Experience & Opportunities For Methane Projects in India

Ashok Verma

DGH

Directorate General of Hydrocarbons

New Delhi, India

PRESENTATION HIGHLIGHTS

- Major coal & lignite fields of India
- Coal & lignite resources of India
- CBM resources of India
- Market and Infrastructure
- Favorable geological factors for development of CBM
- CBM policy initiative in India
- Current activities in CBM exploration & production
- Prospects of CBM in the awarded blocks
- Expected production potential of CBM in India
- Major Forthcoming CBM Exploration Opportunities
- Development of CMM/ AMM
- Concluding Remarks

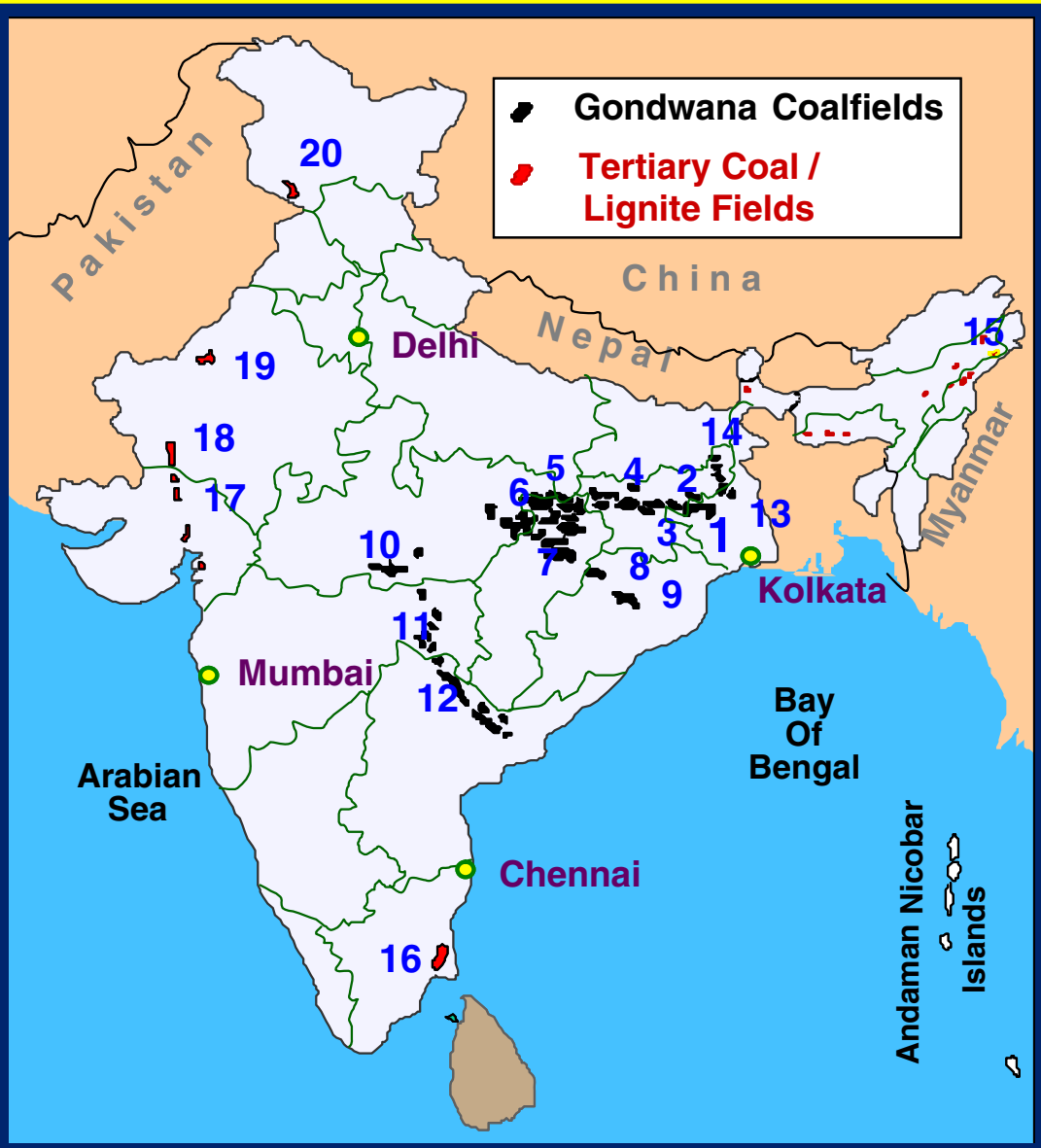
COAL AND LIGNITE

FIELDS OF INDIA

&

THE RESOURCES BASE

MAJOR COAL & LIGNITE FIELDS OF INDIA



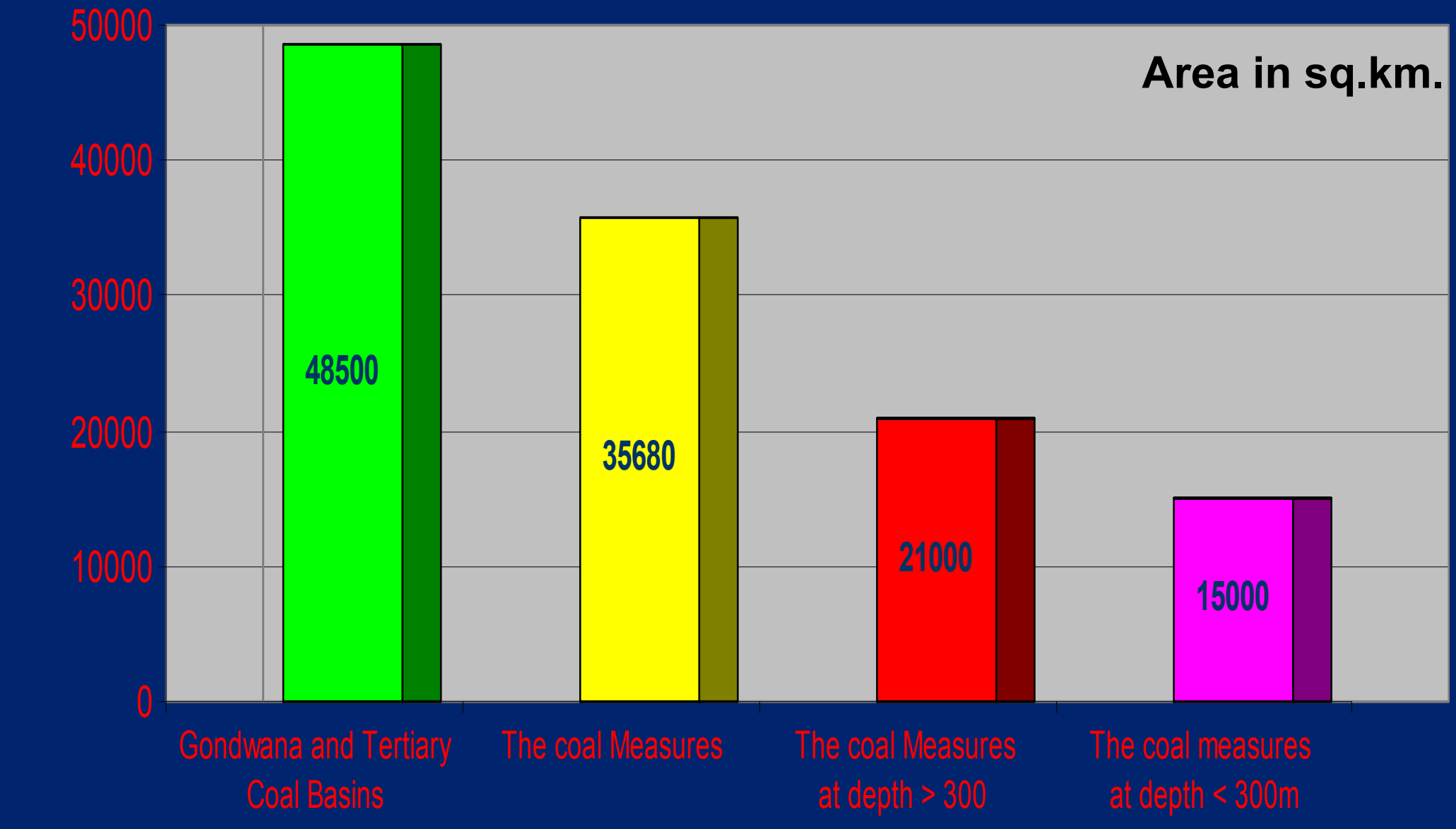
GONDWANA COALFIELDS

Ref. No.	Coalfield/Coal Belt		Ref. No.	Coalfield/Coal Belt	
1.	Raniganj	DAMODAR VALLEY BELT	8.	Ib-valley	MAHANADI VALLEY BELT
2.	Jharia		9.	Talchir	
3.	Bokaro		10.	Satpura	NARMADA BELT
4.	N. Karanpura		11.	Wardha	PRANHITA GODAVARI BELT
5.	Singrauli	SON VALLEY BELT	12.	Godavari	
6.	Sohagpur		13.	Birbhum	
7.	Korba		14.	Rajmahal	

TERTIARY COAL / LIGNITE FIELDS

Ref. No.	Coal/Lignite Field	Ref. No.	Coal/Lignite Field
15.	Assam-Meghalaya	18.	Barmer-Sanchor
16.	Neyveli	19.	Bikaner
17.	Cambay	20.	Jammu & Kashmir

RESOURCE BASE



RESOURCE BASE

Total Area Covering Indian Gondwana and Tertiary coal basins	: 48500 sq.km.
The prognosticated coal bearing area from the known coalfields	: 35680 sq.km.
The area of coal bearing Barakar measures occurring at depth below the thick cover of younger rocks	: 21000 sq.km.
Coal bearing area spread over 44 Gondwana and 16 Tertiary coalfields containing economically viable coal resources of the country	: 15000 sq.km.

COAL / LIGNITE RESOURCES OF INDIA (AS ON 1.1.2005)

A. COAL

S. NO.	STATE	RESOURCES (BILLION TONNES)
1	WEST BENGAL	27.40
2	JHARKHAND	72.36
3	MADHYA PRADESH	19.23
4	CHATTISGARH	39.97
5	MAHARASHTRA	8.54
6	ORISSA	60.98
7	ANDHRA PRADESH	16.93
8	NORTH EAST	0.91
TOTAL		* 247.85

B. LIGNITE

S. NO.	STATE	RESOURCES (BILLION TONNES)
1	RAJASTHAN	120
2	GUJARAT	100
3	TAMIL NADU	30
TOTAL		250

* Source GSI

CBM RESOURCES OF INDIA

STATEWISE ESTIMATED CBM RESOURCES FOR AWARDED AND IDENTIFIED BLOCKS

Sl. No.	STATE	COALFIELD./ BLOCK	AREA (Sq. Km.)	CBM RESOURCES (BCM)
1	West Bengal	Raniganj East Raniganj North Raniganj South Birbhum	1330	144
2	Jharkhand	Jharia Bokaro North Karanpura North Karanpura (West) South Karanpura Rajmahal	1857	322.10
3	Madhya Pradesh	Sohagpur (East) Sohagpur (West) Satpura Sohagpur (North) Singrauli (West)	3059	195.30
4	Chattisgarh	Sonhat Tatapani-Ramkola Mand-Raigarh	2195	119.90

Contd..

STATEWISE ESTIMATED CBM RESOURCES FOR AWARDED AND IDENTIFIED BLOCKS

Sl. No.	STATE	COALFIELD./ BLOCK	AREA (Sq. Km.)	CBM RESOURCES (BCM)
5	Orissa	Talchir	500	35.0
6	Maharashtra	Wardha	503	19.90
7	Andhra Pradesh	Godavari Kothagudem (East)	926	63.65
8	Tamil Nadu	Manargudi	739	27.7
9	Gujarat	Barmer – Sanchor - III Cambay - I Cambay – II	3010	224.20
10	Rajasthan	Barmer - Sanchor - I Barmer - Sanchor - II	2065	182.80
TOTAL			16,184	1334.55 (1.33 TCM)

