	Dark grey shale .
84.40	84.87	0.47	<u>Coal</u> .
84.87	86.90	2.03	Grey shale with slickensides, a 10 cm. coal band at the bottom .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
86.90	89.65	2.75	Very coarse grained, feldspathic, fragile, white, sandstone with reworked coal fragments at lower part, highly jointed and broken (sludge of coal and shale.) Milt (?).
89.65	89.71	0.06	Grey shale .
89.71	94.27	4.56	<u>Coal</u> .
94.27	94.73	0.46	Grey shale .
94.73	95.48	0.75	Coal .
95.48	96.55	1.07	Grey shale .
96.55	98.25	1.70	<u>Coal</u> .
98.25	99.92	1.67	Fine grained, to medium grained dirty white, sandstone with laminations of grey shale and a 14 cm. coal band .
99.92	100.12	0.20	Grey arenaceous shale .
100.12	100.60	0.48	<u>Coal</u> with siderite bands .
100.60	103.20	2.60	Dark grey shale .
103.20	104.85	1.65	Fine grained, dirty white, feldspathic massive sandstone .
104.85	106.65	1.80	Grey shale .
106.65	108.94	2.29	Medium grained to coarse grained arenaceous sandstone, with laminations of grey shale, lower part is very coarse grained.
108.94	109.39	0.45	<u>Coal</u> .
109.39	110.44	1.05	Grey shale .
110.44	112.74	2.30	<u>Coal</u> .
112.74	114.80	2.06	Fine grained to coarse grained dirty white, sandstone with shale bands .
114.80	115.20	0.40	<u>Coal</u> .
115.20	115.95	0.75	Grey shale .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
115.95	116.30	0.35	<u>Coal</u> .
116.30	117.15	0.85	Grey shale .
117.15	119.45	2.30	Fine grained to coarse grained feldspathic, pebbly sandstone .
119.45	119.75	0.30	<u>Coal</u> .
119.75	120.20	0.45	Very coarse grained, grey sandstone .
120.20	120.90	0.70	Grey arenaceous shale .
120.90	124.60	3.70	Very coarse grained, pebbly sandstone (rounded to sub rounded).
124.60	124.87	0.27	Shaly coal, dull .
124.87	125.49	0.62	Grey shale .
125.49	127.02	1.53	<u>Coal</u> .
127.02	127.75	0.73	Grey shale .
127.75	128.05	0.30	<u>Coal</u> .
128.05	128.45	0.40	Grey arenaceous shale .
128.45	129.20	0.75	Very fine grained dirty white, feldspathic sandstone .
129.20	130.30	1.10	<u>Coal</u> .
130.30	131.70	1.40	Grey arenaceous shale with coal bands and sideritic bands .
131.70	132.00	0.30	<u>Coal</u> .
132.00	133.50	1.50	Grey to dark grey shale .
133.50	133.90	0.40	Coarse grained, dirty white, to greyish feldspathic sandstone .
133.90	133.96	0.06	Grey shale .
133.96	134.74	0.78	<u>Coal</u> .
134.74	136.69	1.95	Dark grey shale, upper part carbonaceous .
136.69	138.09	1.40	Fine grained, grey sandstone with shale band .
138.09	139.49	1.40	Dark grey shale .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
139.49	139.69	0.20	<u>Coal</u> .
139.69	140.60	0.91	Dark grey, medium grained sandstone with grey shale band .
140.60	141.15	0.55	Dark grey shale .
141.15	141.45	0.30	<u>Shaly coal</u> . .
141.45	142.05	0.60	Dark grey shale .
142.05	143.00	0.95	Dark grey, medium grained sandstone.
143.00	143.40	0.40	Carb. shale .
143.40	144.70	1.30	<u>Coal</u> , with shale bands .
144.70	147.60	2.90	Grey shale .
147.60	148.60	1.00	Coarse grained, dirty white to greyish, feldspathic sandstone with streaks and lamellae of carb. matters .
148.60	149.35	0.75	Dark grey shale .
149.35	150.85	1.50	Medium grained, greyish to dirty white sandstone with shale band .
150.85	152.15	1.30	<u>Coal</u> .
152.15	153.50	1.35	Fine grained, dirty white, sandstone with a grey shale band at the top .
153.50	158.60	5.10	<u>Coal</u> with shale bands .
158.60	159.75	1.15	Medium grained to coarse grained greyish sandstone .
159.75	160.15	0.40	Greyish mudstone .
160.15	160.75	0.60	Greyish, fine grained cross bedded sandstone .
160.75	161.10	0.35	Greyish clay .
161.10	162.35	1.25	Argillaceous, fine grained to coarse grained, sandstone, lower part pebbly with lamellae of grey shale .
162.35	162.85	0.50	<u>Coal</u> .
162.85	163.85	1.00	Coarse grained, feldspathic, dirty white, sandstone .

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
163.85	164.10	0.25	Grey shale .
164.10	164.40	0.30	<u>Coal</u> .
164.40	167.40	3.00	Medium grained to very coarse grained, coarse grained to pebbly (towards bottom) dirty white sandstone .
167.40	168.00	0.60	Grey to dark grey shale .
168.00	168.50	0.50	Coarse grained, pebbly, laminated sandstone .
168.50	169.40	0.90	Silty shale, grey .
169.40	169.85	0.45	Siltstone .
169.85	205.80	35.95	Grey white, feldspathic, compact sandstone .
205.80	206.70	0.90	Grey arenaceous shale .
206.70	208.30	1.60	Medium grained to fine grained dirty white, feldspathic sandstone with shale bands .
208.30	210.55	2.25	Grey arenaceous shale.
210.55	211.05	0.50	Fine grained, dirty white, massive sandstone .
211.05	211.55	0.50	Grey shale .
211.55	211.95	0.40	Fine grained, dirty white sandstone with thin bands of grey shale .
211.95	215.00	3.05	Dark grey shale .
215.00	215.95	0.95	Fine grained, dirty white, feldspathic sandstone, with grey shale lamination .
215.95	216.50	0.55	Dark grey shale with 5 cm. coal band.
216.50	217.45	0.95	Fine grained, dirty white, sandstone with laminations of grey shale .
217.45	218.10	0.65	Grey arenaceous shale .
218.10	220.25	2.15	Medium grained to coarse grained feldspathic, dirty white sandstone with grey shale bands and few reworked pebbles of grey shale (lower part).

1	2	3	4
<u>Borehole No. RJBS - 10 (Contd.)</u>			
220.25	221.40	1.15	Alternate grey shale and fine grained, dirty white sandstone bands .
221.40	221.80	0.40	Grey shale .
221.80	245.00	23.20	Medium grained to fine grained greyish white sandstone with lamellae and bands of grey shale and few reworked pebbles .
245.00	254.90	9.90	Greyish (With greenish tinge) medium, massive sandstone with subrounded pebbles .
254.90	256.40	1.50	Grey siltstone .
256.40	258.10	1.70	Shale, grey .
258.10	259.10	1.00	Greenish grey medium massive sandstone.
259.10	265.05	5.95	Grey siltstone .
265.05	268.05	3.00	Medium grained, to fine grained greyish (with greenish tinge) sandstone with fine lamellae of grey shale, specks of coal micaceous .
<u>Barakar</u> <u>Talchir</u>			
268.05	299.11	31.06	Grey arenaceous shale with bioturbidites .
299.11	299.69	0.58	Medium grained, dark grey, argillaceous sandstone with shale bands .
299.69	312.90	13.21	Dark grey splintery shale with occasional bands of sandstone and few reworked pebbles of sandstone present at the bottom .
312.90	319.75	6.85	Fine grained to medium grained dirty white, sandstone, loose and fragile, with reworked pebbles of shale .
319.75	320.55	0.80	Grey arenaceous shale .
320.55	336.40	15.85	Very fine grained massive, pinkish massive sandstone, fractures filled with calcite veins, micro faults present, lower part laminated .
336.40	344.40	7.60	Pebbly sandstone, pebbles arenaceous mainly of gneisses, quartzite, shale, etc. rounded , sub-rounded to angular.
344.00	345.00	1.00	Granite gneiss (metamorphics) .

BOREHOLE CLOSED AT 345.00m.

I/61

BOREHOLE NO. RJBS - 11

Location : Lat : 24° 07' 24" R. L. : 106.29 m.
 Long : 87° 32' 18" Unit No.: 181
 Date of Commencement : 29.2.88 . Driller : A. B. Bhowmik .
 Date of Closing : 19.5.88 Logged by : R. Bandyopadhyay.
 Total depth : 435.50 m.

From (m)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	4.50	4.50	Sludge of Coarse grained brownish band .
4.50	5.30	0.80	Brownish mudstone ferruginous .
5.30	9.00	3.70	Coarse grained, loose and fragile, arenaceous brownish sandstone .
9.00	9.90	0.90	<u>COAL</u> .(all broken pieces).
9.90	10.32	0.42	Grey shale with coal streaks .
10.32	10.47	0.15	Coarse grained, dirty white, sandstone
10.47	13.10	2.63	Alternate fine grained dirty white sandstone and grey shale .
13.10	14.05	0.95	Grey shale .
14.05	15.18	1.13	<u>COAL</u> with shale bands .
15.18	16.21	1.03	Grey shale with fire clay & siderite bands .
16.21	21.96	5.75	<u>COAL</u> with shale bands .
21.96	22.54	0.58	Grey arenaceous shale .
22.54	22.65	0.11	<u>COAL</u> .
22.65	23.15	0.50	Coarse grained, arenaceous, fragile greyish sandstone .
23.15	23.75	0.60	Grey shale .
23.75	23.95	0.20	<u>SHALY COAL</u> .
23.95	24.40	0.45	Grey shale .
24.40	25.25	0.85	<u>COAL</u> .
25.25	25.75	0.50	Grey shale .

1	2	3	4
<u>Borehole No. EJBS - 11 (Contd.)</u>			
25.75	26.55	0.80	<u>Coal</u> .
26.55	28.75	2.20	fine grained dirty white, feldspathic sandstone with laminations of grey shale, middle part coarser.
28.75	29.25	0.50	Alternate grey shale and dirty white, fine grained sandstone .
29.25	32.99	3.74	Medium grained to very coarse grained, pebbly at the lower part, feldspathic sandstone pyritiferous.
32.99	33.14	0.15	Grey shale .
33.14	33.33	0.19	<u>Coal</u> .
33.33	33.63	0.30	Grey shale .
33.63	35.39	1.76	<u>Coal</u> with shale bands .
35.39	42.00	6.61	Alternate grey shale and fine grained to coarse grained, dirty white, sandstone with leaf impressions .
42.00	42.40	0.40	<u>Coal</u> .
42.40	47.67	5.27	Grey shale .
47.67	52.55	4.88	<u>Coal</u> with bands .
52.55	52.65	0.10	Carb. shale .
52.65	53.05	0.40	Coarse grained, dirty white, sandstone .
53.05	56.85	3.80	Alternate grey shale and fine grained to coarse grained arenaceous sandstone .
56.85	57.44	0.59	Carb. shale .
57.44	61.97	4.53	<u>Coal</u> with shale bands .
61.97	62.20	0.23	Carb. shale .
62.20	62.70	0.50	Grey siltstone .
62.70	63.60	0.90	Coarse grained greyish sandstone with siderite bands and laminations of coal and pebbles of coal .
63.60	64.50	0.90	Grey shale .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
64.50	64.90	0.40	<u>COAL</u> .
64.90	65.40	0.50	Grey shale .
65.40	67.35	1.95	<u>Coal</u> with band .
67.35	67.75	0.40	Alternate grey shale and fine grained, dirty white, sandstone bands .
67.75	68.95	1.20	<u>Coal</u> with shale band .
68.95	72.85	3.90	Grey shale .
72.85	73.50	0.65	Medium grained, to coarse grained, dirty white, arenaceous sandstone .
73.50	76.85	3.35	Grey shale .
76.85	77.95	1.10	Coarse grained, dirty white, sandstone .
77.95	79.00	1.05	Alternate grey shale and fine grained, dirty white sandstone .
79.00	79.40	0.40	Grey arenaceous shale .
79.40	80.50	1.10	<u>COAL</u> .
80.50	81.50	1.00	Medium grained, arenaceous feldspathic, sandstone with laminations of shale .
81.50	81.95	0.45	Grey shale with coal band .
81.95	82.60	0.65	Very fine grained greyish sandstone with bands .
82.60	83.24	0.64	Grey shale .
83.24	84.10	0.86	<u>COAL</u> .
84.10	84.50	0.40	Grey shale .
84.50	85.10	0.60	Medium grained to fine grained, dirty white, sandstone, upper part silicified .
85.10	85.20	0.10	Carb. shale .
85.20	91.10	5.90	<u>Coal</u> , with shale band .
91.10	94.00	2.90	Fine grained, greyish sandstone with laminations of coal & grey shale .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
94.00	96.60	2.60	Grey arenaceous shale with a thin (0.05m) coal band .
96.60	97.95	1.35	Fine grained, to medium grained, dirty white, sand tone .
97.95	98.35	0.40	Grey arenaceous shale .
98.35	101.35	3.00	<u>Coal</u> (pyritiferous) with bands .
101.35	103.60	2.25	Grey shale .
103.60	105.80	2.20	<u>Coal</u> with shale band .
105.80	106.70	0.90	Grey shale .
106.70	110.32	3.62	Fine grained, dirty white, sandstone with a few shale band .
110.32	111.60	1.28	<u>Coal</u> with shale band .
111.60	112.80	1.20	Grey shale, arenaceous .
112.80	113.30	0.50	<u>Coal</u> .
113.30	114.80	1.50	Grey shale .
114.80	115.08	0.28	Shaly coal .
115.08	115.43	0.35	Carb. shale .
115.43	116.05	0.62	<u>Coal</u> .
116.05	117.70	1.65	Grey siltstone .
117.70	118.20	0.50	<u>Shaly coal</u> .
118.20	119.40	1.20	Fine grained, grey, sandstone with shale laminations .
119.40	119.90	0.50	Carb. shale .
119.90	122.10	2.20	<u>Coal</u> with band .
122.10	122.60	0.50	Fine grained, grey, sandstone arenaceous .
122.60	123.10	0.50	Carb. shale .
123.10	132.90	9.80	<u>Coal</u> with shale band .
132.90	134.60	1.70	Fine grained, to coarse grained, pebbly, grey sandstone with shale band, a thin carb. shale band in upper part .

1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
134.60	141.90	7.30	Grey shale .
141.90	146.70	4.80	Fine grained to medium grained greyish sandstone with laminations of shale .
146.70	146.87	0.17	Carb. shale .
146.87	147.22	0.35	Grey, medium grained, to coarse grained, massive sandstone .
147.22	147.50	0.28	<u>Coal</u> .
147.50	148.35	0.85	Fine grained to medium grained greyish sandstone with band of coal and carb. shale .
148.35	149.20	0.85	Grey shale .
149.20	151.40	2.20	<u>Coal</u> with shale band .
151.40	152.55	1.15	Carb. shale .
152.55	152.95	0.40	<u>Coal</u> .
152.95	157.70	4.75	Carb. shale .
157.70	159.15	1.45	<u>Coal shale</u> .
159.15	160.30	1.15	Carb. shale .
160.30	170.58	10.58	<u>Coal</u> with shale band .
170.88	171.80	0.92	Grey shale with sandstone band and a thin coal band .
171.80	174.05	2.25	Fine grained to coarse grained (Lower part perforated), argillaceous greyish sandstone small sized rounded pebbles .
174.05	176.60	2.55	Grey shale .
176.60	181.95	5.25	Medium grained to coarse grained (pebbly) greyish sandstone rounded pebbles .
181.95	183.30	1.35	Grey shale .
183.30	184.90	1.60	<u>Shaly coal</u> .
184.90	187.90	3.00	Grey shale .
187.90	189.20	1.30	Alternate grey shale and fine grained, greyish white sandstone .

1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
189.20	189.70	0.50	Fine grained, dirty white, massive sandstone with shale band .
189.70	190.35	0.65	Grey shale .
190.35	191.10	9.75	Fine grained massive, greyish white, sandstone with few shaly layer .
191.10	192.15	1.05	Grey shale with plant fossils .
192.15	192.58	0.43	<u>Coal shaly</u> .
192.58	195.60	3.02	Grey shale with fine grained dirty white sandstone and few thin coal band .
195.60	198.80	3.20	Fine grained to medium greyish white, massive sandstone with grey shale layer .
198.80	202.00	3.20	Alternate grey shale and fine grained greyish sandstone .
202.00	207.35	5.35	Medium grained to very coarse grained pebbly massive feldspathic sandstone .
207.35	207.40	0.05	Carbonaceous shale .
207.40	210.20	2.80	<u>Shaley coal</u> .
210.20	211.55	1.35	Grey shale .
211.55	213.80	2.25	Alternate grey shale and fine grained greyish sandstone .
213.80	215.60	1.80	Fine grained to medium grained greyish white, massive sandstone .
215.60	215.90	0.30	Grey shale .
215.90	224.44	8.54	Fine grained to very coarse grained to pebbly (at lower part), feldspathic sandstone with small rounded pebbles of quartzite and shale .
224.44	224.94	0.50	<u>Shaly coal</u> .
224.94	224.09	0.15	Grey shale .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
224.09	228.30	3.21	Fine grained to very coarse grained (Pebbly at lower part), sandstone, rounded pebbles of quartzite .
228.30	229.80	1.50	Alternate grey shale and fine grained sandstone, dirty white .
229.80	232.15	2.35	Very coarse grained to pebbly, massive sandstone, pebbles are mainly of quartzite rounded to sub-rounded .
232.15	233.00	0.85	Fine grained, grey, massive sandstone with muscovite flakes .
233.00	234.55	1.55	Medium grained to very coarse grained feldspathic massive sandstone with small sub- rounded pebbles of quartzite .
234.55	237.00	4.45	Grey arenaceous shale .
237.00	239.74	2.74	Fine grained, laminated , greyish white sandstone, pebbles of coal and grey shale present in the lower part .
239.74	241.25	1.51	Coarse grained to pebbly, dirty white, sandstone mainly rounded pebbles .
241.25	253.90	12.65	Very coarse grained to pebbly, greyish sandstone streaks and laminations of grey shale and coal present, pebbles are mainly of quartzite, shales sub-rounded to angular with two thin bands of coal at the lower parts .
253.90	254.38	0.48	Grey shale .
254.38	261.85	7.47	<u>Coal</u> with shale band .
261.85	262.82	0.97	Greyish, fine grained to medium grained, sandstone with a few shale band .
262.82	263.32	0.50	Grey shale .
263.32	265.00	1.68	Fine grained to very coarse grained (at lower part), white, feldspathic sandstone with streaks of coal .
265.00	266.35	1.35	Grey shale .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
266.35	271.70	5.30	Coarse grained to very coarse grained to pebbly, greyish sandstone pebbles are well rounded to sub-angular.
271.70	272.35	0.65	Grey shale.
272.35	276.70	4.35	Fine grained to coarse grained (very coarse grained in the middle), greyish massive sandstone.
276.70	276.90	0.20	Grey shale.
276.90	283.75	6.85	<u>Coal</u> with shale band.
283.75	284.25	0.50	Fine grained to medium grained, greyish sandstone.
284.25	284.95	0.70	Grey shale.
284.95	289.50	4.55	<u>Coal</u> with band.
289.50	289.90	0.40	Grey shale.
289.90	295.30	5.40	Very coarse grained, coarse grained to gritty, greyish massive sandstone, upper part is fine grained.
295.30	295.90	0.60	Carb. shale with sandstone band.
295.90	296.30	0.40	Grey shale.
296.30	297.43	1.13	Medium grained, to fine grained massive, greyish sandstone, with grey shale laminations.
297.43	298.03	0.60	Grey shale.
298.03	301.38	3.35	Medium, fine grained to coarse grained (lower part) grey sandstone.
301.38	301.85	0.47	Grey shale.
301.85	306.30	4.45	Coarse grained to pebbly, feldspathic greyish white sandstone.
306.30	307.80	1.50	Grey shale with a 0.15m coal band at the top.
307.80	308.10	0.30	Alternate grey shale and fine grained, dirty white sandstone.
308.10	309.50	1.40	Gritty to pebbly, dirty white, feldspathic sandstone.

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
309.50	311.00	1.50	Fine grained, dirty white to brownish (silicified at the lower part) massive sandstone .
311.00	311.30	0.30	Alternate grey shale and fine grained, grey sandstone .
311.30	312.25	0.95	Grey shale with quartzite breins .
312.25	312.95	0.70	Coarse grained feldspathic, dirty white, sandstone massive .
312.95	313.15	0.20	Alternate grey shale and fine grained, dirty white sandstone .
313.15	314.15	1.00	Grey shale .
314.15	315.80	1.65	<u>Coal</u> with shale band .
315.80	318.60	2.80	Fine grained, greyish sandstone with thin shale band .
318.60	319.35	0.75	Coarse grained, greyish massive sandstone .
319.35	320.45	1.10	Carb. shale .
320.45	320.68	0.23	Coarse grained, greyish white sandstone with grey shale band .
320.68	322.95	2.27	Alternate bands of shale and coarse grained, dirty white, sandstone .
322.95	324.05	1.10	Coarse grained, feldspathic, massive sandstone .
324.05	325.05	1.00	Grey shale with alternate fine grained, greyish sandstone band in the upper part .
325.05	326.50	1.45	Fine grained, greyish, sandstone lower part silicified and brownish in coal .
326.50	331.60	5.10	Coarse grained to pebbly (rounded to sub-angular) sandstone, pebbles are mainly of quartzite, sandstone, shale, clay feldspathic .
331.60	331.80	0.20	<u>Shaly coal</u> .
331.80	332.05	0.25	Grey shale .
332.05	333.15	1.10	Medium grained to fine grained grey sandstone with angular to sub-rounded pebbles .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
333.15	334.35	1.20	Grey shale .
334.35	336.80	2.45	Coarse grained to pebbly, greyish sandstone .
336.80	337.90	1.10	Fine grained greyish, massive sandstone .
337.90	354.50	6.60	Coarse grained to pebbly, greyish, massive sandstone .
354.50	354.95	0.45	Grey shale .
354.95	359.70	4.75	Pebbly sandstone, lower part fine grained and silicified with a band of grey shale .
359.70	361.25	1.55	<u>Shaly</u> coal with bands .
361.25	362.25	1.00	Grey shale .
362.25	362.70	0.45	Fine grained, greyish, sandstone .
362.70	363.70	1.00	Pebbly, massive, greyish sandstone .
363.70	364.25	0.55	Silicified fine grained brownish, hard and compact, sandstone with few pebbles (small).
364.25	374.05	9.80	Coarse grained to very coarse grained to pebbly, greyish, massive sandstone, with small rounded to sub-angular pebbles of quartzite, sandstone, shale etc. Few bands of fine grained and medium grained sandstone are also present .
374.05	374.55	0.50	Fine grained, greyish white sandstone .
374.55	381.05	6.50	Coarse grained, to pebbly, greyish massive sandstone .
381.05	381.45	0.40	Grey shale .
381.45	382.30	0.85	Pebbly to gritty, greyish black sandstone .
382.30	382.80	0.50	Alternate bands of grey shale and fine grained, dirty white sandstone .

1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
382.80	399.50	16.70	Coarse grained to pebbly, greyish, massive sandstone with few bands of grey shale .
399.50	400.00	0.50	<u>Coal</u> .
400.00	400.10	0.10	Grey shale .
400.10	405.35	5.25	Pebbly to gritty, greyish sandstone with a 0.15m thick coal band in the lower part .
405.35	405.70	0.35	Dark grey shale with a 0.15m coal band at the top .
405.70	406.05	0.35	Gritty to pebbly, dark grey sandstone .
406.05	406.50	0.45	Dark grey shale with 0.15m coal band in the bottom .
406.50	407.00	0.50	Dark grey to grey coarse grained to gritty, feldspathic sandstone .
407.00	408.00	1.00	Alternate grey shale and fine grained greyish white sandstone .
408.00	409.60	1.60	Coarse grained to pebbly, dirty white, sandstone with shale pebbles .
409.60	410.00	0.40	Grey shale .
410.00	411.15	1.15	Gritty sandstone, with a few reworked pebbles of shale and sandstone .
411.15	411.60	0.45	Carb. shale with a band of fine grained sandstone .
411.60	412.30	0.70	Coarse grained, massive, greyish white sandstone .
412.30	412.80	0.50	Grey shale .
412.80	414.00	1.20	Fine grained to medium grained greyish sandstone with shale bands, lower part pebbly .

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1	2	3	4
<u>Borehole No. RJBS - 11 (Contd.)</u>			
414.00	414.35	0.35	Coal with siderite and grey shale bands .
414.35	417.20	2.85	Gritty to pebbly, greyish sandstone , with pyrite nodules .
417.20	417.70	0.50	Fine grained, dirty white sandstone with grey shale bands which are faulted (micro faulting).
417.70	418.20	0.50	Dirty white, pebbly sandstone .
418.20	435.50	17.30	Coarse grained to medium grained (at places) greyish white, sandstone with grey shale bands and laminations. Pyrite nodules present .

BORSHOLE CLOSED AT 435.50m .

1	2	3	4
<u>Borehole No. RJBS -12 (Contd.)</u>			
19.70	25.00	5.30	Grey shale with sub-angular to rounded small pebbles of shale .
25.00	25.50	0.50	Brownish grey siltstone with rounded pebbles c. shale (small in size).
25.50	27.23	1.73	Grey shale .
27.23	28.23	1.00	Medium grained to fine grained greyish sandstone with dissiminated quartzite grains .
28.23	31.00	2.77	Grey shale .
31.00	31.35	0.35	Silicified, very fine grained sandstone with quartzite veins
31.35	32.65	1.30	Grey arenaceous shale .
32.65	40.15	7.50	Greyish to dark grey, medium grained to coarse grained, massive sandstone with rounded small pebbles of sandstone and shale .
40.15	50.60	10.45	Grey shale with a few angular small pebbles of dark grey shale and coal .
50.60	52.10	1.50	Very fine grained sandstone upper part shaly .
52.10	54.50	2.40	Grey shale .
54.50	54.75	0.25	<u>Shaly</u> coal .
54.75	61.80	7.05	Medium grained to coarse grained grey sandstone, with laminations of grey shale and small sub-rounded pebbles of shale and siltstone .
61.80	62.20	0.40	<u>Coal</u> shaly .
62.20	62.50	0.30	Grey shale .
62.50	73.30	10.80	Medium grained greyish white, sandstone with small pebbles of siltstone and shale and grey shale laminations .
73.30	74.25	0.95	Grey shale .
74.25	93.15	8.90	Pebbly, grey medium grained sandstone lower part brownish middle part is coarser.

1	2	3	4
<u>Borehole No. RJBS - 12 (Contd.)</u>			
93.15	93.55	0.40	Greyish siltstone .
93.55	97.10	3.55	Grey shale with thin bands of coal and rounded pebbles of shale .
97.10	110.40	13.30	Greyish, medium grained pebbly sandstone lower part is devoid of pebbles .
110.40	111.40	1.00	Dark grey shale with coal laminations
111.40	131.80	21.40	Dirty white, medium grained to coarse grained, pebbly massive argillaceous sandstone, pebbles are rounded to sub-rounded. Lower part without pebbles .
131.80	134.00	2.20	Alternate fine grained greyish white sandstone and grey shale .
134.00	135.20	1.20	Fine grained greyish, argillaceous sandstone .
135.20	137.10	1.90	Grey arenaceous shale .
137.10	137.55	0.45	<u>Coal</u> .
137.55	138.45	0.90	Alternate fine grained to medium grained greyish white sandstone and grey shale bands .
138.45	138.95	0.50	Grey shale .
138.95	144.48	5.53	Medium grained to fine grained greyish white sandstone with laminations and bands of grey shale .
144.48	145.03	0.55	Alternate grey shale and dirty white, fine grained sandstone .
145.03	145.32	0.29	Grey shale with a 0.12m coal band at the top .
145.32	151.00	5.68	Dirty white, medium grained to fine large sub-angular pebbles in the middle .
151.00	154.25	3.25	Alternate grey shale and fine grained dirty white sandstone .
154.25	154.65	0.40	Grey shale .
154.65	155.05	0.40	Fine grained grey sandstone with grey shale bands .

1	2	3	4
<u>Borehole No. RJES - 12 (Contd.)</u>			
155.45	155.95	0.50	Greyish fine grained sandstone with shale bands .
155.95	156.50	0.50	Grey shale .
156.50	159.88	3.38	Medium grained to fine grained, greyish white, massive sandstone lower part silicified .
159.88	161.13	1.25	alternate fine grained dirty white, sandstone and grey shale .
161.13	175.60	14.47	Pyritiferous grey shale with a thin coal band .
175.60	191.85	16.25	Fine grained greyish white (brownish at places) massive sandstone with few rounded pebbles of shale and sandstone .
191.85	192.70	0.85	Grey shale .
192.70	196.90	4.20	Dark grey, massive, fine grained sandstone with few dispersed pebbles .
196.90	199.00	2.10	Grey shale with occasional rounded pebbles of shale .
199.00	202.02	3.02	Dirty white, medium grained to fine grained laminated sandstone lower part silty .
202.02	205.20	3.18	Carb. shale with coarse grained dirty white sandstone band .
205.20	206.40	1.20	Dirty white, medium grained to fine grained sandstone, cross bedded .
206.40	207.00	0.60	Carb. shale .
207.00	209.10	2.10	Dark grey medium grained sandstone with desiccated grains of quartzite and feldspar .
209.10	209.60	0.50	Carb. shale .
209.60	216.60	7.00	Fine grained, dirty white massive sandstone, upper part coarse grained .

(Talchir Fm.)

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Borehole No. RJBS - 12 (Contd.)

1	2	3	4
216.60	234.35	17.75	Grey arenaceous shale fractured, calcite veins present, bioturbation present .
234.35	238.45	4.10	Pebbly sandstone, greyish, pebbles are mainly of grains quartzite, sandstone angular to sub-rounded.
238.45	239.25	0.80	Greenish grey siltstone .
239.25	244.85	5.60	Greyish, massive, medium grained sandstone with poorly developed lamination .
244.85	246.35	1.50	Pebbly grey shale .
246.35	263.65	17.30	Variegated coloured, massive, fine grained to medium grained sandstone .

Metamorphics

263.65	265.00	1.35	Sludge of sand, feldspar and quartzite (Fault zone ?).
265.0	275.20	10.20	Gneissic rock, pebbles of quartzite and feldspars, . (cores are all broken and recovery was very poor) passing through fault zone .

BOREHOLE CLOSED AT 275.20 m.

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BOREHOLE NO. RJBS - 13

Location : Lat : 24° 07' 23" R. L. : 103.06m.
 Long : 87° 32' 37" Unit No. : 374
 Date of Commencement : 16.8.88 Driller : A. B. Bhowmik
 Date of Closing : 17.12.88 Logged by : R. Bandyopadhyay
 Total depth : 450.00m.

From (m)	To (m)	Thickness (m)	Lithology
1	2	3	4
0.00	3.00	3.00	Sludge of yellowish white coarse sand .
3.00	8.00	5.00	Brownish to dirty white, coarse grained to medium grained, cross bedded, feldspathic sandstone .
8.00	9.50	1.50	Grey sandy shale .
9.50	11.45	1.95	Coarse grained to medium grained sandstone with clay bands, . Upper part fine grained .
11.45	13.18	1.73	<u>Coal</u> with shale bands .
13.18	13.25	0.07	Carb. shale .
13.25	13.50	0.25	Silicified fine grained sandstone brownish .
13.50	14.20	0.70	Grey shale .
14.20	15.00	0.80	<u>Coal</u> .
15.00	15.67	0.67	Carb. shale .
15.67	17.55	1.88	<u>Coal</u> .
17.55	19.45	1.90	Greyish white, fine grained sandstone with laminations of coal, and grey shale, lower portion coarser.
19.45	20.00	0.55	<u>Coal</u> with bands .
20.00	21.15	1.15	Coarse grained, greyish white sandstone with lamination of coal and carb. matters .
21.15	25.15	<u>4.00</u>	<u>Coal</u> with shale bands .
25.15	26.49	1.34	Fine grained greyish, hard and compact sandstone with a band of grey shale .
26.49	27.07	0.58	<u>Coal</u> .

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
27.07	27.94	0.87	Coarse grained, massive, sandstone with laminations of grey shale and streaks of coal .
27.94	40.40	12.46	<u>Co 1</u> with bands .
40.40	41.60	1.60	Medium grained dirty white sandstone with bands of grey shale .
41.60	42.10	0.50	<u>Coal</u> .
42.10	43.00	0.90	Medium grained to coarse grained dirty white sandstone with bands of grey shale .
43.00	47.75	4.75	Grey sandy shale .
47.75	49.66	1.91	Medium grained feldspathic dirty white sandstone with bands of shale .
49.66	52.86	3.20	Grey sandy shale .
52.86	54.75	1.86	Fine grained to medium grained dirty white sandstone with bands of grey shale .
54.75	55.30	0.55	<u>Coal</u> with shale band.
55.30	56.00	0.70	Fine grained to medium grained sandstone, lower portion finer .
56.00	56.44	0.44	Grey shale .
56.44	62.85	6.41	<u>Coal</u> with bands .
62.85	63.89	1.04	Carb. shale .
63.89	64.57	0.68	<u>Coal</u> .
64.57	65.41	0.84	Grey shale and fine grained sandstone.
65.41	71.73	6.32	<u>Coal</u> with shale bands .
71.73	71.91	0.18	Fine grained, dirty white, sandstone and grey shale, alternate bands.
71.91	72.00	0.09	Dark grey carb. shale .
72.00	76.01	4.01	<u>Coal</u> with shale bands .
76.01	76.70	0.69	Carb. shale .
76.70	80.80	5.10	<u>Coal</u> with shale bands .
80.80	81.05	0.25	Grey shale .

I/80

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
81.05	81.25	0.20	Medium grained white sandstone with grey shale bands .
81.25	82.10	0.85	Grey arenaceous shale with a 0.5m coal band .
82.10	82.50	0.40	<u>Coal</u> .
82.50	85.04	2.54	Medium grained to very coarse grained to gritty (lower part) dirty white feldspathic sandstone with small pebbles of shale and sandstone .
85.04	86.42	1.38	Carb. shale .
86.42	87.06	0.64	Grey shale .
87.06	87.81	0.75	<u>Shaly coal</u> .
87.81	88.01	0.20	Carb. shale .
88.01	88.49	0.48	Coarse grained feldspathic, dirty white sandstone .
88.49	88.92	0.43	Carb. shale with small angular sandstone pebble at the top .
88.92	89.60	0.68	Grey shale .
89.60	91.60	2.00	<u>Coal</u> with shale bands .
91.60	92.10	0.50	alternate medium grained sandstone and grey shale .
92.10	93.30	1.20	Dark grey sandstone, massive, medium grained .
93.30	93.78	0.48	Carb. shale .
93.78	93.87	0.09	<u>Coal</u> .
93.87	93.95	0.08	Carb. shale .
93.95	94.21	0.26	<u>Coal</u> .
94.21	94.70	0.49	Carb. shale .
94.70	96.45	1.75	<u>Coal</u> .
96.45	97.10	0.65	Fine grained, dirty white sandstone with grey shale bands .
97.10	99.51	2.41	Alternate grey shale and medium grained to fine grained dirty white, sandstone with a 0.12m. coal band in the lower part .

I/81

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
99.51	101.96	2.45	Grey shale with coal bands .
101.96	102.26	0.30	<u>Coal</u> .
102.26	102.80	0.54	Grey shale .
102.80	104.40	1.60	Alternate fine grained dirty sandstone and grey shale .
104.40	108.36	3.96	Coarse grained to medium grained dirty white, feldspathic sandstone with shale laminactions and bands.
108.36	109.40	1.04	Grey shale with siderite bands .
109.40	109.55	0.15	Brownish silicified fine grained sandstone .
109.55	110.15	0.60	Grey sandy shale .
110.15	110.95	0.80	Medium grained, dirty white sand- stone with grey shale bands .
110.95	111.04	0.09	Grey shale .
111.04	112.60	1.56	<u>Coal</u> with band and pyrite nodules.
112.60	113.70	1.10	Medium grained to fine grained dark grey sandstone with small angular to sub-angular pebbles .
113.70	114.70	1.00	<u>Coal</u> .
114.70	115.50	0.80	Grey arenaceous shale .
115.50	117.00	1.50	Alternate grey shale and dirty white, fine grained sandstone .
117.00	119.50	2.50	Coarse grained to gritty, dirty white, sandstone with lenses and pebbles of coal .
119.50	120.50	1.00	Grey shale .
120.50	128.90	8.40	Fine grained to coarse grained (at the bottom) dirty white, feldspathic sandstone, flaggy with streaks and laminations of coal and bands of shale .
128.90	129.40	0.50	<u>Coal</u> with shale bands.
129.40	130.60	1.20	Grey shale .

I/82

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
130.60	137.95	7.35	Coarse grained to gritty dirty white massive sandstone, upper part finer .
137.95	139.95	2.00	Grey shale .
139.95	144.30	4.35	Coarse grained to gritty dirty white massive sandstone .
144.30	145.30	1.00	Grey shale .
145.30	155.20	9.90	Medium grained to coarse grained, occasionally gritty grey sandstone with rounded to sub-rounded pebbles of sandstone and shale .
155.20	155.90	0.70	Grey shale .
155.90	157.75	1.85	<u>Coal</u> with bands .
157.75	158.20	0.45	Gritty, greyish, sandstone .
158.20	164.60	6.40	<u>Coal</u> with bands .
164.60	165.20	0.60	Grey arenaceous shale .
165.20	166.40	1.20	Coarse grained, dirty white, flaggy feldspathic sandstone with few small pebbles .
166.40	166.65	0.25	Grey arenaceous shale .
166.65	169.70	3.05	Medium grained, dirty white sandstone with shale laminations .
169.70	170.90	1.20	Grey arenaceous shale .
170.90	174.73	3.83	Coarse grained, gritty, dirty white sandstone with few small pebbles at the lower part .
174.73	175.33	0.60	Grey arenaceous shale .
175.33	177.80	2.47	Fine grained, dirty white, sandstone with shale bands .
177.80	182.70	4.90	<u>Coal</u> with bands .
182.70	183.70	1.00	Grey shale, lower part arenaceous .
183.70	184.35	0.65	<u>Coal</u> .
184.35	186.20	1.85	Medium grained to fine grained, micaceous grey sandstone with shale bands .

I/83

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
186.20	188.10	1.90	Grey shale .
188.10	188.35	0.25	Pyritiferous, grey fine grained sandstone .
188.35	191.00	2.55	Carb. shale with coal (6 cm.) and sandstone (8 cm.) bands .
191.00	191.30	0.30	Fine grained, grey sandstone with shale bands .
191.30	191.38	0.08	Grey shale .
191.38	193.90	2.52	Coal with shale bands .
193.90	194.60	0.70	Grey shale .
194.60	199.22	4.62	Fine grained to coarse grained (towards bottom), massive feldspathic sandstone with pyrite nodules.
199.22	199.67	0.45	Carb. shale .
199.67	200.72	1.05	Grey arenaceous shale .
200.72	201.32	0.60	Fine grained, dirty white, sandstone with laminations of grey shale.
201.32	201.82	0.50	Alternate fine grained, dirty white sandstone and grey shale .
201.82	202.17	0.35	Grey arenaceous shale .
202.17	203.00	0.83	Very fine grained, to medium grained dirty white massive sandstone .
203.00	206.10	3.10	Coarse grained to gritty, massive flaggy sandstone .
206.10	206.70	0.60	Grey arenaceous shale .
206.70	208.70	2.00	Medium grained, dirty white massive sandstone .
208.70	215.20	6.50	Coarse grained to pebbly dirty white, sandstone with small sub-angular pebbles of quartzite.
215.20	215.60	0.40	Grey shale .
215.60	216.10	0.50	Medium grained, dirty white sandstone with grey shale bands .
216.10	217.86	1.76	Grey arenaceous shale .

I/84

1	2	3	4
<u>Borehole No. HJBS - 13 (Contd.)</u>			
217.86	218.80	0.94	<u>Coal</u> with bands .
218.80	219.30	0.50	Carb. shale .
219.30	222.60	3.30	Argillaceous, medium grained to fine grained feldspathic sandstone.
222.60	223.86	1.26	Grey shale .
223.86	224.83	0.97	Coarse grained feldspathic dirty white sandstone with bands of grey shale .
224.83	226.81	1.98	Alternate fine grained, dirty white sandstone and grey shale bands .
226.81	234.00	7.19	Coarse grained to very coarse grained to pebbly greyish white sandstone with few shale bands at the bottom and the sandstone is finer grained towards bottom .
234.00	237.60	3.60	Medium grained, dirty white sandstone with big sub-rounded pebbles of sandstone .
237.60	244.60	7.00	Very fine grained to silty, dirty white, sandstone with small pebbles of sandstone & quartzite .
244.60	248.20	3.60	Coarse grained to gritty, white, argillaceous sandstone with angular to sub-angular pebbles .
248.20	248.70	0.50	Grey shale .
248.70	249.10	0.40	Alternate grey shale and fine grained dirty white sandstone .
249.10	259.70	10.60	Medium grained to coarse grained dirty white massive sandstone with big pebbles of quartzite sub-rounded .
259.70	260.75	1.05	Grey shale with 0.18m. shaly coal at the top of fine grained siltstone band .
260.75	262.50	1.75	Carb. shale with fine grained sandstone bands at the middle .
262.50	262.80	0.30	<u>Coal</u> .
262.80	263.25	0.45	Grey shale .