PROGNOSTICATED CBM RESOURCES : 2.6 TCM

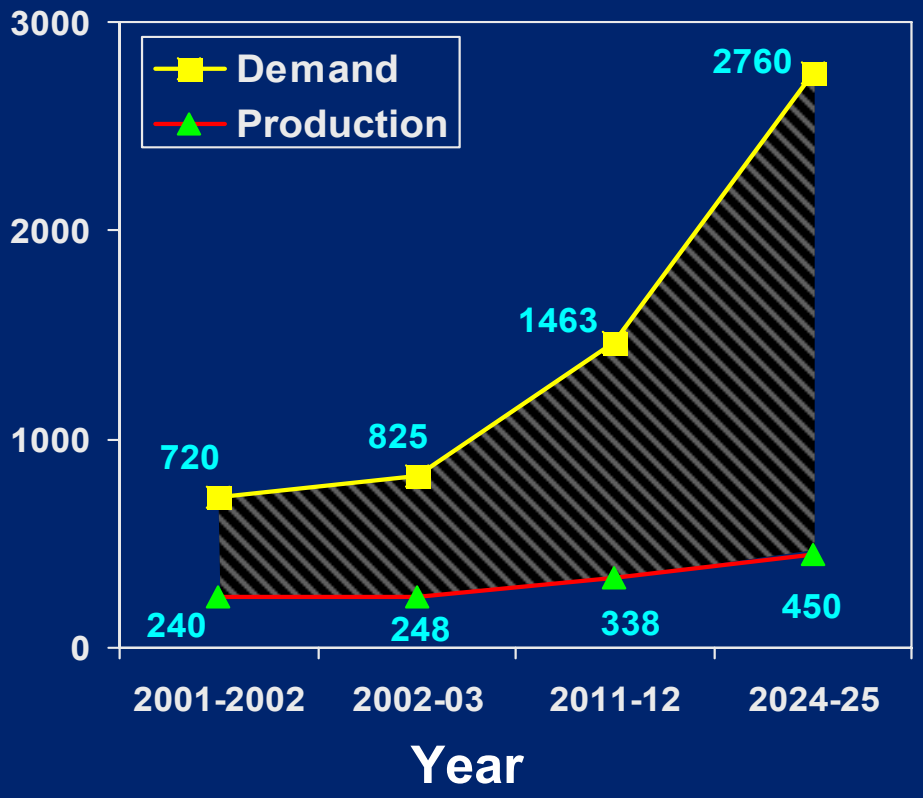
MARKET

&

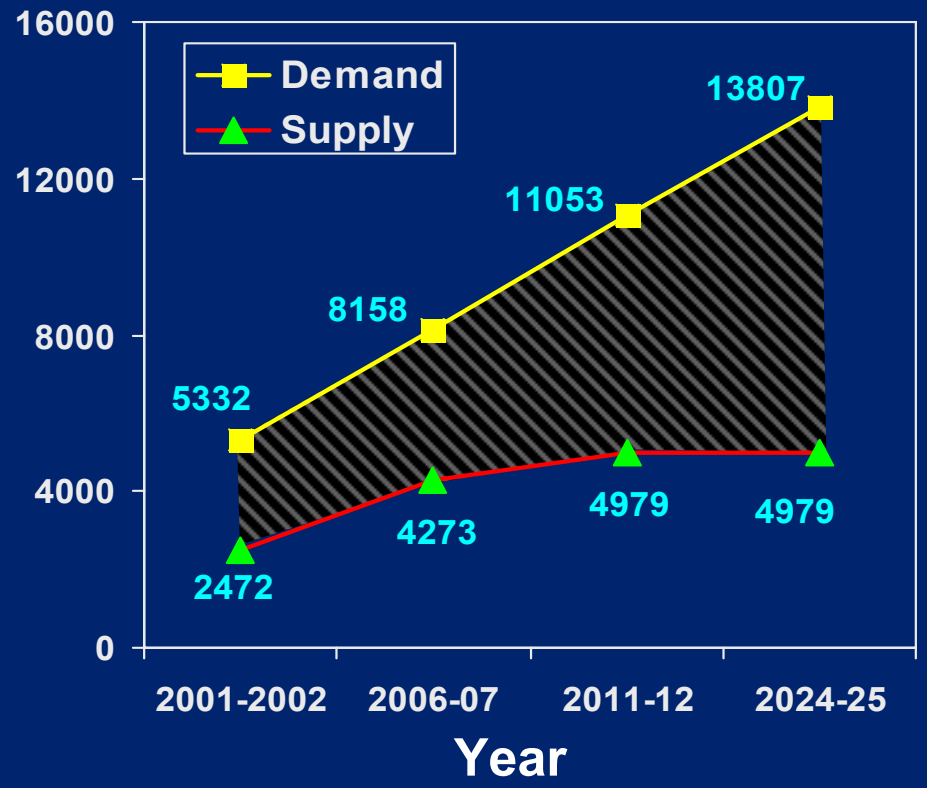
INFRASTRUCTURE

Ever Expanding Market…

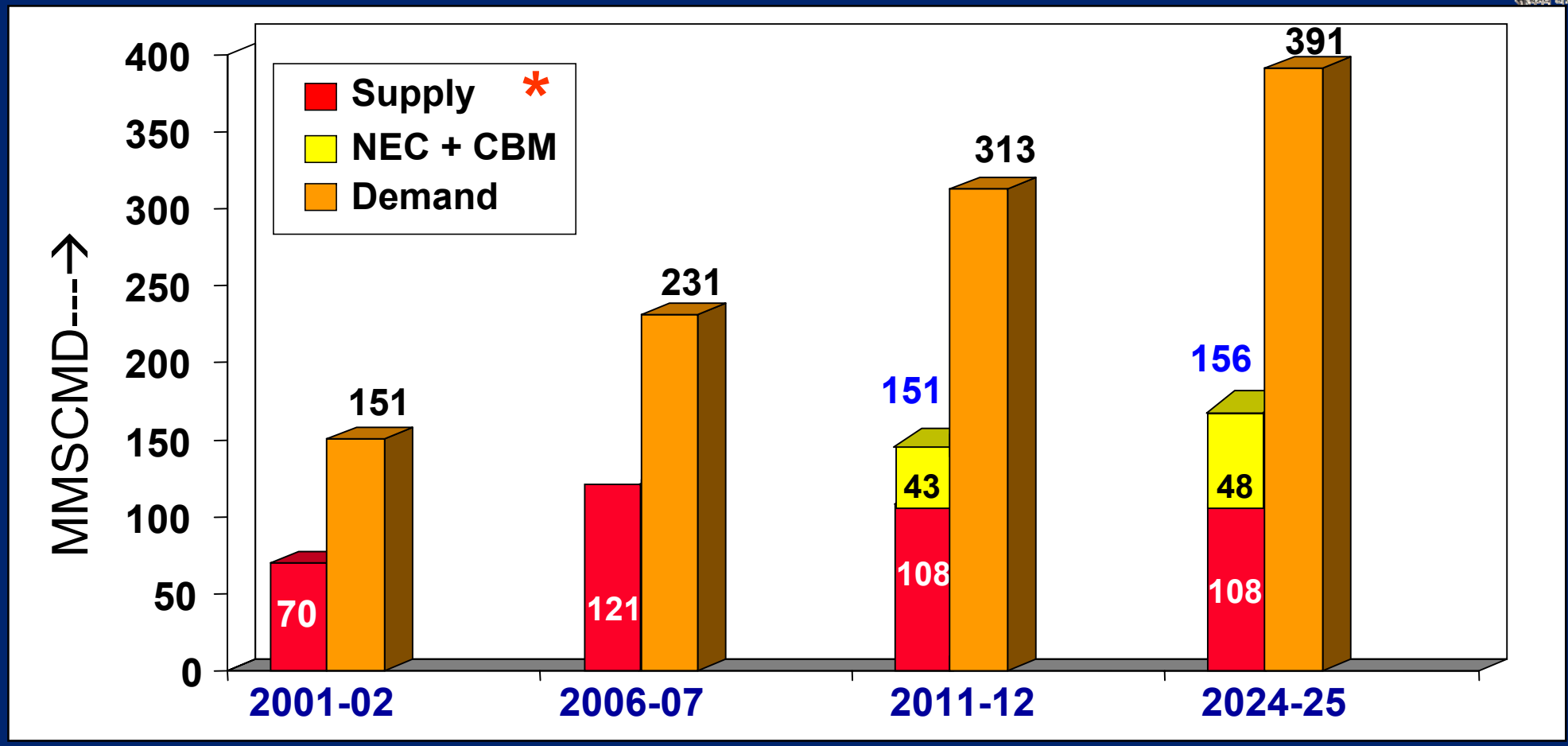
Crude Oil (MMBBLS)



Natural Gas (MMSCFD)



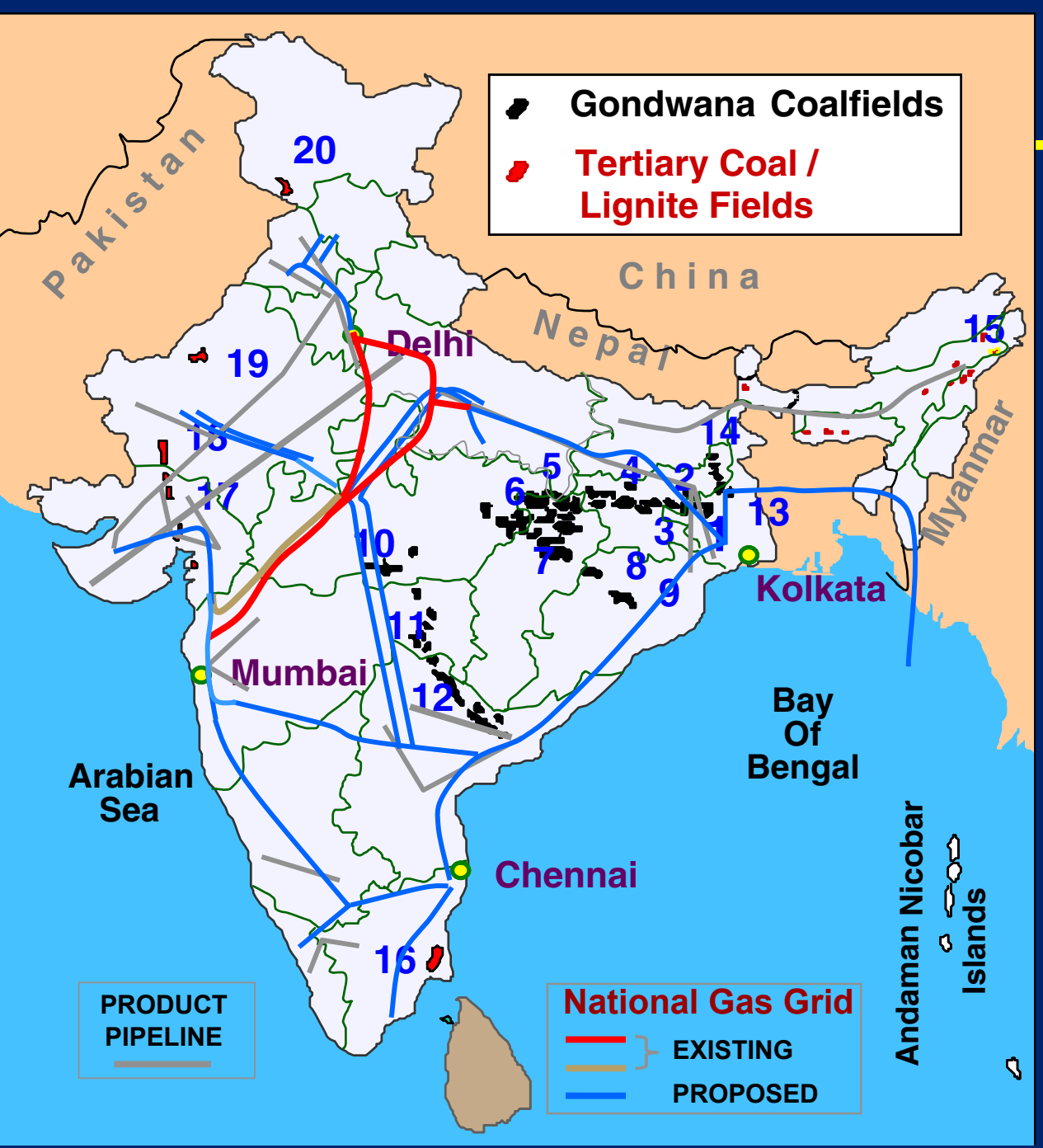
Natural Gas Demand / Supply Projections



* SUPPLY PROJECTIONS BASED ON PRESENT RESERVES

→ ALMOST 100% INCREASE DUE TO RECENT DISCOVERIES IN PVT./J.V. SECTOR

* INSTANT DEMAND FOR NATURAL GAS AVAILABLE IN THE COUNTRY



- COAL FIELD OF INDIA
- NATIONAL GAS GRID
- PRODUCT PIPELINES IN INDIA

GEOLOGICAL FACTORS FOR DEVELOPMENT OF CBM

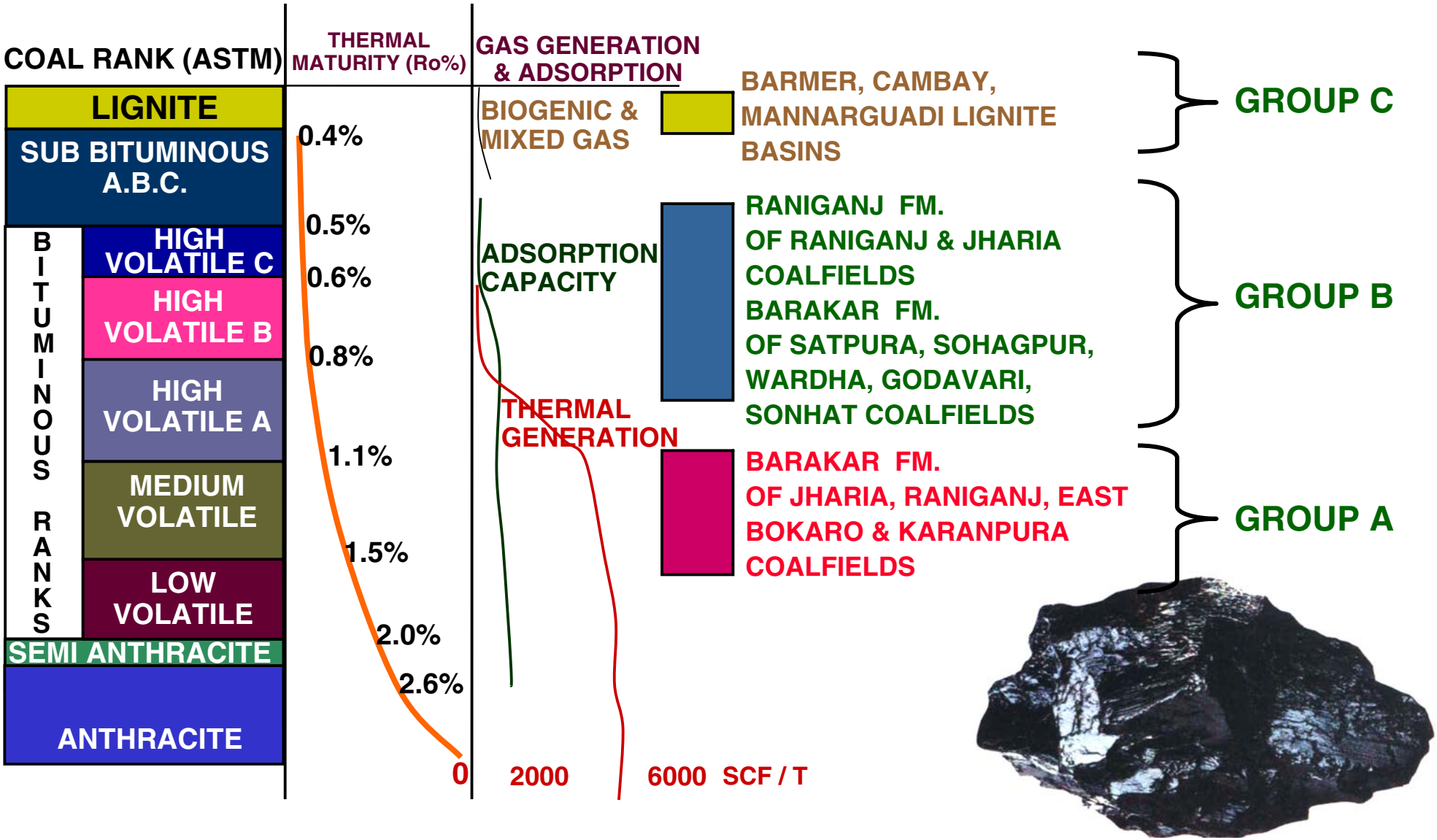
FAVOURABLE GEOLOGICAL FACTORS FOR DEVELOPMENT OF CBM

- THICK, LATERALLY CONTINUOUS COALS OF HIGH THERMAL MATURITY
- HIGHER PERMEABILTY OF COAL
- HIGH GAS CONTENT OF COAL SEAM
- BASINWARD FLOW OF GROUND WATER THROUGH COALS OF HIGH RANK AND GAS CONTENT ORTHOGONALLY TOWARD NO-FLOW BOUNDARIES (REGIONAL HINGELINES, FAULT SYSTEMS, FACIES CHANGES, AND / OR DISCHARGE AREAS)
- CONVENTIONAL TRAPPING ALONG THOSE BOUNDARIES TO PROVIDE ADDITIONAL GAS BEYOND THAT GENERATED DURING COLIFICATION.
- SIZEABLE IN PLACE COAL RESERVES

GEOLOGICAL CHARACTERISTICS OF INDIAN COALBED METHANE RESERVOIRS

- HIGH RANK COALS STORE THERMOGENIC METHANE (JHARIA, BOKARO, RANIGANJ)
- LIGNITES CONTAIN BIOGENIC METHANE (CAMBAY, BARMER)
- HETEROGENEOUS INDIAN COALS SHOW VARIATIONS IN RESERVOIR PARAMETERS.
- LITHOSTATIC STRESS DECREASES PERMEABILITY BEYOND 700M DEPTH. HOWEVER NETWORK OF FAULT IN GONDWANA RIFT BASINS INCREASES PERMEABILITY LOCALLY.
- GAS CONTENT INCREASES AT DEPTH.
- COAL UNDERSATURATED AT 300M DEPTH, SATURATED BEYOND 600M.

COAL RANK, GAS GENERATION AND ADSORPTION



CBM POLICY INITIATIVES IN INDIA

CBM POLICY INITIATIVE IN INDIA

- THE GOVERNMENT OF INDIA, IN ORDER TO UTILISE THE CBM POTENTIAL IN THE COUNTRY FORMULATED A CBM POLICY JULY'97

- MOP&NG BECAME ADMINISTRATIVE MINISTRY AND DGH BECAME IMPLEMENTING AGENCY FOR CBM POLICY

- DGH DID COMMENDABLE WORK TO OPERATIONALISE THE CBM POLICY.

....Cont

CBM POLICY INITIATIVE IN INDIA

....Contd.

- DGH IDENTIFIED BLOCKS FOR CBM EXPLORATION AFTER INTERACTION WITH THE MINISTRY OF COAL AND OTHER AGENCIES IN THE KNOWN HIGH RANK COALFIELD AREAS
- BLOCKS OFFERED THROUGH GLOBAL COMPETITIVE BIDDING BY MOP&NG
- FISCAL, CONTRACTUAL AND OPERATING REGIME AND MODEL CONTRACT PUT IN PLACE WITH ONE OF THE BEST TERMS
- VERY LIBERAL FISCAL TERMS OFFERED TO ATTRACT INVESTORS

COAL BED METHANE - FISCAL TERMS

- No participating interest of the Government
- No Signature Bonus
- Allotment of blocks through global bidding
- Provision for bidding for more than one block
- 10% Ad-valorem Royalty payable to state Govt.
- Additional Production Linked Payment Biddable
  - ✓ Payment on sliding scale for every 0.5 MMSCMD incremental gas production beyond 1.0 MMSCMD
- Freedom to sell gas in the domestic market – determined prices
- Fiscal stability provision in the Contract

....Cont

COAL BED METHANE - FISCAL TERMS

- No Customs Duty on imports required for CBM operations
- Arbitration provisions to be governed by the Arbitration and Conciliation Act, 1996, which is based on UNCITRAL provisions.
- Nominal Commercial Bonus of US$ 0.3 Million after discovery
- New Petroleum Tax Guide to facilitate investors
- Corporate Income Tax payable as per Income Tax Act, 1961
- Model Contract to serve as guideline.
- 7 year Tax Holiday from the date of Commencement of Commercial Production

CURRENT ACTIVITIES IN CBM EXPLORATION AND PRODUCTION IN INDIA

CBM EXPLORATION – ROUND-I & II

- A TOTAL OF 16 BLOCKS AWARDED UNDER CBM-I & CBM-II ROUNDS OF BIDDING AND NOMINATION BASIS AS ON DATE
- A TOTAL AREA OF 7810 SQ. KM. OPENED UP FOR EXPLORATION AND PRODUCTION OF CBM
- THE TOTAL CBM RESOURCE IN THESE 16 BLOCKS IS ESTIMATED TO BE AROUND 820 BILLION CUBIC METRES
- THE APPROXIMATE PRODUCTION OF CBM GAS ESTIMATED FROM THESE BLOCKS IS 23 MMSCMD AT PEAK PRODUCTION LEVELS

DISCOVERIES & RESERVE ACCRETION

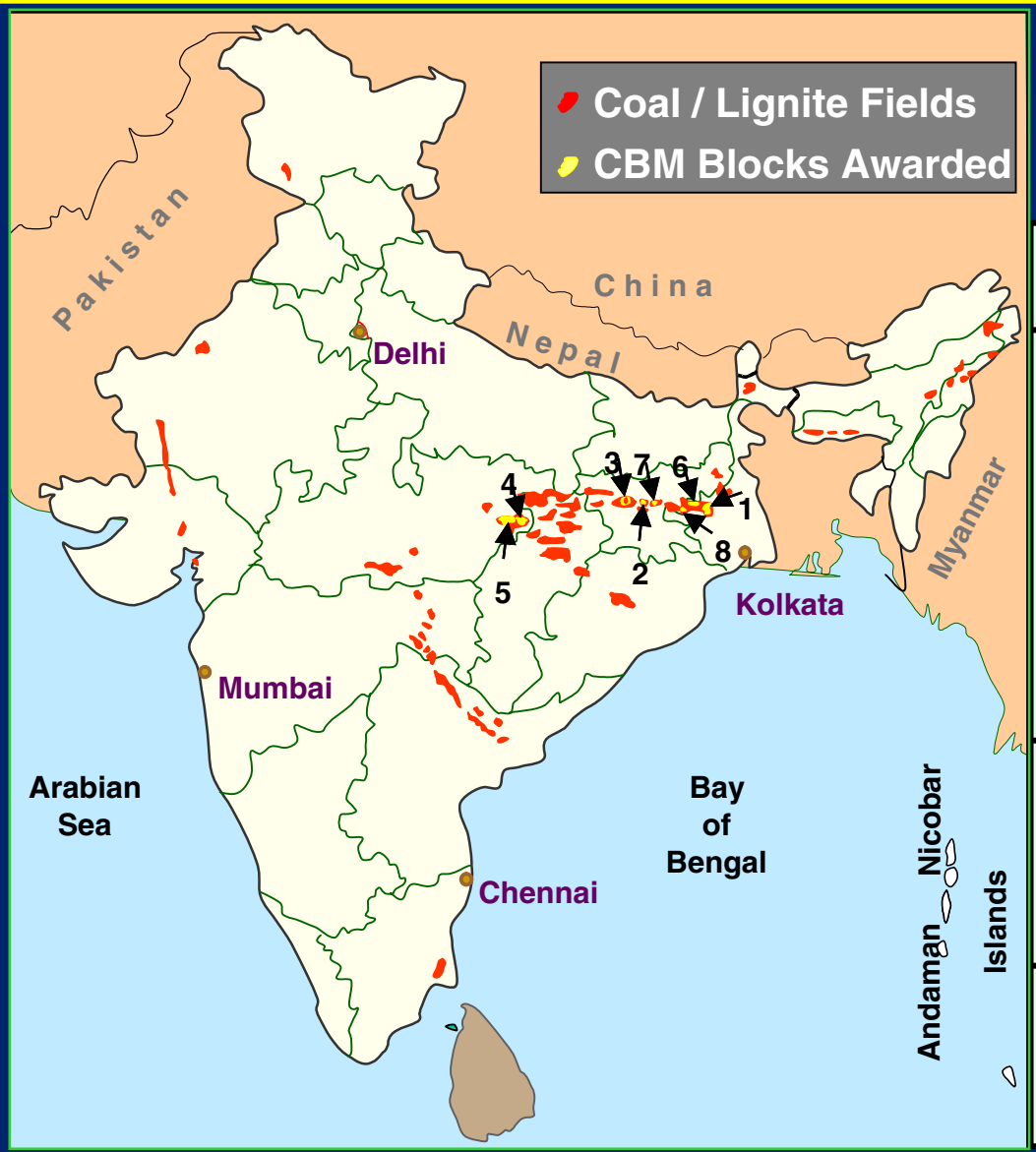
BLOCKS	OPERATOR / BLOCK CODE	AREA (SQ.KM.)	GAS IN-PLACE (TCF)
Sohagpur (East)	RIL SP(East)-CBM-2001/I	495	1.69
Sohagpur (West)	RIL SP(West)-CBM-2001/I	500	1.96
Raniganj (East)	EOL RG (East)-CBM-2001/I	500	1.385
Bokaro	ONGC BK-CBM-2001/I	95	1.2

As per the committed work programme and time schedule in the contract & keeping in view the status of work progress in the awarded CBM blocks, the commercial production of CBM in the country is likely to commence by 2007-08.

SIGNIFICANT CBM EXPLORATION ACTIVITIES

- During the last three years more than 50 Coreholes, 15 Test Wells and 3 Pilot Wells have been drilled in the awarded blocks.
- Air drilling technology employed for the first time in India for production test wells.
- Faster drilling and well completion rates of average 7 days / well and 15 days / corehole achieved against an average of 60 days required earlier for similar operations.
- Some operators have already completed their Phase-I exploration activities and have entered into Pilot Assessment Phase-II.
- To establish the commercial potentiality of the identified fairways in different blocks, additional 50 wells are proposed to be drilled.

CBM BLOCKS AWARDED UNDER CBM-I ROUND AND ON NOMINATION BASIS



Total area opened up for exploration & production of CBM — **2575 Sq. Km. (8 Blocks)**

Block Name	State	Ref. No.	Awarded
A. Awarded through CBM-I Round			
RG(East)-CBM-2001/1	West Bengal	1	EOL
BK-CBM-2001/1	Jharkhand	2	ONGC-IOC
NK-CBM-2001/1	Jharkhand	3	ONGC-IOC
SP(East)-CBM-2001/1	M.P.	4	RIL
SP(West)-CBM-2001/1	M.P.	5	RIL
B. Awarded on Nomination basis			
Raniganj North	West Bengal	6	ONGC-CIL
Jharia	Jharkhand	7	ONGC-CIL
C. Awarded through FIPB route			
Raniganj South	West Bengal	8	GEECL

Total Resources : 393 BCM, Production Potential : 13.5 MMSCMD

CBM BLOCKS AWARDED UNDER CBM-I ROUND & ON NOMINATION BASIS

A. CBM BLOCKS AWARDED UNDER FIRST OFFER OF BIDDING

SL. NO	BLOCK	STATE	AREA IN SQ.KM.	CBM RESOURCES TCF (BCM)	AWARDEE	Date of signing of Contact
1	Bokaro	Jharkhand	95.00	1.59 (45)	ONGC-IOC	26.7.2002
2	North Karanpura	Jharkhand	340.00	2.19 (62)	ONGC-IOC	
3	Sohapgpur (East)	Madhya Pradesh	495.00	1.74 (49.3)	Reliance Industries Ltd. (RIL)	
4	Sohagpur (West)	Madhya Pradesh	500.00	1.30 (37)	Reliance Industries Ltd. (RIL)	
5	Raniganj (East)	W.Bengal	500.00	1.48 (42)	Essar Oil Ltd. (EOL)	

Contd...

CBM BLOCKS AWARDED UNDER CBM-I ROUND & ON NOMINATION BASIS

....Contd.