I/85

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
263.25	263.85	0.60	Grey siltstone .
263.85	272.95	9.10	Coarse grained to pebbly, angular to sub-angular pebbles, dirty white sandstone .
272.95	273.20	0.25	Grey silty shale .
273.20	276.38	3.18	Coarse grained pebbly sandstone dirty white .
276.38	276.62	0.24	Grey sandy shale .
276.62	277.67	1.05	Coarse grained to gritty, feldspathic, dirty white sandstone .
277.67	277.95	0.28	Carb. shale .
277.95	281.61	3.66	Coarse grained to gritty dirty white, feldspathic sandstone, lower part pebbly .
281.61	282.06	0.45	Grey shale .
282.06	282.60	0.54	Grey pebbly sandstone .
282.60	282.92	0.32	Fine grained, dirty white, massive sandstone with laminations of grey shale .
282.92	287.90	5.98	Coarse grained to gritty, massive greyish white to brownish sandstone .
287.90	288.40	0.50	Alternate fine grained sandstone dirty white and grey shale .
288.40	289.15	0.75	Coarse grained, to very coarse grained, feldspathic, dirty white sandstone .
289.15	291.15	2.00	Grey shale with thin coal bands.
291.15	305.95	14.80	Coarse grained to gritty, pebbly dirty white sandstone, with angular to sub-angular pebbles of quartzitic sandstone and feldspathic etc.
305.95	307.05	1.10	Grey arenaceous shale .
307.05	307.50	0.45	Coarse grained, feldspathic sandstone with grey shale bands.
307.50	307.85	0.35	Grey shale .

I/86

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
307.85	308.68	0.83	Coarse grained, dirty white feldspathic sandstone with grey shale bands .
308.68	309.21	0.53	Grey silty shale .
309.21	311.80	2.59	Coarse grained, dirty white, massive, feldspathic sandstone .
311.80	312.15	0.35	Grey shale .
312.15	315.90	3.75	Dark grey to grey, medium grained to coarse grained, massive sandstone with small sub-rounded pebbles of quartzite .
315.90	316.85	0.95	Grey arenaceous shale with 0.25m. coal band .
316.85	319.39	2.54	Coarse grained, pebbly sandstone dirty white, pebbles are sub-angular to angular unassorted, mica flakes present (bigger pebbles) .
319.39	321.55	2.16	Grey mudstone .
321.55	324.80	3.25	Coarse grained to medium grained massive, dirty white sandstone .
324.80	325.70	0.90	Grey mudstone .
325.70	339.40	13.70	Coarse grained, massive, feldspathic dirty white, sandstone at places pebbly granite pebbles are noticed.
339.40	341.95	2.55	Greyish (with greenish tinger) arenaceous shale .
341.95	342.30	0.35	Massive, medium grained, dirty white, sandstone .
342.30	343.70	1.40	Greyish siltstone (with greenish tinger).
343.70	345.40	1.70	Medium grained, dirty white massive sandstone, lower part silicified with small sub-rounded pebbles of quartzite & feldspart .
345.40	348.80	3.40	Greyish shale, at places chocolate coal patches .
348.80	367.30	18.50	Massive dirty white, coarse grained to very coarse grained (at places) feldspathic sandstone, with a few bands of grey shale .

1	2	3	4
<u>Borehole No. RJBS - 13 (Contd.)</u>			
367.30	367.70	0.40	Grey arenaceous shale with pyrite nodules .
367.70	369.41	1.71	Coarse grained massive sandstone dirty white with reworked pebbles of grey shale and grey shale in the upper part .
369.41	370.21	0.80	Grey shale with grey shale band in the upper part .
370.21	370.01	0.80	Alternate grey shale and coarse grained, dirty white sandstone with reworked pebbles of grey shale .
370.01	371.68	1.67	Grey arenaceous shale .
371.68	372.10	0.42	Coarse grained, dirty white feldspathic sandstone .
372.10	372.90	0.80	Grey arenaceous shale .
372.90	376.90	4.00	Medium grained, dirty white, sandstone with bands of grey shale , coal streaks and pyrite nodules .
376.90	377.25	0.35	Grey shale with leaf impressions .
377.25	382.40	5.15	Medium grained to coarse grained dirty white sandstone with bands of grey shale, carb. shale, pyrite nodules, leaf impressions .
382.40	382.90	0.50	Grey arenaceous shale .
382.90	384.15	1.25	Medium grained, dirty white sandstone with shale bands .
384.15	384.30	0.15	Grey shale .
384.30	384.70	0.40	Dirty white mudstone .
384.70	385.10	0.40	Grey arenaceous shale .
385.10	385.70	0.60	Alternate grey shale and fine grained, dirty white sandstone .
385.70	391.20	5.50	Coarse grained, white, massive, feldspathic sandstone .
391.20	392.07	0.87	Fine grained, white, massive, argillaceous sandstone .

I/88

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Borehole No. RJBS - 13 (Contd.)</u>			
392.07	397.90	5.83	Grey mudstone with shale bands and a few small rounded pebbles of shale.
<u>Barakar Formation</u> <u>Talchir Formation</u>			
397.20	402.25	5.05	Greyish siltstone with shale laminations and small rounded pebbles of gneiss in the middle .
402.25	405.90	3.65	Greyish shale with greenish tinge.
405.90	406.78	0.88	Grey siltstone .
406.78	407.18	0.40	Grey shale with greenish tinge .
407.18	412.75	5.57	Medium grained, greenish grey massive sandstone with sub-angular small pebbles of shale .
412.75	417.50	4.75	Greenish grey siltstone .
417.50	418.25	0.75	Grey shale .
418.25	435.05	16.80	Fine grained to medium grained greenish grey sandstone with garnet grains, flaggy, massive, small rounded pebbles of shale present .
435.05	436.45	1.40	Medium grained, argillaceous, greenish grey, massive sandstone .
436.45	439.75	3.30	Greenish grey, splintary shale with sub-angular pebbles of granite grains .
439.75	441.50	1.75	Greenish grey siltstone with sub-angular pebbles of shale.
441.50	443.00	1.50	Medium grained greenish grey, massive sandstone .
443.00	449.20	6.20	Medium grained greyish sandstone, with angular to sub-angular grains, quartzite pebbles of larger size .
<u>Talchir Formation</u> <u>Metamorphics</u>			
449.20	450.00	0.80	Quartzite .

BOREHOLE CLOSED AT 450.00m.

I/90

1	2	3	4
<u>Borehole No. RJBS - 14 (Contd.)</u>			
41.95	43.80	1.85	Fine to medium grained, greyish sandstone with streaks and fine laminations of coaly matters and grey shale .
43.80	46.10	2.30	Very coarse graine to gritty, pyritiferous dirty white massive sandstone with angular to sub-angular pebbles of quartz and feldspar .
46.10	47.10	1.00	Medium to fine grained, laminated sandstone with feldspar grains. Microfaulting present .
47.10	48.65	1.55	Very coarse grained, dirty white, feldspathic sandstone with reworked pebbles of grey shale .
48.65	51.00	2.35	Grey shale .
51.00	66.42	15.42	Medium to very coarse grained, feldspathic sandstone with fine laminations of grey shale .
66.42	67.10	0.68	Grey shale .
67.10	68.20	1.10	Medium to fine grained, argillaceous, greyish white massive sandstone.
68.20	68.50	0.30	Grey shale .
68.50	69.55	1.05	Coarse grained, flaggy, massive sandstone, white .
69.55	71.55	2.00	Grey shale .
71.55	77.55	6.00	Fine grained, dark grey sandstone with angular to sub-angular quartz and feldspar pebbles .
77.55	83.49	5.94	Dark grey to grey, coarse grained, flaggy sandstone with reworked pebbles of coal, grey shale .
83.49	83.89	0.40	Dark grey shale .
83.89	84.49	0.60	Coarse grained, dirty white, feldspathic sandstone .
84.49	87.39	2.90	Dark grey shale .
87.39	88.26	0.87	Coarse grained, dirty white, fragile, feldspathic sandstone with streaks and laminations of coal & grey shale.

I/91

1	2	3	4
<u>Borehole No. HJBS - 14 (Contd.)</u>			
88.26	89.85	1.59	Grey arenaceous shale .
89.85	91.85	2.00	Coarse grained, feldspathic, dirty white sandstone with laminations of grey shale.
91.85	93.70	1.85	Grey shale .
93.70	94.25	0.55	Grey siltstone with reworked pebbles of grey shale .
94.25	100.85	6.60	Coarse grained, grayish sandstone with laminations thin bands and reworked pebbles of Carb. shale and grey shale .
100.85	101.35	0.50	Fine grained, massive, greyish white sandstone .
101.35	103.60	2.25	Grey shale .
103.60	109.65	6.05	Medium to very coarse grained (lower part) feldspathic, dirty white sandstone with laminations and reworked pebbles of grey shale .
109.65	114.10	4.45	Grey arenaceous shale .
114.10	118.65	4.45	Coarse to very coarse grained, faggy, feldspathic, greyish white sandstone .
118.65	119.40	0.75	Grey shale .
119.40	120.05	0.65	Fine grained, grey, massive sandstone.
120.05	120.15	0.10	<u>Coal</u> .
120.15	120.45	0.30	Grey shale .
120.45	120.95	0.50	<u>Coal</u> with pyrite specks .
120.95	122.70	1.75	Grey shale .
122.70	125.55	2.85	Medium grained, greyish white, feldspathic sandstone with laminations of grey shale.
125.55	127.80	2.25	Carb. shale .
127.80	129.20	1.40	Alternate grey shale and fine grained, dirty white sandstone .
129.20	130.95	1.75	Grey shale .
130.95	131.70	0.75	Coarse grained, feldspathic, dirty white sandstone with thin lamination of shale. Micro faulting present.

1/92

1	2	3	4
Borshole . o. 1535 -14 (Contd.)			
131.70	133.25	1.55	Grey shale.
133.25	134.75	1.50	Medium to coarse grained (lower) greyish sandstone with laminations of grey shale.
134.75	135.25	0.50	Grey shale.
135.25	139.10	3.85	Loose grained, flaggy, fragile, feldspathic, greyish white sandstone.
139.10	141.50	2.40	Grey shale.
141.50	142.50	1.00	Coarse grained, massive, grey sandstone.
142.50	145.00	2.50	Grey shale.
145.00	149.50	4.50	Coarse to gritty (upper part medium grained), dirty white, feldspathic, massive sandstone.
149.50	151.00	1.50	Grey shale.
151.00	155.05	4.05	Gritty, flaggy, fragile, greyish white, sandstone with small pebbles of sandstone.
155.05	155.60	0.55	Grey shale.
155.60	156.35	0.75	Fine grained, grey, cross bedded sandstone.
156.35	158.10	1.75	Coarse grained, flaggy, greyish white sandstone.
158.10	158.90	0.80	Grey shale.
158.90	161.00	2.10	Very coarse grained, dirty white, pebbly sandstone.
161.00	161.90	0.82	Grey shale.
161.90	182.20	20.30	Coarse to gritty, flaggy, greyish white, sandstone with small angular pebbles of quartz and feldspars.
182.20	183.70	1.50	Grey shale.
183.70	184.15	0.45	Fine grained, silicified sandstone with specks of pyrite.
184.15	184.52	0.37	Coal shaly,
184.52	185.15	0.63	Grey shale.
185.15	186.90	1.75	Medium to coarse grained, dirty white, feldspathic sandstone with shale laminations.
186.90	189.05	2.95	Grey shale.

1	2	3	4
Borehole No. RJBs - 14 (Contd.)			
189.85	193.70	3.85	Alternate grey shal and medium grained, grey, sandstone.
193.70	196.55	2.85	Grey, gritty, feldspathic sandstone.
196.55	198.10	1.55	Grey shale.
198.10	205.60	7.50	Medium to gritty (lower part), greyish white, feldspathic sandstone with a few bands of grey shale.
205.60	206.50	0.90	Carb. shale.
206.50	209.37	2.87	Fine to medium grained, grey sandstone with a few thin bands of grey shale.
209.37	209.80	0.43	Coal, shaly.
209.80	211.20	1.40	Grey shale.
211.20	213.87	2.67	Fine to medium grained, grey, feldspathic sandstone.
213.87	214.60	0.73	Grey shale.
214.60	215.15	0.55	Coal.
215.15	216.30	1.15	Grey shale.
216.30	216.80	0.50	Fine grained, carb. sandstone (fractured - fault(?)).
216.80	217.72	0.92	Grey arenaceous shale.
217.72	218.36	0.64	Coal.
218.36	218.90	0.59	Grey shale.
218.95	220.60	1.65	Coal, powdered, fault (?).
220.60	225.05	4.45	Very coarse to coarse grained, carb. sandstone.
225.05	226.30	1.25	Carb. shale.
226.30	227.15	0.85	Medium grained, carb. sandstone.
227.15	228.95	1.80	Grey shale.
228.95	235.85	6.90	Fine grained, greyish white, feldspathic sandstone.
235.35	259.85	24.00	Grey shale, (all broken pieces) with calcite veins, fault zone(?).
259.85	260.35	0.50	White clay.
<u>Barakar Formation.</u> <u>Talchir Formation.</u>			
260.35	262.50	2.15	Coarse grained, feldspathic, dirty white massive sandstone.
262.50	281.15	18.65	Greenish, coarse grained, pebbly sandstone. Angular to sub-angular pebbles of quartz, gneiss, quartzites fractured from 265.55 m. (Fault ?)

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1 2 3 4
Borehole No. RJS - 14 (Contd.)

Talchir Formation,
Pre-Cambrian.

281.15 291.95 10.80 Granite gneiss, contact with Talchirs
is faulted.

Borehole closed at 291.95 m.

BOREHOLE NO. RJS - 16.

Location . Lat : 24°09'24" A.L. : 154.75 m.
Long : 87°32'04" Unit No. : 200/214
Date of commencement : 7.4.89. S.F.A.(D) : ...L. Banga.
Date of closing : 30.4.89. Logged by : K. Bandyopadhyay.
Total depth : 77.40 m.

From(m)	To(m)	Thickness	Description.
1	2	3	4

6.00	3.00	3.00	Sludge of coarse, greyish white sand.
3.00	14.00	11.00	Coarse grained, pebbly, to gritty, feldspathic sandstone. angular to sub- angular quartz pebbles.
14.00	14.85	0.85	Coarse grained, carbonaceous sandstone.
14.85	16.05	1.20	Grey shale.
16.05	17.05	1.00	Coarse grained, carbonaceous sandstone.
17.05	18.25	1.30	Grey shale.
18.35	19.25	0.90	Medium grained, carbonaceous sandstone.
19.25	20.35	1.10	Coarse grained, pebbly sandstone, grey.
20.35	21.05	0.70	Grey shale.
21.05	43.10	22.05	Pebbly, coarse grained, feldspathic, grey sandstone with a few grey shale bands. angular to sub-angular pebbles of quartz. A few pebbles are big almost boulder size.

Barakar Formation.
Talchir Formation.

43.10 69.65 26.55 Coarse grained, greyish white sandstone
with boulders of gneiss, quartzite.
Steering effect present. Fracture plains
filled up by quartz veins. (Fault ?).

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<u>1.</u>	<u>2.</u>	<u>3.</u>	<u>4.</u>
<u>Bolehole No. RJBS - 17 (Contd.)</u>			
33.35	33.85	0.50	Fine grained, dirty white, feldspathic sandstone.
33.85	43.75	9.90	Grey shale with fine grained sandstone bands(thin).
43.75	41.49	0.71	<u>Coal.</u>
44.49	44.89	0.40	Greyish white, medium grained sandstone.
44.89	45.86	0.97	<u>Coal.</u>
45.86	46.50	0.64	Grey shale with thin bands of sandstone and coal.
46.50	46.90	0.40	Fine grained, grey sandstone with shale laminations.
46.90	47.60	0.70	<u>Coal.</u>
47.60	48.60	1.00	Grey shale.
48.60	52.20	3.60	Coarse grained, dirty white, feldspathic sandstone.
52.20	52.70	0.50	Grey shale.
52.70	54.90	2.20	Very coarse grained, dirty white, massive sandstone.
54.90	55.20	0.30	<u>Coal.</u>
55.20	56.00	0.80	Carb. shale.
56.00	56.30	0.30	<u>Coal.</u>
56.30	57.70	1.40	Grey shale.
57.70	61.27	3.57	<u>Coal with bands.</u>
61.27	61.90	0.63	Grey shale.
61.90	62.55	0.65	<u>Coal.</u>
62.55	63.05	0.50	Grey shale.
63.05	63.85	0.80	Coarse grained, feldspathic sandstone, dirty white with shale laminations.
63.85	64.60	0.75	Grey shale with thin coal bands.
64.60	68.40	3.80	<u>Coal with shale bands.</u>
68.40	68.70	0.30	Grey shale.
68.70	71.60	2.90	Fine to coars. grained (lower part), grey to dirty white sandstone with grey shale laminations.
71.60	74.20	2.60	<u>Coal with shale bands.</u>
74.20	75.20	1.00	Grey siltstone.
75.20	76.50	1.30	Coarse to very coarse grained, fragile, feldspathic dirty white sandstone.
76.50	76.75	0.25	Grey shale.

1.	2.	3.	4.
Borehole No. RJBS - 17 (Contd.)			
76.75	77.15	0.40	<u>Coal.</u>
77.15	78.05	0.90	Grey shale.
78.05	79.55	1.50	Medium grained, massive, dirty white sand tone.
79.55	80.25	0.70	Alternate fine grained, dirty white sandstone and grey shale.
80.25	80.85	0.60	Grey shale.
80.85	81.60	0.75	<u>Coal.</u>
81.60	82.05	0.45	Grey shale.
82.05	82.70	0.65	Grey siltstone.
82.70	87.90	5.20	Very coarse grained, pebbly, dirty white, fragile, feldspathic sandstone with grey shale bands. Pebbles are small in size and sub-angular.
87.90	88.22	0.32	<u>Coal.</u>
88.22	88.80	0.58	Carb. shale.
88.80	90.20	1.40	<u>Coal.</u>
90.20	91.40	1.20	Grey shale.
91.40	95.45	4.05	Very coarse to pebbly, grey, feldspathic sandstone. Pebbles are of quartz and feldspars.
95.45	96.10	0.65	Grey shale.
96.10	96.85	0.75	Pebbly to coarse grained, dirty white sandstone. Pebbles are mainly small sized quartz of angular to sub-angular shape.
96.85	98.05	1.20	<u>Coal</u> with bands.
98.05	104.15	6.10	Coarse grained to pebbly, dark grey sandstone with small angular to sub-angular quartz pebbles.
104.15	105.00	0.85	Grey shale.
105.00	105.30	0.30	Very coarse grained, feldspathic, dirty white sandstone.
105.30	105.45	0.15	<u>Coal.</u>
105.45	106.45	1.00	Grey shale.
106.45	106.90	0.45	Grey siltstone.
106.90	108.65	1.75	Coarse grained to very coarse grained (bottom), dirty white feldspathic sandstone.
108.65	115.33	6.68	<u>Coal</u> with bands.

1.	2.	3.	4.
Borehole No. RJBS - 17 (Contd.)			
115.33	115.91	0.58	Medium grained, carbonaceous, massive sandstone.
115.91	116.63	0.72	<u>Coal.</u>
116.63	117.13	0.50	Grey shale.
117.13	117.70	0.57	Grey siltstone.
117.70	118.35	0.65	Coarse grained, feldspathic, dirty white sandstone.
118.35	119.95	1.60	Grey shale.
119.95	125.45	5.50	Very coarse grained, feldspathic, dirty white sandstone with shale laminations.
125.45	128.15	2.70	Grey shale.
128.15	128.75	0.60	Alternate grey shale and fine grained, greyish white sandstone.
128.75	129.05	0.30	Very coarse grained, fragile, feldspathic grey sandstone.
129.05	129.85	0.80	Grey shale.
129.85	132.35	2.50	Very coarse grained, dirty white, feldspathic sandstone.
132.35	132.55	0.20	Grey shale.
132.55	134.20	1.65	Pebbly carbonaceous sandstone, pebbles are angular to sub-angular quartz.
134.20	134.70	0.50	Grey shale.
134.70	135.40	0.70	Alternate grey shale and fine grained, dirty white sandstone.
135.40	139.25	3.85	Coarse grained, dirty white, feldspathic sandstone with shale laminations.
139.25	139.65	0.40	Grey shale.
139.65	140.15	0.50	<u>Coal.</u>
140.15	142.17	2.02	Dirty white siltstone with grey shale bands.

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1.	2.	3.	4.
<u>Borehole No. BJBS -17 (Contd.)</u>			
142.17	142.72	0.55	<u>Coal</u> , shaly.
142.72	144.52	1.00	Fine grained, dirty white sandstone, coarser towards bottom.
144.52	144.60	3.00	Grey shale with fine grained sandstone bands.
147.60	149.10	1.50	Medium to coarse grained, feldspathic, dirty white laminated sandstone, core dip 10°
149.10	150.00	0.90	Grey siltstone,
150.00	152.00	2.00	Coarse grained, dirty white, feldspathic sandstone with grey shale and siderite bands.
152.00	152.60	0.60	<u>Coal</u> .
152.60	153.45	0.85	Grey shale.
153.45	154.30	0.85	Alternate grey shale and fine grained, dirty white sandstone.
154.30	159.55	5.25	Fine grained, to medium grained, dirty white sandstone with grey shale laminations.
159.55	162.15	2.60	Grey shale.
162.15	163.00	0.85	Greyish, coarse grained, fragile sandstone.
163.00	167.00	4.00	<u>Coal</u> .
167.00	167.50	0.50	Grey shale.
167.50	169.15	1.65	Medium to coarse grained, grey, feldspathic sandstone with shale laminations.
169.15	169.65	0.50	Grey shale.
169.65	170.40	0.75	Medium grained, massive, dirty white sandstone.
170.40	171.40	1.00	Grey shale.
171.40	172.20	0.80	Alternate grey shale and fine grained, grey sandstone.
172.20	172.80	0.60	Grey shale.
172.80	175.05	2.25	Gritty, dirty white, feldspathic sandstone.
175.05	176.05	1.00	Grey shale.

1.	2.	3.	4.
<u>Borehole No. RJBS - 17 (Contd.)</u>			
176.05	177.55	1.50	Dirty white, fine grained, feldspathic sandstone with laminations of grey shale.
177.55	178.15	0.60	Alternate grey shale and fine grained, grey sandstone.
178.15	178.90	0.75	Grey shale.
178.90	179.55	0.65	Fine grained, dirty white sandstone.
179.55	181.30	1.75	Grey shale.
181.30	181.80	0.50	Fine grained, hard and compact sandstone, grey.
181.30	183.50	1.70	Grey shale.
183.50	185.70	2.20	Medium grained, massive, feldspathic, dirty white sandstone.
185.70	186.10	0.40	Grey shale.
186.10	189.10	3.00	Very coarse grained, fragile, feldspathic, greyish white sandstone with grey shale bands.
189.10	189.90	0.80	Grey shale.
189.90	191.10	1.20	Coarse grained, fragile, dirty white, feldspathic sandstone.
191.10	192.85	1.75	Alternate grey shale and fine to medium grained, grey sandstone.
192.85	201.10	8.25	Very coarse grained to pebbly, fragile, feldspathic, dirty white sandstone. Pebbles are small in size, quartz, angular to sub-angular.
201.10	202.05	0.95	<u>Coal.</u>
202.05	203.20	1.15	Coarse grained, feldspathic, dirty white, massive sandstone.
<u>Bargur Formation.</u> <u>Talchir Formation.</u>			
203.20	206.20	3.00	Grey argillaceous siltstone.
206.20	220.00	13.80	Boulder bed. Boulders are mainly sub-rounded to rounded, gneiss, quartzite, and amphibolite.

Borehole closed at 220.00 m.

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BOREHOLE NO. RJBS - 18

Location : Lat. : 24°07'18" R.L. : 96.17 m.
 Long : 87°32'24" Unit No. : 374
 Date of commencement : 23.6.89. Driller : A. B. Bhowmik.
 Date of closing : 11.7.89. Logged by : R. Bandyopadhyay.
 Total depth : 124.50 m.

<u>From(m)</u>	<u>To(m)</u>	<u>Thickness(m)</u>	<u>Description.</u>
1.	2.	3.	4.
0.00	2.50	2.50	Sludge of coarse yellow sand.
2.50	14.90	12.40	Coarse grained, argillaceous, dirty white sandstone with a few thin clay and coal bands. Occasionally ferruginous.
14.90	16.20	1.30	Carbonaceous shale.
16.20	16.50	0.30	Sandy fire clay, grey.
16.50	20.15	2.65	Carbonaceous shale with a few thin coal bands.
20.15	20.75	0.60	Medium grained, carbonaceous sandstone with a few sub-rounded clay pebbles.
20.75	21.25	0.50	Grey shale.
21.25	44.55	23.30	Argillaceous, dirty white, coarsegrained sandstone, with a few sub-angular to angular, grey shale, clay. Coal and quartz pebbles of small sizes. Cores broken, water loss. Fault(?) around 25.00 m.
44.55	46.60	2.05	Alternate coarse grained, chocolate and greyish sandstone.
46.60	49.10	2.50	Dirty white, massive, argillaceous sandstone, lower part pebbly.
49.10	51.80	2.70	Grey shale.
51.80	52.55	0.75	Carbonaceous, medium grained sandstone, pebbly.
52.55	53.00	0.45	Grey shale.

1	2	3	4
53.00	62.35	9.35	Dirty white to grey, argillaceous sandstone with small sub-angular to angular quartz pebbles. Lower part carbonaceous.
62.35	64.35	2.00	Grey shale.
64.35	78.85	14.50	Argillaceous, greyish white, massive sandstone medium to coarse grained, with a few pebbles (Fault(?) at 76.00 m.)
78.85	80.50	1.65	Grey shale.
80.50	82.05	1.55	Grey, coarse grained, massive sandstone.
82.05	83.35	1.30	Alternate grey shale and fine grained, dirty white sandstone.
83.35	83.50	0.15	<u>Coal.</u>
83.50	91.25	7.75	Grey shale, pyritiferous, with a few thin coal bands, (Fault(?) at 84.00 m. depth).
			— Barakar Formation — — Talchir Formation —
91.25	96.65	5.40	Medium to coarse grained, dirty white, feldspathic, sandstone with sub-angular pebbles of quartz.
96.65	104.55	7.90	Fine grained, variegated coloured (grey to chocolate) argillaceous sandstone.
104.55	114.10	9.55	Boulder bed, mainly gneissic boulders of very big size (upto 3.00 m.).
			— Talchir Formation — — Precambrian. —
114.10	124.50	10.40	Granite gneiss.

Borehole closed at 124.50 m.

I/103

Borehole No. RJBS - 1'

Location : Lat : 24°09'16" RL. : 137.45 m.
 Long : 87°32'18" Unit No. : 200/214.
 Date of commencement : 3.7.89. S.f.A.(D) : M. L. Banga.
 Date of closing : 30.7.89. Logged by : R. Bandyopachyay.
 Total depth : 207.50 m.

1	2	3	4
0.00	9.00	9.00	Sludge of fine grained, brownish to dirty white sand.
9.00	10.00	1.00	<u>Coal</u> .
10.00	11.00	1.00	Medium to coarse grained, greyish sandstone with grey shale and carbonaceous laminations.
11.00	12.60	1.60	Carbonaceous shale.
12.60	15.55	2.95	Medium to coarse grained, dirty white sandstone.
15.55	17.15	1.60	Grey shale.
17.15	17.45	0.30	<u>Coal</u> .
17.45	17.70	0.25	Medium grained, grey, carb. sandstone.
17.70	18.95	1.25	<u>Coal</u> with bands.
18.95	19.95	1.00	Carb. shale.
19.95	23.70	3.75	Coarse grained, fragile, dirty white, feldspathic sandstone.
23.70	24.48	0.78	Carb. shale.
24.48	26.50	2.02	<u>Coal</u> with band.
26.50	26.90	0.40	Grey shale.
26.90	27.70	0.80	Fine grained, grey, carb. sandstone.
27.70	30.45	2.75	Coarse grained, feldspathic, dirty white, fragile sandstone.
30.45	32.45	2.00	Grey shale.
32.45	33.30	0.85	Alternate grey shale and fine grained, dirty white sandstone.
33.30	34.80	1.50	Grey shale.

1	2	3	4
<u>Borehole No. RJBS - 19. (Contd.)</u>			
34.80	36.82	2.02	Medium to coarse grained, grey, carb. sandstone with a grey shale band.
36.82	39.32	2.50	Grey shale.
39.32	40.70	1.38	<u>Coal.</u>
40.70	41.00	0.30	Grey shale.
41.00	50.60	9.60	Coarse grained to gritty, feldspathic, fragile, greyish white sandstone with a few small sub-angular quartz pebbles and a thin coal band at the bottom.
50.60	50.80	0.20	Carb. shale.
50.80	53.30	2.50	Carb., coarse grained, grey sandstone with a few angular to sub-angular quartz pebbles.
53.30	54.30	1.00	Grey siltstone.
54.30	54.95	0.65	Alternate fine grained, dirty white sandstone and grey shale with small scale faulting.
54.95	55.70	0.75	Grey shale.
55.70	58.75	3.05	Very coarse grained, feldspathic, fragile sandstone.
58.75	60.00	1.25	Grey siltstone with grey shale laminations.
60.00	63.65	3.35	Very coarse grained, fragile, dirty white, feldspathic sandstone with a few very small angular quartz pebbles.
63.35	71.50	8.15	<u>Coal</u> with band.
71.50	71.75	0.25	Grey shale.
71.75	72.25	0.50	Medium grained, grey, carb. sandstone.
72.25	73.00	0.75	Alternate fine grained, dirty white sandstone and grey shale.
73.00	73.35	0.35	Grey shale.

1	2	3	4
<u>Borehole No. RJBS - 19. (Contd.)</u>			
73.35	74.85	1.50	Fine grained, grey, carb. sandstone with a few shale laminations.
74.85	75.35	0.50	Grey shale.
75.35	77.60	2.25	Very coarse grained, occasionally pebbly, grey sandstone.
77.60	78.40	0.80	Alternate grey shale and medium grained, dirty white sandstone.
78.40	85.30	6.90	Medium to very coarse grained(lower), greyish white, feldspathic, fragile sandstone with bands of grey shale and siltstone.
85.30	85.65	0.35	<u>Coal.</u>
85.65	87.50	1.85	Alternate grey shale and grey, coarse grained sandstone.
87.50	92.40	4.90	Coarse to very coarse grained, dirty white fragile feldspathic sandstone with grey shale laminations.
92.40	92.65	0.25	<u>Coal.</u>
92.65	92.75	0.10	Grey shale.
92.75	94.30	1.55	Medium to coarse grained, grey, carb. sandstone with angular to sub-angular small pebbles of quartz.
94.30	94.60	0.30	<u>Coal.</u>
94.60	102.00	5.40	Fine to very coarse grained(from top to bottom) feldspathic, dirty white, massive sandstone.
102.00	102.25	0.25	<u>Coal.</u>
102.25	104.10	1.85	Fine grained, grey, sandstone with reworked pebbles of coal.
104.10	104.80	0.70	Alternate grey shale and dirty white, fine grained sandstone.
104.80	105.30	0.50	<u>Coal.</u>
105.30	105.50	0.20	Grey shale.
105.50	107.40	1.90	Grey siltstone.
107.40	109.05	1.65	Grey shale.
109.05	109.75	0.70	Grey siltstone.
109.75	110.65	0.90	Alternate grey shale & fine grained, dirty white sandstone.

1	2	3	4
<u>Borehole No. AJBS - 19. (Contd.)</u>			
110.65	119.10	8.45	Coarse to very coarse grained, dirty white, feldspathic sandstone with grey shale laminations.
119.10	119.66	0.56	<u>Coal.</u>
119.66	119.94	0.28	Carb., medium grained sandstone.
119.94	120.97	1.03	<u>Coal.</u>
120.97	125.75	4.78	Medium to coarse grained, grey to greyish white, feldspathic fragile sandstone.
125.75	126.85	1.10	Grey shale.
126.85	131.40	4.55	<u>Coal.</u>
131.40	131.90	0.50	Grey shale.
131.90	133.25	1.35	White, fragile, coarse grained, argillaceous sandstone.
133.25	134.95	1.70	Alternate grey shale and fine grained, dirty white sandstone.
134.95	138.70	3.75	Coarse grained, feldspathic, dirty white, massive sandstone.
138.70	139.55	0.85	Grey shale with thin bands of grey siltstone.
139.55	144.30	4.75	Medium to coarse grained, dirty white, feldspathic sandstone with angular to sub-angular small quartz pebbles.
144.30	145.90	1.60	Grey shale.
145.90	147.15	1.25	Grey siltstone.
147.15	148.05	0.90	Medium to coarse grained, dirty white, massive sandstone.
148.05	148.90	0.85	Grey shale.
148.90	152.60	3.70	Coarse grained, feldspathic, dirty white massive sandstone.
152.60	153.80	1.20	Grey shale.
153.80	154.55	0.75	Grey siltstone with grey shale bands.
154.55	159.25	4.70	Very coarse grained, dirty white, massive sandstone with a few feldspar and quartz pebbles.
159.25	160.75	1.50	Alternate grey shale and fine grained, dirty white sandstone.
160.75	161.90	1.15	Medium to coarse grained, dirty white, feldspathic sandstone with grey shale bands and laminations.

1	2	3	4
<u>Borehole No. RJBS - 19, (Contd.)</u>			
161.90	162.80	0.90	Grey siltstone.
162.80	163.40	0.60	Grey shale.
163.40	167.05	3.65	Very coarse grained, feldspathic, greyish white, fragile, sandstone with angular to sub-angular small quartz pebbles.
167.05	167.60	0.55	Grey shale.
167.60	168.40	0.80	Grey siltstone, faintly laminated.
168.40	175.70	7.30	Pebbly to bouldery, dirty white, fragile sandstone mainly angular to sub-rounded quartz pebbles & boulders.
175.70	176.34	0.64	Grey silty shale with a thin coal band.
176.34	176.95	0.61	<u>Coal.</u>
176.95	178.25	1.30	Grey shale.
178.25	180.85	2.60	Dirty white, coarse grained, pebbly, fragile sandstone.
180.85	181.15	0.30	Grey shale.
181.15	181.65	0.50	Medium to coarse grained, grey, sandstone with thin bands of grey shale.
181.65	182.20	0.55	Grey shale.
182.20	183.50	1.30	Coarse grained, feldspathic, greyish to dirty white sandstone with laminations of grey shale.
183.50	183.80	0.30	Alternate medium to fine grained, dirty white sandstone and grey shale.
183.80	184.05	0.25	Grey shale.
184.05	191.80	7.75	Very coarse grained to pebbly, dirty white, feldspathic, sandstone with big angular to sub-rounded pebbles of quartz.
Barakar Formation. Talchir Formation.			
191.80	192.10	0.30	Dirty white, argillaceous, coarse grained massive sandstone.
192.10	193.00	0.90	Grey claystone, sandy and medium grained sandstone alternate bands with greenish tinge.
193.00	207.50	14.50	Boulder bed, angular to sub-rounded big pebbles and boulders of quartzite, quartz, amphibolite and gneiss.

Borehole closed at 207.50 m.

I/108

BOREHOLE NO. RJBS - 20

Location : Lat : 24°08'00" R.L. : 118.57 m.
 Long : 87°32'18" Unit No. : 374
 Date of commencement : 24.7.89. Driller : A. B. Bhowmik.
 Date of closing : 30.9.89. Logged by : R. Bandyopadhyay.
 Total depth : 415.00 m.

1	2	3	4
0.00	4.00	4.00	Sludge of yellowish, coarse sand.
4.00	10.70	6.70	Buff to chocolate coloured, coarse grained, highly ferruginous sandstone with sandy clay bands.
10.70	11.90	1.20	Grey siltstone with a few thin grey shale bands.
11.90	12.50	0.60	Coarse grained, dirty white sandstone and grey shale alternate bands.
12.50	13.90	1.40	<u>Coal</u> with bands.
13.90	14.03	0.13	Grey arenaceous shale.
14.03	15.21	1.18	Coarse grained, feldspathic, fragile sandstone with a carb. shale band (23 cm.)
15.21	15.51	0.30	Sandy fire clay.
15.51	16.21	0.70	Fine grained, massive, dirty white sandstone.
16.21	16.51	0.30	Grey shale.
16.51	16.92	0.41	Grey siltstone with coal laminations.
16.92	18.03	1.11	<u>Coal</u> with bands.
18.03	18.32	0.29	Siltstone carb. shale.
18.32	18.62	0.30	<u>Shaly coal</u> .
18.62	19.17	0.55	Carb. shale.
19.17	20.20	1.03	Grey shale.
20.20	21.18	0.98	Grey, medium grained sandstone with thin coal, grey shale bands with vertebrae impressions.
21.18	22.52	1.34	Grey siltstone with thin coal bands.
22.52	23.12	0.60	Grey arenaceous shale.
23.12	25.05	1.93	Dirty white to grey, fine grained sandstone to siltstone (top to bottom) with thin grey shale bands.
25.05	26.50	1.45	Coarse grained, fragile, grey, feldspathic sandstone.
26.50	27.17	0.67	Grey arenaceous shale.

1	2	3	4
<u>Borehole No. RJES - 20 (Contd.)</u>			
27.17	27.65	0.48	<u>Coal.</u>
27.65	28.00	0.35	Grey shale.
28.00	28.42	0.42	Coal with band.
28.42	29.45	1.03	Grey siltstone with laminations of coal.
29.45	31.09	1.64	Grey arenaceous shale with thin coal bands
31.09	31.49	0.40	Coarse grained, dirty white sandstone with shale bands.
31.49	32.09	0.60	Grey siltstone.
32.09	32.59	0.50	<u>Coal.</u>
32.59	33.49	0.90	Dirty white, coarse to fine grained (lower), massive sandstone.
33.49	34.14	0.05	Coal with a 16cm. siltstone band.
34.14	37.00	2.86	Grey siltstone with thin shale and coal bands.
37.00	38.95	1.95	Very coarse grained to medium grained (bottom) fragile, greyish white sandstone with very thin coal bands.
38.95	39.30	0.35	Grey shale,
39.30	39.90	0.60	<u>Coal.</u>
39.90	40.60	0.70	Coarse grained, grey to dirty white, massive sandstone.
40.60	40.75	0.15	<u>Coal.</u>
40.75	41.39	0.64	Carb. shale with thin sandstone bands.
41.39	41.75	0.36	<u>Coal.</u>
41.75	42.30	0.55	Grey siltstone.
42.30	43.30	1.00	Grey shale with a thin coal band.
43.30	51.10	7.80	<u>Coal</u> with bands.
51.10	51.20	0.10	Carb. shale.
51.20	52.70	1.50	Fine to medium grained, grey sandstone with grey shale bands - alternate.
52.70	57.70	5.00	Grey arenaceous shale.
57.70	60.90	3.20	Medium to coarse grained, white, massive sandstone.
60.90	62.00	1.10	Grey siltstone with a few thin coal bands.
62.00	63.59	1.59	Medium to coarse grained, grey sandstone with lenses and laminations of coal.
63.59	63.95	0.36	Grey shale with vertebraria impressions.
63.95	67.25	3.30	<u>Coal</u> with shale bands.

1	2	3	4
<u>Borehole No. RJBS - 20 (Contd.)</u>			
67.25	67.70	0.45	Grey shale.
67.70	68.20	0.50	Medium grained, argillaceous, grey sandstone.
68.20	70.05	1.85	Grey shale.
70.05	70.85	0.80	<u>Coal</u> with bands.
70.85	71.45	0.60	Grey shale.
71.45	72.25	0.80	Carb. shale.
72.25	73.55	1.30	Grey shale.
73.55	74.10	0.55	Grey siltstone.
74.10	74.70	0.60	Medium to coarse grained(bottom), grey sandstone.
74.70	74.99	0.29	Carb. shale.
74.99	75.58	0.59	<u>Coal</u> .
75.58	75.85	0.27	Carb. shale.
75.85	76.10	0.25	Medium grained, greyish white sandstone.
76.10	76.68	0.58	Carb. shale.
76.68	78.85	2.17	Coal with band.
78.85	79.10	0.25	Medium grained, grey sandstone with grey shale bands.
79.10	80.50	1.40	Grey shale with vertebraria impressions.
80.50	82.00	1.50	<u>Coal</u> .
82.00	84.05	2.05	Coarse grained, dirty white sandstone with grey shale bands.
84.05	84.13	0.08	Carb. shale.
84.13	85.95	1.82	<u>Coal</u> .
85.95	88.25	2.30	Grey shale with thin coal bands.
88.25	90.65	2.40	Medium to very coarse grained, pebbly at bottom, dirty white, sandstone, angular to sub-angular quartz pebbles.
90.65	91.77	1.12	Carb. shale.
91.77	93.27	1.50	Coarse grained, grey to dirty white sandstone with laminations of grey shale.
93.27	93.87	0.60	Grey shale.
93.87	94.62	0.75	Alternate greyish white, fine grained sandstone and grey shale.
94.62	95.12	0.50	Carb. shale.
95.12	96.50	1.39	Alternate grey shale and fine grained, grey sandstone.