B. CBM BLOCKS AWARDED ON NOMINATION BASIS

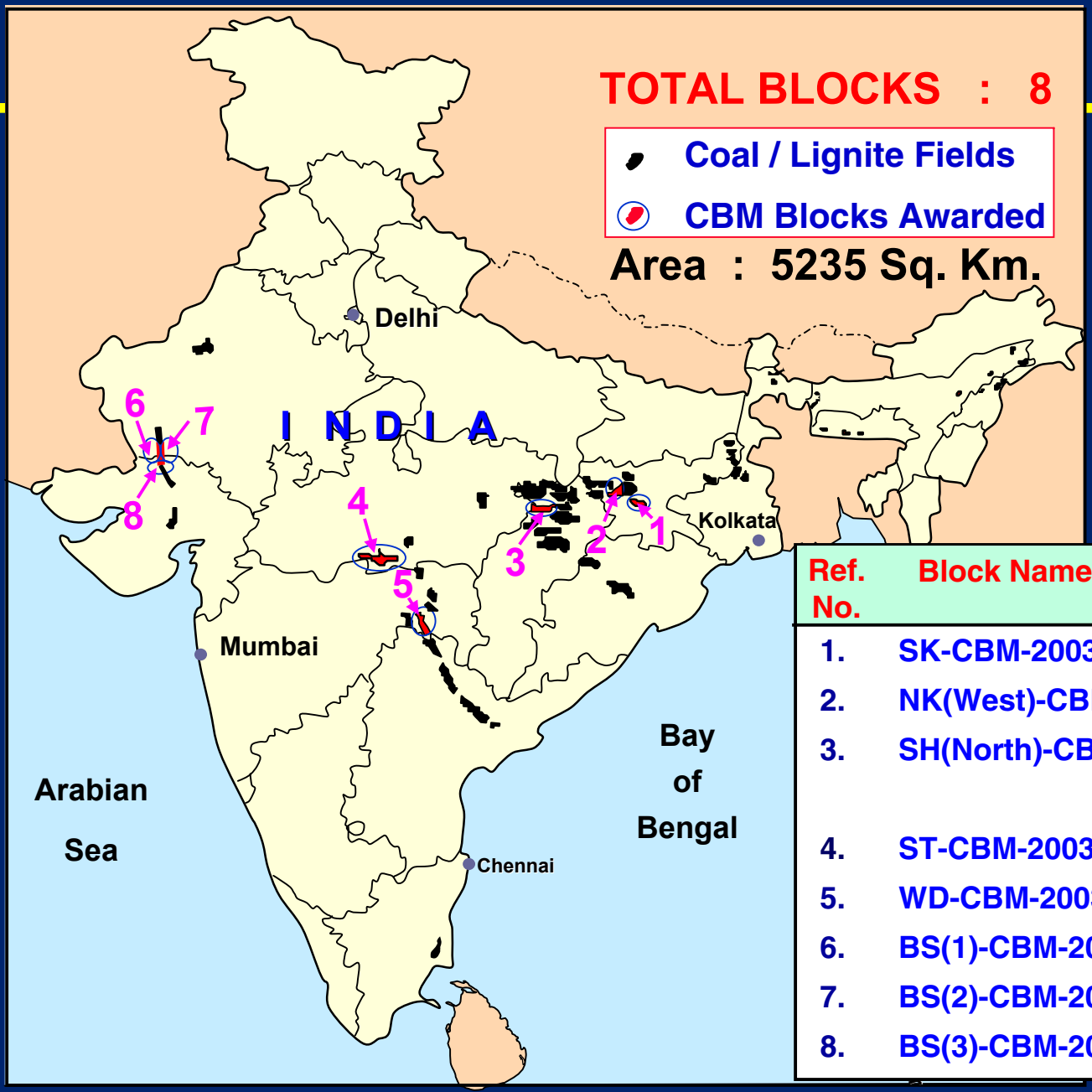
SL. NO	BLOCK	STATE	AREA IN SQ.KM.	CBM RESOURCES TCF (BCM)	AWARDEE	Date of signing of Contact
6	Raniganj North	W.Bengal	350.00	1.52 (43)	ONGC-CIL	6.2.2003
7	Jharia	Jharkhand	85.00	3.00 (85)	ONGC-CIL	

C. CBM BLOCKS AWARDED THROUGH FIPB ROUTE & LATER UNDER CBM POLICY

8	Raniganj South	W.Bengal	210.00	1.00 (28)	GEECL	31.5.2001

GRAND TOTAL	13.87 (393)		

CBM BLOCKS AWARDED UNDER CBM-II ROUND



Ref. No.	Block Name	State	Company / Consortium
1.	SK-CBM-2003/II	Jharkhand	ONGC
2.	NK(West)-CBM-2003/II	Jharkhand	ONGC
3.	SH(North)-CBM-2003/II	Chattisgarh & Madhya Pradesh	RIL
4.	ST-CBM-2003/II	Madhya Pradesh	ONGC
5.	WD-CBM-2003/II	Maharashtra	ONGC
6.	BS(1)-CBM-2003/II	Rajasthan	RIL
7.	BS(2)-CBM-2003/II	Rajasthan	RIL
8.	BS(3)-CBM-2003/II	Gujarat	ONGC-GSPCL

Total Resources : 425 BCM, Production Potential : 9.5 MMSCMD

DETAILS OF 8 AWARDED BLOCKS UNDER CBM-II ROUND

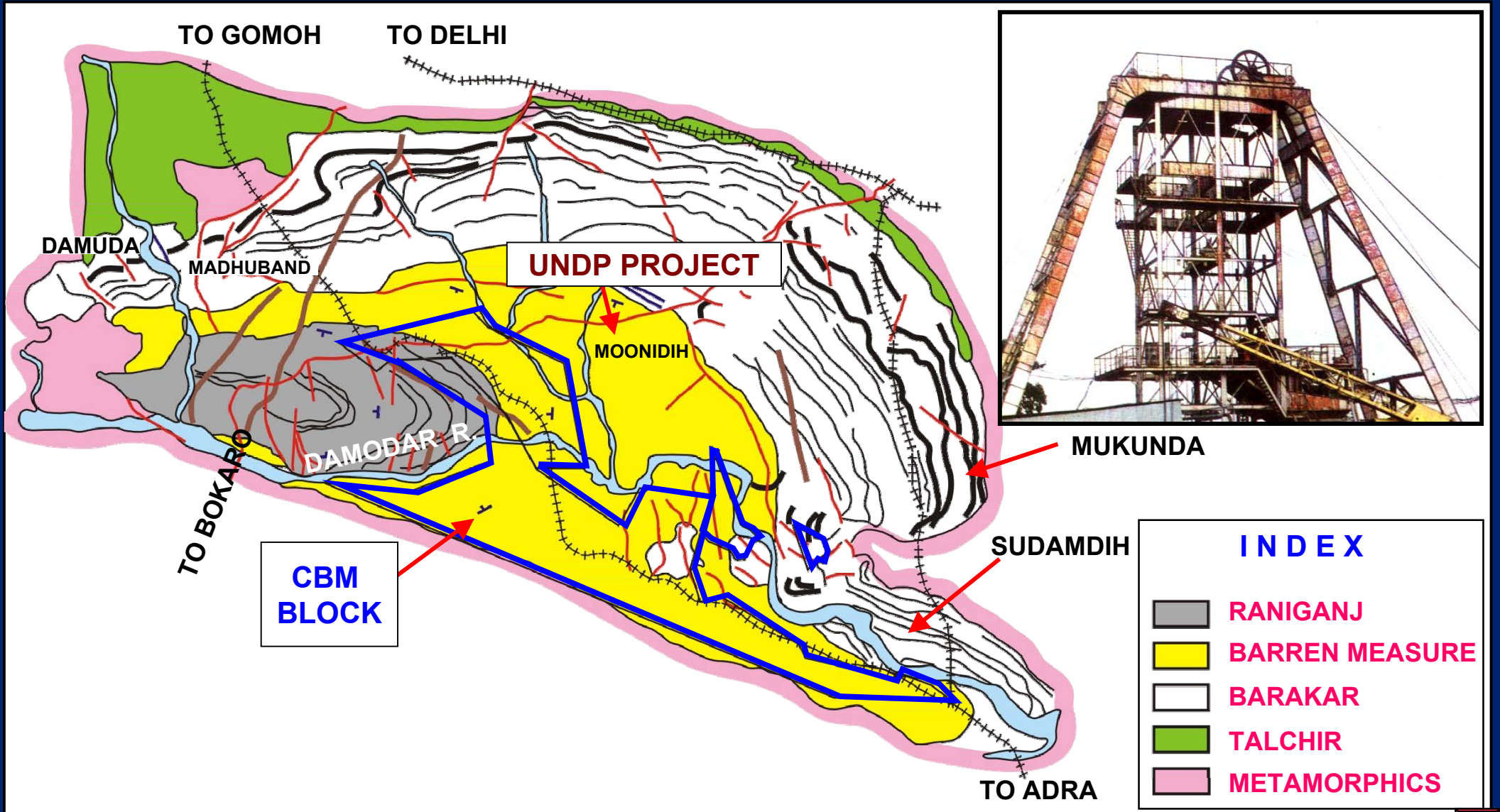
SL. NO.	BLOCK NAME (COAL / LIGNITE FIELD)	STATE (DISTRICT)	AREA (SQ.KM)	CBM RESOURCES (BCM)	AWARDED	DATE OF SIGNING OF CONTRACT
1	SK-CBM-2003/II (SOUTH KARANPURA)	JHARKHAND (HAZARIBAGH)	70	30.50	ONGC	6.2.2004
2	NK(WEST)-CBM-2003/II (NORTH KARANPURA)	JHARKHAND (CHATRA, LATEHAR, RANCHI)	267	43.60	ONGC	
3	SH(NORTH)-CBM-2003/II (SONHAT)	CHATTISGARH & MADHYA PRADESH (KOREA)	825	33.90	RIL	
4	ST-CBM-2003/II (SATPURA)	MADHYA PRADESH (SHAHDOL)	714	29.30	ONGC	
5	WD-CBM-2003/II (WARDHA)	MAHARASHTRA (CHANDRAPUR)	503	19.90	ONGC	
6	BS(1)-CBM-2003/II (BARMER)	RAJASTHAN (JALORE, BARMER)	1045	95.10	RIL	
7	BS(2)-CBM-2003/II (BARMER)	RAJASTHAN (JALORE, BARMER)	1020	87.70	RIL	
8	BS(3)-CBM-2003/II (BARMER)	GUJARAT (BANASKANTHA)	790	87.20	ONGC-GSPCL	
TOTAL			5234	427.20		

PROSPECTS OF CBM IN THE AWARDED BLOCKS

JHARIA COALFIELD – A STOREHOUSE OF COALBED METHANE

- CBM BLOCK : 1 (AREA – 85 SQ.KM)
- COAL SEAMS : 18 Regional Seams
- SEAM THICKNESS : 1 – 33 m
- DEPTH : 300 – 1200 m
- GAS CONTENT : 6 – 16 M^3/t
- PERMEABILITY : 0.03 (Deeper Seam) to 3.0 md (Upper Seam)
- CBM RESOURCE : 85 BCM
- GAS PRODUCTION : 8000 M^3/d in Test Well
- WATER PRODUCTION : 2 – 5 M^3/d
- R&D ACTIVITY : UNDP Project in another part of this field

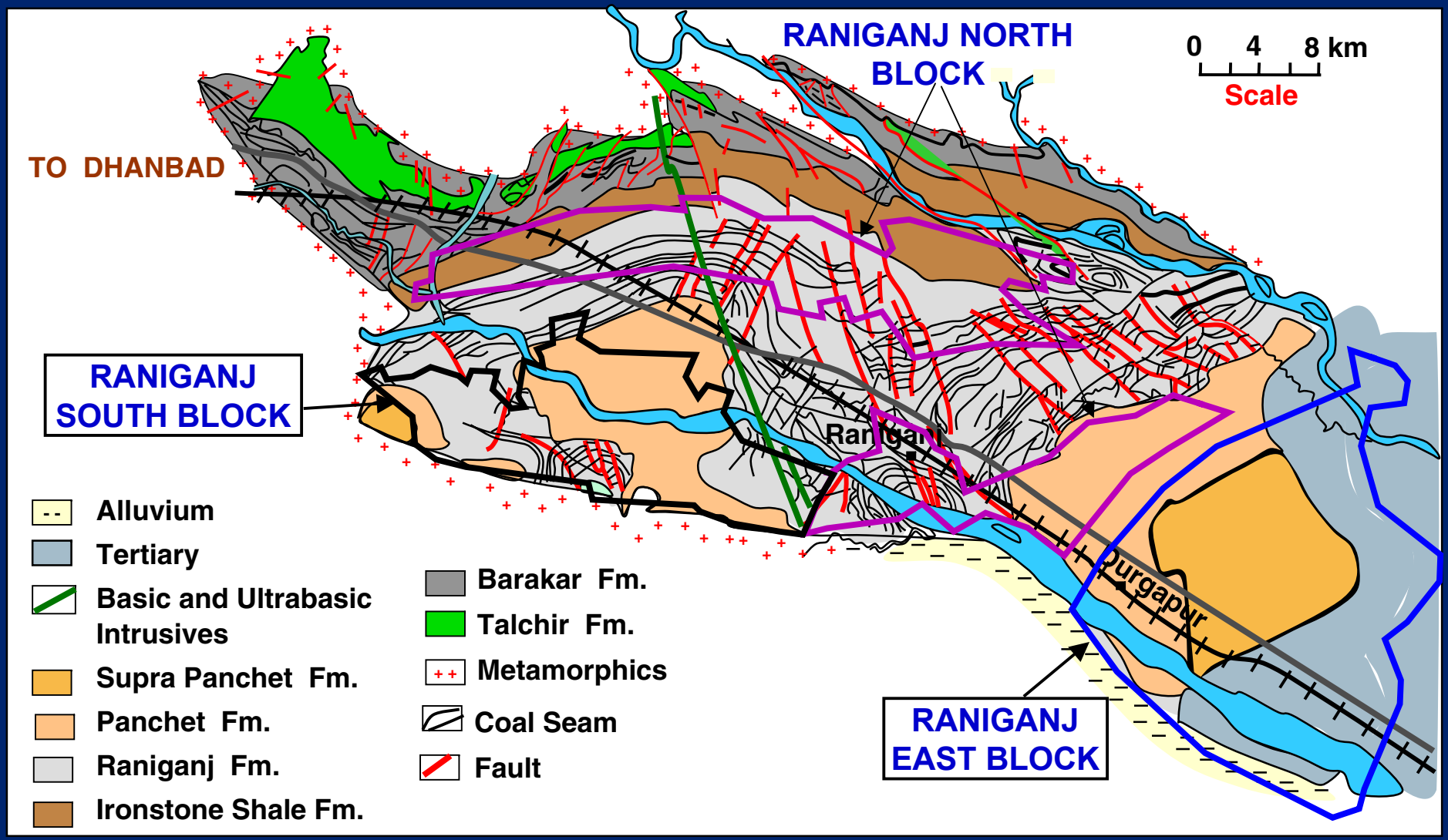
JHARIA COAL FIELD SHOWING CBM BLOCKS



RANIGANJ COALFIELD
THRESHOLD OF CBM DEVELOPMENT

• THREE CBM BLOCKS (AREA – 1060 SQ.KM)	:	EAST RANIGANJ (500 Sq.Km.) NORTH RANIGANJ (350 Sq.Km.) SOUTH RANIGANJ (210 Sq.Km.)
• COAL SEAMS	:	10 Regional Seams
• SEAM THICKNESS	:	4 – 46 m
• GAS CONTENT	:	2 – 17 M^3/t
• PERMEABILITY	:	Continuous Gas emission from coreholes shows good permeability
• CBM RESOURCES	:	115 BCM
• ANTCIPATED GAS PRODUCTION	:	2 – 3 MMSCMD