1	2	3	4
<u>Borehole No. RJ3S - 20 (Contd.)</u>			
96.50	101.35	4.85	Coarse grained, greysh white sandstone, lower part with small quartz pebbles.
101.35	102.20	0.85	Grey siltstone with grey shale bands at the top.
102.20	102.60	0.40	Alternate grey shale and fine grained, dirty white sandstone.
102.60	108.94	6.34	Coarse to very coarse grained, dirty white, feldspathic sandstone.
108.94	109.54	0.60	Grey arenaceous shale.
109.54	111.55	2.01	Coarse to pebbly, dirty white to greyish sandstone with sub. rounded quartz pebbles.
111.55	112.70	1.15	Medium grained, carb. sandstone with grey shale lamination.
112.70	117.36	4.66	Very coarse grained to pebbly (small quartz pebbles) dirty white sandstone.
117.36	118.51	1.15	Carb. shale.
118.51	119.20	0.69	Alternate medium grained, greyish white sandstone and grey shale.
119.20	120.55	1.35	Grey shale.
120.55	122.00	1.45	Medium to coarse grained, dirty white, feldspathic sandstone.
122.00	122.42	0.42	Grey arenaceous shale.
122.42	122.70	0.28	<u>Coal.</u>
122.70	122.96	0.36	Grey shale.
122.96	123.40	0.44	Carb. grey, medium grained sandstone.
123.40	124.20	0.80	Alternate grey shale and medium grained, dirty white sandstone.
124.20	131.10	6.90	Coarse to very coarse grained, feldspathic, dirty white sandstone.
131.10	140.35	9.25	Alternate grey shale and medium to fine grained, dirty white sandstone.
140.35	142.30	1.95	Fine to coarse grained (lower part), feldspathic, dirty white sandstone with sideritic band at the top.
142.30	143.10	0.80	Alternate grey shale and fine grained, greyish s white sandstone.

1	2	3	4
Borehole No. RJBS - 20(Contd.)			
143.10	143.50	0.40	Carb. shale.
143.50	144.05	0.55	Alternate bands of medium grained, dirty white, sandstone and grey shale.
144.05	147.10	3.05	Coarse to pebbly, grey sandstone with sub-angular quartz pebbles of small size.
147.10	147.40	0.30	Carb. shale.
147.40	148.55	1.15	Coarse grained, massive, dirty white, sandstone with faint laminations of grey shale.
148.55	148.85	0.30	Grey arenaceous shale.
148.85	152.05	3.20	Dirty white, coarse grained, feldspathic sandstone with cross beddings.
152.05	152.55	0.50	Grey, carb. fine grained sandstone with grey shale bands.
152.55	156.05	3.50	Coarse grained, dirty white, feldspathic sandstone.
156.05	156.55	0.50	Grey shale.
156.55	157.90	1.35	Fine to medium grained, feldspathic, dirty white sandstone.
157.90	158.40	0.50	Grey shale.
158.40	158.75	0.35	Fine grained, grey, carb. sandstone.
158.75	165.40	6.65	Very coarse grained to gritty, feldspathic, dirty white, sandstone with grey shale bands.
165.40	167.90	2.50	Coal with bands (with vertebraria stem impressions).
167.90	168.70	0.80	Alternate grey, fine grained sandstone and grey shale.
168.70	180.80	12.10	Coarse to gritty (lower part pebbly), dirty white, massive sandstone. Small quartz pebbles are sub-angular shaped.
180.80	182.70	1.90	Grey shale with coal laminations.
182.70	184.00	1.30	Fine to coarse grained (bottom), massive, greyish white sandstone.
184.00	184.60	0.60	Alternate bands, dirty white, fine grained sandstone and grey shale.
184.60	185.30	0.70	Grey arenaceous shale.
185.30	186.30	1.00	Gritty, dirty white sandstone.

1	2	3	4
<u>Borehole No. RJBS - 20 (Contd.)</u>			
186.30	186.75	0.45	Grey, pebbly sandstone, sub-angular quartz pebbles.
186.75	189.27	2.52	<u>Coal</u> with bands.
189.27	190.00	0.73	Grey shale with a thin coal band in the upper part.
190.00	190.75	0.75	Fine grained, grey carb. sandstone.
190.75	191.25	0.50	Alternate medium grained, greyish white, sandstone and grey shale.
191.25	192.25	1.00	Very coarse grained, pebbly, greyish white sandstone.
192.25	193.64	1.39	<u>Coal</u> .
193.64	194.19	0.55	Carb. shale.
194.19	197.10	2.91	<u>Coal</u> .
197.10	197.85	0.75	Fine to coarse grained(lower part), dirty white, feldspathic sandstone.
197.85	198.60	0.75	Carb. shale.
198.60	199.10	0.50	<u>Coal</u> .
199.10	200.00	0.90	Grey arenaceous shale.
200.00	204.90	4.90	Medium grained to gritty, feldspathic, massive dirty white sandstone.
204.90	209.80	4.90	<u>Coal</u> with band.
209.80	210.90	1.10	Fine grained, dirty white sandstone and grey shale bands.
210.90	211.30	0.40	<u>Coal</u> .
211.30	212.50	1.20	Grey arenaceous shale.
212.50	218.20	5.70	Fine grained(upper) to gritty, dirty white, feldspathic sandstone.
218.20	219.60	1.40	Grey shale.
219.60	221.30	1.70	Alternate grey shale and fine grained, dirty white sandstone.
221.30	224.95	3.65	Grey arenaceous shale.
224.95	226.40	1.40	Fine grained, dirty white sandstone with grey shale bands.
226.40	227.70	1.30	Medium grained, feldspathic sandstone with a few shale bands at the lower part.
227.70	228.45	0.75	Grey shale.
228.45	229.60	1.15	Fine grained, grey, massive sandstone.

1	2	3	4
<u>Borehole No. RJBS - 20 (Contd.)</u>			
229.60	231.85	2.25	Coarse grained, dirty white, feldspathic, sandstone with shale laminations.
231.85	232.88	1.03	<u>Coal</u> with shale and siderite bands.
232.88	233.50	0.62	Grey shale.
233.50	234.30	0.80	Fine grained, grey, massive sandstone.
234.30	235.65	1.35	Alternate grey shale and fine grained, dirty white sandstone bands.
235.65	236.05	0.40	Grey arenaceous shale.
236.05	237.40	1.35	Dirty white, coarse grained, feldspathic sandstone.
237.40	238.75	1.35	Grey shale with a siderite band at the top.
238.75	239.10	0.35	Carb., medium grained, grey sandstone.
239.10	240.10	1.00	Alternate grey shale and fine grained, dirty white sandstone.
240.10	251.10	10.00	Gritty to pebbly sandstone mainly sub-angular to sub-rounded small quartz pebbles. Greyish white.
251.10	252.10	1.00	Fine grained, grey sandstone.
252.10	253.20	1.10	Coarse to gritty, lower part laminated, dirty white sandstone with siderite band.
253.20	254.50	1.30	Alternate grey shale and fine grained, dirty white to grey sandstone. Small scale faulting in the lower part.
254.50	256.40	1.90	Dirty white, pebbly sandstone sub-angular medium sized quartz pebbles.
256.40	256.80	0.40	Grey shale, arenaceous, with sideritic bands in the lower part.
256.80	257.05	0.25	Alternate grey shale and fine grained, dirty white sandstone.
257.05	260.50	3.45	Pebbly, dirty white sandstone, larger, sub-angular quartz pebbles.
260.50	261.30	0.80	Grey arenaceous shale.
261.30	267.10	5.80	Medium grained to gritty, dirty white, massive sandstone, occasionally pebbly.
267.10	268.00	0.90	Grey, arenaceous shale.
268.00	269.40	1.40	Alternate grey shale and fine grained, dirty white, sandstone with small scale faulting, cross-bedded.

1	2	3	4
Borehole No. RJBS - 20 (Contd.)			
269.40	270.95	1.55	Grey shale.
270.95	271.75	0.80	Dirty white, medium grained, feldspathic sandstone with grey shale laminations.
271.75	272.25	0.50	Grey shale with a siderite band at the lower part.
272.25	276.80	4.55	Gritty to pebbly (mainly, medium sized, sub-angular quartz pebbles) sandstone with shale bands. Slickensides in shale bands.
276.80	277.15	0.35	Fine grained, grey massive sandstone.
277.15	278.35	1.20	Coarse grained, occasionally pebbly, dirty white sandstone.
278.35	279.13	0.78	Grey, arenaceous shale.
279.13	283.70	4.57	Coarse grained, dirty white sandstone. Pebbles are mainly smaller to medium sized, sub-angular quartz.
283.70	288.20	4.50	Coarse grained to pebbly (lower), greyish white, sandstone.
288.20	293.35	5.15	Pebbly, greyish white sandstone. Pebbles are larger in size, sub-angular to sub-rounded quartz. Upper part crushed, water loss. Fault(?).
293.35	294.10	0.75	Coarse grained, dirty white, massive sandstone.
294.10	298.30	4.20	Dirty white, pebbles (small quartz pebbles) sandstone.
298.30	307.25	8.95	Gritty, feldspathic, greyish white, sandstone with a few grey shale and siderite bands.
307.25	307.40	0.15	<u>Coal</u> .
307.40	307.70	0.30	Grey shale.
307.70	308.40	0.70	Grey siltstone.
308.40	312.70	4.30	Coarse grained to gritty, feldspathic sandstone, dirty white with a few reworked pebbles of coal.
312.70	313.28	0.58	<u>Coal</u> , shaly.
313.28	313.48	0.20	Carb. shale.
313.48	313.85	0.37	Grey siltstone.

1	2	3	4
<u>Borehole No. RJBS - 20 (Contd.)</u>			
313.85	314.20	0.35	Grey, arenaceous shale.
314.20	321.10	6.90	Coarse to very coarse grained, dirty white sandstone, lower part pebbly with a few feworked coal pebbles, grey shale and siderite bands present.
321.10	321.90	0.80	Grey shale.
321.90	322.60	0.70	Alternate thin bands of grey shale and fine grained, dirty white sandstone.
322.60	334.50	11.90	Medium to coarse grained, lower part pebbly (with small quartz pebbles), dirty white, fragile sandstone.
334.50	345.15	10.65	Coarse grained, greyish white, massive, occasionally pebbly sandstone.
345.15	346.20	1.05	Grey shale, arenaceous.
346.20	346.90	0.70	Grey siltstone.
346.90	348.90	2.00	Grey, arenaceous shale.
348.90	352.30	3.40	Alternate grey shale and feldspathic, dirty white, fine grained sandstone.
352.30	353.80	1.50	Medium to coarse grained, grey sandstone with small sub-angular quartz pebbles.
353.80	354.50	0.70	Grey shale.
354.50	369.50	15.00	Dirty white, coarse grained to pebbly (lower part), feldspathic sandstone with mainly large sub-angular to sub-rounded quartz pebbles.
369.50	369.95	0.45	Grey, arenaceous shale.
369.95	377.35	7.40	Dirty white, fragile, pebbly sandstone.
377.35	377.50	0.15	<u>Coal</u> , shaly.
377.50	378.10	0.60	alternate grey shale and coarse grained, white sandstone with a sideritic band in the bottom.
378.10	379.10	1.00	Grey, arenaceous shale.
379.10	386.00	6.90	Grey, fragile, sandstone with sub-angular quartz pebbles and a few disseminated feldspar grains and laminations of carb. matters.

1 2 3 4

Borehole No. RJBS - 20 (Contd.)

Barakar Formation.

Talchir Formation.

386.00	403.00	7.00	Dirty white, coarse grained, massive, occasionally faintly laminated sandstone with greenish tinge and a few grey shale bands at the lower part.
403.00	404.50	1.50	Greyish siltstone with small scale faulting in the shale laminatrous.
404.50	408.25	3.75	Faintly laminated, coarse grained, greenish sandstone.
408.25	415.00	6.75	Boulders bed. Boulders are mainly of angular to sub-angular gneisses, quartzites granites etc.

Borehole closed at 415.00 m.

I/110

Borehole No., RJBS - 21.

Location : Lat : 24°09'37" R.L. : 115.48 m.

Long : 87°32'34" Unit No. : 200/214.

Date of Commencement : 22.8.89. S.P.A.(D) : M. L. Banga.

Date of closing : 14.12.89. Logged by : R. Bandyopadhyay.

Total depth : 304.55 m.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
0.00	9.00	9.00	Sludge of brownish and yellowish, fine grained sand (containing fragments of porcellinitic creamy shale of inter-trappeans).
9.00	12.75	3.75	Yellowish to brownish, ferruginous, highly fractured, argillaceous sandstone.
12.75	14.80	2.05	Brownish, sandy clay.
14.80	16.10	1.30	Grey shale.
16.10	16.95	0.85	Fine to medium grained, grey, massive sandstone (a few sub-angular small quartz pebbles present).
16.95	17.45	0.50	Grey shale.
17.45	17.65	0.20	<u>Coal.</u>
17.65	17.90	0.25	Medium grained, greyish white, argillaceous sandstone.
17.90	18.65	0.75	Grey, sandy fire clay.
18.65	19.90	1.25	Medium grained, greyish white, argillaceous sandstone with a few thin clay bands.
19.90	23.40	3.50	Grey shale.
23.40	23.70	0.30	<u>Coal.</u>
23.70	24.70	1.00	Dirty white, coarse grained, massive sandstone.
24.70	25.95	1.25	Grey shale.

1	2	3	4
25.95	28.25	2.30	<u>Coal.</u>
28.25	29.25	1.00	Grey shale.
29.25	29.55	0.30	<u>Coal.</u>
29.55	30.50	0.95	Grey shale.
30.50	33.45	2.95	<u>Coal</u> with band.
33.45	33.95	0.50	Medium to coarse grained, feldspathic, greyish white, sandstone with thin laminations of coal.
33.95	35.75	1.80	Grey shale.
35.75	36.00	0.25	Greyish white, fine grained, sandstone with grey shale laminations.
36.00	38.60	2.60	<u>Coal</u> with bands.
38.60	39.60	1.00	Fine to medium grained (lower part coarser) greyish white sandstone, with laminations of grey shale and streaks of coal. Cross-bedded.
39.60	39.85	0.25	Grey shale.
39.85	40.19	0.34	Grey shale.
40.19	40.80	0.61	<u>Coal.</u>
40.80	41.15	0.35	Grey shale.
41.15	41.65	0.50	Medium to coarse grained, dirty white, feldspathic sandstone, massive.
41.65	42.30	0.65	Grey shale.
42.30	44.15	1.85	Alternate grey shale and fine grained, greyish white sandstone.
44.15	44.60	0.45	<u>Coal</u> with shale bands.
44.60	45.55	0.95	Grey shale.
45.55	48.10	2.55	Alternate grey shale and fine grained, greyish white sandstone.
48.10	48.30	0.20	Grey shale.

1	2	3	4
48.30	50.70	2.40	Medium to coarse grained, dirty white, feldspathic sandstone with laminations of grey shale.
50.70	51.50	0.80	Alternate grey shale and fine grained, greyish white sandstone.
51.50	55.00	3.50	Grey shale with a thin coal band.
55.00	56.58	1.58	<u>Coal</u> .
56.58	56.97	0.39	Carb. shale with fire clay band.
56.97	57.10	0.13	<u>Coal</u> , shaly.
57.10	59.40	2.30	Grey shale.
59.40	61.40	2.00	<u>Coal</u> with bands.
61.40	66.90	5.50	Grey shale with a thin coal band.
66.90	67.15	0.25	Fine grained, dirty white sandstone with grey shale laminations.
67.15	68.65	1.50	<u>Coal</u> with a fire clay band (0.22 m. thick fire clay after 0.47 m. of coal from top).
68.65	69.05	0.40	Grey shale.
69.05	69.25	0.20	Coarse grained, greyish white sandstone with grey shale laminations.
69.25	69.75	0.50	Alternate grey shale and medium grained, dirty white sandstone.
69.75	70.20	0.45	Grey shale.
70.20	70.55	0.35	<u>Coal</u> .
70.55	70.85	0.30	Alternate grey shale and fine grained, dirty white sandstone.
70.85	71.55	0.70	Grey siltstone.
71.55	71.80	0.25	Alternate grey shale & fine grained, dirty white sandstone.
71.80	72.00	0.20	Grey shale.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Borehole No. RJBS - 21 (Contd.)</u>			
72.00	72.35	0.35	Dirty white, coarse grained sandstone with laminations of grey shale.
72.35	73.90	1.55	Grey shale.
73.90	74.35	0.45	<u>Coal.</u>
74.35	74.80	0.45	Grey shale.
74.80	75.05	0.25	Coarse grained, feldspathic, dirty white sandstone.
75.05	79.05	4.00	Grey shale.
79.05	80.10	1.05	Fine grained, dirty white to greyish. (bottom) massive, feldspathic sandstone.
80.10	80.40	0.30	<u>Coal.</u>
80.40	80.90	0.50	Alternate grey shale and fine grained, dirty white sandstone.
80.90	90.00	9.10	Grey shale.
90.00	90.40	0.40	Alternate dirty white, fine grained sandstone and grey shale.
90.40	91.60	1.20	Coarse grained, feldspathic, greyish white sandstone.
91.60	92.50	0.90	Alternate grey shale & fine grained, dirty white sandstone.
92.50	94.05	1.55	Grey shale.
94.05	94.85	0.80	Alternate grey shale and fine grained, dirty white sandstone.
94.85	95.15	0.30	<u>Coal.</u>
95.15	95.65	0.50	Fine grained, dirty white, feldspathic sandstone with grey shale laminations.
95.65	96.45	0.80	Grey shale.
96.45	97.50	1.05	Medium grained to fine grained, dirty white, feldspathic sandstone with faint grey shale laminations and sideritic bands.

1	2	3	4
Borehole No. RJBS - 21 (Contd.)			
97.50	100.40	2.90	Grey shale.
100.40	101.30	0.90	Fine grained, greyish white sandstone with laminations of grey shale.
101.30	102.85	1.55	Grey shale.
102.85	103.15	0.30	Medium grained, dirty white, sandstone with grey shale and coal laminations.
103.15	103.35	0.20	Carb. shale.
103.35	103.86	0.51	<u>Coal</u> .
103.86	106.70	2.84	Grey shale, upper part carb.
106.70	107.55	0.85	Dirty white, feldspathic, medium grained to fine grained(bottom)sandstone with one or two grey shale bands.
107.55	108.05	0.50	Grey siltstone.
108.05	108.35	0.30	Grey shale.
108.35	108.55	0.20	Grey, fine grained, feldspathic sandstone with shale laminations.
108.55	116.10	7.55	<u>Coal</u> with grey shale bands.
116.10	117.00	0.90	Alternate fine grained, dirty white sandstone & grey shale.
117.00	124.75	7.75	Grey shale.
124.75	125.00	0.25	Alternate fine grained, dirty white sandstone & grey shale.
125.00	127.55	2.55	Feldspathic dirty white, medium grained sandstone with bands & laminations of grey shale, micro-faulting near the contact of the shale.
127.55	130.69	3.14	Grey shale.
130.69	131.55	0.86	<u>Coal</u> with shale bands.
131.55	132.05	0.50	Grey shale.
132.05	132.35	0.30	<u>Coal</u> .
132.35	132.85	0.50	Grey shale.
132.85	134.10	1.25	<u>Coal</u> with shale band.
134.10	135.60	1.50	Grey shale.
135.60	138.90	3.30	Coarse grained, feldspathic, greyish white sandstone with laminations of coal/carb. shale/shale with a few clasts of feldspar.

1	2	3	4
<u>Borehole No. RJBS - 21 (Contd.)</u>			
138.90	140.25	1.35	<u>Coal</u> with grey shale bands.
140.25	140.95	0.70	Grey shale.
140.95	145.05	4.10	Coarse grained, feldspathic, greyish white sandstone with thin bands of grey shale & coal and a few pebbles of re-worked shale.
145.05	145.35	0.30	Grey shale.
145.35	148.75	3.40	Coarse grained, feldspathic, dirty white, fragile sandstone with laminations and bands of grey shale.
148.75	149.25	0.50	Grey siltstone.
149.25	149.50	0.25	Coarse grained, dirty white, feldspathic sandstone.
149.50	167.30	17.80	<u>Coal</u> with grey shale bands.
167.30	168.05	0.75	Fine grained to medium grained, grey to greyish white feldspathic sandstone.
168.05	169.30	1.25	Grey shale with sandstone band in the middle.
169.30	170.30	1.00	Alternate bands of grey shale and fine grained, dirty white sandstone.
170.30	170.90	0.60	Grey shale.
170.90	171.01	0.11	Carbonaceous shale.
171.01	172.20	1.19	<u>Coal</u> .
172.20	172.80	0.60	Grey shale.
172.80	183.00	10.20	Coarse grained to pebbly, feldspathic, greyish white sandstone. Sub-angular, small quartz pebbles. Lower part more pebbly.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Borehole No. RJBS - 21 (Contd.)</u>			
183.00	184.91	1.91	<u>Coal</u> with grey shale band.
184.91	185.80	0.89	Grey shale and siderite bands in the upper part.
185.80	194.10	8.30	Dirty white, feldspathic, fragile, coarse grained to pebbly (lower part) sandstones with a few grey shale & siderite bands.
194.10	195.10	1.00	Grey shale.
195.10	195.40	0.30	<u>Coal</u> .
195.40	196.15	0.75	Grey shale.
196.15	196.75	0.60	Greyish, medium grained, pebbly sandstone.
196.75	197.15	0.40	Grey shale.
197.15	203.45	6.30	Coarse grained, to pebbly, feldspathic, fragile, greyish white sandstone. Pebbles are mainly sub-angular to sub-rounded of small quartz.
203.45	211.95	8.50	<u>Coal</u> with grey shale bands. (Core recovery very poor, length adjusted after geophysical logging).
211.95	213.30	1.35	Grey, medium grained to fine grained sandstone with grey shale laminations (water loss).
213.30	213.70	0.40	Carb. shale.
213.70	214.55	0.85	Grey, fine grained, sandstone with grey shale laminations.
214.55	216.30	1.75	Carb. shale, occasionally sandy.
216.30	217.80	1.50	Grey siltstone with streaks and lenses of coal.
217.80	218.65	0.85	Coarse grained, feldspathic, dirty white sandstone with coal and carb. shale bands.

1	2	3	4
<u>Borehole No. RJBS - 21 (Contd.)</u>			
218.65	218.85	0.20	Carb. shale.
218.85	219.30	0.45	<u>Coal.</u>
219.30	219.60	0.30	Carb. shale.
219.60	220.35	0.75	Grey shale.
220.35	221.85	1.50	Fine grained, grey to coarse grained, white, feldspathic sandstone.
221.85	222.80	0.95	<u>Coal.</u>
222.80	223.35	0.55	Grey shale.
223.35	223.80	0.45	<u>Coal.</u>
223.80	233.55	9.75	Coarse grained to pebbly, feldspathic, greyish white, fragile sandstone with bands of fine grained and medium grained, dirty white sandstone.
233.55	235.85	2.30	Sandy, grey shale, lower part carb.
235.85	236.55	0.70	<u>Coal.</u>
236.55	237.15	0.60	Sandy grey shale, upper part carb.
237.15	237.28	0.13	Medium grained, grey, massive sandstone.
237.28	241.70	4.42	<u>Coal</u> with a few grey shale bands.
241.70	242.55	0.85	Grey shale.
242.55	251.30	8.75	Dirty white, argillaceous, feldspathic, coarse grained sandstone, upper part with a few thin clay bands.
251.30	252.35	1.03	Grey shale.
252.35	255.30	2.95	Medium to coarse grained, dirty white, fragile, sandstone with a few shale bands.
255.30	255.70	0.40	Grey shale.
255.70	257.45	1.75	Grey siltstone with grey shale bands.
257.45	260.40	2.95	Grey, arenaceous shale.
260.40	261.40	1.00	Medium to coarse grained, dirty white, feldspathic massive sandstone.
261.40	263.85	2.45	Grey shale.
263.85	268.70	4.85	Coarse to medium grained, feldspathic, dirty white sandstone with small quartz clasts, grey shale bands and reworked pebbles of grey shale.
268.70	269.20	0.50	Grey shale.
269.20	272.30	3.10	Coarse grained, massive, feldspathic sandstone with a few reworked small pebbles of grey shale.

1	2	3	4
<u>Borehole No. RJBS - 21. (Contd.)</u>			
272.30	273.20	0.90	Grey shale,
273.20	277.20	4.00	Coarse grained to (small) pebbly, greyish white sandstone with grey shale bands.
277.20	278.30	1.10	Grey shale.
278.30	286.55	8.25	Coarse grained to pebbly, feldspathic, greyish white sandstone. Small angular to sub-angular quartz pebbles with one grey shale band.
286.55	287.60	1.05	Grey shale.
287.60	288.70	1.10	Coarse grained, fragile, dirty white, feldspathic sandstone, massive.
288.70	289.50	0.80	<u>Coal.</u>
289.50	290.45	0.95	Grey shale, upper part carbonaceous.
290.45	301.00	10.55	Coarse grained to pebbly, feldspathic, fragile, dirty white sandstone, small sub-angular to sub-rounded quartz pebbles, lower part without any pebble, massive.
301.00	301.15	0.15	<u>Coal.</u>
301.15	301.50	0.35	Grey shale.
301.50	302.10	0.60	Coarse grained, greyish white sandstone with small sub-rounded pebbles of quartz.

Barakar Formation.Talchir (?) Formation.

302.10	304.55	2.45	Coarse grained (with sub-angular to angular, medium sized quartz & feldspar pebbles) sandstone. Greyish white with a faint greenish tinge.
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Borehole closed at 304.55 m.

I/127

BOREHOLE NO. RJB - 11.

Location : 800 m. EN. of Badalpara R. L. : 124.27 m.
 Lat. : 24°03'00" Unit No. : 200
 Long : 87°33'00" S.T.A.(D) : M.L. Banga,
 Date of Commencement : 11.7.84.
 Date of Closing : 31.7.84. Legged by : A.K. Mukherjee.
 Total depth : 326.95 m.

1	2	3	4
0.00	7.30	7.30	Sludge of sandy soil.
7.30	7.47	0.17	Co l, shaly with 0.02m. sandstone at top.
7.47	9.80	2.33	Grey shale, sandy.
9.80	11.25	1.45	Greyish white gritty sandstone.
11.25	11.36	0.11	<u>Coal.</u>
11.36	11.44	0.08	Grey shale.
11.44	11.80	0.36	Carb. shale.
11.80	12.28	0.48	<u>Coal.</u>
12.28	12.62	0.34	Grey sandy shale with a thin (0.04m.) coal band in the middle.
12.62	14.10	1.48	<u>Coal.</u>
14.10	14.86	0.76	Grey shale.
14.86	15.20	0.34	<u>Coal, shaly.</u>
15.20	16.14	0.94	Grey siltstone.
16.14	26.70	10.56	Greyish white coarse grained feldspathic sandstone with shale bands.
26.70	28.90	2.20	Grey shale.
28.90	29.80	0.90	Greyish white coarse grained sandstone.
29.80	31.85	2.05	Grey shale with iron stone shale at bottom.
31.85	32.45	0.60	<u>Coal, shaly.</u>
32.45	32.98	0.43	Grey shale, sandy.
32.98	34.38	1.10	<u>Coal with bands.</u>
34.38	35.25	0.87	Grey shale with carb. shale at bottom.
35.25	35.79	0.48	<u>Coal.</u>
35.73	38.38	2.65	Grey shale.
38.38	39.30	0.92	<u>Coal</u> with minor bands.
39.30	40.10	0.80	Grey shale.
40.10	41.80	1.70	<u>Coal.</u>
41.80	45.75	3.95	Grey shale.
45.75	46.82	1.07	Greyish white medium grained sandstone with shale laminae.

1	2	3	4
Borehole No. RJB. - 11. (Contd.)			
46.82	47.24	0.42	<u>Coal.</u>
47.24	47.57	0.33	Grey shale.
47.57	48.40	0.83	<u>Coal.</u>
48.40	50.83	2.43	Alternate band of grey shale and medium grained sandstone.
50.83	52.13	1.30	Grey shale.
52.13	53.15	1.02	<u>Coal</u> with shale bands.
53.15	59.78	6.63	Grey shale with thin coal bands.
59.78	61.25	1.47	Greyish white fine to medium grained sandstone with thin coal band.
61.25	79.13	17.88	Grey shale with occasional bands of fine to medium grained sandstone.
79.13	79.95	0.82	<u>Coal.</u>
79.95	82.05	2.25	Grey shale with coal laminae.
82.05	83.10	1.05	White coarse grained felspathic sandstone.
83.10	83.45	0.35	Grey shale.
83.45	91.88	8.43	<u>Coal</u> , shaly at places.
91.88	93.00	1.12	Greyish white fine grained felspathic sandstone.
93.00	99.68	6.68	Grey shale.
99.68	100.20	0.52	Quartzitic sandstone.
100.20	103.25	3.05	Grey shale.
103.25	104.05	0.80	<u>Coal.</u> with shale band.
104.05	105.20	1.15	Grey shale with coal laminations.
105.20	105.75	0.55	<u>Coal</u> with shale band.
105.75	106.92	1.17	Grey shale.
106.92	108.20	1.28	Greyish white medium to coarse grained felspathic sandstone.
108.20	109.35	1.15	<u>Coal.</u>
109.35	116.35	7.00	Greyish white coarse to pebbly gritty sandstone with grey shale band at top.
116.35	118.50	2.15	Alternation of grey shale and fine to medium grained sandstone.
118.50	122.10	3.60	White gritty to pebbly sandstone.
122.10	124.60	2.50	<u>Coal.</u>
124.60	125.11	0.51	Grey shale.
125.11	134.39	9.28	<u>Coal</u> with bands.

1	2	3	4
<u>Borehole No. RJB - 11. (Contd.)</u>			
134.39	134.91	0.52	Fine grained, greyish white sandstone.
134.91	135.90	0.99	<u>Coal.</u>
135.90	136.71	0.81	Grey shale, sandy.
136.71	136.93	0.22	<u>Coal.</u>
136.93	150.48	13.55	Greyish white coarse to gritty sandstone with minor grey shale band.
150.48	150.74	0.26	<u>Coal.</u>
150.74	151.29	0.55	Grey shale.
151.29	151.81	0.52	<u>Coal.</u>
151.81	152.28	0.47	Grey shale with thin coal band.
152.28	156.05	3.77	Alternate bands of coarse to gritty felspathic sandstone & grey shale.
156.05	156.92	0.87	<u>Coal.</u>
156.92	158.00	1.08	Interbanded grey shale and medium grained sandstone with fire clay at top.
158.00	159.20	1.20	<u>Coal.</u>
159.20	160.90	1.70	Grey shale with coal band.
160.90	162.25	1.35	<u>Coal.</u>
162.25	165.00	2.75	Grey shale.
165.00	172.50	7.50	Alternate bands of grey shale/white pebbly sandstone.
172.50	172.66	0.16	<u>Coal.</u>
172.66	178.93	6.27	Greyish white gritty to pebbly sandstone.
178.93	179.35	0.42	<u>Coal.</u>
179.35	182.03	2.68	Carb. sandstone with grey shale at top.
182.03	187.54	5.51	Greyish white gritty sandstone with grey shale bands.
187.54	188.14	0.60	<u>Coal.</u>
188.14	189.74	1.60	Grey shale.
189.74	191.36	1.62	Greyish white pebbly sandstone.
191.36	200.38	9.02	<u>Coal</u> with bands.
200.38	201.84	1.46	Grey shaly sandstone.
201.84	202.65	0.81	<u>Coal</u> with shale bands.
202.65	207.00	4.35	Grey shale, sandy.
207.00	208.86	1.86	<u>Coal</u> , shale at places.
208.86	210.65	1.79	Grey shale with thin coal bands.
210.65	212.23	1.58	White pebbly sandstone.

1	2	3	4
<u>Borehole No. BJB - 11. (Contd.)</u>			
212.23	212.83	0.60	<u>Coal.</u>
212.83	220.09	7.26	Alternate bands of grey shale and coarse to pebbly sandstone.
220.09	220.57	0.48	<u>Coal.</u>
220.57	222.30	2.23	Greyish white medium to coarse grained sandstone with grey shale bands.
222.30	223.21	0.44	<u>Coal.</u>
223.24	225.73	2.49	Alternate bands of grey shale and coarse to gritty sandstone.
225.73	228.85	3.12	<u>Coal.</u>
228.85	234.10	5.25	Alternation of grey shale and medium to gritty sandstone.
234.10	237.00	2.90	White coarse grained gritty sandstone.
237.00	242.75	5.75	<u>Coal.</u>
242.75	247.65	4.90	Alternate bands of grey shale and greyish white gritty sandstone.
247.65	247.80	0.15	<u>Coal.</u>
247.80	254.30	6.50	Greyish white medium to coarse felspathic sandstone with grey shale bands.
254.30	259.10	4.80	Alternate bands of grey shale and coarse to gritty sandstone.
259.10	259.40	0.30	<u>Coal.</u>
259.40	263.45	4.05	Alternate bands of grey shale and medium to coarse grained sandstone.
263.45	283.20	19.75	White coarse to gritty sandstone with grey shale bands.
283.20	283.50	0.30	<u>Coal.</u>
283.50	284.80	1.30	Grey sandy shale.
284.80	286.72	1.92	Greyish white pebbly sandstone with quartzitic sandstone at top.
286.72	287.27	0.55	<u>Coal.</u>
287.27	287.95	0.68	Greyish white medium grained sandstone with grey shale at bottom.

1	2	3	4
<u>Borehole No. RJB - 11. (Contd.)</u>			
287.95	288.37	0.42	<u>Coal.</u>
288.37	289.45	1.08	Grey shale with fire clay (?).
289.45	307.40	17.95	Greyish white pebbly sandstone with minor shale bands.
307.40	307.90	0.50	<u>Coal.</u>
307.90	308.65	0.75	Grey shale.
308.65	311.70	3.05	Greyish white pebbly sandstone.
311.70	315.80	4.10	Grey shale with a band of medium grained sandstone & thin coal bands.
315.80	317.10	1.30	<u>Coal.</u>
317.10	318.00	0.90	Grey shale with carbonaceous sandstone.
318.00	325.15	7.15	Greyish white pebbly sandstone.
325.15	325.30	0.15	Grey shale, sandy.
325.30	326.95	1.65	Metamorphics (Granite gneiss).

Borehole closed at 326.95 m.

APPENDIX-II

DETAILS OF THE COAL SEAMS WITH QUALITY INTERSECTED IN BOREHOLES DRILLED IN
KALYANPUR-MURGADANGAL-DALDALI BLOCK.

Borehole No. - RJBS-1

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Ex-band thickness (m)						Ash %	Moisture %	Useful heat value K/cal	Grade	Class	Remarks.
					1	2	3	4	5	6						
II	21.70	23.30	1.60	-	-	-	-	2.5	50.8	53.3	1545	G	IV			
	32.49	38.35	5.86	-	-	-	-	3.3	34.9	38.2	3628	E	III			
	40.15	50.70	10.55	4	0.86	9.69	-	4.1	32.1	36.2	3904	E	III	(Ex)		
I A	59.06	65.05	6.00	2	0.53	5.47	-	3.9	36.2	40.1	3366	E	IV	(In)		
	69.50	76.70	7.20	-	-	-	-	3.6	36.5	40.1	3366	E	IV	(Ex)		
	82.75	83.44	0.69	-	-	-	-	2.5	39.3	41.8	3155	F	IV	(In)		
I	84.60	85.85	1.25	-	-	-	-	3.2	32.2	35.4	4015	E	III			
	97.81	98.93	1.12	-	-	-	-	3.6	29.2	32.8	4374	D	III			
	113.60	118.90	5.30	-	-	-	-	2.4	40.1	42.5	3035	F	IV			
				-	-	-	-	2.3	45.4	47.7	2317	G	IV			

RJBS-2

Local	From (m)	To (m)	Thickness (m)	No. of bands	Ex-band thickness (m)						Ash %	Moisture %	Useful heat value K/cal	Grade	Class	Remarks.
					1	2	3	4	5	6						
VII	225.80	227.55	1.75	1	0.09	1.66	-	3.3	43.5	46.8	2442	F	IV	(Ex)		
	294.25	295.62	1.38	-	-	-	-	3.2	41.9	48.1	2262	G	IV	(In)		
VII	300.14	300.58	0.44	-	-	-	-	3.6	24.6	28.4	4981	C	III			
	301.30	301.62	0.32	-	-	-	-	3.4	44.0	47.4	2359	G	IV			
	301.99	302.75	0.76	-	-	-	-	3.6	35.2	38.8	3546	E	III			
	323.10	323.70	0.60	-	-	-	-	3.2	43.7	46.9	2428	F	IV			
				-	-	-	-	3.2	47.1	50.3	1959	G	IV			

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
VI	343.00	343.72	0.72	-	-	-	-	3.0	36.7	39.7	3421	E	III	
V	357.65	358.75	1.10	-	-	-	-	3.8	29.2	33.0	4346	D	III	
	363.88	365.00	1.12	1	0.13	0.99	-	2.8	36.0	38.8	3546	E	III	(Ex)
	385.08	387.20	2.12	-	-	-	-	2.6	39.5	42.1	3090	F	IV	(In)
IV	397.65	401.00	3.35	1	0.18	3.17	-	3.2	28.0	31.2	4594	D	III	
	413.70	422.40	8.70	3	0.39	8.31	-	5.1	35.7	40.8	3270	F	IV	(Ex)
III	444.00	446.20	2.20	-	-	-	-	4.9	37.8	42.7	3007	F	IV	(In)
	452.50	454.40	1.90	-	-	-	-	6.3	26.4	32.7	4387	D	III	(Ex)
	459.00	462.90	3.90	-	-	-	-	6.1	28.4	34.5	4139	E	III	(In)
	466.90	469.37	2.47	1	0.21	2.26	-	5.4	33.8	39.2	3490	E	III	
	470.10	479.20	9.10	-	-	-	-	6.0	18.2	24.2	5560	C	II	
	481.50	492.46	10.96	-	-	-	-	6.6	20.0	26.6	5229	C	II	
	493.10	496.00	3.50	1	0.21	2.26	-	5.2	25.4	30.6	4677	D	III	
	503.50	506.50	3.00	-	-	-	-	4.9	29.1	34.0	4208	D	III	
				-	-	-	-	5.8	22.3	28.1	5022	C	III	
				2	0.32	10.64	-	5.4	26.5	31.2	4498	D	III	
			-	-	-	-	5.3	27.7	33.0	4346	D	III		
			-	-	-	-	5.4	20.0	25.4	5395	C	II		
			-	-	-	-	5.1	34.6	39.7	3421	E	III		

II/3

RJBS-3(Contd.)