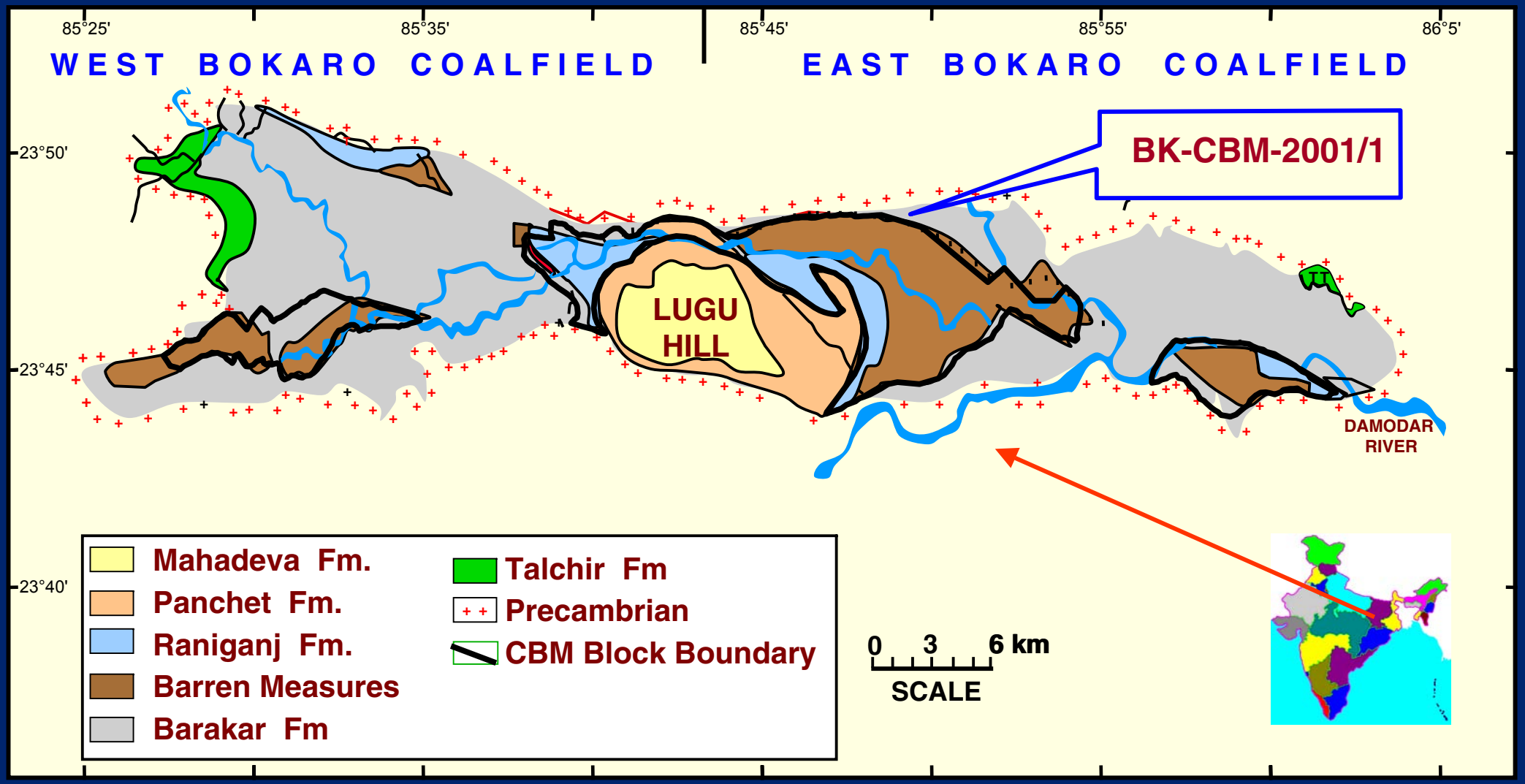
GEOLOGICAL MAP OF RANIGANJ COALFIELD SHOWING CBM BLOCKS



BOKARO COALFIELD : A SMALL YET AN EXCELLENT CBM PROSPECT

- CBM BLOCK : 1 (AREA – 95 SQ.KM)
- COAL SEAMS : 22 Nos.
- SEAM THICKNESS : 2 – 36 m
- DEPTH : 300 – 1500 m
- GAS CONTENT : 6 – 12 m^3/t
- HYDROGEOLOGY : SUB ARTESIAN AT PLACES
- PERMEABILITY : CONTINUOUS GAS EMISSION FROM OLD BOREHOLES SHOWS GOOD PERMEABILITY
- CBM RESOURCES : 45.03 BCM
- ANTICIPATED PRODUCTION : 2 MMSCMD

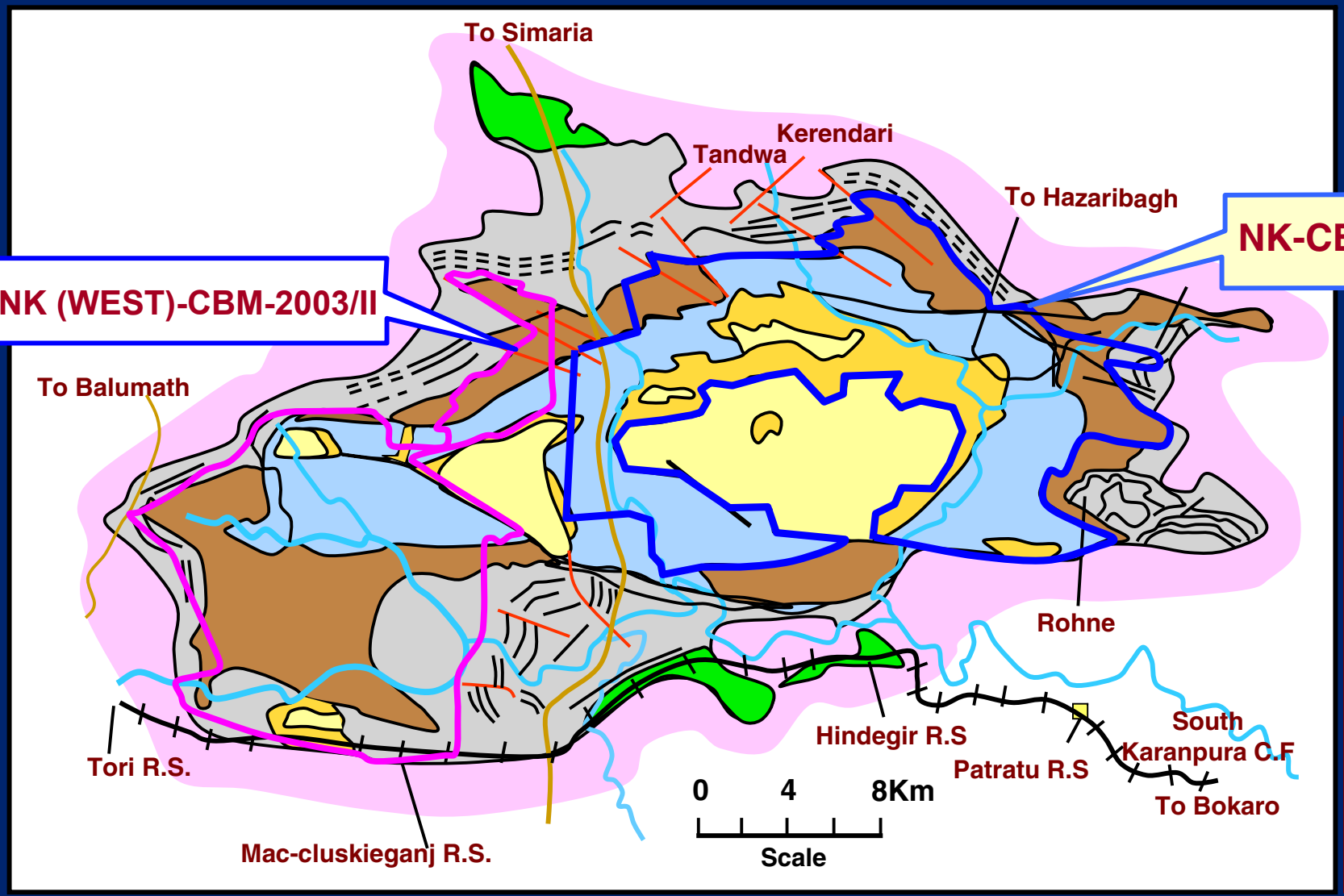
GEOLOGICAL MAP OF BOKARO COALFIELD



PROSPECTS IN CBM BLOCKS NORTH KARANPURA, JHARKHAND

CBM BLOCKS	:	2 NOS (AREA - 607 SQ.KM)
COAL SEAMS	:	5 REGIONAL SEAMS
SEAM THICKNESS	:	20 – 90 M
COAL SEAM DEPTH	:	300 - 1200 M
PERMEABILITY	:	GOOD
GAS CONTENT	:	4 – 8 M^3/T
CBM RESOURCES	:	105.50 BCM

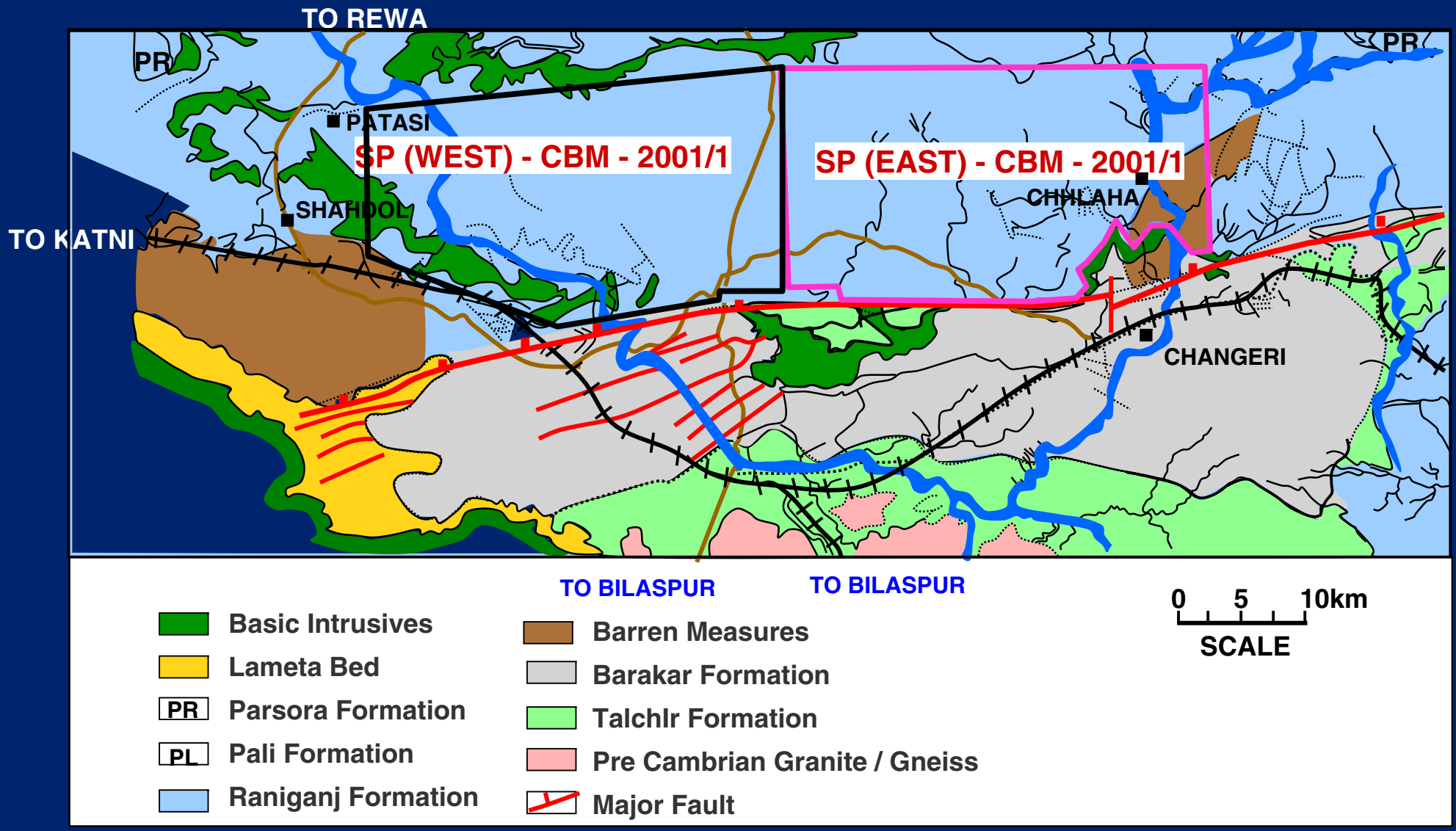
GEOLOGICAL MAP OF NORTH KARANPURA COALFIELD



SOHAGPUR – SONHAT COALFIELDS
A CBM SOURCE IN LOCALLY FORMED HIGH RANK COALS

- CBM BLOCKS : 4 (AREA – 2520 SQ.KM)
- COAL SEAM : 5 – 6 NOS.
- SEAM THICKNESS : 1 – 15 M
- GAS CONTENT : 3 – 10 M^3/T
- CBM RESOURCE : 159 BCM
- PRODUCTION PROSPECT : 4.8 MMSCMD GOOD AS LARGE COMMAND AREA AVAILABLE FOR CBM EXPLOITATION