Swam zone	From (m) To (m)		Thickness (m)	No. of Thick- Ex. hand bands ness of thick- bands ness(m)	Moisture %	Ash %	Moisture + Ash %		Useful heat va- lue K/Cal	Grade	Class	Remarks
	2	3					6	7				
V	14.65	15.65	1.00	-	5.8	40.8	46.6	2469	F	IV	(Ex)	
	19.30	20.40	1.10	0.97	5.5	46.3	51.8	1752	G	IV	(In)	
	21.25	22.65	1.40	-	7.2	27.8	35.0	4070	E	III		
	23.14	25.60	2.46	2.32	7.4	24.9	31.3	3753	E	III	(Ex)	
	33.00	35.15	2.15	1.85	7.3	31.6	38.9	3532	E	III	(In)	
	38.27	40.55	2.28	2.16	6.3	36.4	42.7	3007	F	IV	(Ex)	
	43.85	44.95	1.10	0.99	5.8	39.8	45.6	2607	F	IV	(In)	
	49.29	50.80	1.51	1.04	6.8	42.1	48.9	2152	G	IV	(Ex)	
	54.35	55.76	1.41	-	6.6	42.9	49.5	2069	G	IV	(In)	
	59.62	61.52	1.90	-	6.0	39.5	45.5	2621	F	IV	(Ex)	
IV	61.82	66.50	4.68	4.43	5.7	41.9	47.6	2331	G	IV	(In)	
	80.78	81.83	1.05	0.84	4.3	48.0	52.3	1683	G	IV	(Ex)	
	82.23	84.93	2.70	-	5.6	43.8	49.4	2083	G	IV		
	85.49	86.48	0.99	-	5.2	36.2	41.4	3187	F	IV		
	89.76	94.12	4.36	-	6.2	32.7	38.9	3532	E	III	(Ex)	
	94.51	95.85	1.34	1.10	6.1	34.0	40.1	3366	F	IV	(In)	
	96.85	100.40	3.55	3.44	7.5	23.3	30.8	4650	D	III	(Ex)	
	103.10	105.33	2.23	2.10	6.5	31.9	38.4	3601	E	III	(In)	
	82.23	84.93	2.70	-	5.6	34.2	39.8	3408	E	III		
	85.49	86.48	0.99	0.82	5.4	40.0	45.4	2635	F	IV	(Ex)	
III	89.76	94.12	4.36	-	4.6	47.5	52.1	1710	G	IV	(In)	
	94.51	95.85	1.34	1.10	5.2	36.7	41.9	3118	E	III		
	96.85	100.40	3.55	3.44	5.3	33.1	38.4	3601	E	III	(Ex)	
	103.10	105.33	2.23	2.10	5.0	37.4	42.4	3049	F	IV	(In)	
	82.23	84.93	2.70	-	6.7	27.3	34.0	4208	D	III	(Ex)	
	85.49	86.48	0.99	0.82	6.6	28.3	34.9	4084	E	III	(In)	
	89.76	94.12	4.36	-	5.7	39.4	45.1	2676	F	IV	(Ex)	
	94.51	95.85	1.34	1.10	5.5	41.2	46.7	2455	F	IV	(In)	
	96.85	100.40	3.55	3.44	5.2	36.7	41.9	3118	E	III		
	103.10	105.33	2.23	2.10	5.4	40.0	45.4	2635	F	IV	(Ex)	

II/4
 RJBS-3(Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	127.10	127.55	0.45	-	-	-	-	6.7	29.4	36.1	3918	E	III	
	132.45	133.00	0.55	-	-	-	-	3.9	47.3	51.2	1834	G	IV	
	163.90	164.00	2.10	-	-	-	-	7.2	20.8	28.0	5036	C	II	
	196.17	203.60	7.43	-	-	-	-	5.8	27.0	32.8	4374	D	III	
	212.00	216.66	4.66	-	-	-	-	4.9	30.1	35.0	4070	E	III	
	232.55	233.65	1.10	-	-	-	-	5.2	25.8	31.0	4622	D	III	

II

RJBS-5

Coal Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total thickness (m)	Ex-band Thickness (m)	Moisture %	Ash %	Ash + Moisture %	Useful heat value K/cal	Grade	Class	Remarks
I.	2	3	1	1	1	-	-	-	-	-	-	-	-
	5.63	6.25	0.62	-	-	-	4.0	39.1	43.1	2952	F	IV	
	14.76	15.30	0.54	-	-	-	4.5	36.2	40.7	3283	F	IV	
	24.42	25.83	1.41	3	0.70	0.71	5.2	33.7	38.9	3532	E	III	(Ex)
	28.45	28.92	0.47	-	-	-	4.0	51.4	55.4	-	-	-	(In)
	30.17	31.50	1.33	1	0.26	1.07	5.8	26.8	32.6	4401	D	III	
							5.0	32.7	37.7	3697	E	III	(Ex)
							4.8	39.0	43.8	2856	F	IV	(In)

VI

V

II/5

RJBS-5 (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	747.56	48.50	0.94	1	0.22	0.72	5.3	33.2	38.5	3587	E	III	(Ex)
							4.7	39.3	44.0	2828	F	IV	(In)
	51.90	52.29	0.39	-	-	-	5.7	32.6	38.3	3615	E	III	
	54.38	54.71	0.33	-	-	-	5.0	35.3	40.3	3339	F	IV	
	55.77	56.87	1.10	-	-	-	4.8	36.1	40.9	3256	F	IV	
	58.21	58.60	0.39	-	-	-	4.8	34.6	39.4	3463	E	III	
	59.56	60.45	0.89	-	-	-	4.5	33.9	38.4	3601	E	III	
	67.50	69.36	1.86	3	0.25	1.61	4.5	36.5	41.0	3242	F	IV	(Ex)
							4.4	37.2	41.6	3159	F	IV	(In)
	74.11	74.40	0.29	1	0.10	0.13	4.6	39.4	44.0	2828	F	IV	(Ex)
							3.8	52.2	56.0	-	-	-	(In)
	74.81	75.85	1.04	1	0.06	0.98	4.5	39.3	43.8	2856	F	IV	(Ex)
							4.4	40.8	45.2	2662	F	IV	(In)
	78.67	79.09	0.42	-	-	-	4.4	36.0	40.4	3325	F	IV	
	79.67	80.05	0.38	-	-	-	4.8	41.9	46.7	2455	F	IV	
	80.79	81.23	0.44	-	-	-	4.4	47.6	52.0	1724	G	IV	
	82.06	82.90	0.84	-	-	-	3.8	47.2	51.0	1862	G	IV	
	84.58	85.03	0.45	-	-	-	4.8	33.8	38.6	3573	E	III	
	86.05	86.60	0.55	-	-	-	3.6	54.4	58.0	-	-	-	
	87.30	94.88	7.58	8	2.84	4.74	5.3	38.6	43.2	2842	F	IV	(Ex)
							3.8	48.0	51.8	1751	G	IV	(In)
	100.80	101.14	0.34	-	-	-	4.0	37.6	41.6	3159	F	IV	

IV

II/6

RJBS-5(Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	102.60	103.00	0.40	-	-	-	5.1	37.0	42.1	3090	F	IV	
	104.76	105.99	1.23	2	0.11	1.12	4.3 4.3	45.8 46.8	50.1 51.1	1986 1848	G G	IV IV	(Ex) (In)
	108.83	109.29	0.46	-	-	-	4.1	43.5	44.6	2745	F	IV	
	109.83	110.18	0.35	1	0.08	0.27	4.3 4.2	38.5 44.1	42.8 48.3	2994 2235	F G	IV IV	(Ex) (In)
	112.29	112.57	0.28	-	-	-	4.3	41.9	46.2	2524	F	IV	
	117.00	119.10	2.10	-	-	-	3.8	46.3	50.1	1986	G	IV	
	120.50	121.30	0.80	2	0.23	0.57	4.1 3.8	41.5 45.6	45.6 49.4	2607 2083	F G	IV IV	(Ex) (In)
III	122.90	124.35	1.45	-	-	-	5.5	26.9	32.4	4429	D	III	
	130.35	131.90	1.55	-	-	-	4.5	45.8	50.3	1959	G	IV	
	137.75	138.25	0.60	-	-	-	4.4	40.9	45.3	2649	F	IV	
	140.62	141.25	0.63	-	-	-	5.0	24.6	29.6	4815	D	III	
	145.59	149.75	4.16	1	0.16	4.00	4.5 4.5	36.6 38.0	41.1 42.5	3228 3035	F F	IV IV	(Ex) (In)
	151.00	155.90	4.90	1	0.25	4.65	4.4 4.3	33.4 35.3	37.8 39.6	3684 3435	E E	III III	(Ex) (In)

II/7

RJBS-6.

Coal Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total thickness of bands (m)	Ex-band thickness (m)	Moisture %	Ash %	Ash + Moisture %	Useful heat value K-Cal	Grade	Class	Remarks
VI	8.56	9.64	1.08	1	0.10	0.98	4.9	36.3	41.2	3214	F	IV	(Ex)
							4.8	38.0	42.8	2994	F	IV	(In)
	12.61	20.24	7.63	5	1.16	6.47	5.3	31.7	37.0	3794	E	III	(Ex)
							4.9	36.6	41.5	3173	F	IV	(In)
	21.30	21.60	0.30	-	-	-	5.4	34.3	39.7	3421	E	III	
V	29.28	29.68	0.40	-	-	-	5.0	23.2	28.2	5008	C	III	
	30.88	31.81	0.93	-	-	-	4.2	33.5	37.7				
	32.51	38.51	6.00	4	0.34	5.66	4.0	36.2	40.2	3352	F	IV	(Ex)
	45.60	48.65	3.05	1	0.17	2.88	3.8	35.2	39.0	3518	E	III	(Ex)
	50.75	52.75	2.00	1	0.08	1.92	3.6	37.4	41.0	3242	F	IV	(Ex)
IV	54.35	54.55	0.20	-	-	-	4.6	34.1	38.7	3559	E	III	
	55.50	59.15	2.65	2	0.32	2.33	3.1	45.1	48.2	2248	G	IV	(Ex)
							3.0	47.0	50.0	2000	G	IV	(In)
	59.05	59.70	0.65	-	-	-	3.3	35.9	39.2	3490	E	III	
	61.28	61.83	0.55	-	-	-	3.5	35.0	38.5	3587	E	III	
	62.75	75.30	12.55	6	1.29	11.76	3.3	40.4	43.7	2869	F	IV	(Ex)
							3.2	43.4	46.6	2469	F	IV	(In)
	76.30	76.80	0.50	-	-	-	4.0	23.8	32.8	4374	D	III	
	91.98	92.48	0.50	-	-	-	5.2	42.0	47.2	2386	G	IV	
	92.65	98.24	5.59	2	0.28	5.31	4.3	40.1	44.4	2773	F	IV	(Ex)
100.72	101.17	0.45	-	-	-	4.2	41.9	46.1	2538	F	IV	(In)	
103.29	103.74	0.45	-	-	-	4.4	43.1	47.5	2345	G	IV		
						4.2	45.0	49.2	2110	G	IV		

III

II/8

RJBS-6(Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	105.45	105.92	0.47	-	-	-	3.8	50.0	53.8	1476	G	IV	
	106.65	113.85	7.20	-	-	-	4.7	33.2	37.9	3670	B	III (Ex)	
	116.65	117.20	0.55	-	-	-	4.8	49.1	53.9	1462	6	IV	
	124.02	135.32	1.30	-	-	-	4.5	38.7	43.2	2938	F	IV	
	131.75	133.47	1.72	1	0.10	1.62	4.8	39.8	44.6	2745	F	IV (Ex)	
	136.75	139.65	2.90	-	-	-	4.6	41.9	46.5	2483	F	IV (In)	
	147.20	148.17	0.97	-	-	-	4.0	41.1	45.1	2814	F	IV	
	152.50	154.60	2.10	1	0.16	1.94	4.8	18.2	23.0	5768	B	II	
	159.83	163.50	3.67	3	0.58	3.09	3.5	37.0	40.5	3311	F	IV (Ex)	
	164.25	164.65	0.40	-	-	-	3.4	40.1	43.5	2897	F	IV (In)	
	165.00	166.62	1.62	2	0.31	1.31	2.9	26.5	29.4	4843	D	III (Ex)	
	183.69	196.00	12.31	3	0.42	11.89	2.7	30.0	32.7	4387	D	III (In)	
	212.60	224.70	12.10	1	0.09	12.01	2.4	42.8	45.2	2662	F	IV	
	291.45	297.60	6.15	-	-	-	2.5	34.6	37.1	3780	E	III (Ex)	
	313.25	314.11	0.86	-	-	-	2.3	41.3	43.6	2883	F	IV (In)	
	327.90	328.71	0.81	-	-	-	2.0	36.9	38.9	3532	E	III (Ex)	
	330.31	331.00	0.69	-	-	-	2.0	37.9	39.9	3394	E	III (In)	
	331.40	334.05	2.65	-	-	-	4.4	30.5	34.9	4084	E	III (Ex)	
				-	-	-	4.4	30.8	35.2	4042	E	III (In)	
				-	-	-	4.0	37.7	41.7	3145	F	IV	
				-	-	-	3.4	45.3	48.7	2179	G	IV	
				-	-	-	3.2	49.7	52.9	1600	G	IV	
				-	-	-	3.5	45.6	49.1	2124	G	IV	
				-	-	-	4.8	31.9	36.7	3835	E	III	

II/9

BOREHOLE NO. - RJBS - 7

SL. NO.	From (m)	To (m)	Thickness (m)	No. of bands	Total thickness of band (m)	Ex-band Thickness (m)	Ash %	Moisture %	Ash + Moisture %	Useful heat value K. cal.	Grade	Class	Remarks
	2	3	4	5	6	7	8	9	10	11	12	13	14
1)	40.35	40.90	0.55	-	-	-	4.8	36.8	41.6	3159	F	IV	
2)	43.40	44.25	0.85	-	-	-	5.4	36.0	41.4	3187	F	IV	
3)	123.50	125.30	1.80	-	-	-	4.2	39.7	43.9	2842	F	IV	
4)	154.65	155.15	0.50	-	-	-	4.3	42.8	47.1	24.00	F	IV	

BOREHOLE NO. - RJBS - 8

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total thickness of bands (m)	Ex-band thickness (m)	Moisture %	Ash %	Ash + Moisture %	Useful heat value K/Cal	Grade	Class	Remarks
	2	3	4	5	6	7	8	9	10	11	12	13	14
	45.80	48.70	2.90	-	-	-	6.4	22.9	29.3	4857	D	III	
	51.00	51.95	0.95	-	-	-	6.1	34.0	40.1	3366	E	IV	
	71.90	72.32	0.42	-	-	-	5.3	37.7	43.0	2966	F	IV	
	72.72	74.45	0.73	-	-	-	7.0	44.9	51.9	4498	D	III	
I	102.76	103.20	0.44	1	0.04	0.40	4.8	34.5	39.3	3477	E	III	(Ex-band)
	103.35	104.67	1.32	1	0.08	1.24	5.3	23.7	29.0	4898	D	III	
							5.2	26.0	31.2	4594	D	III	

II/10

BOREHOLE NO. RJBS - 9

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total thickness of bands (m)	Ex-band thickness (m)	Ash %	Moisture %	Ash + Moist. %	Useful heat value K/cal	Grade	Class	Remarks
Local	131.20	132.13	0.93	2	0.35	0.58	7.3(E) 6.2(I)	29.5 41.2	36.8 47.4	3822 2359	E G	III IV	
VII	143.40	145.08	1.68	2	0.72	0.96	5.1(E) 4.3(I)	44.1 55.1	49.2 59.4	2110 703	F -	IV -	
	146.95	150.43	3.50	4	0.64	2.86	5.4(E) 5.0(I)	38.5 41.8	43.9 46.8	2842 2442	F F	IV IV	
	152.05	153.50	1.55	-	-	-	6.8	26.0	32.8	4374	D	III	
Local	164.89	165.31	0.42	-	-	-	6.7	28.1	34.8	4098	E	III	
	166.10	166.45	0.35	-	-	-	7.2	29.2	36.4	3877	E	III	
Local	171.58	172.07	1.29	-	0.47	0.82	6.2(I)	30.5	36.7(E)	3835	E	III(E)	
VI	180.30	185.47	5.17	3	1.38	3.79	5.7(E) 5.4(I)	32.3 36.8	38.0 42.2	3656 3076	F F	III IV	
	191.95	192.84	0.89	-	-	-	6.8	18.2	25.0	5450	C	II	
	195.60	196.95	1.35	-	-	-	5.6	35.0	40.6	3297	F	IV	
	198.33	201.90	3.57	2	0.57	3.00	6.0(E) 5.6(I)	27.0 32.8	33.0 38.4	4346 3601	D E	III III	
Local	220.00	221.25	1.25	-	-	-	7.1	20.8	27.9	5050	C	II	
V	224.05	225.00	0.95	-	-	-	6.6	26.6	33.2	4318	D	III	
	227.12	234.10	6.98	4	1.33	5.65	6.5(E)	25.5	32.0	4484	D	III	
							6.4(I)	27.1	33.5	4277	D	III	

II/11

RJBS-9(Gontd.)

	1	2	3	4	5	6	7	.8	9	10	11	12	13	14
	250.35	253.70	3.35	-	-	-	-	5.3	31.5	36.8	3822	E	III	
	260.75	262.37	1.62	1	0.19	1.43	-	5.6(E) 5.4(I)	34.2 36.3	39.8 41.7	3408 3145	E F	III IV	
	268.93	271.40	2.47	2	0.28	2.19	-	5.2(E) 5.1(I)	38.9 39.5	44.1 44.6	2814 2745	E F	IV IV	
IV	272.72	273.85	1.13	-	-	-	-	5.0	32.1	37.1	3780	E	III	
	276.20	276.90	0.70	-	-	-	-	5.1	32.3	37.4	3739	E	III	
	278.28	294.00	15.72	-	-	-	-	4.8(E) 4.3(I)	32.2 37.4	37.0 41.7	3794 3145	E F	III IV	
	295.80	296.50	0.70	-	-	-	-	5.0	22.1	27.1	5160	C	II	
	313.15	313.85	0.70	-	-	-	-	2.0	40.6	42.6	3021	F	IV	
	315.50	316.15	0.65	-	-	-	-	2.0	27.2	29.2	4870	D	III	
	316.49	318.20	1.71	-	-	-	-	1.8	36.7	38.5	3587	E	III	
III	318.78	319.77	0.99	-	-	-	-	1.6	30.4	32.0	4484	D	III	
	320.15	321.40	1.25	-	-	-	-	1.6	35.8	37.4	3739	E	III	
	315.50	321.40	5.90	-	-	-	-	1.6	38.9	40.5	3311	F	IV	
	333.60	354.19	20.59	-	-	-	-	1.7(E) 1.6(I)	34.8 36.4	36.5 38.0	3863 3656	E E	III III	

11/12

RJBS-9(Contd)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
III	355.71	364.40	8.69	-	-	-	-	2.1(E) 2.0(I)	32.7 33.5	34.8 35.5	4098 4001	E E	III III	
	369.30	370.71	1.41	-	-	-	-	1.8	47.7	49.5	2069	G	IV	
	376.70	378.91	2.21	-	-	-	-	1.8(E) 1.8(I)	30.0 31.0	31.8 32.8	4512 4374	D D	III III	
	379.31	380.07	0.76	-	-	-	-	1.9(E) 1.8(I)	26.7 30.7	28.6 32.5	4953 4415	C D	III III	
	376.70	380.07	3.37	-	-	-	-	1.7	32.2	33.9	4222	D	III	
II	412.00	419.60	7.60	2	0.59	7.01	-	2.0(E) 1.9(I)	38.2 39.7	40.2 41.6	3256 3159	F F	IV IV	

BOREHOLE NO. RJBS-10

Seam Zone	From (m)	To (m)	Thickness (m)	No. of band	Thickness of band (m)	Ex-band thickness (m)	Moisture %	Ash %	Ash + Useful		Grade	Class	Remarks
									Moisture %	heat value (K. Cal)			
VI	17.66	21.21	3.55	5	0.76	2.79	6.3 5.8	35.3 40.1	41.6 45.9	3159 2565	F F	IV(E) IV(I)	
	26.72	28.08	1.36	1	0.19	1.17	6.9 6.4	31.2 37.4	38.8 43.8	3545 2856	E F	III(E) IV(I)	

II/13

RJBS-10(Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
V	34.47	34.98	0.51	-	-	-	-	6.3	30.2	36.5	3863	E	III	
	37.05	37.56	0.51	-	-	-	-	7.8	19.8	27.6	5091	C	II	
	38.11	39.52	1.11	-	-	-	-	6.1	32.0	38.1	36.42	E	III	
	55.29	55.99	0.70	-	-	-	-	6.2	25.4	31.6	4539	D	III	
58.06	58.65	0.60	-	-	-	-	6.6	30.6	37.2	3766	E	III		
61.37	65.10	3.73	2	0.51	3.22	3.22	6.2	28.9	35.1	4056	E	III(E)		
							5.8	34.9	40.7	3283	F	IV(I)		
IV	72.76	75.33	2.58	1	0.29	2.29	4.6	35.2	39.8	3408	E	III(Ex-band)		
	77.93	79.72	1.79	2	0.24	1.55	5.6	34.4	40.0	3380	E	IV(E)		
	83.15	83.70	0.55	-	-	-	5.3	38.2	43.5	2897	F	IV(I)		
	89.71	94.27	4.56	-	-	-	4.1	37.0	41.1	3228	F	IV		
	94.73	95.48	0.75	-	-	-	4.2	46.0	50.2	1972	G	IV		
	96.55	98.33	1.70	1	0.14	1.56	5.8	35.0	40.8	3270	F	IV		
							6.1	30.5	36.2	3808	E	III(E)		
							6.1	33.7	39.8	3408	F	III(I)		
89.71	98.25	8.54	3	1.67	6.87	6.87	4.2	41.3	46.2	2524	F	IV(E)		
							4.6	45.5	50.1	1986	G	IV(I)		

II/14

RJBS-10(Contd.)

	2	3	4	5	6	7	8	9	10	11	12	13	14
	108.94	109.39	0.45	-	-	-	5.4	39.3	44.7	2731	F	IV	
	110.14	112.74	2.30	5	0.61	1.69	6.4	34.4	40.8	3270	F	IV(E)	
	114.80	115.20	0.40	-	-	-	5.8	40.8	46.6	2469	D	IV(I)	
	124.60	124.87	0.27	-	-	-	5.9	27.7	33.6	4263	D	III	
	125.49	127.02	1.53	-	-	-	6.6	34.1	40.7	3283	F	IV	
	129.20	130.30	1.10	-	-	-	5.2	39.0	44.2	2800	F	IV	
	133.96	134.74	0.78	1	-	-	5.8	27.1	32.9	4360	D	III	
	143.40	144.70	1.30	1	0.18	0.60	4.3	43.0	47.3	2373	G	IV(Ex-band)	
	150.85	152.15	1.30	1	0.13	1.17	6.3	31.1	37.4	3739	E	(E)	III
	153.50	158.60	5.10	-	-	-	6.1	33.4	39.5	3449	E	(I)	III
	162.35	162.85	0.50	-	-	-	5.6	30.0	35.6	3987	E	III	
				-	-	-	5.4	32.1	37.5	3725	E	III	
				-	-	-	4.9	32.1	37.0	3794	E	III	

III

II/15

BOREHOLE NO. RJBS-II

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total band thickness (m)	Ex-band thickness	Moisture %	Ash %	Moisture + ash value in K. Cal	Useful heat value in K. Cal	Grade	Class	Remarks
VII	9.00	9.90	0.90	-	-	-	5.0	46.9	51.9	1738	G	IV	
	14.05	15.18	1.13	3	0.47	0.66	4.4 3.7	41.2 51.2	46.3 54.9	2511 1324	F G	IV IV	E I
	16.22	21.96	5.75	3	0.44	5.31	4.1 4.0	40.2 41.9	45.0 45.9	2690 2566	F F	IV IV	E I
	24.40	25.25	0.85	-	-	-	3.5	41.8	48.3	2235	G	IV	
	25.75	26.55	0.80	-	-	-	5.5	31.8	37.3	3753	E	III	
Local	33.63	35.39	1.76	1	0.21	1.55	4.8 4.5	36.5 39.8	41.3 44.3	3201 2787	F F	IV IV	E I
VI	47.67	52.55	4.88	4	0.61	4.27	4.2 3.8	29.5 31.9	33.7 35.7	4249 3973	D E	III III	E I
	57.44	61.97	4.53	5	0.80	3.73	4.6 4.2	31.4 37.8	36.0 42.0	3932 3104	E F	III IV	E I
	65.40	67.35	1.95	1	0.09	1.86	3.5 5.3	23.9 26.6	29.1 31.9	4843 4498	D D	III III	E I
	67.75	68.95	1.20	1	0.29	0.91	4.0 3.4	40.2 49.5	44.2 52.9	2800 1600	F G	IV IV	E I

RJBS-11 (Cont'd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
V	79.40	80.50	1.10	-	-	-	-	5.4	25.3	30.7	4663	D	III	
	83.24	84.10	0.86	-	-	-	-	4.2	35.2	39.4	3463	E	III	
	85.20	91.10	5.90	6	0.95	4.95	4.8	27.8	32.6	4401	4401	D	III	E
							4.4	32.8	37.2	3766	3766	E	III	I
	98.35	101.35	3.00	1	0.22	2.78	4.1	31.5	35.6	3987	3987	E	III	E
							4.0	33.3	37.3	3753	3753	E	III	I
	103.60	105.80	2.20	3	0.26	1.94	4.4	28.7	33.1	4532	4532	D	III	F
							4.1	33.4	37.5	3725	3725	E	III	I
	110.32	111.60	1.28	1	0.24	1.04	4.0	34.1	38.1	3642	3642	E	III	E
							3.6	39.1	42.7	3007	3007	F	IV	I
IV	112.80	113.30	0.50	1	0.09	0.41	3.4	36.3	39.7	3421	3421	E	III	E
							3.2	40.0	43.2	2938	2938	F	IV	I
	114.80	116.05	1.25	1	0.35	0.90	4.2	27.4	31.6	4939	4939	D	III	E
							3.7	36.5	40.2	3352	3352	E	IV	I
	115.43	116.05	0.62	-	-	-	4.6	20.9	25.5	5381	5381	C	II	
	117.70	118.20	0.50	-	-	-	4.0	32.3	36.3	3891	3891	E	III	
	119.90	122.10	2.20	3	0.52	1.68	3.0	39.2	42.9	2980	2980	F	IV	E
							2.9	40.8	43.7	2699	2699	F	IV	I
	123.10	132.90	9.80	8	1.61	8.19	4.1	29.2	33.3	4305	4305	D	III	E
							3.8	34.9	38.7	3559	3559	E	III	I

II/17

RJBS-11 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		149.20	151.80	2.20	2	0.26	1.94	3.9 3.7	33.1 36.6	37.0 40.3	3794 3339	E F	III IV	E I
		157.70	159.15	1.45	-	-	-	3.6	29.8	33.4	4291	D	III	
III.		160.30	170.88	10.58	6	0.94	9.64	4.3 4.0	26.7 29.5	31.0 33.5	4622 4277	D D	III III	E I
		183.30	184.90	1.60	-	-	-	4.1	27.7	31.8	4512	D	III	
		207.40	210.20	2.80	-	-	-	3.9	23.1	27.0	5174	C	II	
		254.30	261.85	7.47	-	-	-	3.5	23.9	27.4	5119	C	II	
II		276.90	283.75	6.85	-	-	-	3.3	28.5	31.8	4512	D	III	
		284.95	289.50	4.55	2	0.22	4.33	2.9 2.8	26.5 26.9	29.4 29.8	4843 4801	D D	III III	E I
		314.15	315.80	1.65	-	-	-	3.0	32.4	35.4	4015	E	III	
I		359.70	361.25	1.55	3	0.25	1.30	2.7 2.5	39.6 43.7	42.3 46.2	3063 2524	F F	IV IV	E I
		399.50	400.00	0.50	-	-	-	2.7	21.0	23.7	5629	B	II	

11/18

BOREHOLE NO. RJBS-13

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total Thickness of band (m)	Ex-band Moisture %	Ash %	Moisture + Ash %	Useful heat value S. Cal	Grade	Class	Remarks	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
IV	11.45	13.18	1.73	1	0.11	1.62	4.6 4.5	40.2 42.3	44.8 46.8	2718 2442	F F	IV IV	E I
	14.20	17.55	3.35	4	0.62	2.73	5.5 4.9	37.0 44.5	42.5 49.4	3035 2083	F F	IV IV	E I
	14.20	15.00	0.80	1	0.16	0.64	5.5 4.9	38.0 45.2	43.5 50.1	2897 1986	F G	IV IV	E I
	15.67	17.55	1.88	1	0.05	1.83	5.5 5.4	35.9 36.5	41.4 41.9	3187 3118	F F	IV IV	E I
	19.15	20.00	0.55	-	-	-	5.4	34.9	40.3	3339	F	IV	
	21.15	25.13	4.00	3	0.59	3.41	4.2 4.0	43.8 46.5	48.0 50.5	2276 1936	G G	IV IV	E I
	27.94	40.40	12.46	7	1.76	10.70	5.1 4.7	35.6 36.2	40.7 40.9	3283 3256	F E	IV IV	E I
	27.94	30.04	2.10	-	-	-	4.4	42.7	47.1	2400	F	IV	
	30.35	40.40	10.05	6	1.45	8.60	5.3 4.9	33.9 42.1	39.2 47.0	3190 2414	E F	III IV	E I

II/19

RJBS-13(Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	54.75	55.30	0.55	-	-	-	-	5.0	34.4	39.4	3463	E	III	
	56.44	62.85	6.41	6	1.22	5.19	5.19	5.3	37.5	42.8	2994	F	IV	E
	63.89	64.57	0.68	-	-	-	-	5.0	41.3	46.3	2511	F	IV	I
	65.41	71.73	6.32	6	1.20	5.12	5.12	5.2	37.4	42.6	3021	F	IV	
	72.00	76.01	1.01	1	0.07	3.94	3.94	5.3	29.2	35.2	4042	E	III	E
III	76.70	80.90	4.10	3	0.12	3.68	3.68	4.9	35.5	40.4	3328	F	IV	I
	87.06	87.81	0.75	-	-	-	-	4.9	30.4	35.3	4029	E	III	E
	89.60	91.60	2.00	1	0.12	1.88	1.88	4.9	30.9	35.6	3560	E	III	I
	94.70	96.45	1.75	-	-	-	-	5.1	34.9	40.0	3380	E	III	E
	93.78	96.45	2.67	2	0.57	2.10	2.10	4.9	37.9	42.8	2994	F	IV	I
	111.04	112.60	1.56	1	0.13	0.43	0.43	5.4	38.6	41.0	2828	F	IV	
III	113.70	114.70	1.00	-	-	-	-	5.1	39.9	45.0	2690	F	IV	E
								5.0	41.3	46.3	2511	F	IV	I
								4.9	32.2	37.1	3780	E	III	
								5.1	31.7	36.8	3822	D	III	E
								4.9	37.0	41.9	3118	F	IV	I
								4.2	33.7	38.6	3573	E	III	E
								4.8	35.8	40.6	3297	F	IV	I
								5.0	26.7	31.7	4525	D	III	

II/20

RJBS-13 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		153.90	157.75	1.85	-	-	-	5.4	25.8	31.2	4594	D	III	
		158.20	164.60	6.40	-	-	-	5.2	24.1	29.3	4857	D	III	
		177.80	182.70	4.90	-	-	-	4.9	29.4	34.3	4167	E	III	
		183.70	184.35	0.65	-	-	-	4.6	26.8	31.4	4567	D	III	
		191.38	193.90	2.52	-	-	-	5.3	25.0	30.3	4719	D	III	
		217.86	218.80	0.94	-	-	-	4.3	47.6	51.9	1738	G	IV	

BOREHOLE NO. RJBS-17

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Ex-band Thickness (m)	Moisture %	Ash %	Ash + Useful Moisture %	Moisture heat value K.Cal	Grade	Class	Remarks	
I	2	3	4	5	6	7	8	9	10	11	12	13	14
	21.00	21.68	0.68	-	-	-	5.6	32.0	37.6	3711	E	III	
II	25.65	33.35	7.70	8	0.94	6.76	6.5	27.8	34.3	4166	E	III	(Ex)
							6.2	31.9	38.1	3642	E	III	(In)

II/21

RJBS-17(Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	43.75	41.49	7.74	1	0.18	0.56	7.2 6.2	25.2 36.0	32.4 48.2	4429 3076	D F	III IV	(Ex) (In)
	44.89	45.86	0.97	1	0.08	0.89	5.5 5.3	42.2 44.1	47.7 49.4	2317 2083	G G	IV IV	(Ex) (In)
II	46.90	47.60	0.70	-	-	-	5.6	31.8	37.4	3739	E	III	
	57.70	61.27	3.57	-	-	-	5.4	33.5	38.9	3532	E	III	
	64.60	68.40	3.80	1	0.17	3.63	5.7 5.6	30.3 31.9	36.0 37.5	3932 3725	E E	III III	(Ex) (In)
	71.60	74.20	2.60	1	0.10	2.50	5.8 5.7	30.2 31.4	36.0 37.1	3932 3780	E E	III III	(Ex) (In)
	80.85	81.60	0.75	-	-	-	6.4	19.6	26.0	5312	C	II	
	88.90	88.22	0.32	-	-	-	5.4	15.6	21.0	6002	B	II	
IA	88.80	90.20	1.40	-	-	-	5.8	23.0	28.8	4926	D	III	
	96.85	98.05	1.20	3	0.40	0.80	5.7 4.5	28.2 44.2	33.9 48.7	4222 2179	D G	III IV	(Ex) (In)
	108.65	115.33	6.68	1	0.0	6.61	5.9 5.9	26.2 26.5	32.1 32.4	4470 4429	D D	III III	(Ex) (In)
I	163.00	167.00	4.00	-	-	-	5.4	28.4	33.8	4236	D	III	
Local	201.10	202.05	0.95	-	-	-	4.2	35.1	39.3	3477	E	III	

11/22

BORHOLE NO. RJS-19

Seam Zone	From (m)	To (m)	Thickness (m)	No. of Total bands thickness (m)	Ex-band thickness (m)	Moisture %	Ash %	Ash + Useful Moisture %	Useful heat value K/Cal	Grade	Class	Remarks
IA	9.00	10.00	1.00	-	-	4.4	36.2	40.6	3297	F	IV	
	17.70	18.95	1.25	-	-	5.8	22.2	28.0	5036	C	II	
	24.49	26.50	2.02	1	0.24	5.7	25.1	30.8	4649	D	III	(Ex)
	39.32	40.70	1.38	-	-	5.4	28.9	34.3	4166	E	III	(In)
I	63.35	71.50	3.15	1	0.14	5.6	27.6	33.2	3318	D	III	(Ex)
	119.10	119.66	0.56	-	-	5.6	28.0	33.6	4263	E	III	(In)
	119.94	120.97	1.03	-	-	3.9	33.9	37.8	3683	E	III	
	126.85	131.10	1.55	-	-	4.2	47.6	51.8	1751	G	IV	
				-	-	4.9	28.3	33.2	4318	D	III	
	176.31	176.95	0.61	-	-	1.6	38.3	42.9	2979	F	IV	

BORHOLE NO. RJS-20

Seam Zone	From (m)	To (m)	Thickness (m)	No. of Total bands thickness (m)	Ex-band thickness (m)	Moisture %	Ash %	Ash + Useful Moisture %	Useful heat value K/Cal	Grade	Class	Remarks
I	12.50	13.90	1.40	3	0.45	7.1	29.1	36.2	3904	E	III	
				5	0.95	5.8	40.8	46.6	2169	F	IV	
IV	16.92	18.03	1.11	2	0.20	5.9	32.2	38.1	3642	E	III	
	27.17	28.42	1.25	2	0.50	5.7	36.3	42.0	3104	F	IV	
				2	0.75	6.5	32.1	38.9	3532	E	III	(Ex-band)

II/23

RJBS-20 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IV	40.60	41.75	1.15		1	0.61	0.51	5.4	38.8	44.2	2890	F	IV	(Ex-band)
	43.30	51.10	7.80			0.92	6.88	7.2 6.8	31.1 34.3	30.3 41.5	3615 3173	F	III E IV I	Excluding 0.08m band of siderite
III	63.95	67.25	3.30		2	0.29	3.01	5.9 5.6	37.4 40.4	43.3 46.0	2925 2552	F	IV E IV I	
	70.05	70.85	0.80		1	0.12	0.68	6.4	35.2	41.6	3159	F	IV	(ex-band)
II	74.99	75.56	0.59		-	-	-	5.0	39.0	44.0	2828	F	IV	
	76.68	78.95	2.17		1	0.09	2.08	5.3 5.2	36.7 37.5	42.0 42.7	3101 3007	F	IV E IV I	
Local	80.50	82.00	1.50		-	-	-	6.6	27.4	34.0	4203	D	III	
	84.13	85.95	1.82		-	-	-	6.6	25.6	32.2	4456	D	III	
II	165.40	167.90	2.50		2	0.27	2.23	6.6 6.3	19.6 23.3	26.2 29.6	5284 4815	C	II III	E I
	186.73	189.27	2.52		3	0.46	2.06	5.7 5.2	27.2 34.5	32.3 39.7	4359 3412	D	III III	E I
Local	192.25	193.64	1.13		-	-	-	5.3	18.1	24.4	5533	C	II	
	194.19	197.10	2.91		-	-	-	5.4	29.0	34.4	4153	D	III	
Local	201.94	207.80	4.90		1	0.05	4.84	5.3 5.3	28.6 28.9	33.9 34.2	4222 4180	D	III III	E I
	231.03	232.86	1.03		2	0.14	0.89	5.3 5.0	21.0 26.3	26.3 31.3	5274 4580	C	III	E I

Ex 0.05m siderite
band after
0.63m coal
fro. top

II/24

BOREHOLE NO. RJBS-21

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total and subband thickness (m)			Moisture %		Useful heat value K/Cal	Grdde	Class	Remarks
					7	8	9	10	11				
I	25.95	28.25	2.30	-	-	-	4.4	46.7	51.1	1848	G	IV	
	30.50	33.45	2.95	1	0.25	2.70	4.9	35.3	40.7	3283	F	IV	E
							4.7	38.9	43.6	2883	F	IV	I
	36.00	38.60	2.60	2	0.22	2.38	4.7	43.5	48.2	2248	J	IV	E
							4.4	46.3	50.7	1903	S	IV	I
	40.19	40.80	0.61	-	-	-	5.6	30.8	36.4	3877	E	III	
	55.00	56.58	1.58	-	-	-	5.0	38.2	43.2	2938	F	IV	
	59.40	61.10	2.00	-	-	-	7.2	21.2	26.1	4981	C	III	
	67.15	68.65	1.50	1	0.22	1.28	5.4	31.2	36.6	3019	I	III	(Ex-band)
	103.35	103.66	0.51	-	-	-	5.3	32.2	37.5	3125	E	III	
II	108.55	116.10	7.55	8	1.75	5.80	5.2	32.0	37.3	3753	E	III	E
	130.69	131.55	0.86	-	-	-	4.8	37.1	41.9	3118	F	IV	Ex sid.rite band
							5.8	31.2	36.5	3522	F	III	
	132.85	134.10	1.25	1	0.11	1.14	5.6	32.7	38.3	3613	I	III	E
	138.90	140.25	1.35	-	-	-	5.4	34.8	40.2	3352	E	IV	I
	149.90	167.30	17.80	9	2.65	15.15	4.9	34.3	39.2	3490	E	III	
							4.7	34.0	39.5	3449	E	III	E
							4.5	38.0	42.5	3035	F	IV	I
	171.01	172.20	1.19	-	-	-	5.4	19.2	24.6	5505	C	II	
							5.0	30.6	35.6	3987	E	III	E
IA	183.00	184.91	1.91	1	0.22	1.69	4.8	33.1	38.2	3628	E	III	I

(excluding 3 bands totalling 0.73m in thickness)

II/25

RJBS-21 (Contd.)

1.	2	3	4	5	6	7	8	9	10	11	12	13	14
	203.45	211.95	8.50	?	?	?	5.5	23.9	29.4	4843	D	III	Excluding one side-rite band
I	221.85	222.80	0.95	-	-	-	4.5	27.0	31.5	4553	D	III	
	235.85	236.55	0.70	-	-	-	4.9	28.6	33.5	4277	D	III	
	237.23	241.70	4.42	1	0.06	4.36	5.0	29.1	33.1	4332	D	III	E
							4.9	28.6	33.5	4277	D	III	I
Local	280.70	289.50	0.80	-	-	-	4.4	31.3	38.7	3559	E	III	

BOREHOLE NO. RJB-11

Seam Zone	From (m)	To (m)	Thickness (m)	No. of bands	Total band thickness (m)	Moisture %	Ash %	Ash moisture %	Useful heat value K/Cal	Grade	Class	Remarks	
												7	8
I	11.80	12.28	0.48	-	-	3.8	35.4	39.2	3490	E	III		
	12.62	14.10	1.43	-	-	4.4	27.6	32.0	4484	D	III		(Ex-band)
	31.05	32.45	0.60	-	-	6.6	40.2	44.8	2718	F	IV		
	32.98	34.38	1.40	3	0.36	3.9	25.0	28.9	4912	D	III		{Ex}
						3.3	35.5	38.8	3546	E	III		{In}
III	38.38	39.30	0.92	1	0.20	3.2	36.4	39.6	3135	E	III		(Ex-band)
	40.10	41.80	1.70	-	-	5.1	21.4	26.5	5243	C	II		
	46.92	47.24	0.42	-	-	4.3	38.2	42.5	3035	F	IV		

II/26

RJB-11 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
III,	47.52	48.40	0.83	-	-	-	-	5.8	24.9	30.7	4663	D	III	
	52.13	53.15	1.02	1	0.13	0.89		4.3 4.0	26.2 31.8	32.5 35.0	4115 3960	D E	III III	(Ex) (In)
II	79.13	79.95	0.82	1	0.11	0.71		5.0 4.6	29.9 34.7	34.9 39.3	4084 3477	E E	III III	(Ex) (In)
	83.45	91.83	8.43	3	0.83	7.60		4.1 3.9	30.3 33.2	34.4 37.1	4153 3780	E E	III III	(Ex) (In)
	103.25	104.05	0.80	1	0.16	0.64		5.5 4.0	16.3 25.8	21.8 30.6	5892 4677	E D	II III	(Ex) (In)
	105.20	105.75	0.55	1	0.10	0.45		4.5 4.1	23.2 29.8	27.7 33.9	5077 4222	C D	II III	(Ex) (In)
	108.20	109.35	1.15	-	-	-		3.3	30.2	33.5	4277	D	IVI	
	122.10	127.60	4.50	3	0.53	1.97		3.4 3.0	39.2 44.9	42.6 47.9	3021 2290	F G	IV IV	(Ex) (In)
	125.11	134.39	9.28	4	0.81	8.47		3.7 3.6	31.4 32.5	35.1 36.1	4056 3918	E E	III III	(Ex) (In)
	134.91	135.90	0.99	-	-	-		3.8	33.6	37.4	3739	E	III	
	151.29	151.81	0.52	-	-	-		2.5	28.4	30.9	4636	D	I.I	
	156.05	156.92	0.87	-	-	-		3.5	20.6	24.1	5574	C	II	
IA	158.00	159.20	1.20	1	0.12	1.08		3.2	30.2	33.4	4291	D	III	(Ex-band)
	160.90	162.25	1.35	-	-	-		3.9	27.6	31.5	4553	D	III	

II/27
 RJB-11 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	187.54	188.14	0.60		1	0.07	0.53	1.2 3.7	24.2 28.9	28.4 32.6	4981 4401	C D	III III	(Ex) (In)
	191.36	200.38	9.02		3	0.63	0.39	3.3 3.7	21.9 24.5	25.7 28.2	5354 5008	C C	II III	(Ex) (In)
	201.84	202.65	0.81		1	0.26	0.55	3.7 3.1	22.5 35.8	26.2 38.9	5284 3532	C E	II III	(Ex) (In)
I	207.00	208.86	1.86		1	0.17	1.69	3.6 3.5	21.9 25.2	25.5 28.7	5381 4939	C D	II III	(Ex) (In)
	212.23	212.83	0.60		-	-	-	3.6	21.5	27.1	5160	G	II	
	225.73	220.85	3.12		3	0.64	2.48	2.0 2.6	33.4 38.1	36.2 40.7	3904 3283	E F	III IV	(Ex) (In)
	237.00	242.75	5.75		-	-	-	3.0	27.8	30.9	4636	D	III	
	286.72	287.27	0.55		-	-	-	3.0	27.6	30.6	4677	D	III	
Local	315.80	317.10	1.30		-	-	-	2.4	43.1	45.5	2621	F	IV	

RESERVE OF COAL IN KALYANPUR - MORGADANGAL - DALLALI BLOCK OF
DEHRIANI SOUTHERN EXPANSION AREA, RAJMAHAL COALFIELDS, DUMKA
DISTRICT, BIHAR

APPENDIX-III

Southern area :

Name of the Coal Seam Zone	Borehole No.	Depth (in metres)	Thickness (in metres)	Grade	Area (in sq.km)	I N D I C A T E D RESERVE (in m.t.)				Grand Total Reserve in million tonnes	Remarks		
						C	D	E	F			G	
	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-VII	WB-12/ WBS-2	0-300	1.38	C	0.894	1.66	-	-	-	-	1.66	1.66	
	WB-9		6.01	F	1.23	-	-	-	11.18	-	11.18	11.18	
	PBS-11		6.68	F	0.763	-	-	-	7.94	-	7.94	7.94	
Total		0-300	-	-	-	1.66	-	-	19.12	-	20.78	20.78	
Total	WB-12/ WBS-2	300-600	1.38	C	0.310	0.58	-	-	-	-	0.58	0.58	
TOTAL		0-600	-	-	-	2.24	-	-	19.12	-	21.36	21.36	

III/2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-VI	RJBE-6	0-300	8.71	F	0.232	-	-	-	3.05	-	3.05	3.05	3.05
	RJBE-9		9.60	B	0.589	-	-	8.14	-	-	8.14	8.14	8.14
	RJBE-10		4.91	F	0.174	-	-	-	1.29	-	1.29	1.29	1.29
	RJBE-11		12.56	B	0.916	-	-	16.57	-	-	16.57	16.57	16.57
Total		0-300	-	-	-	-	-	24.71	4.34	-	29.05	29.05	29.05
Total	RJBE-9	300-600	9.60	B	0.154	-	-	2.13	-	-	2.13	2.13	2.13
TOTAL		0-600	-	-	-	-	-	26.34	4.34	-	31.18	31.18	31.18
Zone-V	RJB-12/ RJBE-2	0-300	2.22	B	0.499	-	-	1.59	-	-	1.59	1.59	1.59
	RJBE-3		5.96	F	0.432	-	-	-	3.89	-	3.89	3.89	3.89
	RJBE-5		1.11	F	0.610	-	-	-	1.02	-	1.02	1.02	1.02
	RJBE-6		6.71	F	0.289	-	-	-	2.93	-	2.93	2.93	2.93
	RJBE-9		9.18	D	0.496	-	6.35	-	-	-	6.35	6.35	6.35
	RJBE-10		1.10	B	0.215	-	-	0.34	-	-	0.34	0.34	0.34
	RJBE-11		7.00	B	0.585	-	-	5.90	-	-	5.90	5.90	5.90
Total		0-300	-	-	-	-	6.35	7.83	7.84	-	22.02	22.02	22.02
	RJBE-9	300-600	9.18	D	0.247	-	3.16	-	-	-	3.16	3.16	3.16
	RJBE-2		2.22	B	0.705	-	-	2.25	-	-	2.25	2.25	2.25
Total		300-600	-	-	-	-	3.16	2.25	-	-	5.41	5.41	5.41
TOTAL		0-600	-	-	-	-	9.51	10.08	7.84	-	27.43	27.43	27.43

III/3

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-IV	RJBS-2	0-300	14.17	B	0.275	-	-	5.61	-	-	5.61	5.61	5.61
	RJBS-3		13.52	F	0.271	-	-	-	5.54	-	5.54	5.54	5.54
	RJBS-5		13.15	F	0.449	-	-	-	8.93	-	8.93	8.93	8.93
	RJBS-6		21.45	F	0.335	-	-	-	10.86	-	10.86	10.86	10.86
	RJBS-9		24.99	F	0.338	-	-	-	12.77	-	12.77	12.77	12.77
	RJBS-10		16.84	F	0.215	-	-	-	5.47	-	5.47	5.47	5.47
	RJBS-11		21.16	B	0.546	-	-	16.64	-	-	16.64	16.64	16.64
	RJBS-13		23.14	F	0.144	-	-	-	5.04	-	5.04	5.04	5.04
	RJBS-20		10.31	F	0.217	-	-	-	3.38	-	3.38	3.38	3.38
	Total	0-300	-	-	-	-	-	22.25	51.99	-	74.24	74.24	74.24
	RJBS-2	300-600	14.17	B	0.929	-	-	18.95	-	-	18.95	18.95	18.95
	RJBS-5		13.15	F	0.161	-	-	-	3.20	-	3.20	3.20	3.20
	RJBS-9		24.99	F	0.405	-	-	-	15.30	-	15.30	15.30	15.30
	Total	300-600	-	-	-	-	-	18.95	18.50	-	37.45	37.45	37.45
TOTAL		0-600	-	-	-	-	-	41.20	70.49	-	111.69	111.69	111.69

III/4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-III														
RJBL-3			0-300	15.56	B	0.343	-	-	7.68	-	-	7.68	7.68	
RJBL-5				15.39	F	0.019	-	-	-	0.44	-	0.44	0.44	
RJBL-6				27.76	F	0.340	-	-	-	14.27	-	14.27	14.27	
RJBL-9				39.18	B	0.096	-	-	5.48	-	-	5.48	5.48	
RJBL-10				11.60	S	0.215	-	-	3.59	-	-	3.59	3.59	
RJBL-11				18.56	D	0.302	-	7.73	-	-	-	7.73	7.73	
RJBL-13				27.12	F	0.169	-	-	-	6.93	-	6.93	6.93	
RJBL-20				8.59	B	0.232	-	-	2.87	-	-	2.87	2.87	
Total			0-300	-	-	-	-	7.73	19.56	21.64	-	48.93	48.93	
RJBL-2			300-600	37.81	D	1.204	-	63.50	-	-	-	63.50	63.50	
RJBL-5				15.39	F	0.591	-	-	-	13.75	-	13.75	13.75	
RJBS-9				39.18	B	0.647	-	-	36.50	-	-	36.50	36.50	
RJBS-11				18.36	D	0.244	-	6.25	-	-	-	6.25	6.25	
Total			300-600	-	-	-	-	69.75	36.50	13.75	-	120.00	120.00	
TOTAL			0-600	-	-	-	-	77.48	56.06	35.39	-	168.93	168.93	

III/5

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-II	RJBS-3	0-300	15.29	D	0.241	-	5.14	-	-	-	5.14	5.14	
	RJBS-6		24.41	B	0.218	-	-	7.66	-	-	7.66	7.66	
	RJBS-11		18.87	D	0.110	-	2.89	-	-	-	2.89	2.89	
	RJBS-13		16.32	D	0.169	-	3.85	-	-	-	3.85	3.85	
	RJBS-20		14.22	D	0.137	-	2.72	-	-	-	2.72	2.72	
	m otr 1	0-300	-	-	-	-	14.60	7.66	-	-	22.26	22.26	
	RJBS-3	300-600	15.29	D	0.102	-	2.17	-	-	-	2.17	2.17	
	RJBS-6		24.41	B	0.122	-	-	4.29	-	-	4.29	4.29	
	RJBS-9		7.60	F	0.743	-	-	-	8.54	-	8.54	8.54	
	RJBS-14		18.87	D	0.436	-	11.48	-	-	-	11.48	11.48	
	RJBS-20		14.22	D	0.095	-	1.88	-	-	-	1.88	1.88	
Total		300-600	-	-	-	-	15.53	4.29	8.54	-	28.36	28.36	
		0-600	-	-	-	-	30.13	11.95	8.54	-	50.62	50.62	
GRAND		0-300	-	-	-	-	1.66	28.68	82.01	104.93	-	217.28	
TOTAL		300-600	-	-	-	-	0.58	88.44	64.12	40.79	-	193.93	
		0-600	-	-	-	-	2.24	117.12	146.13	145.72	-	411.21	

Northern area :

III/6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zone-III			0-300	8.02	B	0.25	-	-	2.89	-	-	2.89	2.89	
				12.29	F	0.651	-	-	-	12.09	-	12.09	12.09	
TOTAL			0-300	-	-	-	-	-	2.89	12.09	-	14.98	14.98	
Zone-II			0-300	17.64	B	0.288	-	-	7.31	-	-	7.31	7.31	
				21.63	B	0.403	-	-	12.55	-	-	12.55	12.55	
				19.76	B	0.232	-	-	6.60	-	-	6.60	6.60	
				26.24	F	0.371	-	-	-	15.84	-	15.84	15.84	
TOTAL			0-300	-	-	-	-	-	26.46	15.84	-	42.30	42.30	
Zone-I A			0-300	6.00	F	0.304	-	-	-	2.76	-	2.76	2.76	
				2.43	D	0.196	-	0.66	-	-	-	0.66	0.66	
				2.30	D	0.261	-	0.84	-	-	-	0.84	0.84	
				5.65	B	0.438	-	-	3.56	-	-	3.56	3.56	
				1.91	B	0.371	-	-	1.02	-	-	1.02	1.02	
TOTAL			0-300	-	-	-	-	1.50	4.58	2.76	-	8.84	8.84	

III/7

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	RJBS-1	0-300	17.64	B	0.274	-	-	6.96	-	-	6.96	6.96	
	RJBS-8		6.76	D	0.34	-	3.21	-	-	-	3.21	3.21	
Zone-I	RJB-111		19.11	D	0.196	-	5.22	-	-	-	5.22	5.22	
	RJBS-17		10.68	D	0.261	-	3.89	-	-	-	3.89	3.89	
	RJBS-19		14.29	B	0.438	-	-	9.01	-	-	9.01	9.01	
	RJBS-21		13.87	D	0.321	-	6.21	-	-	-	6.21	6.21	
	Total	0-300	-	-	-	-	18.53	15.97	-	-	34.50	34.50	
	RJBS-1	300-600	17.64	B	0.03	-	-	0.76	-	-	0.76	0.76	
	RJBU-21		13.87	D	0.05	-	0.97	-	-	-	0.97	0.97	
	Total	300-600	-	-	-	-	0.97	0.76	-	-	1.73	1.73	
	TOTAL	0-600	-	-	-	-	19.50	16.73	-	-	36.23	36.23	
	GRAND	0-300	-	-	-	-	20.03	49.90	30.69	-	100.62	100.62	
	TOTAL	300-600	-	-	-	-	0.97	0.76	-	-	1.73	1.73	
		0-600	-	-	-	-	21.00	50.66	30.69	-	102.35	102.35	

Total indicated reserve of coal in the Kalyanpur - Murugdangal - Daldali block :

GRAND	0-300	-	1.66	48.71	131.91	135.62	-	317.90	317.90
TOTAL	300-600	-	0.58	89.41	64.88	40.79	-	195.66	195.66
	0-600	-	2.24	138.12	196.79	176.41	-	513.56	513.56

APPENDIX-IV

CHEMICAL ANALYSIS OF COAL CORES OF BRAHMANI SOUTHERN EXTENSION
 AREA, RAJMAHAL COALFIELDS, BIHAR
 (After Coal Survey Laboratory, Ranigang).

CSL. No. CAR/BH-GSI-248/RJB-11/1/84/B.H.No.:RJB-11

Depth from Surface		Run (m)	Core length (m)	Lithology	C.S.L. Sample No.	Wt. (gms)	Proximate Analysis As analysed basis			
From (m)	To (m)						Moist %	Ash %	V.M. %	F.C. %
1	2	3	4	5	6	7	8	9	10	11
11.25	11.80	0.55	0.10	Coal	G-1	263	4.4	24.9	-	-
			0.08	Band	B-1	252	1.9	72.0	-	-
			0.34	Band	C-2	893	2.8	57.1	-	-
11.80	14.10	2.30	0.41	Coal	C-3	917	3.8	35.4	-	-
			0.08	Sandy Shale with Coal	N.S.					
			0.04	Carby Shale	N.S.					
			0.08	Coal	C-4	180	3.6	33.0	-	-
			0.10	Sand. Shale	N.S.					
			1.27	Coal	C-5	2300	4.4	27.6	2.0	38.
31.75	32.45	0.70	0.09	Iron. Stone	N.S.					
			0.56	Sh. Coal	C-6	1075	4.6	40.2	-	-
32.98	34.38	1.40	0.26	Coal	C-7	597	3.4	33.0	-	-
			0.09	Band	B-2	272	2.8	58.8	-	-
			0.31	Coal	C-8	677	4.2	28.0	-	-
			0.17	Band	B-3	610	1.2	68.0	-	-
			0.29	Coal	C-9	482	4.0	15.4	-	-
			0.06	Band	B-4	244	1.3	67.8	-	-
			0.05	Coal	C-10	106	3.8	21.4	-	-
35.03	35.73	0.70	0.22	Band	B-5	537	2.6	60.5	-	-
			0.45	Coal	C-11	1152	4.3	32.4	-	-
38.38	39.30	0.92	0.30	Coal	C-11A	680	5.0	17.2	-	-
			0.16	Gr. Shale	N.S.					
			0.03	Carb. Shale						
			0.36	Sh. Coal	B-6	988	1.7	52.5	-	-
40.10	41.80	1.70	0.18	Coal	C-12	404	5.2	20.4	-	-
			0.10	Sh. Coal	B-7	285	2.8	50.0	-	-
			1.40	Coal	C-13	2700	5.2	19.5	35.8	39.5
46.82	47.90	1.08	0.40	Sh. Coal	C-14	1055	4.3	38.2	-	-
			0.18	Band	B-8	595	1.8	77.4	-	-

Borehole No. : RJB-11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
		0.13	Sandy.Gr. N.S. Shale							
47.90-48.40	0.50	0.33	Coal	C-15	1585	6.2	24.3	29.1	40.4	
		0.38	Coal							
52.00-53.15	1.15	0.07	Coal	B-9	190	2.0	30.5	-	-	
		0.12	Band	B-10	374	2.3	56.0	-	-	
		0.17	Coal	C-16	372	4.1	20.1	-	-	
		0.12	Band	B-11	345	2.4	55.9	-	-	
79.13-79.95	0.82	0.64	Coal	C-17	1600	4.3	30.4	26.7	38.6	
		0.19	Coal	C-18	418	3.4	33.6	-	-	
		0.11	Sh.Coal	B-12	276	2.9	48.1	-	-	
		0.34	Coal	C-19	675	4.6	23.5	-	-	
		0.11	Band	B-13	375	2.0	66.9	-	-	
83.45-84.95	1.50	0.10	Coal	C-20	212	4.6	24.5	-	-	
		0.35	Sh.Coal	C-21	815	3.5	42.0	-	-	
		0.12	Band	B-14	442	2.0	72.9	-	-	
84.95-88.00	3.05	1.06	Coal	C-22	4000	4.3	32.4	26.8	36.5	
		0.61	Coal							
		0.05	Band	B-15	154	2.0	66.4	-	-	
		0.17	Coal	C-23	425	4.7	27.2	-	-	
		0.10	Band	B-16	300	2.0	61.6	-	-	
		0.14	Sh.Coal	C-24	370	4.3	38.4	-	-	
		0.16	Band	B-17	530	2.2	65.6	-	-	
		0.10	Coal	C-25	980	4.6	33.2	-	-	
		0.10	Band	B-18	289	2.0	59.6	-	-	
		0.21	Sh.Coal	C-26	420	3.0	38.7	-	-	
		0.06	Band	B-19	170	2.0	61.8	-	-	
		0.13	Sh.Coal	C-27	316	3.8	38.0	-	-	
		0.09	Band	B-20	298	2.3	58.9	-	-	
88.00-91.05	3.05	0.46	Coal	C-28	6000	3.6	33.6	26.9	35.9	
		2.15	Coal							
		0.08	Band	B-21	232	2.5	58.2	-	-	
		0.94	Coal	C-29	4500	4.8	17.4	32.8	45.0	
91.05-91.88	0.83	0.79	Coal							
103.25-104.05	0.80	0.38	Coal	C-30	854	5.6	15.3	-	-	
		0.15	Band	B-22	527	2.2	63.4	-	-	
		0.22	Coal	C-31	455	5.3	18.4	-	-	
105.20-105.75	0.55	0.19	Coal	C-32	450	5.2	17.1	-	-	
		0.10	Band	B-23	302	2.6	59.2	-	-	

Borehole No. : HUB-11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
		0.07	Coal	C-33	175	2.8	34.0	-	-	
		0.06	Sh.Coal	B-24	212	2.5	52.1	-	-	
		0.13	Coal	C-34	264	5.2	13.0	-	-	
108.20-109.35	1.15	0.90	Coal	C-35	2400	3.3	30.2	28.2	38.3	
122.10-124.60	2.50	0.23	Coal	C-36	542	3.1	33.9	-	-	
		0.22	Band	B-25	715	1.6	61.0	-	-	
		0.50	Sh.Coal	C-37	1425	3.4	44.2	-	-	
		0.06	Band	B-26	220	2.3	54.9	-	-	
		0.56	Coal	C-38	1312	4.0	31.6	27.8	36.6	
		0.23	Band	B-27	790	1.3	74.0	-	-	
		0.62	Sh.Coal	C-39	1570	3.0	44.0	-	-	
124.60-127.65	3.05	0.49	Band	B-28	1945	1.2	75.0	-	-	
		2.36	Coal	C-40	8000	4.4	34.0	26.4	35.2	
127.65-130.70	3.05	0.53	Coal							
		0.07	Sh.Coal	B-29	216	1.6	47.1	-	-	
		1.45	Coal	C-41	3750	3.9	32.0	26.9	37.2	
		0.13	Band	B-30	470	2.0	60.0	-	-	
		0.18	Sh.Coal	C-42	465	2.4	43.5	-	-	
		0.11	Band	B-31	368	2.2	55.8	-	-	
		0.10	Sh.Coal	C-43	310	2.5	48.0	-	-	
		0.09	Band	B-32	309	1.8	64.6	-	-	
		0.33	Coal	C-44	1465	3.7	33.1	26.7	36.5	
130.70-135.90	5.20	0.30	Coal							
		0.09	Siderite	N.S.						
		0.32	Gr.Shale							
		2.80	Coal	C-45	7000	3.1	26.3	28.1	42.5	
		0.50	Sand.Stone	N.S.						
		0.95	Coal	C-46	2030	3.8	33.6	23.6	39.0	
151.29-151.81	0.52	0.17	Coal	C-47	397	3.3	25.7	-	-	
		0.08	Sh.Coal	B-33	240	2.3	49.5	-	-	
		0.27	Coal	C-48	490	3.8	23.9	-	-	
156.05-156.55	0.50	0.34	Coal	C-49	765	3.8	13.5	-	-	
		0.06	Sh.Coal	B-34	178	2.2	46.5	-	-	
156.55-156.95	0.40	0.37	Coal	C-50	938	3.6	23.0	-	-	
		0.03	Gr.Shale	N.S.						
158.00-159.20	1.20	0.12	Coal	C-51	296	3.4	27.0	-	-	
		0.11	Sandy.Shale	N.S.						
		0.30	Coal	C-52	680	3.6	18.0	-	-	
		0.30	Sh.Coal	B-35	889	2.2	46.7	-	-	
		0.10	Coal	C-53	167	4.8	20.2	-	-	

Borehole No.: RJB-11.....Contd.

1	2	3	4	5	6	7	8	9	10
		0.13	Coal	B-36	313	3.2	30.6	-	-
160.90-162.25	1.35	0.54	Coal	C-54	1325	3.8	27.8	-	-
		0.11	Coal	B-37	292	3.7	20.7	-	-
		0.46	Coal	C-55	1173	4.2	24.4	-	-
		0.14	Sh.Coal	B-38	440	2.5	43.2	-	-
187.54-188.14	0.60	0.03	Sh.Coal	B-39	175	2.7	51.6	-	-
		0.28	Coal	C-56	569	4.9	15.5	-	-
		0.06	Band	B-40	216	1.5	63.8	-	-
		0.08	Coal	C-57	190	3.3	28.2	-	-
191.36-193.25	1.89	0.75	Coal	C-58	989	4.9	20.3	29.8	43.0
		0.07	Sh.Coal	B-41	162	2.6	40.7	-	-
		0.15	Coal	C-59	207	3.5	19.6	-	-
		0.11	Sh.Coal	B-42	295	2.0	47.2	-	-
		0.30	Coal	C-60	642	4.2	14.3	-	-
193.25-195.25	2.00	1.90	Coal	C-61	3300	3.8	20.8	29.3	46.1
195.25-196.30	1.05	0.88	Coal	C-62	1900	4.4	22.0	29.8	43.8
		0.17	Band	B-43	705	1.8	58.8	-	-
196.30-199.35	3.05	0.05	Band						
		0.34	Coal	C-63	700	4.4	17.1	-	-
		0.06	Sh.Coal	B-44	244	2.8	40.1	-	-
		1.13	Coal	C-64	2350	4.0	20.0	31.0	45.0
		0.35	Sh.Coal	B-45	900	2.8	40.2	-	-
		0.71	Coal	C-65	1470	3.2	29.8	29.4	37.6
		0.30	Band	B-46	815	2.4	55.4	-	-
199.35-200.38	1.03	0.38	Coal	C-66	725	2.8	29.8	-	-
		0.08	Band	B-47	305	2.5	26.4	-	-
		0.35	Coal	C-67	870	3.4	24.4	-	-
201.84-202.63	0.81	0.36	Coal	C-68	846	3.9	25.2	-	-
		0.26	Band	B-48	887	1.8	64.4	-	-
		0.20	Coal	C-69	290	3.3	17.5	-	-
207.00-208.50	1.50	0.49	Coal	C-70	1118	3.3	20.3	-	-
		0.15	Band	B-49	480	2.0	59.3	-	-
		0.70	Coal	C-71	2250	3.8	21.4	30.5	44.3
208.50-208.86	0.36	0.36	Coal						
212.23-212.83	0.60	0.60	Coal	C-72	1280	3.6	23.5	32.2	40.7
225.73-226.40	0.67	0.10	Sh.Coal	B-50	260	2.2	41.8	-	-
		0.45	Coal	C-73	1065	2.7	37.0	-	-
		0.10	Band	B-51	315	1.0	55.6	-	-
226.40-228.40	2.00	0.15	Coal	C-74	267	3.4	21.0	-	-

Borehole No. : RJB - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.30	Band	B-52	1000	2.0	38.6	-	-
			0.91	Coal	C-75	2350	3.2	29.5	27.9	39.4
			0.29	Band	B-53	855	2.1	53.8	-	-
			0.05	Coal	C-76	1115	2.8	29.4	-	-
228.40-228.85	0.15	0.40	Coal							
237.00-239.05	2.05	0.74	Coal	B-54	1735	2.1	34.9	-	-	
			0.86	Coal	C-77	2300	3.9	22.8	30.2	43.1
			0.24	Coal	B-55	572	2.1	35.2	-	-
			0.10	Coal	C-78	3800	3.0	25.4	28.3	43.3
239.05-241.05	2.00	1.82	Coal							
241.05-242.10	1.05	0.14	Coal	B-56	450	2.6	36.8	-	-	
			0.42	Coal	C-79	895	3.4	24.9	-	-
			0.12	Sh.Coal	B-57	377	2.2	38.5	-	-
			0.26	Coal	C-80	2300	3.2	28.8	29.1	38.9
242.10-242.75	0.65	0.65	Coal							
286.72-287.27	0.55	0.11	Coal	C-81	240	3.2	17.2	-	-	
			0.43	Coal	B-58	1119	3.0	30.2	-	-
315.80-317.15	1.35	0.11	Coal	C-82	290	3.2	27.5	-	-	
			0.26	Sh. Coal	B-59	830	2.2	51.5	-	-
			0.15	Coal	C-83	404	2.2	35.2	-	-
			0.41	Sh. Coal	B-60	1165	2.2	43.0	-	-
			0.11	Coal	C-84	293	3.0	31.6	-	-
			0.04	Carb.Shale	N.S.					

CSL. No. RNG/86/BH-22/B.H. No. : RJBS - 1.

21.70	23.30	1.60	1.30	Shaly Coal	A(C)	5200	2.5	50.8	-	-
29.45		0.50	0.10	Band						
		0.65	0.61	Band	B(C-1)	9000	2.5	55.9	-	-
		1.90	1.38	Band						
			0.12	Sandy.Gr.Sh.						
		4.10	0.08	Gr. Sh.	N.S.					
			0.26	Gr.Shale/ Carb. shale						
			3.40	Coal	B(C-2)	19500	3.0	34.9	26.2	35.6
38.35	1.75	1.50	Coal							
40.15	2.10	0.30	Sh. Coal	C(C-1)	1015	4.4	41.4	-	-	
			0.22	Band	C(b-1)	1140	1.5	78.0	-	-
			0.88	Coal						
		3.05	3.05	Coal	C(C-2)	600	4.2	33.9	23.5	38.4
		1.35	0.42	Coal						

Borehole No.: RJBS-1.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.17	Band	C(b-2)	1070	2.6	65.6	-	-
			0.84	Coal	C(C-3)	3000	4.3	31.7	-	-
		4.05	0.11	Band	C(b-3)	650	2.9	61.1	-	-
			2.00	Coal	C(C-4)	7300	4.0	34.5	25.0	36.5
			0.15	Band	C(b-4)	940	1.6	73.4	-	-
	50.70		2.67	Coal	C(C-5)	8400	4.0	26.8	29.2	40.0
59.05		3.85	2.17	Coal	D(C-1)	8000	4.0	33.6	24.6	37.8
			0.14	Band	D(b-1)	955	2.1	69.0	-	-
			1.04	Sh.Coal	D(C-2)	4000	3.2	47.4	-	-
		2.15	0.34	Band	D(b-2)	1710	1.6	69.4	-	-
	65.06		1.85	Coal	E(C-3)	6800	3.4	33.8	26.2	36.6
69.50		3.00	2.98	Coal	E(C)	25500	3.2	32.2	24.6	40.0
		2.15	2.15	Coal	Coal					
	76.70	2.05	2.05	Coal						
82.49		0.95	0.25	Band	F(b-1)	1245	2.0	60.4	-	-
	83.44		0.65	Coal	F(C-1)	2000	3.6	29.2	27.3	39.9
84.60		1.25	0.16	Sh.Coal	G(b-1)	780	2.0	45.5	-	-
	85.85		1.09	Sh.Coal	G(C-1)	5600	2.7	39.4	-	-
97.81		1.63	1.05	Sh.Coal	H(C-1)	4300	2.3	45.4	-	-
			0.26	Band	H(b-1)	1675	2.0	65.3	-	-
			0.08	Sh.Coal	H(C-2)	420	3.0	43.1	-	-
	99.44		0.14	Sandy.Gr.Shale	N.S.					
113.60		1.40	1.03	Coal						
		0.50	0.35	Coal	I (C)	16500	3.0	31.8	25.1	40.1
		2.50	2.27	Coal						
118.90		0.90	0.52	Coal						
<u>CSL No. - FN3/85/LH-11/B.H. No. RJE - 12.</u>										
225.80-227.55	1.75	1.30	Sh. Coal	J(C-1)	3150	3.2	42.0	-	-	-
		0.09	Band	A(B-1)	339	1.7	70.7	-	-	-
		0.27	Sh. Coal	A(C-2)	542	3.6	50.8	-	-	-

IV/7

Borehole No.: RJB-12.....Contd.

1	2	3	4	5	6	7	8	9	10	11
294.25-297.25	3.00	1.15	Coal	B(C-1)	2400	3.8	24.6	32.2	39.4	
		0.11	Band	B(B-1)	287	2.5	57.3	-	-	
		1.02	Band	B(C-2)	2300	2.5	53.4	-	-	
		0.08	Band	B(B-2)	272	1.8	72.3	-	-	
		0.14	Sh.Coal	B(C-3)	344	3.1	44.5	-	-	
297.25-300.30	3.05	0.23	Band	B(B-3)	915	1.0	77.0	-	-	
		1.32	Band	B(C-4)	2900	2.7	53.2	-	-	
		0.29	Band	B(B-4)	748	2.6	59.7	-	-	
		0.38	Band	B(C-5)	960	3.2	54.7	-	-	
		0.10	Band	B(B-5)	330	1.2	74.1	-	-	
		0.42	Band	B(B-6)	1369	1.8	74.3	-	-	
		0.15	Sh.Coal	B(C-6)	998	3.4	44.0	-	-	
300.30-300.58	0.28	0.27	Sh.Coal							
301.30-302.75	1.45	0.31	Coal	B(C-7)	855	3.6	35.2	-	-	
		0.36	Band	B(B-7)	1040	2.3	61.6	-	-	
		0.74	Sh.Coal	B(C-8)	1392	3.2	43.7	-	-	
323.10-323.90	0.80	0.41	Sh.Coal	C(C-1)	1038	3.2	47.1	-	-	
		0.14	Sandy.Gr. Shale	N.S.						
342.82-344.72	1.90	0.08	Sh.Coal	D(C-1)	122	3.0	46.4	-	-	
		0.07	Band	D(B-1)	145	2.0	69.6	-	-	
		0.59	Coal	D(C-2)	1027	3.0	36.7	25.9	34.4	
		0.13	Band	D(B-2)	272	1.9	67.4	-	-	
		0.69	Band	D(C-3)	1030	2.2	56.6	-	-	
357.65-358.75	1.10	1.00	Coal	E(C-1)	1070	3.8	29.2	28.8	28.2	
363.88-365.00	1.12	0.20	Coal	F(C-1)	297	3.8	18.0	-	-	
		0.10	Band	F(B-1)	235	1.3	65.4	-	-	
		0.54	Sh.Coal	F(C-2)	957	2.4	42.7	-	-	
385.08-387.20	2.12	1.70	Coal	G(C-1)	2400	3.2	28.0	27.8	41.0	

IV/8

CSL.No. FMG/86/BH-143/B.H.No. RJBS - 2

1	2	3	4	5	6	7	8	9	10	11
397.65		3.35	0.40	Coal	A(C-1)	1800	5.5	26.0	-	-
			0.17	Band	A(b-1)	1500	1.9	75.4	-	-
			0.30	Sh.Coal						
			0.04	Sh.Coal	A(C-2)	12000	5.0	37.2	24.2	33.6
	401.00		2.20	Sh.Coal						
413.70		8.70	4.10	Coal	B(C-1)	23000	5.1	29.9	27.4	37.6
			0.16	Band	B(B-1)	1500	2.5	75.6	-	-
			0.23	Sh.Coal	B(C-2)	1400	5.7	47.1	-	-
			0.12	Band	B(b-2)	1400	3.8	73.8	-	-
			0.10	Sh.Coal	B(C-3)	300	8.4	36.5	-	-
			0.11	Band	B(b-3)	1200	1.7	75.9	-	-
	422.40		3.86	Coal	B(C-4)	18000	7.6	21.2	28.1	43.1
444.00	446.20	2.20	2.20	Coal	C(C)	12000	5.4	33.8	22.8	38.0
452.50	454.40	1.90	1.90	Coal	D(C)	9500	6.0	18.2	29.3	46.5
459.00	462.90	3.90	3.75	Coal	E(C)	19000	6.6	20.0	27.4	46.0
466.90		12.30	0.94	Coal	F(C-1)	5000	5.2	25.8	-	-
			0.20	Band	F(b-1)	19000	2.6	69.0	-	-
			1.21	Coal	F(C-2)	6000	5.2	25.2	-	-
			0.20	Band	F(b-2)	1500	3.0	63.9	-	-
			0.30	Band	F(C-3)	2900	3.6	54.2	-	-
			0.20	Band	F(b-3)	2100	3.5	60.6	-	-
			2.70	Coal	F(C-4)	14400	5.6	25.0	26.6	42.8
	479.20	5.95	5.95	Coal	F(C-5)	31000	6.0	21.2	28.2	44.6
48.50		14.10	0.85	Coal	G(C-1)	6500	4.4	30.6	-	-
			0.03	Coal						
			0.18	Coal						

Borehole No. : RJBS - 2.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.02	Band						
			0.03	Band	G(b-1)	1900	2.3	74.7	-	-
			0.11	Band						
			0.75	Coal	G(C-2)	4900	5.3	26.3	-	-
			0.14	Band	G(b-2)	1100	3.2	59.0	-	-
			2.05	Coal	G(C-3)	10000	5.2	27.0	26.0	41.8
			5.98	Coal	G(C-4)	32000	5.6	25.6	27.7	41.1
			0.11	Sy.Gr.Sh.	N.S.					
			0.20	Band	G(C-5)	1600	3.3	56.6	-	-
			0.28	Sy.Gr.Sh.	N.S.					
			1.05	Coal						
			0.04	S. St	G(C-6)	18000	5.4	28.3	46.3	
	496.60		2.15	Coal						
499.00		0.90	0.07	Band	H(b-1)	700	2.0	73.0	-	-
			0.19	Sh.Coal	H(C-1)	1000	4.0	48.0	-	-
			0.14	Band	H(b-2)	1100	2.2	72.3	-	-
	499.90		0.48	Band	H(C-2)	2900	2.4	69.1	-	-
503.50	506.50	3.00	2.00	Coal	I(C)	9000	5.1	34.6	24.4	35.9

IV/10

No. CSL/CAR/BH-FN3/B6/BH-145/B.H. No. RJBS - 3

1	2	3	4	5	6	7	8	9	10	11
14.65	15.70	1.05	1.00	Sh. Coal	A(C)	3900	5.8	40.8		
			0.05	Carb. shale						
19.30		1.10	0.08	Sh. Coal	B(C-1)	4900	5.1	49.2		
			0.58	Sh. Coal						
			0.11	Band	B(b-1)	1100		69.0		
	20.40		0.18	Sh. Coal	B(C-2)	1200	7.0	35.6		
21.25		4.35	1.50	Coal	C(C-1)	7600	7.2	27.8		
			0.53	Band	C(b-1)	4100	3.9	61.8		
			0.44	Coal	C(C-2)	2300	7.7	20.4		
			0.15	Band	C(b-2)	1600	4.4	59.2		
	25.60		2.05	Coal	C(C-3)	11500	7.4	32.0	24.0	36.6
33.00		2.15	1.25	Sh. Coal	D(C-1)	8000	5.8	42.9		
			0.18	Band	D(b-1)	1500	3.2	57.2		
			0.26	Coal	D(C-2)	1700	4.3	24.6		
			0.12	Band	D(b-2)	1100	2.2	69.2		
	35.15		0.42	Coal	D(C-3)	2400	8.8	24.2		
38.15		2.40	0.12	Carb. shale	N.S.					
			1.86	Sh. Coal	E(C-1)	9500	7.0	45.2		
			0.12	Band	E(b-1)	1000	3.9	56.6		
	40.55		0.52	Coal	E(C-2)	3200	6.2	33.0		
43.85		1.10	0.44	Coal	F(C-1)	2500	6.0	34.0		
			0.11	Band	F(b-1)	1200	3.2	61.1		
	44.95		0.54	Sh. Coal	F(C-2)	3500	6.0	44.0		
49.25		1.25	0.03	Light Gr. shale	N.S.					
			0.40	Sh. Coal	G(C-1)	2400	4.0	51.0		
			0.30	Band	G(b-1)	2300	3.8	63.7		
	50.80	0.30	0.26	Sh. Coal	G(C-2)	1400	4.8	43.6		

IV/11

Borehole No. : RJBS - 3.....Contd.

1	2	3	4	5	6	7	8	9	10	11
54.35		2.02	1.36	Sh. Coal						
		0.11	0.11	S. stone	H(C)	8500	5.6	43.8		
			0.40	Sh. Coal	N.S.					
			0.06	S. stone						
	56.40		0.04	Sh. Coal	N.S.					
57.90		8.60	0.40	Sh. Coal	I(C-1)	1800	4.3	45.6		
			0.70	Band	I(b-1)	3400	3.5	66.1		
			0.38	Coal	I(C-2)	1600	8.2	21.8		
			0.34	Band	I(b-2)	1800	3.8	64.2		
			2.02	Sh. Coal	I(C-3)	9000	5.2	36.2		
			0.32	Band	I(b-3)	2000	2.6	72.9		
			0.72	Sh. Coal	I(C-4)	3500	5.4	38.8		
			0.27	Band	I(b-4)	1600	3.6	56.3		
	66.50		3.98	Coal	I(C-5)	18000	6.4	31.6	24.5	37.5
80.75		15.10	0.03	S. stone	N.S.					
			0.25	Coal	J(C-1)	1000	8.8	13.3		
			0.20	Band	J(b-1)	1300	2.8	66.4		
			0.38	Coal						
			0.04	Coal	J(C-2)	2600	6.9	27.9		
			0.13	Coal						
			0.28	Band						
			0.04	Band	J(b-2)	2400	3.2	66.2		
			0.06	Band						
			0.17	Sh. Coal	J(C-3)	800	5.8	39.8		
			0.28	Sh. Coal	J(b-3)	1400	5.0	47.0		
			0.35	Coal						
			0.28	Coal	J(C-4)	4000	6.8	26.3		
			0.25	Coal						

IV/12

Borehole No. : RJBS -Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.26	Sh. Coal	J(b-4)	1600	4.4	46.8		
			0.30	Coal						
			0.56	Coal	J(C-5)	4300	5.0	33.4		
			0.11	Coal						
			0.15	Band						
			0.11	Band						
			0.08	Band	J(b-5)	3300	-	73.7		
			0.20	Band						
			0.25	Sh. Coal	J(C-6)	1200	5.7	41.4		
			0.16	Band	J(b-6)	1200	1.2	84.1		
			0.24	Sh. Coal						
			0.21	Sh. Coal	J(C-7)	2700	5.2	39.3		
			0.08	Sh. Coal						
			0.19	Band						
			0.42	Band	J(b-7)	6600	3.0	60.2		
			0.50	Band						
			0.24	Coal	J(C-8)	900	7.2	28.8		
			0.17	Coal						
			1.50	Sh.Gr.Sh.	N.S.					
			0.10	Carb.shale						
			0.13	Sh.Coal						
			2.77	Sh.Coal						
			0.02	Sh.Coal	J(C-9)	23000	5.2	36.7		
			0.08	Sh.Coal						
			0.15	Sh.Coal						
			0.36	Band	J(b-8)	2200	3.0	65.2		
			0.22	Coal	J(C-10)	700	5.8	31.7		
			0.21	Band	J(b-9)	1400	3.8	59.4		
			0.34	Coal	J(C-11)	1500	5.8	24.0		
			0.13	Sh. Coal	J(b-10)	600	4.4	43.8		
95.85			0.38	Sh. Coal	J(C-12)	5000	4.9	38.4		
96.85	3.55		1.36	Coal						
			0.56	Coal	K(C-1)	8000	7.2	25.4	21.8	45.6
			1.70	Coal						
			...4	Band	K(b-1)	890	3.8	57.8		

IV/13

Borehole No. RJBS - 3.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.60	Coal	K(C-2)	2700	5.6	29.7		
			0.05	Sandstone	N.S.					
			0.16	Sh. Coal	K(b-2)	930	4.2	45.2		
100.40			0.52	Coal	K(C-3)	2100	6.4	29.0		
103.10		2.30	1.80	Sh. Coal	L(C-1)	8000	5.3	40.6		
			0.14	Band	L(b-1)	1000	3.0	70.4		
			0.48	Sh. Coal	L(C-2)	2500	7.2	35.0		
	105.40		0.08	Gr. Shale	N.S.					
127.10	127.55	0.45	0.45	Coal	M(C)	2200	6.7	29.4		
132.45		0.80	0.50	Sh. Coal	N(C)	3000	3.9	47.3		
	133.15		0.23	Carb. shale	N.S.					
163.90	166.00	2.10	2.00	Coal	O(C)	7000	7.2	20.8	24.2	47.8
196.17		1.93	1.70	Coal	P(C)	32000	5.8	27.0	24.7	42.5
	203.60	5.70	5.60	Coal						
212.00		4.66	1.30	Coal	Q(C-1)	5500	5.6	27.3		
			0.15	Sh. Coal	Q(b-1)	700	4.4	40.4		
	216.66		3.20	Coal	Q(C-2)	8000	4.7	30.8	23.6	40.9
232.55	233.75	1.20	1.10	Coal	R(C)	13300	5.2	25.8	26.8	42.2
			0.10	Gr. Sh.	N.S.					