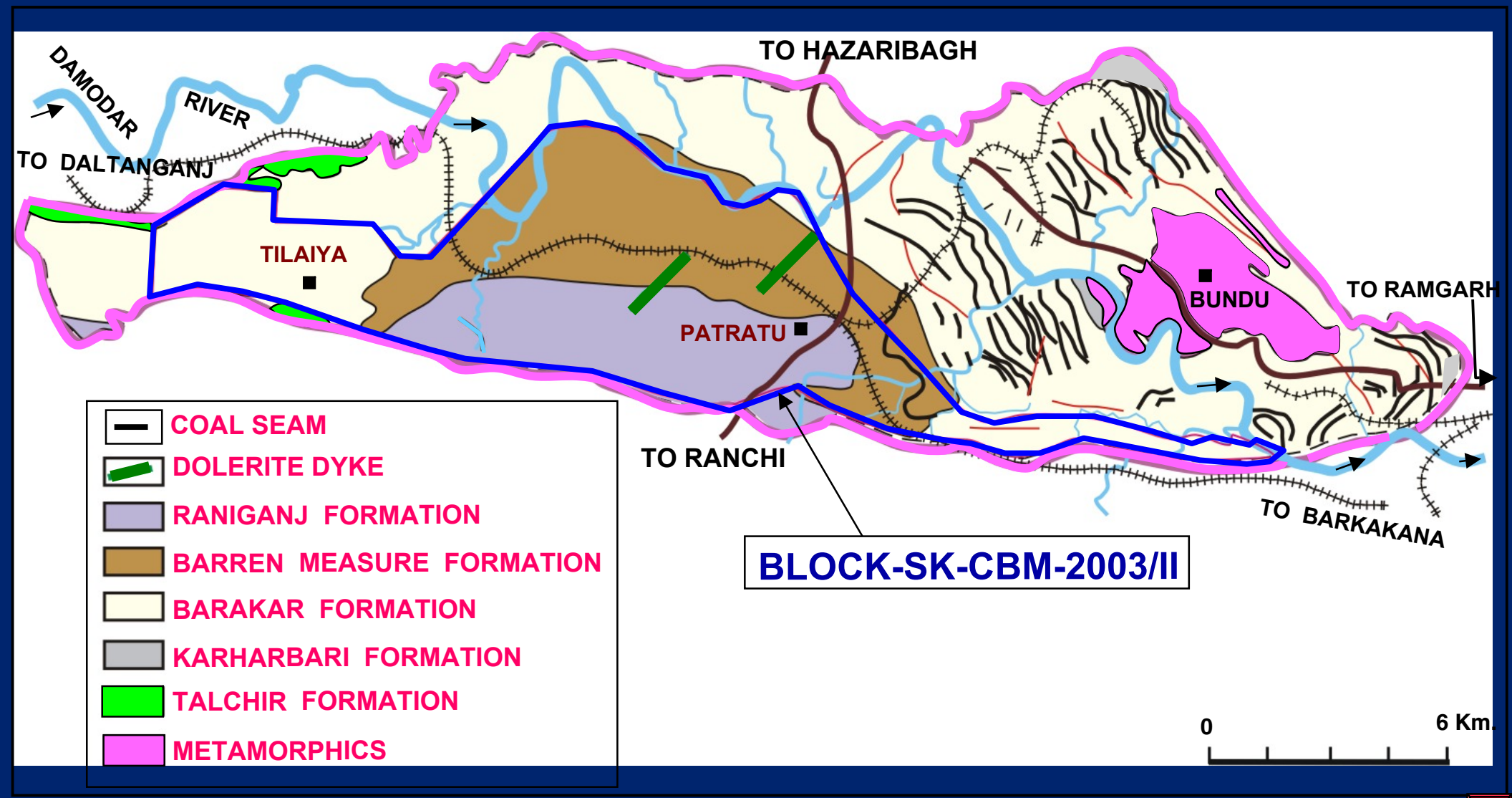
GEOLOGICAL MAP OF SOHAGPUR COALFIELD, MADHYA PRADESH



PROSPECTS IN CBM BLOCK SOUTH KARANPURA, JHARKHAND

CBM BLOCK	:	1 (AREA - 70 SQ.KM)
COAL SEAMS	:	42 REGIONAL SEAMS
SEAM THICKNESS	:	30 – 120 M
COAL DEPTH	:	500 – 1500 M
PERMEABILITY	:	GOOD, HIGH FRACTURE DENSITY IN COALS
GAS CONTENT	:	6 – 10 M^3/T
CBM RESOURCE	:	30.45 BCM

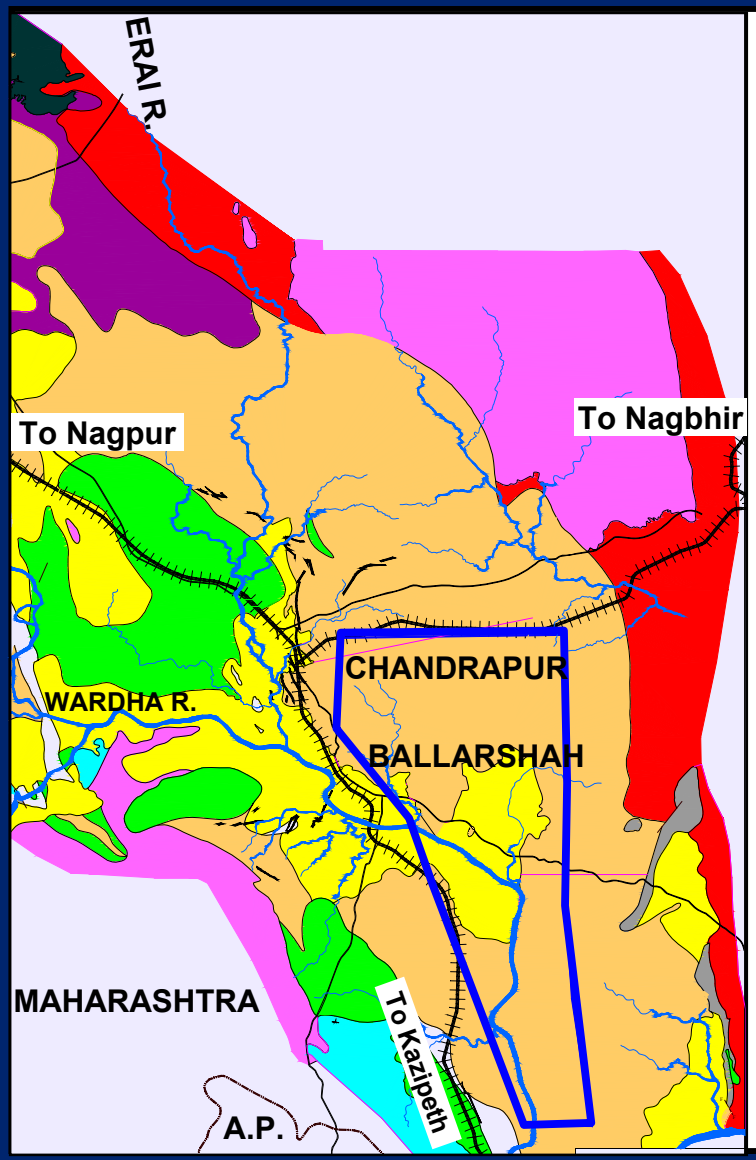
GEOLOGICAL MAP OF SOUTH KARANPURA COALFIELD, JHARKHAND



PROSPECTS IN CBM BLOCK WARDHA, MAHARASTRA

CBM BLOCK	:	1 (AREA - 503 SQ.KM)
COAL SEAMS	:	1 MAIN SEAM (COMPOSITE SEAM)
SEAM THICKNESS	:	10.7 - 14.3 M
SEAM DEPTH	:	300 - 1200 M
GAS CONTENT	:	4 - 6 M^3/T
CBM RESOURCE	:	19.9 BCM

GEOLOGICAL MAP OF EASTERN PART OF WARDHA VALLEY COAL FIELD MAHARASHTRA



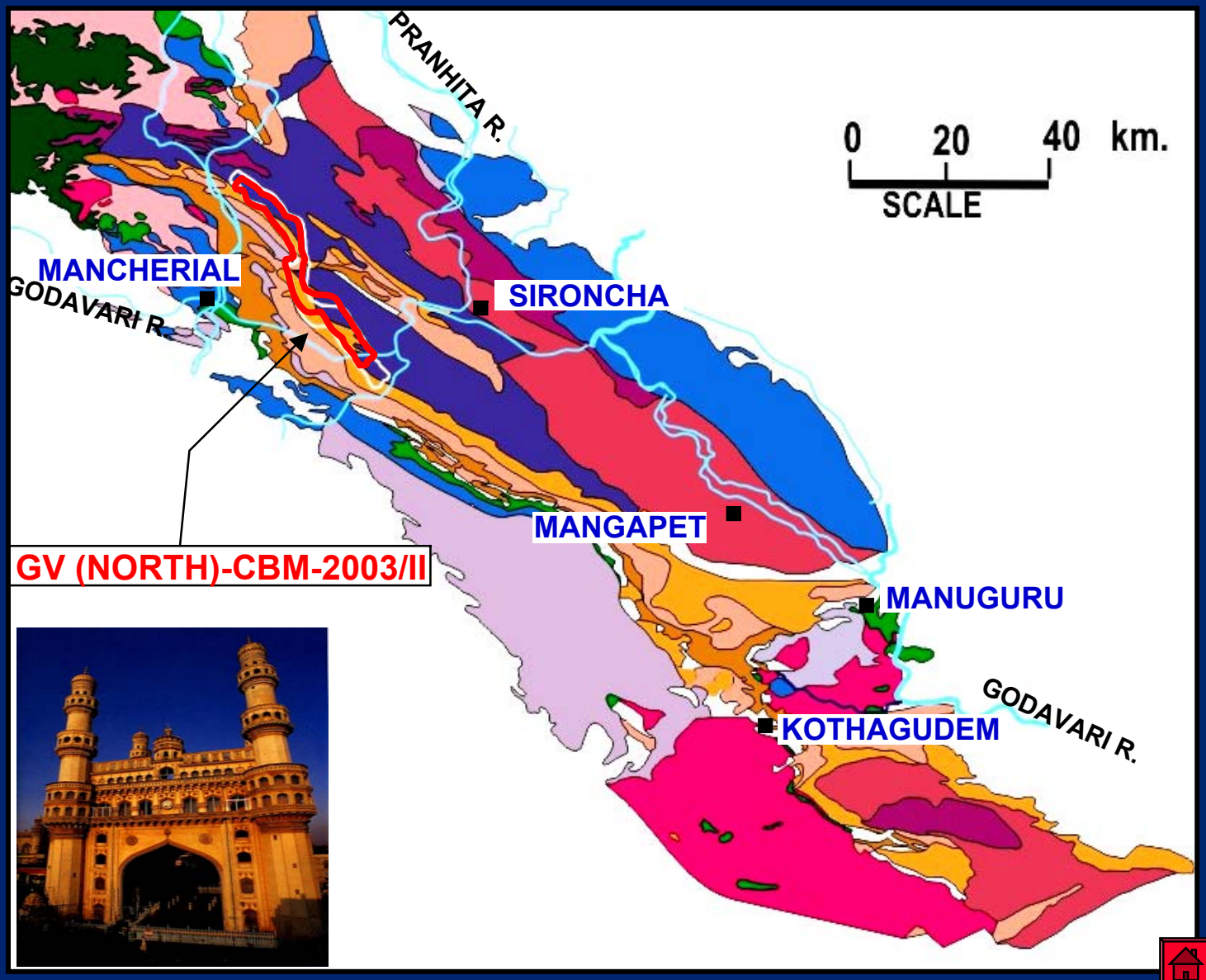
ALLUVIUM / SOIL
DECCAN TRAP
LAMETA FORMATION
KAMTHI FORMATION
BARAKAR FORMATION
TALCHIR FORMATION
UNDIFFERENTIATED PROTEROZOIC SEDIMENTS
SULLAVI GROUP
PAKHAL GROUP
UNCLASSIFIED PRECAMBRIAN METAMORPHICS & GNEISSES
VINDHYAN
CBM BLOCK WD-CBM-2003/II

0 10 Km.

PROSPECTS IN GODAVARI CBM BLOCK ANDHRA PRADESH

CBM BLOCK	:	1 (AREA - 386 SQ.KM)
COAL SEAMS	:	10 REGIONAL SEAMS
SEAM THICKNESS	:	15 – 20 M
SEAM DEPTH	:	450 - 1500 M
PERMEABILITY	:	GOOD TO MODERATE
GAS CONTENT	:	4 – 4.5 M^3/T
CBM RESOURCE	:	29.65 BCM

GEOLOGICAL MAP OF GODAVARI VALLEY COALFIELD, ANDHRA PRADESH

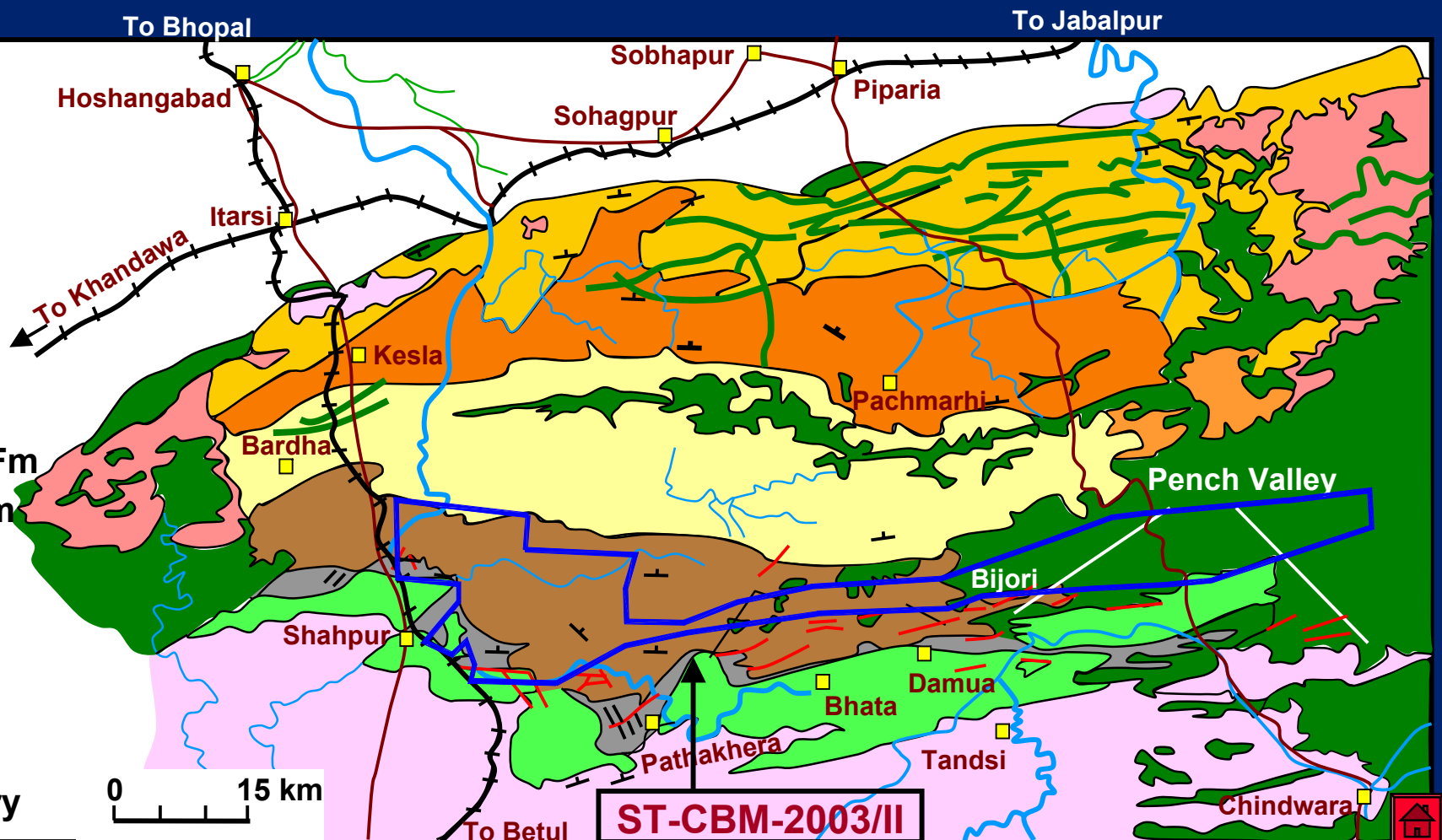


PROSPECTS IN SATPURA CBM BLOCK MADHYA PRADESH

CBM BLOCK	:	1 (AREA - 714 SQ.KM)
COAL SEAMS	:	3 - 5 REGIONAL SEAMS
SEAM THICKNESS	:	3 – 11.5 M
SEAM DEPTH	:	300 - 1200 M
PERMEABILITY	:	GOOD
GAS CONTENT	:	6 – 8 M^3/T
CBM RESOURCE	:	29.3 BCM