No. CSL/RNG/87/BH-72/B.H. No. RJBS - 5

5.50		0.75	0.10	Band	A(b ₁)	840	2.7	64.5		
			0.30	Sh. Coal	A(C ₁)	5200	4.0	39.1		
	6.25		0.08							
14.76	15.30	0.54	0.45	Sh. Coal	B(C)	2000	4.5	36.2		
24.42		1.54	0.14	Coal	C(C ₁)	690	5.8	26.3		
			0.20	Band	C(b ₁)	1200	2.4	73.0		
			0.17	Sh. Coal	C(C ₂)	870	4.5	42.9		
			0.25	Band	C(b ₂)	1600	2.2	74.2		
			0.07	Sh. Coal	C(C ₃)	400	4.6	37.4		
			0.28	Band	C(b ₃)	1700	3.4	62.2		
			0.36	Coal	C(C ₄)	1800	5.4	31.6		
	25.96		0.14	Band	C(b ₄)	320	2.6	62.2		
28.45		2.55	0.35	Coal	D(C ₁)	1500	5.8	26.8		
			0.50	Band	D(b ₁)	3100	3.0	67.5		

IV/14

Borehole No. : RJBS - 5.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.13	Sh. Coal	D(C ₂)	685	5.3	40.6		
			0.38 0.22	Band	D(b ₂)	1900	3.1	67.7		
			0.14 0.04 0.44 0.38	Coal	D(C ₃)	2700	5.1	31.3		
			0.05 0.10	Band	D(b ₃)	1800	3.8	59.8		
			0.14	Sh. Coal	D(C ₄)	555	5.0	39.0		
			0.15 0.92 0.07 0.09	Band	D(b ₄)	1950	2.8	64.2		
	31.92		0.40	Sh. Coal	D(C ₅)	1800	5.0	42.9		
47.56		0.94	0.39	Coal	E(C ₁)	1600	5.4	29.7		
			0.24	Band	E(b ₁)	1400	3.2	58.6		
	48.50		0.37	Sh. Coal	E(C ₂)	1500	5.2	36.8		
51.90		0.39	0.15 0.06	Coal	F(C)	1500	5.7	32.6		
	52.29		0.14							
54.38	54.71	0.33	0.26	Sh. Coal	G(C)	1100	5.0	35.3		
55.77		1.20	0.69 0.03	Sh. Coal	H(C ₁)	4500	4.8	36.1		
			0.29							
	56.97		0.09	Band	H(b ₁)	600	3.2	62.8		
58.00		0.65	0.19	Band	I(b ₁)	950	3.6	56.3		
			0.35	Coal	I(C ₁)	1800	4.8	34.6		
	58.65		0.05	Gr. Sh.	N.S.					
59.56		0.89	0.06	Sh. Coal	J(b ₁)	350	3.8	50.2		
	60.45		0.70	Coal	J(C ₁)	2750	4.6	32.5		
67.50		1.94	0.11	Coal	K(C ₁)	170	4.2	27.9		

Borehole No. : RJBS - 5.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.08	Band	K(b ₁)	525	2.2	72.4		
			0.18	Sh. Coal	K(C ₂)	900	5.6	35.6		
			0.09	Fire Clay	N.S.					
			0.53	Sh. Coal	K(C ₃)	2150	4.2	45.1		
			0.12	Band	K(b ₂)	730	3.6	51.8		
			1.05	Coal	K(C ₄)	4400	4.6	33.2		
	69.44		0.09	Band	K(b ₃)	530	3.1	57.4		
73.95		1.90	0.16	Band	L(b ₁)	900	3.0	63.4		
			0.09	Coal	L(C ₁)	260	5.4	29.2		
			0.10	Band	L(b ₂)	830	2.2	76.6		
			0.10	Sh. Coal	L(C ₂)	470	3.9	48.6		
			0.41	Band	L(b ₃)	2500	2.6	69.5		
			0.11	Coal	L(C ₃)	445	8.0	10.8		
			0.06	Band	L(b ₄)	380	3.1	67.1		
			0.62							
			0.02	Sh. Coal	L(C ₄)	4450	3.9	43.8		
	75.85		0.17							
78.67	79.09	0.42	0.42	Sh. Coal	M(C ₁)	1850	4.4	36.0		
79.67		0.79	0.35	Sh. Coal	M(C ₂)	1800	4.0	41.9		
			0.23	Band	M(b ₁)	1400	3.3	61.0		
	80.46		0.15	Band	M(C ₃)	950	3.8	52.0		
80.79	81.23	0.44	0.43	Sh. Coal	M(C ₄)	2100	4.4	47.6		
82.06	82.90	0.84	0.75	Sh. Coal	M(C ₅)	3150	3.3	47.2		
84.58	85.03	0.45	0.45	Coal	N(C)	2400	4.0	33.8		
86.05	86.60	0.55	0.50	Band	O(C ₁)	2600	3.6	54.4		
87.30		6.50	0.21	Sh. Coal	O(C ₂)	1100	4.1	48.7		
			0.08	Band	O(b ₁)	515	3.0	71.5		
			0.40	Sh. Coal	O(C ₃)	2100	4.5	44.6		

Borehole No. : RJBS - 5....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.41	Band	O(b ₂)	2300	3.6	56.4		
			1.48	Sh. Coal	O(C ₁)	7400	4.3	37.3		
			0.20	Band	O(b ₃)	1000	3.0	65.0		
			0.50	Sh. Coal	O(C ₅)	2200	4.5	36.4		
			0.34	Band	O(b ₄)	2000	2.6	66.7		
			0.16	Coal	O(C ₆)	800	5.2	34.1		
			0.42	Band	O(b ₅)	2600	3.0	57.8		
			0.44	Sh. Coal	O(C ₇)	1900	4.3	38.4		
			0.05							
			0.12							
			0.04	Band	O(b ₆)	3600	3.3	56.5		
			0.21							
			0.14	Sh. Coal	O(C ₈)	640	5.2	34.7		
			0.63	Band	O(b ₇)	3600	2.6	70.1		
			0.17							
		1.08	0.35	Sh. Coal	O(C ₉)	2100	4.0	45.8		
			0.22	Band	O(b ₈)	1100	2.6	58.2		
	94.88		0.50	Coal	O(C ₁₀)	2500	1.2	30.5		
100.80	101.18	0.34	0.33	Sh. Coal	P(C)	1700	4.0	37.6		
102.60	103.00	0.40	0.49	Sh. Coal	Q(C)	2200	5.1	37.0		
104.76		1.34	0.50	Sh. Coal	R(C ₁)	2000	4.1	49.9		
			0.07	Band	R(b ₁)	610	3.7	55.5		
			0.17	Coal	R(C ₂)	815	4.9	34.5		
			0.05	Band	R(b ₂)	430	3.6	57.4		
			0.53	Sh. Coal	R(C ₃)	2600	4.4	45.6		
	106.10		0.12	Band	R(b ₃)	900	2.5	71.2		
108.50		1.68	0.25	Band	S(b ₁)	1400	3.2	61.6		
			0.35	Sh. Coal	S(C ₁)	1900	4.1	40.5		
			0.41	Band	S(b ₂)	2600	2.9	67.1		

IV/17

Borehole No. : RJBS - 5.Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.18	Sh. Coal	S(C ₂)	700	4.7	36.9		
			0.06	Band	S(b ₃)	360	2.9	62.9		
	110.18		0.05	Sh. Coal	S(C ₃)	330	4.2	43.2		
112.15		0.42	0.12	Band	T(b ₁)	770	3.5	50.2		
	112.57		0.24	Sh. Coal	T(C ₁)	1100	4.3	41.9		
117.00	119.10	2.10	1.50	Sh. Coal	U(C)	7800	3.8	46.3		
120.50		0.80	0.30	Sh. Coal	V(C ₁)	1800	3.8	50.9		
			0.08	Band	V(b ₁)	520	3.2	59.0		
			0.11	Coal	V(C ₂)	410	6.1	25.6		
			0.17	Band	V(b ₂)	790	3.0	53.2		
121.30			0.18	Coal	V(C ₃)	660	3.4	35.7		
122.90	124.35	1.45	1.40	Coal	W(C)	5350	5.5	26.9	24.1	43.5
130.35		1.10	1.00	Sh. Coal	X(C)	9000	4.5	45.8		
	131.90	0.45	0.45							
137.75		0.10	0.08							
	138.35	0.50	0.45	Sh. Coal	Y(C)	2700	4.4	40.9		
140.62		0.48	0.48							
	141.25	0.15	0.15	Coal	Z(C)	2400	5.0	24.6		
145.45		2.75	0.03	Band	AA(b ₁)	900	2.5	69.6		
			0.11							
			0.56	Sh. Coal	AA(C ₁)	2500	4.0	45.8		
			0.16	Band	AA(b ₂)	1100	2.5	70.1		
			1.33							
	149.75	1.55	1.55	Coal	AA(C ₂)	1500	4.6	35.1	23.4	36.9
151.00		0.20	0.20	Coal	BB(C ₁)	900	4.2	29.2		
		4.70	0.17	Sh. Coal	BB(b ₁)	1075	3.6	48.6		
			0.76	Sh. Coal	BB(C ₂)	3350	4.4	36.5		
			0.25	Band	BB(b ₂)	1800	2.8	70.4		
	155.90		3.52	Coal	BB(C ₃)	17500	4.4	32.2	24.1	39.3

IV/10

No. CSL/RNG/07/BH-73/B.H. No., RJBS - 6.

1	2	3	4	5	6	7	8	9	10	11
7.56		1.64	0.55	Band	A(C ₁)	46.0	4.2	51.1		
			0.16	Band	A(b ₁)	17.0	1.0	82.6		
			0.11	Band	A(C ₂)	12.0	3.6	53.9		
			0.03	Fire Clay	N.S.					
			0.10	Coal	A(C ₃)	15.0	5.6	29.3		
			0.09	Band	A(b ₂)	9.0	3.2	55.2		
			0.31							
			0.19							
			0.04	Sh. Coal	A(C ₄)	54.0	4.0	30.0		
			0.22							
	9.76		0.11	Fire Clay with Coal	N.S.					
12.20		1.00	0.39	Band	B(b ₁)	30.0	2.0	69.7		
			0.51							
		3.80	1.00	Coal	B(C ₁)	84.0	5.2	31.8		
			0.10	Band	B(b ₂)	6.0	2.2	71.8		
			0.19	Sh. Coal	B(C ₂)	95.0	4.6	40.0		
			0.00	Sy. Grsh	N.S.					
			0.09	Sh. Coal	B(C ₃)	4.0	4.0	50.0		
			0.41	Band	B(b ₃)	31.0	2.0	71.9		
			1.52	Coal	B(C ₄)	80.0	5.4	30.3		
			0.22	Band	B(b ₄)	13.0	4.0	56.4		
			0.16							
		4.30	0.23	Sh. Coal	B(C ₅)	55.0	5.2	35.8		
			0.02							
			0.49							
			0.31	Band	B(b ₅)	275.0	2.6	70.2		
			2.00	Coal	B(C ₆)	123.0	5.5	29.4	27.2	37.9
			0.14	Band	B(b ₆)	14.0	2.2	75.2		

IV/19

Borehole No. : RJBS - 6.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.05	Band	B(C ₇)	500	4.0	53.0		
			0.16	Fire Clay	N.S.					
			0.16							
			0.04	Band	B(C ₈)		3.4	58.6		
			0.23							
			0.24	Band	B(b ₇)	2600	1.5	30.9		
	21.60		0.29	Coal	B(C ₉)	1950	5.4	34.3		
29.20		0.40	0.30	Band	C(b ₁)	700	3.0	58.1		
			0.32							
	29.68		0.38	Coal	C(C ₁)	2100	5.0	23.2		
30.83		0.98	0.5	Fire Clay	N.S.					
	31.01		0.85	Coal	D(C ₁)	5100	4.2	33.5		
32.51		2.44	0.67	Coal	D(C ₂)	2100	4.0	34.2		
			0.18	Fire Clay	N.S.					
			0.94	Coal	D(C ₃)	5600	3.6	36.3		
			0.06	Fire Clay	N.S.					
			0.80							
		3.56	1.43	Sh. Coal	D(C ₄)	13000	4.0	41.2		
			0.07	Band	D(b ₁)	950	2.0	77.0		
			1.86	Coal	D(C ₅)	10750	4.2	34.0	23.9	37.9
			0.05	S _{st}	N.S.					
	38.81		0.45	Coal	D(C ₆)	1000	4.4	28.1		
45.80		3.50	2.60	Coal	E(C)	18500	3.8	35.2	24.0	37.0
			0.18	Fire Clay	N.S.					
	48.65		0.38	Coal						
50.54		0.21	0.21	Carb. fine Clay	N.S.					
		2.00	1.10	Sh. Coal	F(C)	13500	3.6	37.4		
			0.00	Fire Clay	N.S.	87.				
			0.80	Sh. Coal						

IV/2J

Borehole No. : RJBS - 6.....Contd.

1	2	3	4	5	6	7	8	9	10	11
54.35		0.35	0.18	Coal	G(C ₁)	1200	4.6	34.1		
	54.65		0.08	Band	G(b ₁)	650	2.4	59.2		
55.50		1.25	0.69	Coal	H(C ₁)	5100	3.8	33.1		
			0.00	Band	H(b ₁)	600	2.3	62.7		
			0.50	Sh. Coal	H(C ₂)	3600	2.9	48.3		
		1.40	0.28	Band	H(b ₂)	1800	2.5	60.3		
	58.15		1.12	Sh. Coal	H(C ₃)	7300	2.8	51.2		
59.05	59.70	0.65	0.65	Coal	I(C)	4250	3.3	35.9		
61.28	61.83	0.55	0.51	Coal	J(C)	3200	3.5	35.0		
62.75		1.65	1.56	Sh. Coal	K(C ₁)	14900	3.2	42.3		
		5.10	0.70							
			0.19	Band	K(b ₁)	1700	1.7	78.8		
			1.50	Sh. Coal	K(C ₂)	9000	2.7	49.2		
			0.21	Band	K(b ₂)	1700	2.6	58.4		
			0.15	Sh. Coal	K(C ₃)	950	3.0	48.6		
			0.35	Band	K(b ₃)	2700	1.8	75.0		
			2.20							
		5.10	0.45	Sh. Coal	K(C ₄)	17000	3.2	39.3		
			0.38	Band	K(b ₄)	3000	2.3	65.5		
			1.93	Sh. Coal	K(C ₅)	13000	3.0	41.3		
			0.11	Band	K(b ₅)	900	2.0	65.4		
			1.08	Coal	K(C ₆)	6750	3.8	35.2		
			0.07	Band	K(b ₆)	750	1.7	79.3		
			1.21							
	75.30	0.70	0.65	Coal	K(C ₇)	9700	3.4	33.5	25.1	31.0
76.30	76.90	0.50	0.50	Coal	K(C ₈)	2200	4.0	28.1		
91.98	92.48	0.50	0.50	Sh. Coal	L(C ₁)	3300	5.2	42.0		
92.65		1.50	0.35	Sh. Coal	L(C ₂)	4000	4.4	43.3		

IV/21

Borehole No. : RJBS - 6.....Contd.

1	2	3	4	5	6	7	8	9	10	11
		2.20	0.31	Sh. Coal	L(C ₃)	1400	4.2	47.4		
			0.10	Band	L(b ₁)	600	2.6	68.3		
			1.78							
		2.30	0.19	Sh. Coal	L(C ₄)	9300	4.2	33.3		
			0.22	Band	L(b ₂)	1300	2.8	63.0		
			1.23	Sh. Coal	L(C ₅)	5500	4.4	39.8		
			0.07	Band	L(b ₃)	450	2.5	61.2		
	98.65		0.26	Band	L(C ₆)	1500	3.8	51.3		
99.60		1.57	0.12	Band	L(C ₇)	700	3.4	61.4		
			0.19	Band	L(b ₄)	1350	2.3	68.9		
			0.26	Band	L(C ₈)	1650	3.8	55.7		
			0.50	Band	L(b ₅)	3000	2.4	75.8		
	101.17		0.43	Sh. Coal	L(C ₉)	2200	4.4	43.1		
103.29	103.74	0.45	0.30	Sh. Coal	M(C)	1500	4.2	45.0		
105.45	105.92	0.47	0.47	Sh. Coal	N(C ₁)	2500	3.8	50.0		
106.65		4.60	1.23	Coal	N(C ₂)	5750	5.2	32.4		
			0.22	S. st	N.S.					
			3.10	Sh. Coal	N(C ₃)	16000	4.4	33.8		
			0.09	S. St	N.S.					
		2.60	1.30	Coal	N(C ₄)	5000	5.7	20.3		
			0.10	Band	N(b ₁)	700	3.2	62.3		
	113.85		1.20	Coal	N(C ₅)	5600	4.0	34.0		
116.65	117.20	0.45	0.39	Sh. Coal	O(C)	2100	4.8	49.1		
121.90		0.60	0.20	Band	P(b ₁)	1250	3.0	67.2		
	122.50		0.40	Band	P(C ₁)	2400	3.0	67.6		
124.02	125.32	1.30	1.23	Sh. Coal	Q(C ₁)	5200	4.5	38.7		
125.64		0.79	0.09	Band	Q(C ₂)	2000	4.4	54.0		
	126.43		0.37	Band	Q(C ₃)	2200	3.4	54.2		

IV/22

Borehole No. : RJBS - 6.....Contd.

1	2	3	4*	5	6	7	8	9	10	11
127.22	127.53	0.32	0.31	Band	Q(C4)	1900	4.0	52.2		
128.35	129.45	1.10	1.03	Band	Q(C5)	5200	3.8	51.4		
131.70		1.77	0.05	Fire Clay	N.S.					
			0.81	Coal	R(C1)	3700	5.4	33.2		
			0.10	Band	R(b1)	700	2.1	74.8		
	133.47		0.77	Sh. Coal	R(C2)	4000	4.2	46.8		
136.75	139.65	2.90	2.90	Sh. Coal	S(C)	13500	4.0	41.1		
147.20		1.00	0.97	Coal	T(C)	4000	4.8	18.2	28.8	48.2
	148.20		0.03	Siderite	N.S.					
152.50		2.10	0.21	Coal	U(C1)	1000	4.4	32.4		
			0.15	Band	U(b1)	1250	1.4	79.4		
	154.60		1.66	Sh. Coal	U(C2)	8000	3.4	37.6		
159.75		0.45	0.08	Band	V(b1)	550	2.2	64.4		
			0.14	Sh. Coal	V(C1)	650	3.0	44.2		
			0.18	Band	V(b2)	600	1.3	75.2		
			0.20	Coal	V(C2)	900	3.0	37.0		
		3.50	2.48	Coal	V(C3)	10500	3.0	23.4	26.2	47.4
			0.21	Band	V(b3)	1450	1.4	67.4		
			0.20	Sh. Coal	V(C4)	1050	2.2	40.1		
			0.07	Band	V(b4)	450	1.2	69.1		
	163.50		0.29	Coal	V(C5)	1200	2.6	27.5	27.7	42.2
164.25	164.65	0.40	0.35	Sh. Coal	V(C6)	1700	2.4	42.8		
165.00		1.62	0.20	Coal	V(C7)	800	2.6	16.0		
			0.20	Band	V(b5)	1300	1.4	71.3		
			0.76	Coal	V(C8)	3100	2.6	33.6		
			0.07	Band	V(b6)	500	1.4	66.8		
	166.62		0.20	Sh. Coal	V(C9)	900	2.1	41.0		
183.55		2.80	0.13	Band	W(b1)	1100	1.2	76.4		
			0.17	Coal	W(C1)	900	1.4	33.4		

Borehole No. :RJBS - 6.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.04		W(b ₂)	950	1.3	66.7		
			0.36	Band						
			0.5							
			0.68	Sh. Coal	W(C ₂)	3100	1.5	45.2		
			0.76	Band	W(b ₃)	500	1.4	71.6		
			0.74	Sh. Coal	W(C ₃)	4000	1.7	40.6		
			0.19	Band	W(b ₄)	950	1.6	61.6		
			0.60							
		4.90	3.00	Sh. Coal	W(C ₄)	16500	1.8	35.4		
		3.10	1.34	Coal	W(C ₅)	13500	2.4	24.7	26.2	46.9
			2.11							
			0.11	Sh. Coal	W(b ₅)	600	2.6	49.1		
			0.80	Coal	W(C ₆)	9400	3.2	25.6	26.2	45.0
	196.00	1.65	1.55							
212.60		2.90	2.36	Coal	X(C ₁)	10500	4.2	30.2	26.4	39.2
		6.20	1.33							
			0.09	Band	X(b ₁)	450	2.6	66.4		
			3.80	Coal	X(C ₂)	11000	4.3	30.4	26.4	30.9
			2.35	Coal	X(C ₃)	7800	4.4	30.3	26.3	38.5
	224.70	3.09	2.82	Coal	X(C ₄)	8500	4.8	31.1	24.9	39.2
291.45		2.40	2.30							
		1.50	1.42	Sh. Coal	Y(C)	22000	4.0	37.7		
	297.60	2.25	2.25							
313.25		0.10	0.10							
		0.85	0.67	Sh. Coal	Z(C ₁)	3200	3.4	45.3		
	314.20		0.08	Band	Z(b ₁)	400	2.1	61.8		
327.90		3.10	0.78	Sh. Coal	AA(C ₁)	2900	3.2	49.7		
			0.11	Band	AA(b ₁)	700	1.8	80.2		
			1.21	Band	AA(C ₂)	5300	3.0	56.0		
			0.22	Band	AA(b ₂)	1200	1.9	75.8		
	331.00		0.66	Sh. Coal	AA(C ₃)	1900	3.5	45.6		
331.40		0.30	0.20	Coal	CC(C)	7000	4.8	31.9	20.9	42.4
	334.05	2.35	2.05							

IV/24

CSL. No. : RNG/87/BH-211/B.H. No. : RJBS-7.

1	2	3	4	5	6	7	8	9	10	11
40.35	40.90	0.55	0.36	Sh. Coal	A(C)	1990	4.8	36.8		
43.40	44.25	0.85	0.72	Sh. Coal	B(C)	3700	5.4	36.0		
123.50		1.80	0.64	Sh. Coal	C(b-1)	3400	3.6	50.8		
	125.30		0.87	Coal	C(C-1)	3600	4.8	31.6		
149.85		2.00	0.40	Band	D(b-1)	2100	4.3	55.0		
			0.60	Band	D(C-1)	2800	3.6	53.0		
	150.85		0.97	Band						
154.65	155.15	0.50	0.37	Sh. Coal	E(C)	1765	4.3	42.8		

CSL. No. -RNG/87/BH-212/B.H. No. : RJBS - 8.

1	2	3	4	5	6	7	8	9	10	11
45.80	48.70	2.90	2.90	Coal	A(C)	15000	6.4	22.9	27.4	43.3
51.00		1.20	0.85	Sh. Coal	B(C-1)	5000	6.1	34.0		
			0.08	Band	B(b-1)	740	3.2	67.3		
	52.20		0.14	Band	B(C-2)	955	4.5	57.0		
71.90		1.55	0.40	Sh. Coal	C(C-1)	2000	5.3	37.7		
			0.36	Band	C(b-1)	2350	3.2	69.3		
	73.45		0.68	Coal	C(C-2)	3000	7.0	24.9		
78.96	79.40	0.44	0.32	Coal	N.S.					
102.76		0.44	0.41	Coal	D(C-1)	2035	5.0	31.9		
			0.06	Band	D(b-1)	400	2.6	68.1		
	103.20		0.19	Coal	D(C-2)	920	4.9	29.4		
103.35		1.65	0.90	Coal	E(C-1)	4200	5.2	23.7		
			0.08	Band	E(b-1)	560	3.0	61.8		
			0.33	Coal	E(C-2)	1600	5.6	23.6		
	105.00		0.33	Gr. Sh.	N.S.					

CSL. No.-RNG/67/BH-213/B.H. No. : RJBS - 9.

1	2	3	4	5	6	7	8	9	10	11
131.23		1.05	0.20	Sh. Coal	A(C-1)	930	6.6	35.0		
			0.16	Band	A(b-1)	1230	3.0	73.6		
			0.12	Coal	A(C-2)	500	8.8	20.7		
			0.11	Ar. Csh	N.S.					
			0.12	Coal	A(C-3)	340	7.0	29.0		
	132.25		0.09	C. Sh	N.S.					
143.15		1.93	0.24	Gr. Sh.	N.S.					
			0.46	Sh. Coal	B(C-1)	2100	5.2	43.0		
			0.55	Band	B(b-1)	3350	3.4	64.8		
			0.20	Sh. Coal	B(C-2)	855	5.0	42.0		
			0.16	Band	B(b-2)	1180	1.7	86.0		
	145.08		0.28	Sh. Coal	B(C-3)	1525	5.4	47.4		
146.38		1.52	0.58	Band	C(b-1)	3050	4.0	59.5		
			0.08	Coal	C(C-1)	335	5.8	28.2		
			0.42	Sh. Coal	C(b-2)	2200	4.9	40.6		
			0.17	Sh. Coal	C(C-2)	1900	5.0	41.4		
			0.17	Sh. Coal						
		2.55	0.35	Band	C(b-3)	1990	3.5	58.7		
			0.13	Coal	C(C-3)	770	6.2	33.3		
			0.10	Sh. Coal	C(b-4)	580	5.6	36.5		
			0.12	Sh. Coal	C(C-4)	580	5.6	36.5		
			0.10	Sh. Coal	C(b-5)	645	4.5	44.1		
			0.08	Coal	C(C-5)	435	6.6	29.0		
			0.08	Band	C(b-6)	470	3.8	56.4		
			0.38	Coal	C(C-6)	1820	5.4	34.1		
			0.07	Band	C(b-7)	435	2.4	56.4		
			0.22	Coal	C(C-7)	780	7.2	26.0		
			0.14	Band	C(b-8)	835	3.9	51.9		
			0.12	Sh. Coal	C(C-8)	565	5.8	35.2		
			0.12	Sh. Coal	C(b-9)	1305	4.9	46.3		
	150.45		0.48	Sh. Coal	C(C-9)	1920	4.9	46.8		
152.05	153.60	1.55	1.40	Coal	D(C)	6400	6.8	26.0	27.2	40.0
164.60		2.05	0.30	Gr. Sh	N.S.					
			0.14	Coal	E(C-1)	395	7.1	19.6		
			0.16	Sh. Coal	E(b-1)	1070	5.1	43.6		

IV/26

Borehole No. : RJBS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.12	Coal	E(C-2)	515	8.3	17.2		
			0.30	Gr. Sh	N.S.					
			0.36	Coal	E(C-3)	1520	7.2	29.2		
	166.65		0.20	Gr. Sh. with Coal lam.	N.S.					
170.85		2.02	0.30	Coal	N.S.					
			0.57	C. Sh						
			0.58	Coal	F(C)	2200	6.2	30.5		
			0.42	Gr. Sh	N.S.					
	172.07		0.16	Coal						
180.00		5.12	0.25	C. Sh	N.S.					
			0.20	Coal	G(C-1)	500	5.2	33.5		
			0.20	Band	G(b-1)	1135	3.2	61.6		
			0.22	Sh. Coal	G(C-2)	615	5.6	35.0		
			0.25	Sh. Coal	G(b-2)	975	4.7	47.2		
			0.18	Coal	G(C-3)	585	7.0	21.0		
			0.53	CSH with Coal streaks and Sy. Sh.....	N.S.					
			0.10	Coal	G(C-4)	180	7.7	14.8		
			0.30	Sh. Coal	G(b-3)	1185	4.6	30.6		
			0.20	Coal	G(C-5)	615	6.0	23.0		
			0.36	Sh. Coal	G(b-4)	1400	4.0	50.0		
			0.94	Coal	G(C-6)	2900	6.4	26.1		
			0.16	Sh. Coal	G(b-5)	840	4.0	50.7		
			0.15	Coal	G(C-7)	495	7.2	17.2		
			0.20	Band	G(b-6)	1560	3.7	59.5		
		0.30	0.13	Band						
			0.19	Coal	G(C-8)	680	7.2	22.2		
	185.50		0.03	Sy. Sh	N.S.					
186.80		1.25	0.40	CSH/Gr. Sh	N.S.					
			0.05	Coal						
			0.15	C. Sh						
			0.07	Coal						
			0.08	C. Sh						
			0.22	Coal						
	188.25		0.04	Gr. Sh						
191.60		1.50	0.30	C. Sh	N.S.					

IV/27

Borehole No. : RJLS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.75	Coal	H(C)	2200	6.0	18.2		
	193.10		0.22	C. Sh	N.S.					
195.60	196.95	1.35	1.30	Sh. Coal	I(C)	4100	5.6	35.0		
198.30		3.60	0.03	Gr. Sh	N.S.					
			0.76	Coal	J(C-1)	1905	5.	28.4		
			0.33	Band	J(b-1)	145	3.6	59.7		
			0.53	Coal	J(C-2)	1690	6.1	29.4		
			0.24	Band	J(b-2)	1090	2.8	66.6		
	201.90		1.72	Coal	J(C-3)	4550	6.1	25.7		
220.00		0.53	0.53	Coal	K(C-1)	1790	7.2	21.0		
		0.72	0.13	Coal	K(b-1)	420	5.6	29.5		
	221.25			Coal	K(C-2)	1195	7.5	17.6		
223.95		1.10	0.10	C.Sh	N.S.					
			0.90	Coal	L(C)	2800	6.6	26.6		
	225.05		0.05	Gr.Sh	N.S.					
226.90		2.65	0.22	C.Sh	N.S.					
			0.30	Coal	M(C-1)	1015	5.5	34.0		
			0.21	Band	M(b-1)	860	4.2	52.8		
			0.11	Coal	M(C-2)	355	6.2	32.1		
			0.50	Gr.Sh	N.S.					
			0.36	Coal	M(C-3)	745	7.1	19.5		
			0.08	Sh.Coal	M(b-2)	345	4.3	45.3		
			0.71	Coal	M(C-4)	3500	6.7	19.9		
		4.55	0.60	Coal						
			0.25	C.Sh	N.S.					
			0.25	Gr.Sh						
			0.08	Coal	M(C-5)	2600	5.9	32.3		
			0.10	Band	M(b-3)	475	3.2	60.4		
	234.10		2.50	Coal	M(C-6)	770	6.7	25.0	27.9	40.
250.35		3.40	3.32	Coal	N(C)	10000	5.3	31.5	26.7	36.1
	253.75		0.05	C.Sh	N.S.					
260.45		1.05	0.28	C.Sh	N.S.					
			0.62	Sh. Coal	O(C-1)	2300	4.9	39.9		
			0.03	Sh.Coal	O(b-1)	1270	4.2	48.2		
		1.75	0.22	Sh.Coal						
			0.23	Coal	O(C-2)	495	7.3	17.8		

Borehole No. : RJBS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.18	Sand	O(b-2)	785	4.2	51.4		
			0.19	Coal	O(C-3)	465	8.1	13.6		
268.30	263.25		0.02	C.Sh	N.S.					
		2.90	0.60	C.Sh	N.S.					
			0.38	Coal	P(C-1)	1125	7.3	21.4		
			0.10	Band	P(b-1)	420	3.6	51.0		
			1.52	Sh.Coal	P(C-2)	550	4.5	46.0		
271.20	271.20		0.16	C.Sh	N.S.					
271.20	271.40	0.20	0.20	Coal	P(C-3)	310	6.8	18.7		
272.72		1.13	0.32	Sh.Coal	Q(b-1)	116	3.9	45.3		
	273.05		0.78	Coal	Q(C-1)	2100	5.5	26.7		
276.20	276.90	0.70	0.70	Coal	R(C)	2300	5.1	32.3		
278.20	15.80	0.07		Sdy.Sh....	N.S.					
			0.24	Coal	S(C-1)	585	4.9	20.3		
			0.20	Sh.Coal	S(b-1)	830	2.9	51.0		
			0.22	Coal	S(C-2)	1990	3.9	30.9		
			0.16	Coal						
			0.15	Coal						
			0.20	Coal						
			0.35	Sh.Coal	S(b-2)	3100	3.0	49.1		
			0.21	Coal	S(C-3)	630	5.0	22.0		
			0.11	Sh.Coal	S(b-3)	360	3.2	47.4		
			0.18	Coal	S(C-4)	625	5.2	30.4		
			0.30	Band	S(b-4)	1705	2.5	64.0		
			0.60	Coal	S(C-5)	3650	4.7	29.2		
			0.68	Coal						
			0.34	Sh.Coal	S(b-5)	1380	3.2	51.2		
			0.41	Coal	S(C-6)	3500	4.9	23.6	30.2	41.3
			0.72	Coal						
			0.20	Band	S(b-6)	875	2.7	57.7		
			0.12	Sh.Coal	S(C-7)	395	3.4	36.8		
			0.09	Band	S(b-7)	350	2.6	52.7		
			0.18	Coal	S(C-8)	560	4.0	29.7		
			0.12	Band	S(b-8)	405	2.6	65.6		

Borehole No. : RJBS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.20	Coal	S(C-3)	23.0	6.6	19.1		
			0.75	Coal						
			0.15	Band	S(b-9)	6.5	2.2	54.1		
			1.13	Coal	S(C-9)	27.0	4.8	34.5	27.9	32.0
			0.44	Band	S(b-10)	13.0	2.8	56.2		
			0.56	Coal	S(C-10)	149.0	6.4	24.6		
			0.11	Sh.Coal	S(b-11)	45.0	3.2	46.6		
			0.60	Sh.Coal	S(C-11)	25.0	3.6	40.9		
			0.11	Band	S(b-12)	54.0	2.3	65.0		
			0.02	Sh.Coal	S(C-12)	265.0	4.4	30.4		
			0.50	Band	S(b-13)	21.0	2.0	75.8		
			0.17	Sh.Coal	S(C-13)	515	3.4	42.6		
			0.10	Band	S(b-14)	49.0	1.0	56.4		
			0.61	Coal	S(C-14)	109.0	6.3	10.7		
			0.15	Band	S(b-15)	665	1.7	74.1		
			0.20	Coal	S(C-15)	66.0	4.0	32.6		
			0.11	Band	S(b-16)	47.0	2.6	57.4		
			0.17	Coal	S(C-16)	545	4.0	31.5		
			0.13	Band	S(b-17)	595	2.4	64.9		
	294.00		1.02	Coal	S(C-17)	325.0	5.0	23.4	29.3	41.5
295.00	296.50	0.70	0.70	Coal	T(C)	2.70	5.0	22.1		
313.15	313.05	0.70	0.15	Sh.Coal	U(b-1)	6.0	1.0	52.0		
			0.55	Coal	U(C-1)	2.30	2.1	37.3		
315.50		5.90	0.50	Coal	V(C-1)	1375	2.0	27.2		
			0.26	Band	V(b-1)	1110	1.4	62.7		
			0.12	Coal	V(C-2)	30.0	2.0	33.2		
			0.10	Sh.Coal	V(b-2)	42.0	1.4	53.3		
			0.15	Coal	V(C-3)	45.0	2.7	22.0		

IV/3

Corehole No. : RJBS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.67	Sh.Coal	V(b-3)	2300	1.5	43.5		
			0.20	Coal	V(C-4)	770	2.0	23.0		
			0.45	Band	B(b-4)	1700	1.1	56.2		
			0.14	Coal	V(C-5)	395	1.7	19.2		
			0.30	Sh.Coal	V(b-5)	1975	1.3	43.3		
			0.32	Coal	V(C-6)	930	1.0	23.1		
			0.29	Band	V(b-6)	1150	1.3	54.2		
			0.60	Coal	V(C-7)	1600	1.7	29.3		
	321.40		0.36	Sh.Coal	V(b-7)	1120	1.3	40.3		
322.65		0.65	0.45	Coal	W(C-1)	450	1.5	36.6		
	323.30		0.50	Sh.Coal	W(b-1)	1800	1.5	49.1		
333.50		30.9	0.90	Band	X(b-1)	420	1.1	66.2		
			0.16	Coal	X(C-1)	405	1.6	34.4		
			0.35	Sh.Coal	X(b-2)	1310	1.4	43.4		
			0.10	Sh.Coal	X(C-2)	395	1.2	41.1		
			0.90	Sh.Coal	X(C-3)	250	1.4	40.6		
			0.94	Sh.Coal	X(b-3)	320	1.4	44.6		
			0.30	Coal	X(C-4)	1155	1.4	22.4		
			0.90	Coal	X(C-5)	220	1.4	34.9		
			0.65	Band	X(b-4)	2100	1.2	50.4		
			0.33	Sh.Coal	X(C-6)	670	1.4	44.0		
			0.06	Sh.Coal	X(b-5)	225	1.0	46.4		
			2.65	H.A.Coal	X(C-7)	5750	1.7	30.6	19.0	47.9
			0.17	Band	X(b-6)	915	0.8	73.9		
			2.55	H.A.Coal	X(C-8)	5900	1.6	36.9	18.7	42.0
			0.20	Sh.Coal	X(b-7)	760	1.2	40.0		
			1.00	H.A.Coal	X(C-9)	9200	1.6	34.4	21.6	42.4
			2.05	H.A.Coal						

IV/31

Borehole No. : RJBS - 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.12	Sh.Coal	X(b-3)	5.5	1.0	14.0		
			0.9	Coal	X(C-10)	245	2.0	21.0		
			0.26	Sh.Coal	X(b-9)	11.5	1.4	40.0		
			0.94	Coal	X(C-11)	20.0	1.6	20.0		
			0.42	Band	X(b-1.0)	10.95	1.6	56.3		
			1.02	H...Coal	X(C-12)	53.0	1.8	29.6	23.2	45.4
			1.30	Band	X(b-11)	59.0	1.8	62.2		
			0.72	Coal	X(C-13)	245	2.4	22.0		
			0.08	Coal	X(b-12)	29.0	1.8	36.4		
			0.73	Coal	X(C-14)	194.0	2.2	20.3		
			0.12	Sh.Coal	X(b-13)	495	1.9	40.1		
			0.32	Coal	X(C-15)	100.5	2.0	20.1		
			0.06	Sh.Coal	X(b-14)	315	1.0	47.0		
			0.17	Coal	X(C-16)	55.0	2.0	32.6		
			0.20	Band	X(b-15)	111.0	1.7	53.6		
			0.26	Coal	X(C-17)	64.0	2.0	19.1		
			0.24	Sh.Coal	X(b-16)	735	2.0	50.1		
			1.00	Sh.Coal	X(C-18)	22.0	2.0	40.1		
			1.35	Sh.Coal	X(b-17)	45.0	1.9	45.1		
	364.40		2.45	Coal	X(C-19)	60.0	2.0	26.5	24.3	47.2
369.30		1.41	0.20	Coal	Y(C-1)	55.0	2.2	32.5		
			0.23	Band	Y(b-1)	12.0	1.2	75.1		
			0.17	Coal	Y(C-2)	51.0	1.9	29.5		
			0.17	Sh.Coal	Y(b-2)	5.5	1.7	42.2		
			0.26	Coal	Y(C-3)	60.5	2.1	33.6		
	370.71		0.15	Sh.Coal	Y(b-3)	625	1.6	52.7		
376.7		3.40	0.45	Coal	Z(C-1)	131.0	1.4	31.5		
			0.10	Band	Z(b-1)	425	1.5	50.0		

Borehole No. : RJBS- 9.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			2.32	Coal	Z(C-2)	61.0	1.9	29.7	23.1	45.3
			0.53	Band	Z(b-2)	23.0	1.2	67.4		
			0.44	Coal	Z(C-3)	130.0	1.9	23.6		
			0.10	Band	Z(b-3)	33.0	1.2	67.0		
			0.46	Coal	Z(C-4)	125.0	1.9	29.6		
	300.1		0.04	Gr.Sh	N.S.					
412.0		3.90	1.20	H.A.Coal	A(C-1)	41.0	1.9	44.5	13.6	4...
		3.7	0.50	H.A.Coal						
			0.00	Band	A(b-1)	365	2.2	62.7		
			0.30	Coal	A(C-2)	9.5	2.4	31.8		
			0.10	Band	A(b-2)	640	1.4	45.4		
			1.00	H.A.Coal	A(C-3)	29.0	2.0	31.0	15.6	50.6
			0.15	Coal	A(b-3)	52.0	1.7	40.2		
	419.60		0.06	Coal	A(C-4)	215	2.0	34.0		

GSL. No-RNG/00/CH-173/L.H. No. : RJBS - 10.

1	2	3	4	5	6	7	8	9	10	11
17.66		3.55	0.16	Sh.Coal	A(C-1)	36.0	4.9	46.1		
			0.20	Band	A(b-1)	1155	4.3	57.2		
			1.40	Sh.Coal	A(C-2)	65.0	5.0	37.0	21.7	31.7
			0.10	Band	A(b-2)	1.95	4.2	56.0		
			0.43	Sh.Coal	A(C-3)	22.0	6.2	35.7		
			0.09	Band	A(b-3)	51.0	4.0	50.0		
			0.10	Coal	A(C-4)	49.0	6.3	31.2		
			0.09	Band	A(b-1)	52.0	4.3	56.3		

Borehole No. : RJBS - 10.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.26	Coal	A(C-5)	1375	8.6	23.5		
			0.13	Band	A(b-5)	705	4.0	62.3		
	21.21		0.16	Coal	A(C-6)	675	8.2	25.1		
26.51		1.54	0.16	Band	B(b-1)	900	2.9	73.2		
			0.28	Sh.Coal	B(C-1)	1305	5.8	40.9		
			0.17	Band	B(b-2)	1125	2.9	71.4		
	23.00		0.77	Coal	B(C-2)	3200	7.4	28.6		
34.47-34.98		0.51	0.50	Coal	C(C)	2150	6.3	30.2		
37.05-37.56		0.51	0.49	Coal	D(C)	1750	7.8	19.8		
38.41		1.25	0.26	Coal	E(C-1)	1285	7.5	21.0		
			0.07	Sh.Coal	E(b-1)	330	4.6	42.5		
			0.76	Sh.Coal	E(C-2)	3850	5.8	34.8	25.4	34.0
	39.66		0.14	Band	E(b-2)	895	4.1	60.3		
55.29-55.99		0.70	0.69	Coal	F(C)	3100	6.2	25.4	27.7	40.7
		0.66	0.06	Sh.Coal	G(b-1)	400	4.5	50.0		
			0.54	Coal	G(C-1)	2650	6.8	26.4		
	58.72		0.66	Band	G(b-2)	320	3.8	54.6		
60.54		4.56	0.09	Coal	H(C-1)	295	8.6	15.4		
			0.70	Band	H(b-1)	400	4.4	54.0		
			0.84	Coal	H(C-2)	340	7.3	20.0		
			0.10	Sh.Coal	H(b-2)	730	4.5	49.3		
			0.15	Coal	H(C-3)	820	6.0	30.9		
			0.10	Band	H(b-3)	1650	3.2	68.0		
			0.12	Band						
			0.42	Coal	H(C-4)	2045	6.0	28.1		
			0.27	Band	H(b-4)	2005	2.4	75.6		
			0.12	Sh.Coal	H(b-5)	660	5.2	39.2		



Borehole No. : RJBS-10.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.42	Coal	H(C-5)	2100	6.1	32.9		
			0.20	Sh.Coal	H(b-6)	1305	4.5	49.0		
	65.10		0.80	Coal	H(C-6)	3800	6.2	27.1		
72.76		2.68	1.90	Coal	I(C)	10400	4.6	35.2	26.4	33.8
			0.28	Sdy.Sh	N.S.					
			0.35	Coal						
	75.44		0.10	Gr.Sh	N.S.					
77.93		1.79	0.12	Sh.Coal	J(C-1)	705	5.1	38.0		
			0.12	Band	J(b-1)	770	3.6	61.2		
			0.15	Coal	J(C-2)	610	6.5	28.9		
			0.07	Sh.Coal	J(b-2)	455	5.0	46.3		
			0.10	Coal	J(C-3)	535	8.2	18.2		
			0.12	Band	J(b-3)	800	4.0	60.9		
	79.72		1.04	Sh.Coal	J(C-4)	5500	5.3	35.6	25.5	33.6
83.15-83.70		0.55	0.50	Sh.Coal	K(C)	2400	4.1	37.0		
89.65		8.60	0.05	D.Gr.Sh	N.S.					
			3.95	Sh.Coal	L(C-1)	15700	4.2	46.0	21.5	28.3
			0.40	Band	L(b-1)	2500	3.7	56.7		
			0.65	Sh.Coal	L(C-2)	2300	5.8	35.0		
			0.35	Band	L(b-2)	2250	2.7	75.5		
			0.38	Band	L(b-3)	2500	3.8	57.5		
			0.40	Sh.Coal	L(C-3)	1830	5.5	38.2		
			0.12	Band	L(b-4)	780	2.9	69.4		
	98.25		0.95	Coal	L(C-4)	3200	6.8	27.3	27.6	38.3
108.94-109.39		0.45	0.45	Sh.Coal	M(C)	2000	5.4	39.3		
110.44		2.30	0.77	Sh.Coal	N(C-1)	4050	6.4	37.4		
			0.08	Band	N(b-1)	540	3.7	66.4		

Borehole No. RJBS - 10.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.12	Sh.Coal	N(C-2)	675	5.7	41.9		
			0.14	Band	N(b-2)	790	1.6	50.7		
			0.30	Sh. Coal	N(C-3)	1840	5.3	39.9		
			0.07	Band	N(b-3)	745	1.3	70.3		
			0.22	Coal	N(C-4)	1025	8.1	18.1		
			0.06	Band	N(b-4)	385	5.1	52.9		
			0.10	Sh. Coal	N(C-5)	515	5.6	34.9		
			0.24	Band	N(b-5)	1600	4.3	57.1		
	112.74		0.09	Coal	N(C-6)	435	8.1	20.4		
114.80-115.20	0.40	0.40	Coal	O(C)	2050	5.9	27.7			
124.60	3.45	0.26	Sh. Coal	P(C-1)	1435	6.6	34.1			
		0.29	Band	P(b-1)	1965	4.2	51.1			
		0.07	Sh. Coal	P(C-2)	320	5.4	40.6			
		0.25	Band	P(b-2)	1640	3.2	63.7			
		1.50	Sh. Coal	P(C-3)	8200	5.2	39.0	23.2	32.6	
		0.11	Band	P(b-3)	815	3.0	65.9			
		0.09	Coal	P(C-4)	385	6.4	23.5			
		0.51	Gr.Sh.Sdy.....	N.S.						
		0.28	Coal	P(C-5)	1520	6.5	32.1			
	128.05	0.02	Coaly,Sh	N.S.						
129.20-130.30	1.10	1.10	Coal	Q(C)	5300	5.8	27.1	25.5	41.6	
133.90	0.84	0.06	Gr. Sh	N.S.						
		0.36	Sh.Coal	R(C)	3600	4.3	43.0	26.4	26.3	
		0.17	Siderite band	N.S.						
	134.74	0.19	Coal							
143.40	1.30	0.08	Coal	S(C-1)	275	7.8	20.0			
		0.12	Band	S(b-1)	810	3.8	54.6			

IV/36

Borehole No. : RJBS - 10.....Contd.

1	2	3	4	5	6	7	8	9	10	11
	144.70		1.02	Coal	S(C-2)	5000	6.2	32.0	23.6	38.2
150.85-152.15		1.30	1.30	Coal	T(C)	5900	5.6	30.0	25.5	38.9
153.50-158.60		5.10	5.10	Coal	U(C)	23000	5.4	32.1	24.6	37.9
162.35-162.85		0.50	0.40	Coal	V(C)	2000	4.9	32.1	26.6	36.4

CSL. No. RRG/88/BH-249/B.H. No. : RJBS - 11.

1	2	3	4	5	6	7	8	9	10	11
9.00	9.90	0.90	0.84	Sh. Coal	A(C)	4200	5.0	46.9	21.0	27.1
14.05		8.60	0.10	Coal	B(C-1)	540	5.0	32.1		
			0.13	Band	B(b-1)	1100	3.2	62.0		
			0.20	Sh. Coal	B(C-2)	1180	3.8	49.9		
			0.18	Band	B(b-2)	1400	2.6	70.5		
			0.16	Sh. Coal	B(C-3)	865	4.3	43.6		
			0.21	Band	B(b-3)	1710	2.6	69.4		
			0.28	Sh. Coal	B(C-4)	1360	4.8	38.7		
			0.10	Band	B(b-4)	925	2.4	60.6		
			0.96	Band	B(C-5)	7000	3.5	55.4		
			0.05	Gr. Sh & Fire Clay	N.S.					
			0.04	Siderice						
			2.78	Sh. Coal	B(C-6)	12500	4.1	44.4	22.2	29.3
			0.23	Band	B(b-5)	1155	2.1	67.4		
			1.16	Sh. Coal	B(C-7)	7500	3.8	42.9	23.1	30.2
			0.11	Grey. Sh. & Fire Clay....	N.S.					
			0.76	Sh. Coal	B(C-8)	5500	3.9	46.2		
			0.15	Gr. Sh. with fire Clay....	N.S.					
			1.17	Coal	B(C-9)	6000	4.6	27.5	27.6	40.3
			0.65	Sy. Gr. Sh	N.S.					
22.65			0.12	Sh. Coal	B(C-10)	900	3.5	44.8		

Borehole No. : RJBS - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
24.40		2.15	0.86	Coal	C(C)	11500	5.5	31.8	26.2	36.5
			0.10	C.Sh						
			0.40	Gr.Sh	N.S.					
	26.55		0.80	Coal						
32.79		2.40	0.15	C.Sh&Gr.Sh	N.S.					
			0.18	Coal	D(C-1)	1010	5.6	29.2		
			0.29	Band	D(b-1)	2300	2.1	75.9		
			0.74	Sh.Coal	D(C-2)	3600	3.7	47.1		
			0.60	Coal	D(C-3)	2100	6.2	26.2		
			0.20	Band	D(b-2)	1030	2.2	64.4		
	35.39		0.16	Coal	D(C-4)	580	5.0	26.6		
47.60		5.05	0.07	C. Sh	N.S.					
			0.37	Coal	E(C-1)	2600	3.6	35.2		
			0.15	Sh. Coal	E(b-1)	1180	3.2	48.5		
			0.45	Coal	E(C-2)	2500	4.3	25.1		
			0.40	Sh. Coal	E(C-3)	2700	3.4	41.5		
			0.16	Coal	E(C-4)	1000	4.8	23.6		
			0.08	Band	E(b-2)	565	2.2	57.9		
			1.40	Coal	E(C-5)	7500	4.0	28.6	29.2	38.2
			0.15	Mud.Stone	N.S.	500				
			0.55	Sh. Coal	E(C-6)	2300	3.8	41.5		
			0.30	Band	E(b-3)	1950	2.6	65.2		
			0.20	Coal	E(C-7)	1240	5.3	22.7		
			0.07	Sh. Coal	E(b-4)	545	3.2	45.8		
			0.35	Coal	E(C-8)	2200	5.2	30.2		
			0.10	Band	E(b-5)	950	2.0	60.4		
			0.28	Coal	E(C-9)	1720	5.3	20.3		
	52.65		0.10	Band	E(b-6)	1045	2.2	63.0		
57.35		4.85	0.10	C. Sh	N.S.					
			0.16	Coal	F(C-1)	660	6.0	18.2		
			0.13	Band	F(b-1)	845	2.8	60.8		
			1.42	Coal	F(C-2)	5700	4.6	25.5	27.5	42.3
			0.12	Band	F(b-2)	1000	1.8	73.3		
			0.10	Coal	F(C-3)	340	4.9	29.8		
			0.16	Band	F(b-3)	845	3.2	53.8		
			1.10	Sh. Coal	F(C-4)	3100	4.0	29.2	23.8	33.0

Borehole No. : RJBS - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.08	Band	F(b-4)	360	2.5	53.8		
			0.12	Sh. Coal	F(C-5)	510	3.0	49.3		
			0.38	Band	F(b-5)	2050	2.2	70.0		
			1.15	Coal	B(C-6)	4500	5.0	31.4	25.2	38.4
	62.20		0.25	C.Sh & Gr.	N.S.					
				Sh. with						
				Coal Lam						
65.40		1.95	1.63	Coal	G(C-1)	7600	3.5	24.3	28.1	42.1
			0.10	Band	B(b-1)	620	1.2	79.2		
	67.35		0.32	Coal	G(C-2)	900	5.7	22.0		
7.75		1.20	0.46	Sh. Coal	G(C-3)	1800	4.5	43.7		
			0.28	Band	G(b-2)	1920	1.6	78.2		
	68.95		0.40	Coal	G(C-4)	1355	3.4	36.1		
9.40	80.50	1.10	1.10	Coal	H(C)	5600	5.4	25.3	28.2	41.1
3.10		1.00	0.14	C. Sh	N.S.					
	84.10		0.86	Coal	I(C)	5400	4.2	35.2	25.1	35.5
5.10		6.00	0.10	C. Sh	N.S.					
			0.50	Coal	J(C-1)	2300	4.2	30.3		
			0.19	Band	J(b-1)	1190	2.2	59.5		
			0.17	Coal	J(C-2)	850	3.0	34.4		
			0.37	Band	J(b-2)	2400	1.6	72.1		
			1.49	Coal	J(C-3)	5200	6.4	20.0	30.7	42.9
			0.16	Sh. Coal	J(b-3)	960	2.8	51.2		
			0.17	Sh. Coal	J(C-4)	950	4.0	39.6		
			0.11	Band	J(b-4)	665	2.6	62.4		
			0.46	Coal	J(C-5)	2200	4.2	29.4		
			0.09	Sid.	N.S.					
			0.70	Sh. Coal	J(C-6)	3300	3.0	44.6		
			0.22	Band	J(b-5)	1370	3.0	55.8		
1.10			1.45	Coal	J(C-7)	5100	5.0	22.0	29.8	43.2
8.35		3.00	0.24	Coal	K(C-1)	1220	4.1	30.8		
			0.22	Band	K(b-1)	1360	2.6	56.0		
			1.15	Coal	K(C-2)	5500	4.0	35.0	26.4	34.6
			0.06	Band	K(b-2)	360	1.8	57.8		
			0.70	Coal	K(C-3)	2300	5.3	21.8		
			0.28	Sh. Coal	K(b-3)	1730	2.6	49.3		

Borehole No. : RJBS - 11,....Contd.

1	2	3	4	5	6	7	8	9	10	11
101.35		0.30	Coal	K(C-4)	1275	3.9	30.7			
103.60	2.20	0.09	Coal	L(C-1)	295	5.5	19.1			
		0.08	Band	L(b-1)	590	2.9	63.0			
		0.15	Coal	L(C-2)	720	5.4	22.8			
		0.22	Sh. Coal	L(b-2)	1230	3.5	45.3			
		0.28	Coal	L(C-3)	1800	4.8	23.8			
		0.09	Band	L(b-3)	2000	0.9	85.3			
		0.60	Coal	L(C-4)	2600	4.3	26.6			
		0.08	Band	L(b-4)	450	2.4	56.8			
		0.06	Coal	L(C-5)	1520	4.5	30.3			
105.80		0.10	Coal	L(b-5)	540	3.3	35.3			
110.30	1.30	0.02	D.Gr.Sh	N.S.						
		0.44	Coal	M(C-1)	2000	4.5	32.3			
		0.22	Band	M(b-1)	1350	2.0	60.9			
111.60		0.50	Sh.Coal	M(C-2)	2600	3.6	37.8			
112.80	0.50	0.38	Sh. Coal	N(C-1)	2100	3.2	39.6			
		0.12	Band	N(b-1)	780	2.2	55.6			
113.30		0.12	Coal	N(C-2)	575	4.1	25.8			
114.80	1.25	0.19	Sh. Coal	O(C-1)	850	3.3	41.3			
		0.23	Band	O(b-1)	1525	2.5	60.1			
		0.22	Coal	O(C-2)	970	4.8	23.4			
116.05		0.19	Coal	O(C-3)	660	4.4	18.2			
117.70-118.20	0.50	0.50	Coal	P(C)	2200	4.0	32.2			
119.90	2.20	0.11	Sh. Coal	Q(b-1)	630	2.6	50.2			
		0.29	Coal	Q(C-1)	1205	3.2	39.6			
		0.12	Band	Q(b-2)	640	2.6	57.4			
		0.50	Coal	Q(C-2)	2300	3.2	32.3			
		0.17	Band	Q(b-3)	1070	1.6	61.2			
		0.37	Sh. Coal	Q(C-3)	1900	2.5	40.0			
		0.23	S.St.	N.S.						
122.10		0.42	Sh. Coal	Q(C-4)	2400	3.0	37.1			
123.10	9.80	0.70	Coal	R(C-1)	2700	3.2	28.4			
		0.19	Band	R(b-1)	1400	1.3	77.2			
		0.50	Coal	R(C-2)	2300	3.4	36.0			
		0.31	Band	R(b-2)	2030	2.3	65.7			

Borehole No. : RJBS - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.68	Coal	R(C-3)	3000	4.0	21.2		
			0.21	Sh. Coal	R(b-3)	1540	3.0	44.5		
			0.50	Coal	R(C-4)	2000	5.9	23.0		
			0.09	Band	R(B-4)	520	2.1	61.2		
			0.40	Coal	R(C-5)	1725	3.4	32.4		
			0.44	Band	R(b-5)	2800	2.0	63.5		
			0.32	Coal	R(C-6)	1475	4.2	28.0		
			0.07	Sh. Coal	R(b-6)	390	2.1	50.8		
			0.23	Coal	R(C-7)	1150	3.8	35.4		
			0.10	Sh. Coal	R(b-7)	590	2.6	48.5		
			0.15	Sh. Coal	R(C-8)	730	3.3	41.1		
			0.16	Sh. Coal	R(b-8)	920	3.1	51.1		
			0.20	Coal	R(C-9)	800	6.7	21.5		
			0.26	Band	R(B-9)	1750	1.6	64.8		
			0.08	Coal	R(C-10)	410	3.7	30.0		
			0.07	Band	R(b-10)	530	2.0	63.9		
			0.17	Coal	R(C-11)	835	3.6	32.2		
			0.19	Band	R(b-11)	1190	2.4	56.0		
			0.88	Coal	R(C-12)	3700	5.0	27.3		
			0.11	Sh. Coal	R(b-12)	595	3.4	43.9		
			2.15	Coal	R(C-13)	8800	4.5	26.0	26.6	42.9
			0.06	Band	R(b-13)	350	3.1	53.8		
	132.90		0.33	Coal	R(C-14)	1505	5.2	23.0		
149.20		2.20	1.05	Coal	S(C-1)	3600	4.0	32.3	25.0	38.7
			0.10	Band	S(b-1)	660	2.2	65.6		
			0.14	Coal	S(C-2)	620	3.4	34.6		
			0.10	Band	S(b-2)	565	2.1	59.8		
	151.40		0.30	Coal	S(C-3)	1570	3.6	35.2		
157.70-159.15	1.45	1.36	Coal	T(C)	6500	3.6	29.8	27.0	39.6	
160.30		11.10	0.10	Coal	U(C-1)	505	3.8	25.3		
			0.17	Band	U(b-1)	1125	2.2	64.4		
			1.32	Coal	U(C-2)	6000	4.7	29.2	25.2	40.9
			0.10	Band	U(b-2)	650	1.6	66.4		
			2.97	Coal	U(C-3)	12000	4.2	19.8	29.0	47.0
			0.06	Band	U(b-3)	390	2.2	59.0		
			1.86	Coal	U(C-4)	7500	4.3	29.8	24.7	41.2
			0.22	Sh. Coal	U(b-4)	1325	2.8	51.6		
			0.15	Coal	U(C-5)	770	3.6	33.0		

Borehole No. : RJBS - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.22	Band	U(b-5)	1410	2.7	55.6		
			0.42	Sh. Coal	U(C-6)	2200	3.8	38.2		
			0.12	Sh. Coal	U(b-6)	695	3.3	40.4		
			1.44	Coal	J(C-7)	6500	3.0	21.1	29.4	44.5
			0.21	Band	U(b-7)	1400	2.2	58.9		
			0.09	Coal	J(C-8)	390	4.0	27.2		
			0.20	Sh. Coal	U(b-8)	1110	3.4	47.9		
			0.39	Coal	U(C-9)	2000	4.2	29.8		
			0.19	Band	U(b-9)	1630	1.6	66.4		
			0.32	Coal	U(C-10)	1320	3.2	26.0		
			0.10	Coal	U(b-10)	440	3.6	29.1		
			0.19	Coal	U(C-11)	1215	4.0	33.2		
			0.11	C.Sh.with the stasks of br.coal	N.S.					
			0.02	Sy. CSH						
			0.17	SSI						
			0.04	Gr. Sh						
	171.80		0.19	Sh. Coal	U(C-12)	885	2.6	42.5		
183.30-184.90		1.60	1.60	Coal	V(C)	7200	4.1	27.7	27.9	40.3
207.35		2.85	0.05	C.Sh	N.S.					
	210.20		2.44	Coal	W(C)	9800	3.9	23.1	27.1	45.9
254.30		7.55	0.08	Band	X(b-1)	485	2.0	62.1		
			4.08	Coal	X(C-1)	18300	3.6	22.8	28.8	44.8
	261.85		3.00	Coal	X(C-2)	11300	3.4	25.6	27.4	43.6
276.90		6.85	0.50	Coal	Y(C-1)	2250	4.2	24.2		
			0.14	Coal	Y(b-1)	755	2.9	35.3		
			0.93	Coal	Y(C-2)	4500	3.8	27.3		
			0.10	Sh. Coal	Y(b-2)	610	2.4	48.6		
			3.72	Coal	Y(C-3)	16000	3.3	27.6	26.9	42.2
			0.11	Sh. Coal	Y(b-3)	650	2.2	44.9		
	283.75		0.80	Coal	Y(C-4)	3800	2.7	30.8		
284.95		4.55	1.04	Coal	Z(C-1)	4600	2.5	33.6	25.2	38.7
			0.06	Band	Z(b-1)	570	1.8	54.0		
			1.12	Coal	Z(C-2)	5600	3.1	29.2	25.0	42.7
			0.04	Gr. Sh						
			0.09	Sdy. Sh	N.S.					
			0.04	Gr. Sh						

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Borehole No. : RJBS - 11.....Contd.

1	2	3	4	5	6	7	8	9	10	11
	289.50		2.36	Coal	Z(C-3)	11400	2.9	22.1	28.7	46.3
314.15-315.80	1.65	1.65	Coal	AA(C)	7900	3.0	32.4	22.6	42.0	
359.70	1.55	0.22	Sh. Coal	BB(C-1)	865	2.6	40.0			
		0.10	Band	BB(b-1)	515	1.6	67.8			
		0.59	Sh. Coal	BB(C-2)	2100	2.2	47.5			
		0.05	Band	BB(b-2)	210	1.2	63.8			
		0.06	Coal	BB(C-3)	210	2.6	34.6			
		0.08	Band	BB(b-3)	380	1.6	60.7			
	361.25		0.30	Coal	BB(C-4)	905	3.6	24.9		
399.50-400.00	0.50	0.50	Coal	CC(C)	1635	2.7	21.0			

CSL. No. RRG/89/BH-16/B.H. No. : RJBS - 13.

1	2	3	4	5	6	7	8	9	10	11
11.45		1.80	1.20	Sh. Coal	A(C-1)	6500	4.6	45.5		
			0.11	Band	A(b-1)	555	2.8	73.2		
			0.43	Coal	A(C-2)	1640	6.6	25.6		
	13.28		0.07	Band	A(b-2)	420	4.7	58.3		
14.20		3.35	0.48	Sh. Coal	A(C-3)	2200	5.2	40.2		
			0.17	Band	A(b-3)	1500	2.7	74.0		
			0.20	Coal	A(C-4)	1000	6.3	32.8		
			0.41	Band	A(b-4)	2800	2.7	76.1		
			0.20	Sh. Coal	A(C-5)	1200	5.2	45.0		
			0.09	Band	A(b-5)	460	3.8	69.1		
			1.16	Sh. Coal	A(C-6)	5500	5.6	35.6		
			0.05	Band	A(b-6)	430	3.2	60.8		
	17.55		0.78	Sh. Coal	A(C-7)	3500	5.4	36.3		
19.45-20.00	0.55	0.50	Sh. Coal	(B)	2250	5.4	34.9			
21.15		4.00	1.54	Sh. Coal	C(C-1)	7500	4.4	41.4		
			0.08	Band	C(b-1)	380	3.0	66.3		
			1.29	Sh. Coal	C(C-2)	6250	4.1	47.0		
			0.16	Band	C(b-2)	650	2.6	65.6		
			0.11	Band	C(C-3)	415	3.4	54.6		
			0.08	Band	C(b-3)	420	3.2	64.6		

Borehole No. : RJBS - 13.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.10	Sh.Coal	C(C-4)	560	4.2	45.8		
			0.19	Band	C(b-4)	635	2.9	60.2		
	25.15		0.66	Sh.Coal	C(C-5)	2600	4.2	36.1		
27.94		12.46	2.16	Sh.Coal	D(C-1)	10500	4.4	42.7		
			0.32	SSr.	N.S.					
			1.06	Sh.Coal	D(C-2)	5500	4.2	47.0		
			0.29	Band	D(b-1)	1855	3.2	70.7		
			1.49	Coal	D(C-3)	7000	4.9	34.4		
			0.13	Band	D(b-2)	860	2.6	64.4		
			1.10	Coal	D(C-4)	5650	5.1	34.8		
			0.42	Band	D(b-3)	3000	2.2	77.4		
			0.44	Goal	D(C-5)	2500	5.7	33.4		
			0.26	Band	D(b-4)	1740	2.6	74.6		
			2.04	Sh.Coal	D(C-6)	10500	4.7	38.7		
			0.10	Band	D(b-5)	658	3.5	53.0		
			1.02	Coal	D(C-7)	5250	6.4	29.3		
			0.29	Band	D(b-6)	1590	3.8	55.8		
	40.40		1.65	Coal	D(C-8)	7250	6.4	20.4		
54.75-55.30		0.55	0.45	Sh.Coal	(E)	2250	4.2	43.8		
			0.35	Coal	F(C-1)	1400	6.2	22.4		
56.25		24.55	0.19	Band	F(b-1)	1200	2.8	62.6		
			0.77	Sh.Coal	F(C-2)	3600	5.0	39.3		
			0.10	Band	F(b-2)	750	2.5	73.8		
			0.35	Sh.Coal	F(C-3)	1750	4.8	37.7		
			0.15	Band	F(b-3)	1000	3.8	53.4		
			1.13	Coal	F(C-4)	5500	5.8	31.6		
			0.19	Band	F(b-4)	1200	4.4	51.1		
			0.82	Coal	F(C-5)	4000	5.4	32.2		
			0.09	Sh.Coal	F(b-5)	600	4.0	46.4		
			0.21	Sh.Coal	F(C-6)	1100	4.4	39.0		
			0.51	Band	F(b-6)	3000	3.8	59.2		
			0.37	Sh.Coal	F(C-7)	1800	5.1	36.0		
			0.18	Band	F(b-7)	1200	3.9	54.5		
			0.26	Coal	F(C-8)	1700	6.2	32.0		
			0.08	Band	F(b-8)	440	4.4	52.3		
			1.07	Sh.Coal	F(C-9)	5500	5.0	48.0		
			0.69	Band	F(b-9)	4500	3.0	73.0		
			0.10	Band	F(C-10)	520	4.0	52.2		
			0.25	Band	F(b-10)	1700	3.8	69.2		

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Borehole No. : RJBS - 13.....Contd.

1	2	3	4	5	6	7	8	9	10	11
0.68	Sh.Coal	F(C-11)	3250	5.2	37.4					
0.20	Band	F(b-11)	1300	2.8	62.4					
0.64	Fg.SSt	N.S.								
0.18	Sh.Coal	F(C-12)	910	4.0	44.6					
0.21	Band	F(b-12)	1245	3.4	52.4					
0.19	Sh.Coal	F(C-13)	1200	4.2	36.2					
0.15	Band	F(b-13)	1000	1.8	75.9					
0.30	Coal	F(C-14)	1700	4.6	33.4					
0.20	Sh.Coal	F(b-14)	1150	4.5	45.7					
0.36	Coal	F(C-15)	1800	5.0	29.9					
0.12	Sh.Coal	F(b-15)	640	5.7	39.0					
0.55	Sh.Coal	F(C-16)	3000	5.7	34.7					
0.15	Band	F(b-16)	770	4.3	56.4					
0.11	Coal	F(C-17)	460	6.2	29.6					
0.07	Sh.Coal	F(b-17)	330	3.9	46.3					
0.67	Coal	F(C-18)	2700	5.8	27.0					
0.37	Band	F(b-18)	1800	3.5	59.4					
0.11	Sh.Coal	F(C-19)	570	4.5	41.0					
0.26	Band	F(b-19)	1450	4.2	53.1					
0.27	Sh.Coal	F(C-20)	1470	5.2	39.2					
0.05	Band	F(b-20)	370	2.0	77.2					
1.97	Coal	F(C-21)	7250	5.4	22.6					
0.27	SSt.	N.S.								
2.10	Coal	F(C-22)	10000	5.2	26.2					
0.07	Band	F(b-21)	385	4.0	54.8					
1.53	Coal	F(C-23)	7500	4.6	33.6					
0.21	Sh.Coal	F(b-22)	1200	4.8	46.3					
0.08	Sh.Coal	F(C-24)	380	4.9	40.0					
0.10	Band	F(b-23)	670	3.1	67.1					
0.17	SSt	N.S.								
0.42	Band	F(b-24)	2750	2.9	65.8					
0.28	Sh.Coal	F(C-25)	1440	4.4	40.7					
0.09	Band	F(b-25)	660	3.3	61.0					
0.50	Sh.Coal	F(C-26)	2200	5.1	37.4					
0.09	Sh.Coal	F(b-26)	600	4.6	45.0					
1.57	Coal	F(C-27)	7500	5.2	30.4					
0.09	Band	F(b-27)	700	3.6	54.4					
0.98	Sh.Coal	F(C-28)	5000	5.2	39.3					
0.24	Band	F(b-28)	1500	2.8	68.0					

IV/45

Borehole No. : RJBS - 13.....Contd.

1	2	3	4	5	6	7	8	9	10	11
	80.80		0.22	Coal	F(C-29)	855	5.7	31.4		
87.06		0.95	0.75	Sh.Coal	(G)	3300	5.4	38.6		
	88.01		0.20	C.Sh	N.S.					
89.60		2.00	0.87	Coal	H(C-1)	4000	5.2	32.4		
			0.12	Band	n(b-1)	710	3.6	61.7		
	91.60		1.01	Sh.Coal	H(C-2)	5000	5.0	46.5		
93.70		2.75	0.08	Band	I(b-1)	365	2.8	75.4		
			0.09	Sh.Coal	I(C-1)	425	5.6	42.4		
			0.08	Band	I(b-2)	465	4.0	54.2		
			0.26	Coal	I(C-2)	850	6.4	24.0		
			0.50	Band	I(b-3)	2600	4.0	57.0		
			0.11	Sh.Coal	I(C-3)	460	4.4	37.2		
			0.34	Sh.Coal	I(b-4)	1900	4.8	40.9		
			0.50	Coal	I(C-4)	1700	5.4	28.6		
			0.17	Sh.Coal	I(b-5)	900	4.4	47.5		
	96.45		0.65	Coal	I(C-5)	2900	4.8	25.7		
110.95		1.35	0.08	Gr.Sh	N.S.					
			0.86	Sh.Coal	J(C-1)	3700	4.8	35.5		
			0.12	Band	J(b-1)	650	3.6	58.2		
	112.60		0.48	Coal	J(C-2)	1800	5.0	30.6		
113.70-114.70	1.00	1.00	Coal	(K)	4400	5.0	26.7	26.4	41.9	
155.90-157.75	1.85	1.75	Coal	(L)	6500	5.4	25.8	25.7	43.1	
159.20-164.60	6.40	6.40	Coal	(M)	26500	5.2	24.1	27.0	43.7	
177.80-182.70	4.90	4.90	Coal	(N)	22000	4.9	29.4	26.1	39.6	
183.70-184.35	0.65	0.65	Coal	(O)	3800	4.6	26.8			
191.30-193.90	2.60	0.08	Gr.Sh	N.S.						
		2.42	Coal	(P)	11000	5.3	25.0	27.4	42.3	
217.50		1.30	0.35	C.Sh	N.S.					
			0.41	Sh.Coal	Q(C-1)	2700	4.2	48.2		
			0.41	Sh.Coal	Q(b-1)	2400	4.4	46.8		
	218.80		0.08	Sh.Coal	Q(C-2)	455	4.0	48.8		
260.75-261.56	0.81	0.80	Band	(R)	4000	3.6	51.9			

IV/46

CSL. No-RNG/90/BH-14/B.H. No. : RJBS - 14.

1	2	3	4	5	6	7	8	9	10	11
218.95-219.60		1.65	0.65	Sh.Coal	(A)	2100	2.0	47.0		

CSL. No-RNG/90/BH-16/B.H. No. : RJBS - 17.

1	2	3	4	5	6	7	8	9	10	11
21.00		0.85	0.60	Coal	(A)	1920	5.6	32.0		
	21.85		0.15	C.Sh.	N.S.					
25.65		7.70	1.60	Coal	B(C-1)	5100	5.9	32.0	28.2	33.9
			0.12	Band	B(b-1)	585	4.0	67.8		
			0.20	Coal	B(C-2)	706	7.1	27.5		
			0.08	Band	B(b-2)	340	3.7	55.6		
			0.12	Sh.Coal	B(C-3)	470	4.8	44.2		
			0.18	Band	B(b-3)	665	4.0	68.0		
			0.42	Sh.Coal	B(C-4)	1450	6.0	37.2		
			0.07	Band	B(b-4)	495	3.8	61.6		
			0.31	Sh.Coal	B(C-5)	1235	6.3	38.5		
			0.11	Band	B(b-5)	820	4.1	56.6		
			0.23	Coal	B(C-6)	605	7.0	29.4		
			0.15	Band	B(b-6)	770	4.0	57.6		
			2.30	Coal	B(C-7)	7600	6.1	21.0	25.8	37.1
			0.16	Band	B(b-7)	730	3.5	62.9		
			0.07	Sh.Coal	B(C-8)	270	5.6	36.1		
			0.11	Band	B(b-8)	330	4.4	52.5		
	33.35		1.63	Coal	B(C-9)	4500	7.9	13.1	33.8	45.2
43.75		2.35	0.31	Coal	C(C-1)	1150	7.4	26.4		
			0.18	Band	C(b-1)	870	3.0	70.0		
			0.25	Coal	C(C-2)	735	6.9	23.6		
			0.40	SSt.	N.S.					
			0.39	Sh.Coal	C(C-3)	1555	5.5	45.7		
			0.08	Band	C(b-2)	380	3.0	65.7		
			0.50	Sh.Coal	C(C-4)	1915	5.6	39.4		
			0.09	SSt.	N.S.					
			0.11	Sdy.Gr.Sh	N.S.					

Borehole No. : RJ85 - 17.....Contd.

1	2	3	4	5	6	7	8	9	10	11
	46.10		0.04	Coal	N.S.					
46.90-47.60		0.70	0.70	Coal	(D)	2500	5.6	31.8		
57.70		3.10	0.67	Sh.Coal	(C-1)	2300	5.0	38.2		
			0.12	Sh.Coal	c(b-1)	495	4.5	41.5		
			2.80	Coal	E(C-2)	9800	5.5	32.1	27.4	35.0
	61.30		0.03	Gr.Sh	N.S.					
63.85		4.55	0.28	Coal	F(C-1)	670	7.0	13.8		
			0.25	Band	F(b-1)	1105	2.0	74.0		
			0.10	Sh.Coal	F(C-2)	335	4.4	43.7		
			0.12	Sdy.Gr.Sh	N.S.					
			0.44	Sh.Coal	F(C-3)	1700	5.0	38.1		
			0.12	Sh.Coal	F(b-2)	505	3.5	50.7		
			1.55	Coal	F(C-4)	4900	5.9	23.6		
			0.17	Band	F(b-3)	825	3.0	66.1		
	68.40		1.52	Coal	F(C-5)	4950	6.0	33.2		
71.60		2.60	0.18	Coal	G(C-1)	625	6.6	22.8		
			0.07	Sh.Coal	G(b-1)	330	4.4	40.2		
			0.79	Coal	G(C-2)	2400	6.4	21.8		
			0.10	Band	G(b-2)	450	2.9	61.7		
	74.20		1.46	Sh.Coal	G(C-3)	4500	5.4	35.2		
80.85-81.60		0.75	0.75	Coal	(H)	2300	6.4	19.6		
87.90		2.30	0.30	Coal	I(C-1)	740	3.4	15.6		
			0.54	Band	I(b-1)	2100	2.9	60.6		
	90.20		1.30	Coal	I(C-2)	4100	5.8	23.0		
96.85		1.20	0.18	Sh.Coal	J(C-1)	685	5.0	37.2		
			0.17	Band	J(b-1)	770	2.0	79.8		
			0.11	Coal	J(C-2)	400	7.4	20.0		
			0.13	Band	J(b-2)	520	2.6	72.6		
			0.10	Coal	J(C-3)	310	7.3	17.7		
			0.07	Band	J(b-3)	405	1.9	71.6		
	98.05		0.34	Coal	J(C-4)	1130	5.1	29.2		
108.65		6.68	1.20	Coal	K(C-1)	3700	6.0	25.1		
			0.07	Band	K(b-1)	310	3.4	54.7		
			4.31	Coal	K(C-2)	14100	6.2	24.8	28.6	40.4
	115.33		1.10	Coal	K(C-3)	3400	4.6	32.7		
163.90-167.00		4.00	2.96	Coal	(L)	13900	5.4	28.4	26.0	40.2
201.10-202.05		0.95	0.80	Coal	(M)	2100	4.2	35.1		

IV/48

CSL. No-FNG/90/BH-39/B.1. No. : RIBS - 19.

1	2	3	4	5	6	7	8	9	10	11
9.00		1.00	0.50	Sh.Coal	(A)	1060	4.4	36.2		
17.70	18.95	1.25	1.00	Coal	(B)	2800	5.8	22.2	28.4	43.6
23.70		2.80	0.04	Coal	N.S.					
			0.55	Sh/Gr.Ch						
			0.60	Coal	C(C-1)	1600	5.6	24.3		
			0.18	Band	C(b-1)	490	3.5	57.4		
	26.50		0.75	Coal	C(C-2)	1800	5.7	25.7		
39.32	40.70	1.38	0.79	Coal	(D)	2100	5.3	29.0		
63.35		8.15	1.82	Coal	E(C-1)	5200	5.9	23.7		
			0.09	Sh.Coal	E(b-1)	450	4.5	39.3		
			0.14	Coal	E(C-2)	420	6.8	15.8		
			0.18	Sh.Coal	E(b-2)	790	3.8	49.3		
			0.20	Coal	E(C-3)	510	6.8	15.2		
			0.05	Sh.Coal	E(b-3)	270	4.8	35.8		
			0.09	Coal	E(C-4)	210	8.0	12.3		
			0.07	Sh.Coal	E(b-4)	280	4.4	38.2		
			0.29	Coal	E(C-5)	830	6.7	16.0		
			0.15	Sh.Coal	E(b-5)	410	4.0	38.8		
			1.66	Coal	E(C-6)	480	6.2	24.7		
			0.12	Band	E(b-6)	495	4.4	52.5		
			0.12	Coal	E(C-7)	470	6.8	30.2		
			0.16	Sh.Coal	E(b-7)	675	4.4	45.3		
			0.30	Coal	E(C-8)	790	5.4	30.4		
			0.24	Sh.Coal	E(b-8)	790	3.8	50.0		
	71.50		1.28	Coal	E(C-9)	3200	4.8	35.2		
119.10		1.87	0.15	Coal	F(C-1)	265	3.4	31.0		
			0.10	Sh.Coal	F(b-1)	340	3.4	46.9		
			0.23	Coal	F(C-2)	850	4.4	30.2		
			0.24	SSt(Carbo- naceous)	N.S.					
	120.97		0.88	Sh.Coal	F(C-3)	2700	4.2	47.6		
126.85-131.40		4.55	4.55	Coal	(G)	14500	4.9	28.3	27.2	39.6
176.30		0.65	0.04	C.Sh	N.S.					
	176.95	0.61	0.54	Sh.Coal	(H)	1900	4.6	38.8		

IV/49

CSL. No-RNG/90/BH-40/B.H. No. : RJBS -20.