SATPURA COALFIELD, MADHYA PRADESH

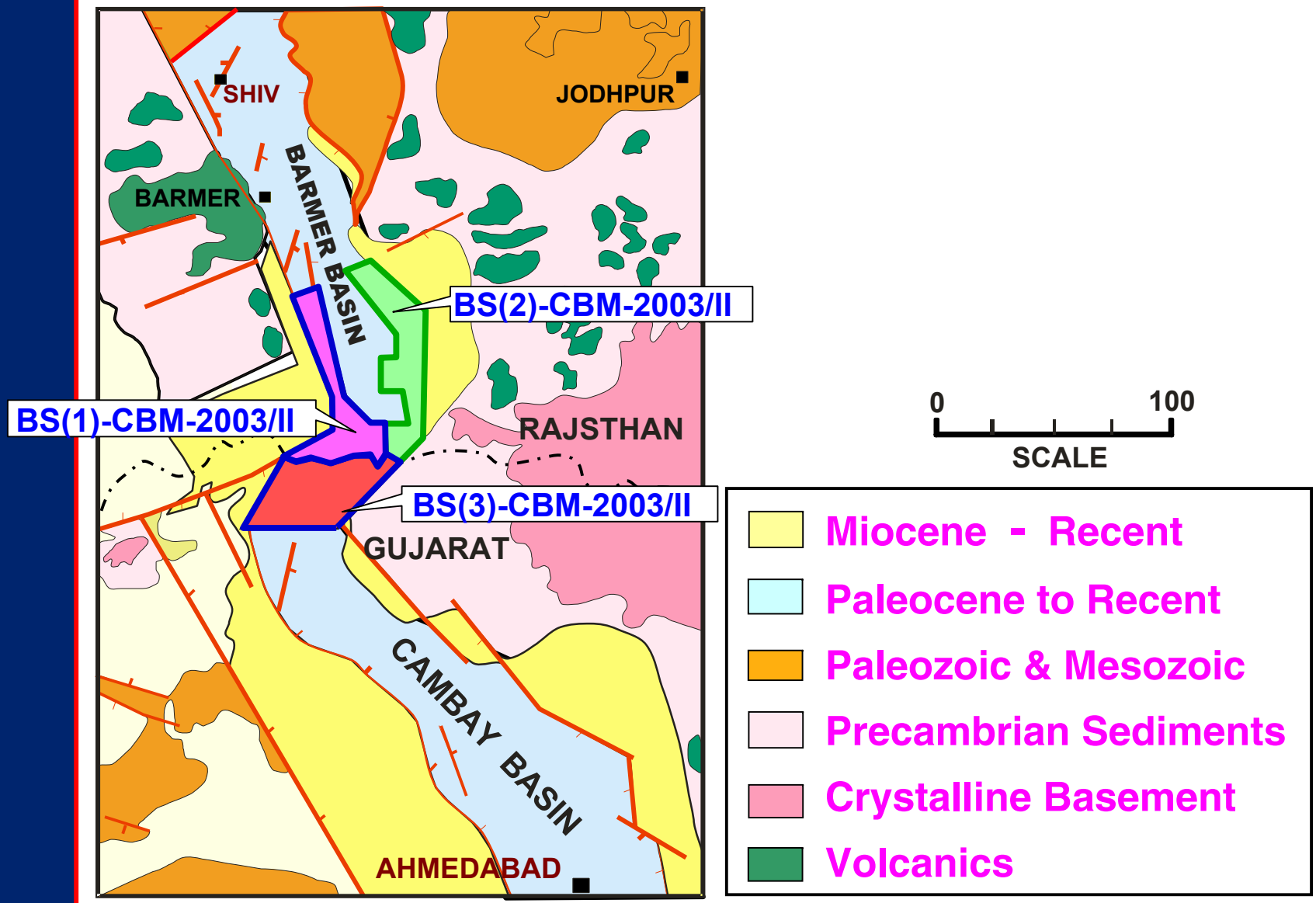
GEOLOGICAL MAP



PROSPECTS OF CBM IN BARMER BASIN

	Western Block BS(1)-CBM-2003/II Rajasthan	Eastern Block BS(2)-CBM-2003/II Rajasthan	Southern Block BS(3)-CBM-2003/II Gujarat
Area	1045 Sq.km	1020 Sq.km	790 Sq.km
Lignite bearing sequence	Thumbli Formation (M. Eocene)	Thumbli Formation (M. Eocene)	Tharad Formation (M. Eocene)
No. of Lignite seam	Composite Seam often split		
Net lignite thickness	20 – 76 m	20 – 40m	25 – 60 m
Rank	Lignito bituminous Vro–0.35%		
Depth of Lignite	600 – 1500 m	700 – 1500 m	600 – 1500 m
Permeability	Very Good	Very Good	Very Good
Gas Origin	Mixed Origin : Early Biogenic & Early Thermogenic		
Gas Content	4 – 6 M^3 / t		
Gas in place resource	95 BCM	87.7 BCM	87.2 BCM

GEOLOGICAL & TECTONIC MAP OF BARMER & CAMBAY BASIN



EXPECTED PRODUCTION POTENTIAL OF CBM IN INDIA

CBM RESOURCES & EXPECTED PRODUCTION POTENTIAL

A. BLOCKS AWARDED UNDER CBM-I ROUND & ON NOMINATION BASIS

SL. NO	BLOCK	STATE	AREA (SQ.KM)	CBM RESOURCES (BCM)	Expected production of CBM / day (MMSCMD)
1	BOKARO	JHARKHAND	95.00	45	1.9
2	NORTH KARANPURA	JHARKHAND	340.00	62	2.0
3	SOHAPGPUR EAST	MADHYA PRADESH	495.00	49.3	1.8
4	SOHAGPUR WEST	MADHYA PRADESH	500.00	37	1.8
5	RANIGANJ EAST	W.BENGAL	500.00	42	1.5
6	RANIGANJ NORTH	W.BENGAL	350.00	43	1.0
7	JHARIA	JHARKHAND	85.00	85	2.0
8	RANIGANJ SOUTH	W.BENGAL	210.00	28	1.5
TOTAL			2575	393	13.5

CBM RESOURCES & EXPECTED PRODUCTION POTENTIAL

B. BLOCKS AWARDED UNDER CBM-II ROUND

SL. NO	BLOCK	STATE	AREA (SQ.KM)	CBM RESOURCES (BCM)	Expected production of CBM / day (MMSCMD)
1	SOUTH KARANPURA	JHARKHAND	70	30.50	1.0
2	NORTH KARANPURA	JHARKHAND	267	43.60	1.3
3	SONHAT	CHATTISGARH & MADHYA PRADESH	825	33.90	1.2
4	SATPURA	MADHYA PRADESH	714	29.30	1.0
5	WARDHA	MAHARASHTRA	503	19.90	0.7
6	BARMER	RAJASTHAN	1045	95.10	1.5
7	BARMER	RAJASTHAN	1020	87.70	1.5
8	BARMER	GUJARAT	790	87.20	1.3
TOTAL			5234	427.20	9.5
GRAND TOTAL (A+B)			7809	820	23

STATEWISE POSSIBLE CBM RESERVES & ANTICIPATED PRODUCTION OF CBM / DAY FROM AWARDED & IDENTIFIED BLOCKS

Sl. No.	State	Prognosticated Resource (BCM)	Recoverable Reserves at 20-25% of Prognosticated Resource (BCM)	Production in MMm^3 per day for 25 years assessed on 20-25% recovery (MMSCMD)
1	WEST BENGAL	144	28.8 – 36.00	3.15 – 3.94
2	JHARKHAND	322.10	64.42 – 80.52	7.0 – 8.8
3	MADHYA PRADESH	195.30	39 – 48.8	4.27 – 5.35
4	GUJARAT	224.20	44.8 – 56.00	4.9 – 6.13
5	RAJASTHAN	182.80	36.56 – 45.7	4.0 – 5.0
6	MAHARASHTRA	19.90	3.98 – 4.97	0.44 – 0.54
7	CHATTISGARH	119.90	23.98 – 29.97	2.63 – 3.28
8	ORISSA	35.00	7.0 – 8.75	0.77 – 0.96
9	ANDHRA PRADESH	63.65	12.73 – 15.91	1.40 – 1.74
10	TAMILNADU	27.70	5.54 – 6.92	0.61 – 0.76
	TOTAL	1334.55	266.91 – 333.64	29.25 – 36.56

* If prognosticated resources of CBM is taken as 2.6 TCM, the projected production potential could be 50 MMm^3 / day

MAJOR FOURTHCOMING

CBM EXPLORATION

OPPORTUNITIES

CBM ROUND III

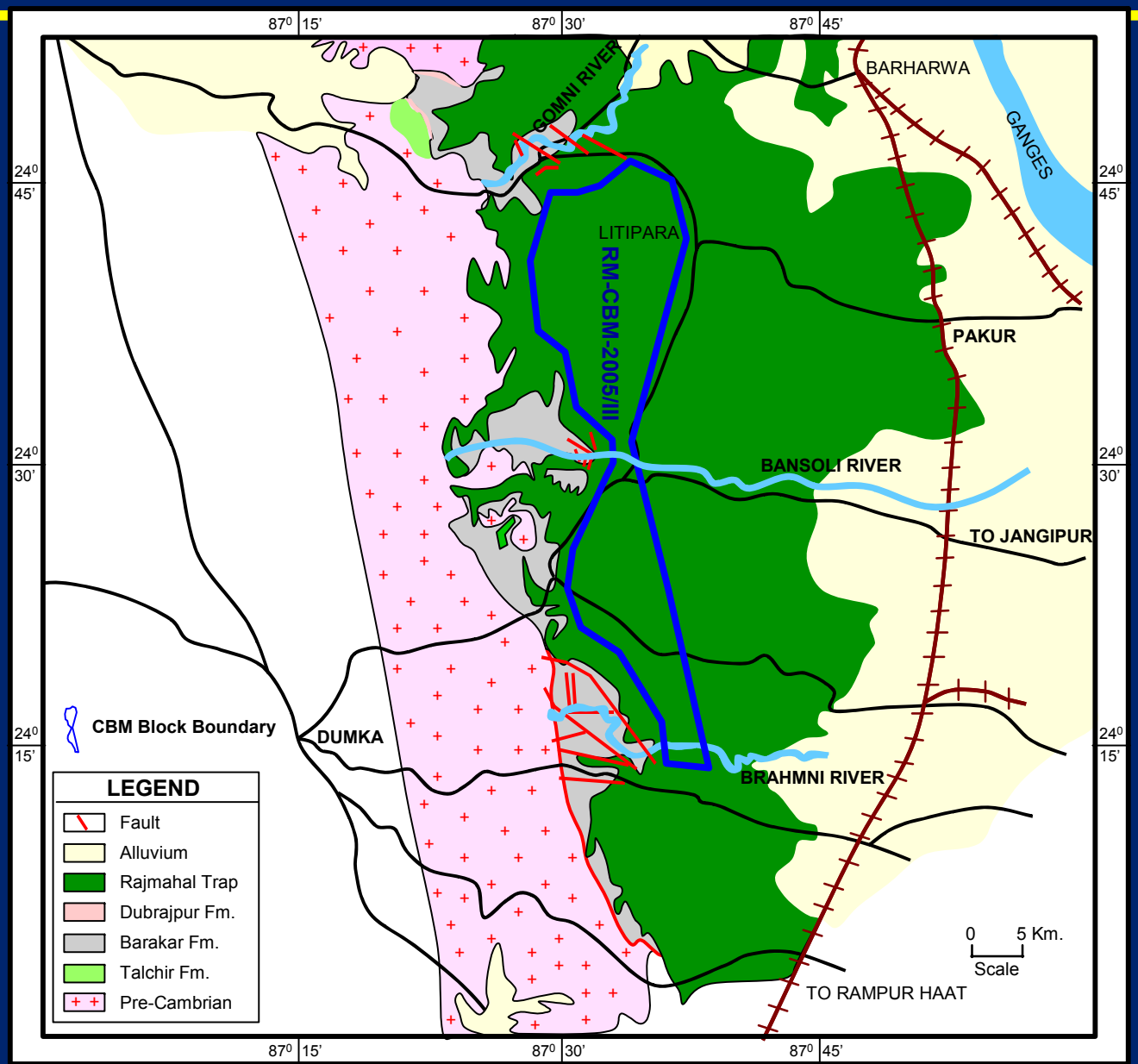
BLOCK ON OFFER UNDER CBM-III ROUND

Ref. No.	Coal-Field	Block Name	State
1	Raj Mahal	RM-CBM-2005/III	Jharkhand
2	Birbhum	BB-CBM-2005/III	West Bengal
3	Tatapani-Ramkola	TR-CBM-2005/III	Chattisgarh
4	Mand-Raigarh	MR-CBM-2005/III	Chattisgarh
5	Sohagpur	SP(North)-CBM-2005/III	Madhya Pradesh
6	Singrauli	SR-CBM-2005/III	Madhya Pradesh
7	Kothagudem	KG(East)-CBM-2005/III	Andhra Pradesh

PROSPECTS & OPPORTUNITIES

- ✓ To increase the pace of exploration and development of CBM the Government of India under CBM-III round of international bidding has identified 7 additional blocks in different coalfields, located in the States of Madhya Pradesh, Chattisgarh, Jharkhand, West Bengal, Andhra Pradesh & Rajasthan and hold sizable resources of CBM showing good prospectivity.
- ✓ The CBM terms offered by Government are definitely the very best in the world:
  - Seven years tax holiday from the date of commencement of production.
  - Fiscal stability provision in the contract.
  - No participating interest of the Government.
  - No signature bonus.
  - No custom duty on imports required for CBM operations.
  - Freedom to sell gas in the domestic market at market determined rate.
- ✓ During the last 3 years more than 75 exploratory / pilot wells have been drilled in the 16 CBM blocks awarded during the last two rounds of international bidding.
- ✓ Significant finds reported in Jharia, Raniganj, Bokaro & Sohagpur Coalfields in the Eastern and Central part of India
- ✓ Test production of CBM in these blocks have yielded encouraging quantities of gas and commercial exploitation of Coalbed Methane (CBM) in India is no longer a myth but a reality.