1	2	3	4	5	6	7	8	9	10	11
12.50		1.53	0.40	Coal	A(C-1)	2000	8.4	21.6		
			0.14	Band	A(b-1)	1365	2.2	71.4		
			0.28	Coal	A(C-2)	2050	6.6	32.9		
			0.23	Band	A(b-2)	1600	3.6	59.9		
			0.14	Sh.Coal	A(C-3)	890	5.2	38.2		
			0.10	Band	A(b-3)	660	2.3	70.0		
			0.18	Coal	A(C-4)	1260	6.4	33.0		
	14.03		0.14	Gr. Sh. with SSt. N.S.						
16.92		1.75	0.19	Coal	B(C-1)	1305	8.4	22.0		
			0.06	Band	B(b-1)	480	5.0	50.4		
			0.65	Sh.Coal	B(C-2)	4300	5.0	35.9		
			0.14	Band	B(b-2)	900	4.4	56.6		
			0.07	Coal	E(C-3)	590	7.5	26.0		
			0.29	Sdy.C.Sh/ Sdy.Sh/Sid.	N.S.	2700				
			0.30	Sh.Coal	B(C-4)	2300	6.2	38.1		
	18.67		0.05	Gr.Sh	N.S.					
27.17		1.25	0.40	Coal						
			0.30	Gr.Sh/Sdy	N.S.	3000				
			0.10	Coal	(C)	4000	6.5	32.4		
			0.12	Sdy.Sh	N.S.	1000				
	28.42		0.12	Coal						
40.60		1.15	0.14	Sh.Coal	(D)	3200	5.4	38.8		
			0.62	C.Sh/Sdy. Sh/SSt.	N.S.	5500				
	41.75		0.35	Sh.Coal						
43.30		7.90	0.36	Sh.Coal	E(C-1)	2300	6.1	42.0		
			0.12	Band	E(b-1)	1150	3.9	65.3		
			0.24	Sh.Coal	E(C-2)	4500	7.2	35.2		
			0.08	Siderite with Coal	N.S.					
			0.41	Sh. Coal						
			0.08	Sh.Coal	E(b-2)	580	4.4	49.2		
			0.63	Coal	E(C-3)	3700	7.6	22.4		
			0.47	Band	E(b-3)	4200	3.7	63.6		
			3.43	Coal	E(C-4)	22000	6.8	34.1	25.4	33.7

IV/50

Borehole No. : RJS - 20.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.24	Band	E(b-4)	2000	3.4	63.8		
			1.60	Coal	E(C-5)	10000	8.1	22.9	28.7	40.3
			0.07	C.Sh	N.S.					
	51.20		0.03	Coal						
63.95		3.30	0.79	Coal	F(C-1)	4700	7.0	30.2		
			0.09	Band	F(b-1)	850	3.8	61.0		
			0.13	Sh.Coal	F(C-2)	820	6.8	39.3		
			0.20	Band	F(b-2)	1800	2.2	76.0		
			0.69	Sh.Coal	F(C-3)	5200	5.0	43.3		
			0.33	Sh. Coal	F(b-3)	2600	4.4	50.0		
	67.25		1.02	Sh.Coal	F(C-4)	7000	6.1	34.7		
70.05		0.95	0.21	Sh.Coal	N.S.					
			0.12	Sdy.Sh/ C.Sh.						
			0.47	Sh.Coal	(G)	4800	6.4	35.2		
	71.00		0.15	G.Sh	N.S.					
74.70		1.00	0.25	C.Sh	N.S.					
			0.51	Sh.Coal	(H)	3800	5.0	39.0		
			0.04	C.Sh	N.S.					
	75.70		0.06	Coal with Sh.lam.	N.S.					
76.10		2.75	0.12	C.Sh	N.S.					
			0.20	Sh.Coal	I(C-1)	1400	4.8	48.6		
			0.26	Band	I(b-1)	2500	3.3	58.2		
			1.38	Coal	I(C-2)	9500	4.9	38.9	25.1	31.1
			0.09	Band	I(b-2)	730	3.5	56.1		
	78.85		0.70	Coal	I(C-3)	4900	6.0	32.4		
80.50		1.50	0.60	Coal	J(C-1)	4000	6.5	27.9		
			0.10	Sh.Coal	J(b-1)	825	3.8	50.8		
	82.00		0.75	Coal	J(C-2)	4500	7.0	23.9		
84.05		1.90	0.08	C.Sh	N.S.					
			0.49	Coal	K(C-1)	2600	6.4	25.0		
			0.08	Coal	K(b-1)	530	5.9	26.7		
			0.72	Coal	K(C-2)	5000	6.4	28.7		
			0.09	Sh.Coal	K(b-2)	610	4.6	36.2		
	85.95		0.40	Coal	K(C-3)	1600	7.6	17.6		
165.40		2.50	1.55	Coal	L(C-1)	6400	6.7	13.2	29.2	45.9

IV/51

Borehole No. : RJBS-20.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.17	Band	L(b-1)	1070	4.3	53.2		
			0.50	Coal	L(C-2)	2100	6.3	23.1		
			0.09	Band	L(b-2)	570	3.7	54.1		
	167.90		0.11	Coal	L(C-3)	640	6.0	24.1		
186.75		2.95	0.42	Sh.Coal	L(C-1)	1890	5.0	36.4		
			0.12	Band	M(b-1)	900	3.0	68.2		
			0.49	Coal	M(C-2)	2300	5.6	24.8		
			0.23	Band	M(b-2)	1500	3.2	64.7		
			0.67	Coal	M(C-3)	3500	5.9	27.0		
			0.11	Band	M(b-3)	710	2.8	68.6		
			0.43	Coal	N(C-4)	2100	6.4	21.2		
			0.11	Sh.Coal	M(b-4)	690	4.7	50.8		
			0.10	Band	M(C-5)	600	5.1	51.5		
			0.06	Band	M(b-5)	410	3.6	60.6		
	189.70		0.15	Coal	M(C-6)	760	6.1	27.4		
192.28		4.85	1.34	Coal	N(C-1)	6000	6.3	18.1	30.3	45.3
			0.53	Band	N(b-1)	3100	2.6	62.2		
			1.21	Coal	N(C-2)	5600	5.3	29.2	28.4	37.1
			0.25	Coal	N(b-2)	350	4.5	34.4		
			0.71	Coal	N(C-3)	3300	5.2	27.6		
			0.22	Sh.Coal	N(b-3)	1000	4.8	43.6		
	197.10		0.42	Coal	N(C-4)	1900	6.8	20.2		
204.90		4.90	0.89	Coal	O(C-1)	3600	5.9	28.7		
			0.07	Sh.Coal	O(b-1)	410	4.2	46.8		
			0.15	Coal	O(C-2)	560	8.2	19.3		
			0.05	Band	O(b-2)	330	3.4	59.6		
			2.00	Coal	O(C-3)	8500	5.5	25.5	26.4	42.6
			0.25	Sh.Coal	O(b-3)	1300	3.8	47.0		
	209.80		1.25	Coal	O(C-4)	5000	4.7	29.9	25.6	39.8
231.85		1.03	0.62	Coal	P(C-1)	3200	5.4	19.0		
			0.05	Sid.	N.S.					
			0.16	Coal						
			0.09	Band	P(b-1)	585	1.9	78.5		
	232.88		0.10	Sh.Coal	P(C-2)	560	4.2	36.4		

IV/52

CSL. No-RNG/90/BH-41/B.H. No. : RJBS - 21.

1	2	3	4	5	6	7	8	9	10	11
25.95	28.25	2.30	2.00	Sh.Coal	(A)	5500	4.4	46.7	21.6	27.3
30.50		2.95	0.38	Sh.Coal	B(C-1)	690	4.7	42.2		
			0.14	Band	B(b-1)	560	2.4	73.4		
	33.45		1.22	Coal	B(C-2)	2300	5.0	33.6		
36.00		2.60	1.23	Sh.Coal	C(C-1)	3600	4.6	45.4		
			0.17	Band	C(b-1)	690	2.3	79.0		
			0.63	Sh.Coal	C(C-2)	2200	4.7	41.7		
			0.05	Band	C(b-2)	200	3.6	63.6		
	38.60		0.42	Sh.Coal	C(C-3)	1400	5.0	40.8		
39.85		0.95	0.09	C.Sh						
			0.09	Sh.C	N.S.					
			0.13	C.Sh.with fire clay						
	40.80		0.55	Coal	(D)	1420	5.6	30.8		
55.00		2.10	0.90	Sh.Coal	(E)	3000	5.0	38.2		
			0.22	Fire clay	N.S.					
	57.10		0.08	Sh.Coal						
59.40-61.40		2.00	1.30	Coal	(F)	2800	7.2	21.2	30.7	40.9
67.15		1.50	0.45	Coal	(G)	2700	5.4	31.2	27.9	35.5
			0.21	Fire clay	N.S.					
	68.65		0.77	Coal						
103.15		1.15	0.06	Coal	N.S.					
			0.13	C.Sh						
			0.47	Coal	(H)	1430	5.3	32.2		
			0.23	Sdy.C.Sh	N.S.					
			0.08	Coal						
	104.30		0.10	C.Sh						
108.55		7.55	0.30	Coal	I(C-1)	820	4.6	35.0		
			0.23	Band	I(b-1)	1120	3.6	58.6		
			0.12	Sh.Coal	I(C-2)	390	5.0	48.2		
			0.25	Band	I(b-2)	865	1.4	61.2		
			0.70	Coal	I(C-3)	1010	6.0	31.0		
			0.13	Band	I(b-3)	485	3.2	60.0		
			0.12	Sh.Coal	I(C-4)	430	5.2	38.2		
			0.42	Band	I(b-4)	1310	3.4	63.6		

IV/53

Borehole No. : RJSB - 21.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.99	Sh.Coal	I(C-5)	2800	5.0	41.0		
			0.20	Band	I(b-5)	780	4.1	54.8		
			0.96	Coal	(C-6)	3100	5.8	30.8		
			0.15	Siderite	N.S.	730				
			1.20	Coal	I(C-7)	4000	4.3	30.6		
			0.09	Band	I(b-6)	420	2.2	62.8		
			0.12	Sh.Coal	I(C-8)	430	4.6	38.3		
			0.08	Band	I(b-7)	310	2.0	53.2		
	116.10		0.65	Coal	I(C-9)	1200	6.9	16.9		
130.50		1.05	0.18	C.Sh with N.S. coal stecks.						
	131.55		0.82	Coal	(J)	3100	5.6	31.2		
132.85		1.25	0.20	Coal	K(C-1)	690	5.9	29.6		
			0.07	Band	K(b-1)	370	3.6	57.0		
	134.10		0.55	Coal	K(C-2)	1390	5.5	33.8		
138.90-140.25	1.35	0.95	Coal	(L)	3000	4.9	34.3	25.6	35.2	
149.50	17.80	0.53	Coal	M(C-1)	1900	4.6	35.0			
			0.20	Sh.Coal	M(b-1)	820	4.1	50.7		
			0.16	Sh.Coal	M(C-2)	540	4.3	44.1		
			0.09	Sh.Coal	M(b-2)	380	3.8	48.2		
			0.21	Sh.Coal	M(C-3)	810	4.4	37.6		
			0.10	Band	M(b-3)	460	3.2	62.8		
			0.34	Sh.Coal	M(C-4)	1090	4.0	44.2		
			0.53	Band	M(b-4)	1960	2.3	65.3		
			0.78	Sh.Coal	M(C-5)	2700	4.2	40.8		
			0.43	Band	M(b-5)	1740	3.2	70.9		
			1.25	Sh.Coal	M(C-6)	3500	5.0	41.0		
			0.06	Band	M(b-6)	295	3.4	58.7		
			0.86	Sh.Coal	M(C-7)	2300	5.0	35.2		
			0.05	Sh.Coal	M(b-7)	240	3.6	44.2		
			0.96	Coal	M(C-8)	6200	4.9	32.7	26.3	35.6
			0.14	Band	M(b-8)	450	3.6	54.1		
			0.35	Sh.Coal	M(C-9)	890	4.0	39.0		
			0.15	Sh.Coal	M(b-9)	670	4.0	49.7		
			0.18	SSt.	N.S.	1150				
			1.00	Coal	M(C-10)	2500	5.2	25.9		
			0.08	Sh.Coal	M(b-10)	350	3.8	47.6		

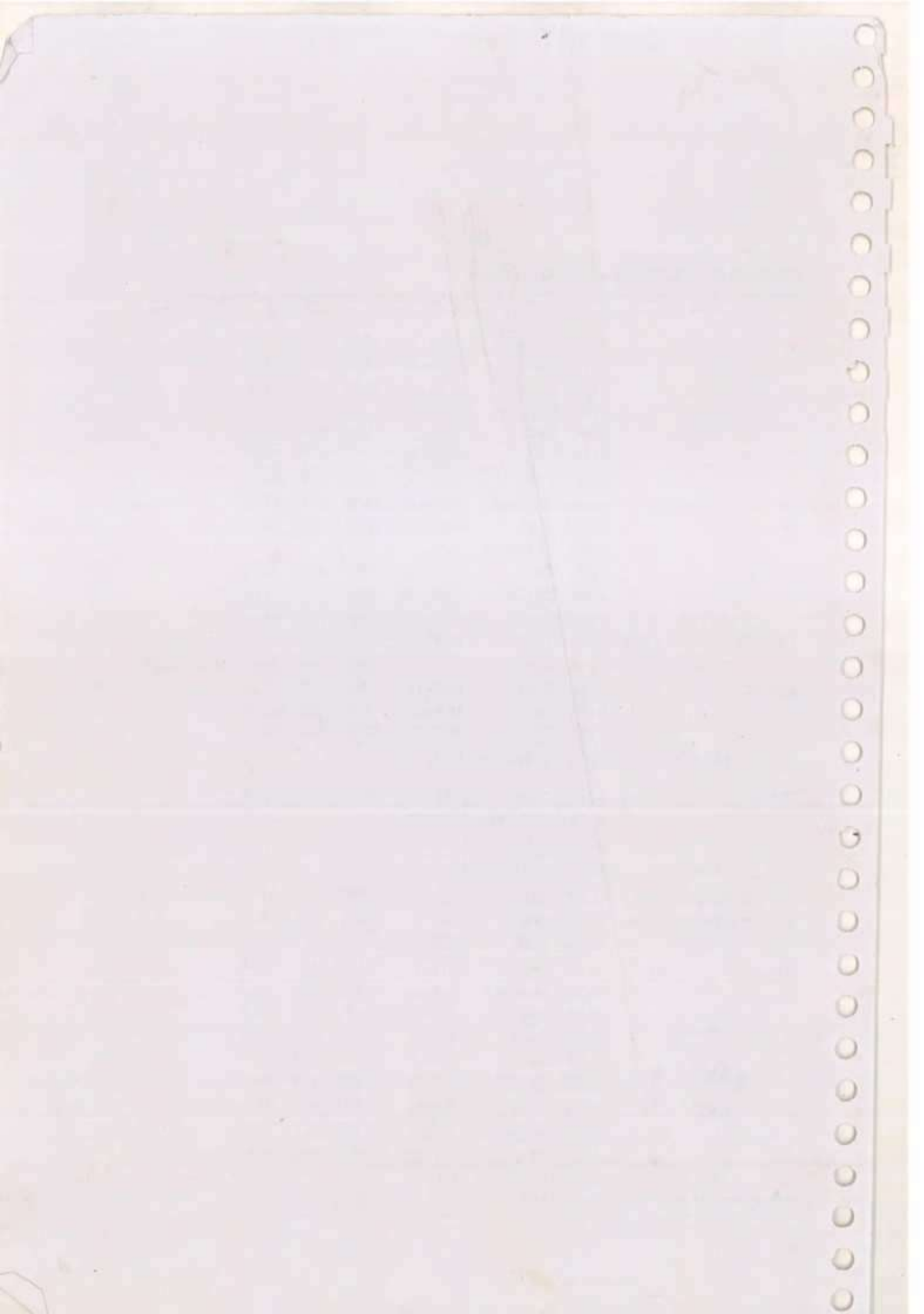
IV/54

Borehole No. : RJBS - 21.....Contd.

1	2	3	4	5	6	7	8	9	10	11
			0.71	Sh.Coal	M(C-11)	2300	4.8	37.2		
			0.31	Band	M(b-11)	1420	3.6	54.8		
			0.62	Coal	(C-12)	1550	5.1	25.8		
			0.3c	Sdy.Sh	N.S.					
			0.0c	Coal	M(b-12)	900	4.6	34.5		
			0.1c	Coal	M(b-12)		4.6	34.5		
			0.6c	Coal	M(C-13)	1860	4.6	32.1		
			0.21	Sh.Coal	M(b-13)	1500	3.7	47.8		
			0.6c	Coal	M(C-14)	1800	5.2	26.1		
			0.06	Siderite	N.S.					
			1.00	Coal	M(C-15)	2700	4.8	34.6		
			0.30	Sh.Coal	M(b-14)	1220	4.0	47.4		
167.30			0.88	Coal	M(C-16)	2500	5.2	26.2		
170.90	1.30		0.10	C.Sh	N.S.					
172.20			1.12	Coal	(N)	2000	5.4	19.2	32.9	42.5
183.00	2.00		0.21	Coal	O(C-1)	400	4.7	32.2		
			0.15	Band	O(b-1)	570	3.4	55.8		
			0.97	Coal	O(C-2)	2800	5.1	30.2		
185.00			0.06	Siderite	N.S.					
203.45	8.50		0.90	Coal	(Ø)	3600	5.5	23.9		
			0.19	Siderite						
			0.12	C.Sh	N.S.					
211.95			0.39	Coal						
221.85-222.80	0.95	0.85	Coal	(J)	1075	4.5	27.0			
235.85-236.65	0.80	0.70	Coal	(R)	2200	4.9	28.6			
			0.10	C.Sh	N.S.					
237.28	4.47	0.40	Coal	S(C-1)	1225	4.8	28.6			
			0.06	Sh.Coal	S(b-1)	385	3.7	47.9		
			0.89	Coal	S(C-2)	2700	5.0	31.5		
			0.06	Band	S(b-2)	270	3.6	60.8		
			0.85	Coal	S(C-3)	2500	5.0	22.8		
			0.24	Sh.Coal	S(b-3)	390	4.6	36.0		
			0.24	Coal	S(C-4)	820	4.7	31.2		
			0.10	Coal	S(b-4)	350	4.6	31.4		
			1.27	Coal	S(C-5)	4000	5.2	25.8		
241.75			0.05	C.Sh	N.S.					
288.70-289.50	0.80	0.79	Coal	(T)	2200	4.4	34.3			

2A03

Coal

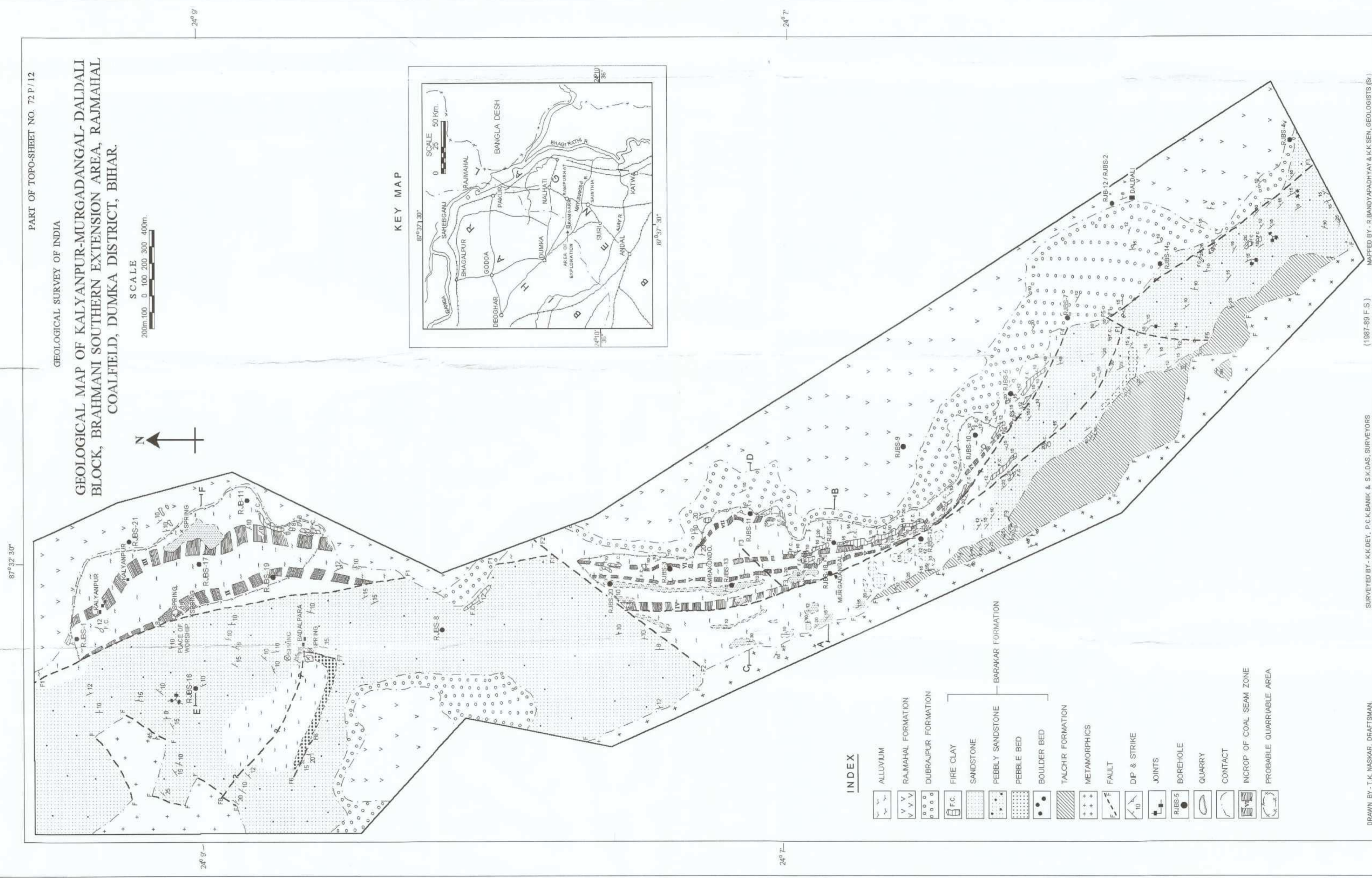


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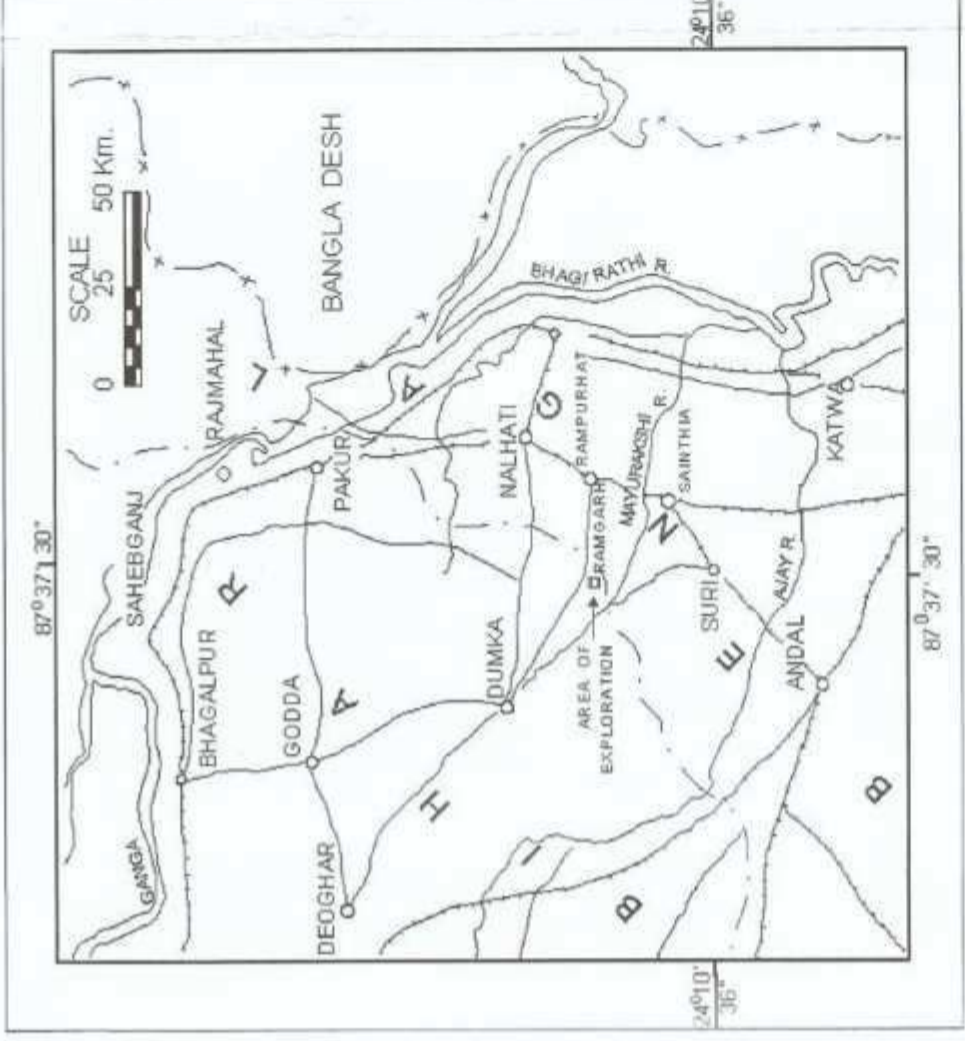
GEOLOGICAL SURVEY OF INDIA

**GEOLOGICAL MAP OF KALYANPUR-MURGADANGAL-DALDALI
BLOCK, BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL
COALFIELD, DUMKA DISTRICT, BIHAR**

SCALE
200m 100 0 100 200 300 400m.



KEY MAP



INDEX

- ALLUVIUM
- RAJMAHAL FORMATION
- DURBAPUR FORMATION
- FIRE CLAY
- SANDSTONE
- PEBBLY SANDSTONE
- PEBBLE BED
- BOULDER BED
- TALCHAR FORMATION
- METAMORPHICS
- FAULT
- DIP & STRIKE
- JOINTS
- BOREHOLE
- QUARRY
- CONTACT
- INCROP OF COAL SEAM ZONE
- PROBABLE QUARRIABLE AREA

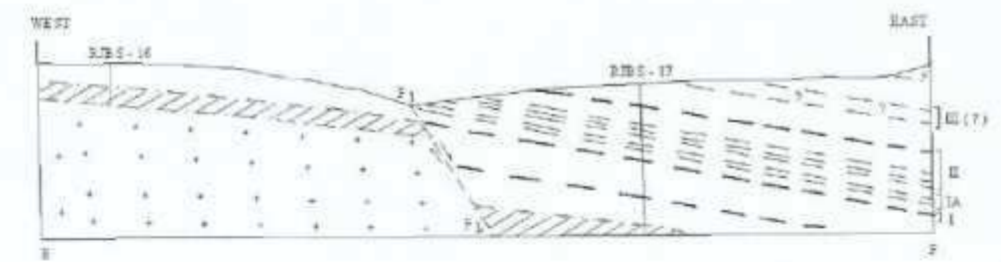
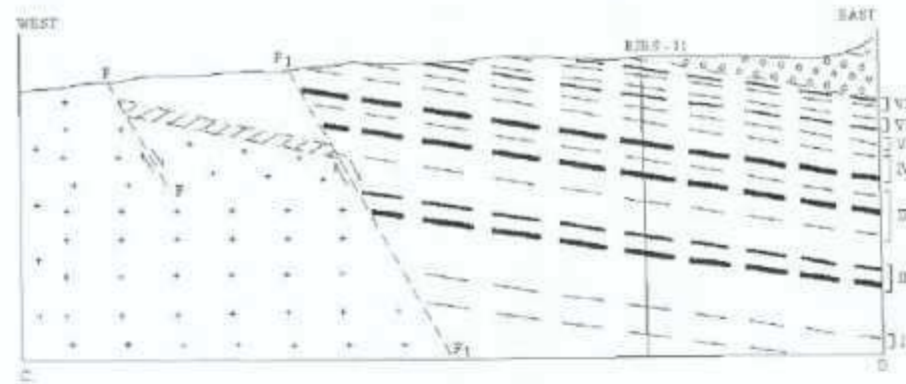
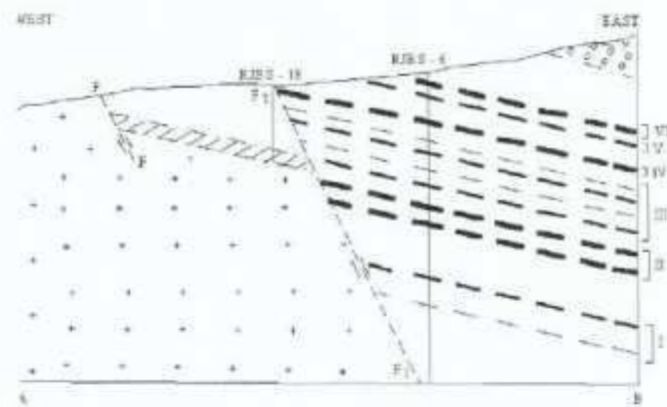
DRAWN BY: T. K. NASKAR, DRAFTSMAN

SURVEYED BY: K.K. DEY, P.C.K. BANIK & S.K. DAS, SURVEYORS

(1967-69 F.S.)

IMAGED BY: R. BANDYOPADHYAY & K.K. SEN, GEOLOGISTS (S)

GEOLOGICAL CROSS SECTIONS ALONG A-B, C-D & E-F LINES, KALYANPUR MURGADANGAL-DALDALI SECTOR OF BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL COALFIELD, DUMKA DISTRICT, BIHAR

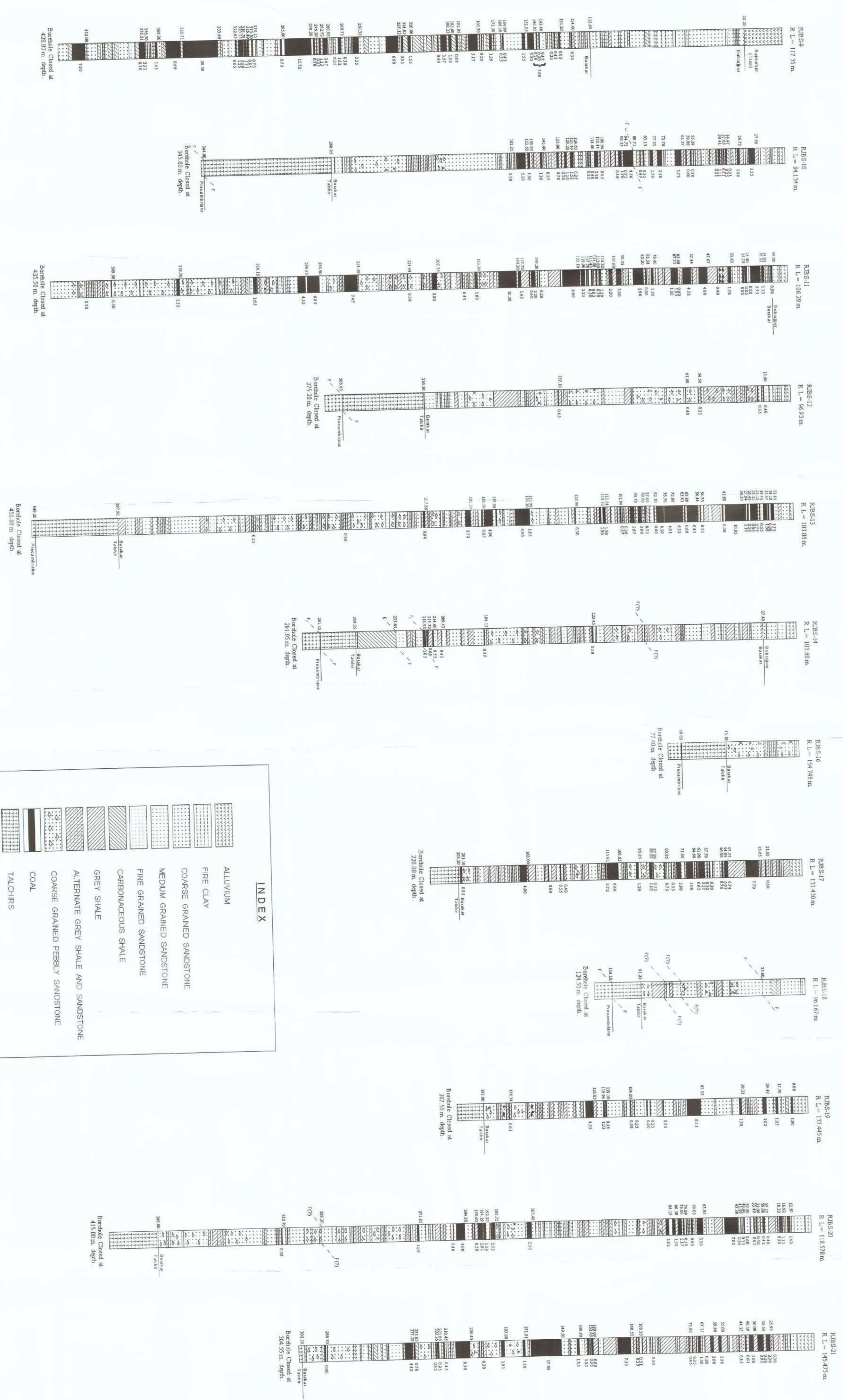


INDEX

	RAJMAHAL FORMATION		METAMORPHICS
	DHERAIPUR FORMATION		COAL SEAM
	BARAKAR FORMATION		FAULT
	TALCHER FORMATION		

LITHOLOGICAL SECTIONS OF DIFFERENT BOREHOLES DRILLED IN KALYANPUR - MURGADANGAL - DALDALI BLOCK OF BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL COALFIELD, DUMKA DISTRICT, BIHAR

SCALE : 1 CM = 10M (VERTICAL)



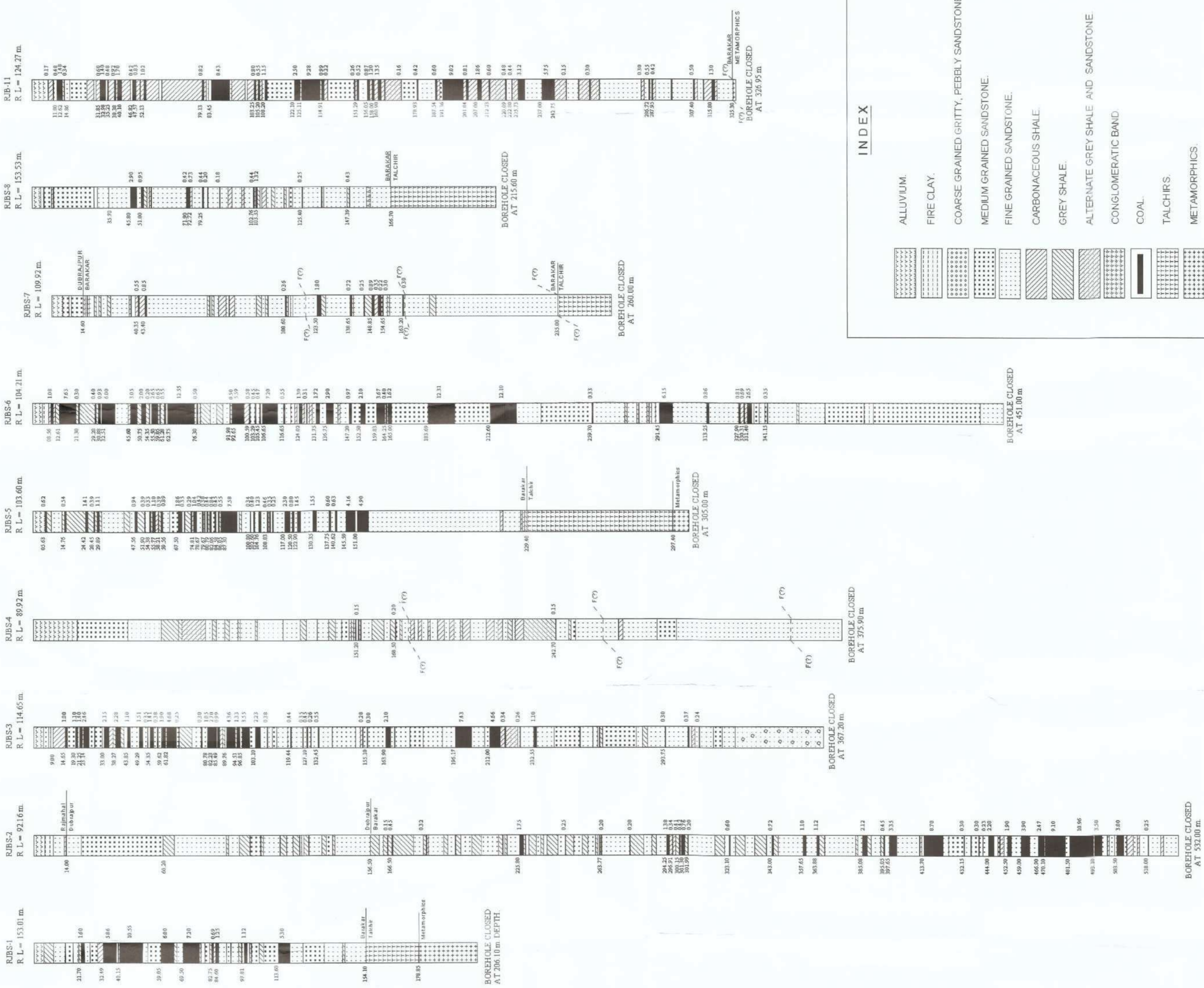
INDEX

[Pattern]	ALLUVIUM
[Pattern]	FIRE CLAY
[Pattern]	COARSE GRAINED SANDSTONE
[Pattern]	MEDIUM GRAINED SANDSTONE
[Pattern]	FINE GRAINED SANDSTONE
[Pattern]	CARBONACEOUS SHALE
[Pattern]	GREY SHALE
[Pattern]	ALTERNATE GREY SHALE AND SANDSTONE
[Pattern]	COARSE GRAINED PEBBLY SANDSTONE
[Pattern]	COAL
[Pattern]	TALCHERS
[Pattern]	PRE-CAMBRIANS



LITHOLOGICAL SECTIONS OF DIFFERENT BOREHOLES DRILLED IN KALYANPUR - MURGADANGAL - DALDALI BLOCK OF BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL COALFIELD, DUMKA DISTRICT, BIHAR

SCALE 1 cm = 10 mts.



INDEX

- ALLUVIUM.
- FIRE CLAY.
- COARSE GRAINED GRITTY, PEBBLY SANDSTONE.
- MEDIUM GRAINED SANDSTONE.
- FINE GRAINED SANDSTONE.
- CARBONACEOUS SHALE.
- GREY SHALE.
- ALTERNATE GREY SHALE AND SANDSTONE.
- CONGLOMERATIC BAND.
- COAL.
- TALCHIRS.
- METAMORPHICS.

D. N. BANDOPADHAYA
GEOLOGIST.

CORRELATION OF COAL - SEAM ZONES INTERSECTED IN DIFFERENT BOREHOLES DRILLED IN
 KALYANPUR - MURGADANGAL - DALDALI BLOCK OF BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL
 COALFIELD, DUMKA DISTRICT, BIHAR.

VERTICAL SCALE :- 1 cm = 20 m.

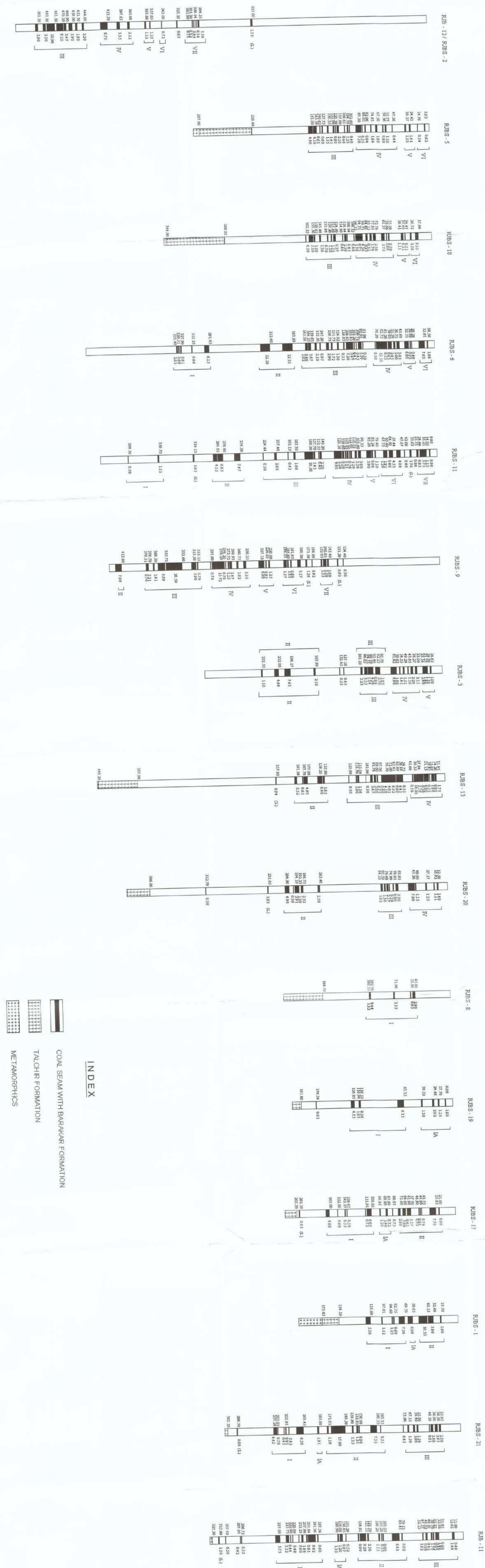
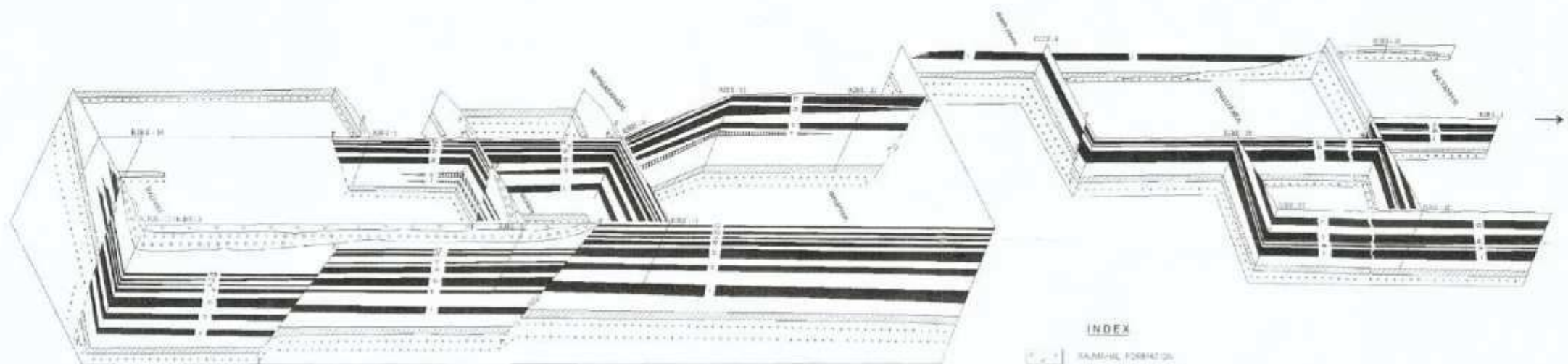


PLATE - VI

ISOMETRIC PANEL DIAGRAM OF KALYANPUR - MURGADANGAL - DALDALI BLOCK,
BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL COALFIELD, DUMKA DISTRICT, BIHAR.

SCALE
0 100 200 300 M



INDEX

[Symbol]	RAJMAHAL FORMATION
[Symbol]	RAJMAHAL SUB-FORMATION
[Symbol]	RAJMAHAL SUB-FORMATION
[Symbol]	DETAILED STRATA WITH BEDDING
[Symbol]	UNCONFORMABLE STRATA
[Symbol]	TALCHER FORMATION
[Symbol]	METHANOHOR
[Symbol]	SHISHOLE

DRAWN BY: P. K. NAGPUR, DUMKA

GEOLOGICAL MAP OF KALYANPUR-MURGADANGAL-DALDALI BLOCK, BRAHMANI SOUTHERN EXTENSION AREA, RAJMAHAL COALFIELD, DUMKA DISTRICT, BIHAR.