GEOLOGICAL MAP OF RAJMAHAL COAL BELT



GEOLOGICAL SETUP

RAJMAHAL COALFIELD:

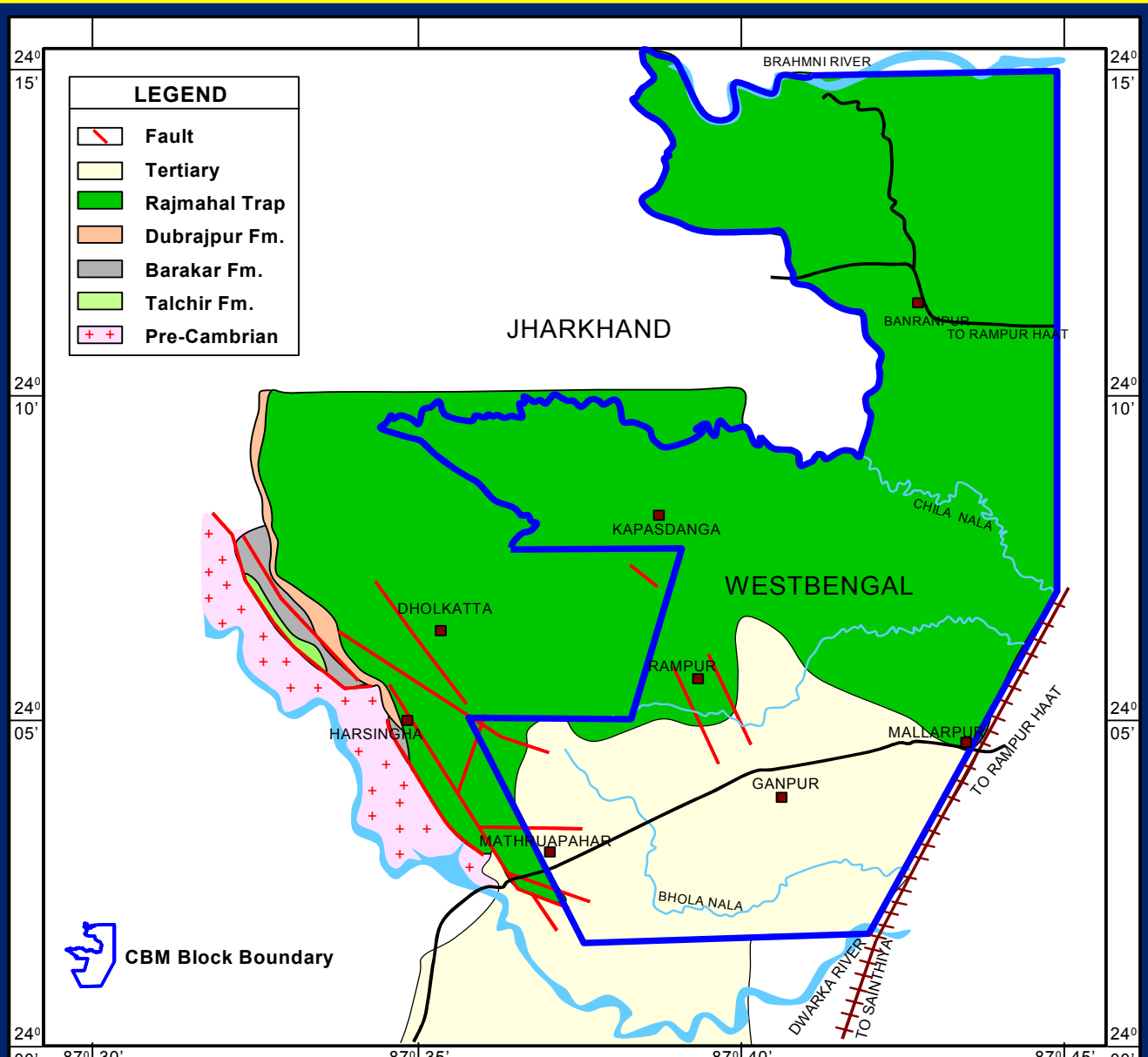
- The coal measures of Rajmahal coalfield are exposed in the marginal part of a large master basin which extends from Purnea trough in the north Bihar across the Rajmahal hills to the Bengal basin in the South East.
- The Barakar formation (L. Permian) of Gondwana sequence is the major repository coal in the basin.
- The guiding factors for delineation of a CBM block in this coalfield include:

(i) occurrence of thick coal seams (about 40-60m) below a variable cover of 300-600m of younger strata with an average gas content of 5-6 m^3/t,

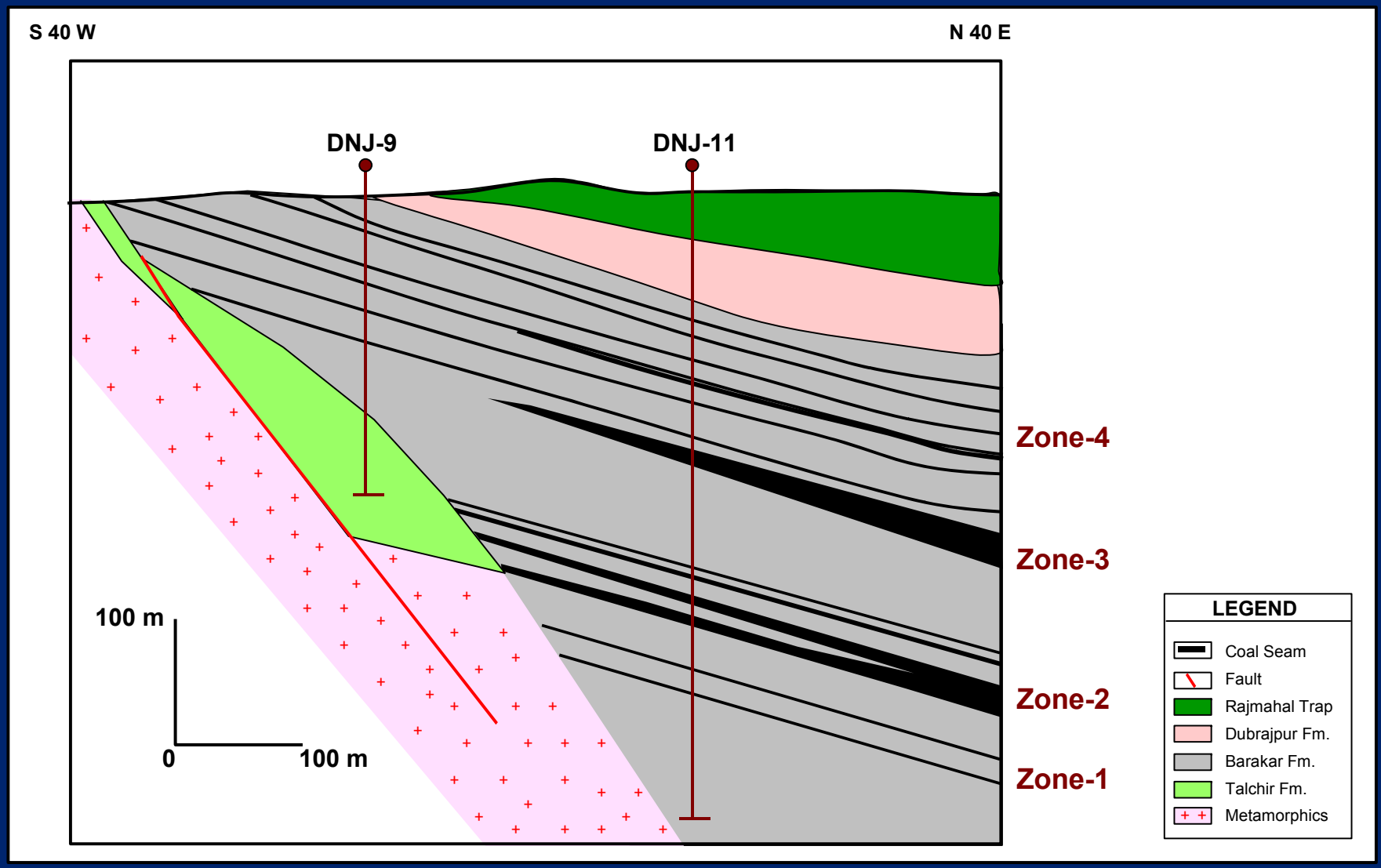
(ii) exposure of coal seams to varying thermal regime below the cover of Rajmahal volcanic suite and the low stress regime in relaxed structural setting.

(iii) One CBM block have been offered in this block

GEOLOGICAL MAP OF BIRBHUM COALFIELD WESTBENGAL



GEOLOGICAL SECTION OF GONDWANA COAL SEAMS, BIRBHUM COAL FIELD



GEOLOGICAL SETUP

BIRBHUM COALFIELD:

It is the south westerly extension of Rajmahal coal belt & the CBM potentiality of the coalfield is characterised by:

a) The concealed nature of the basin

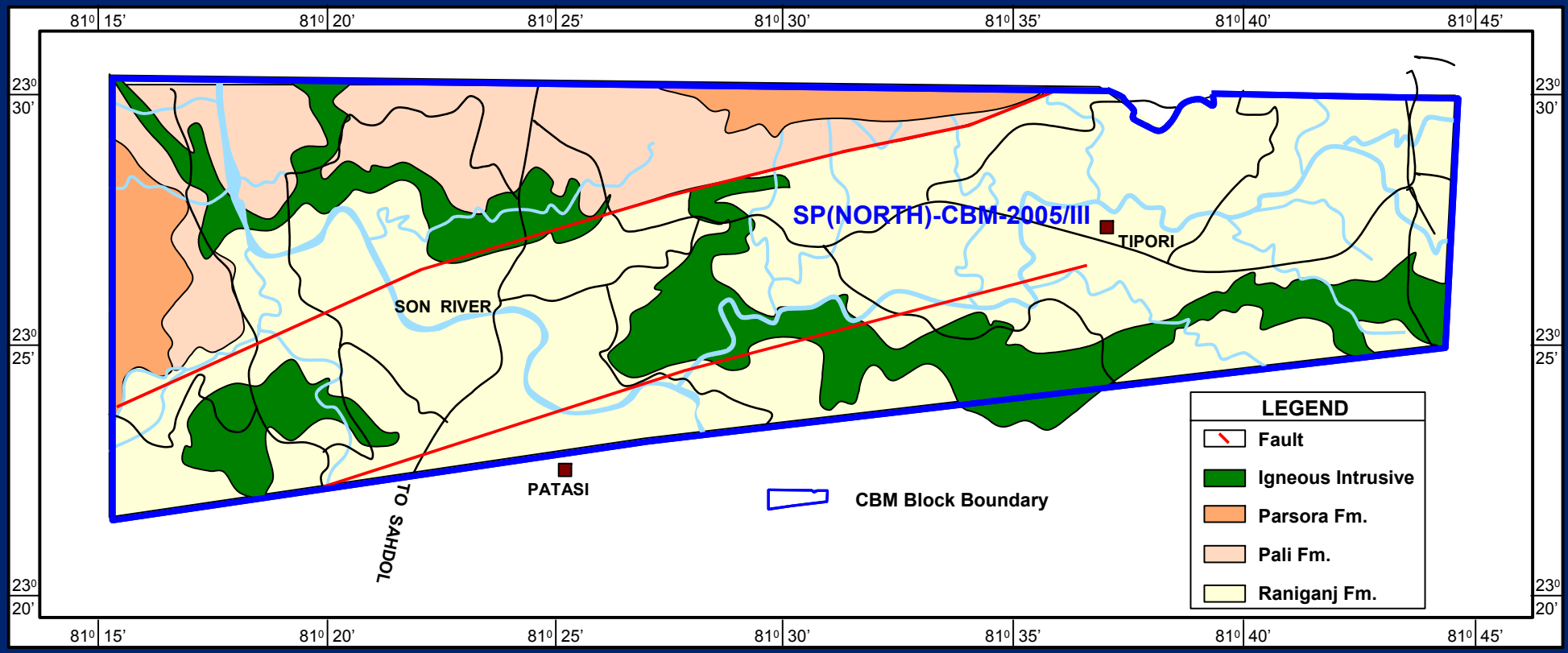
b) development of very thick / super thick coal seams containing section of good quality coal and

c) Evidence of pervasive heat flow from the 200 m thick volcanic suite to the underlying coal measures

d) The desorption & adsorption isotherm data generated from the northern part of the field show that the coal seams store 5-6 m3/t of gas

e) One CBM block is proposed to be offered in this coalfield.

GEOLOGICAL MAP OF SOHAGPUR COALFIELD



GEOLOGICAL SETUP

SOHAGPUR COALFIELD:

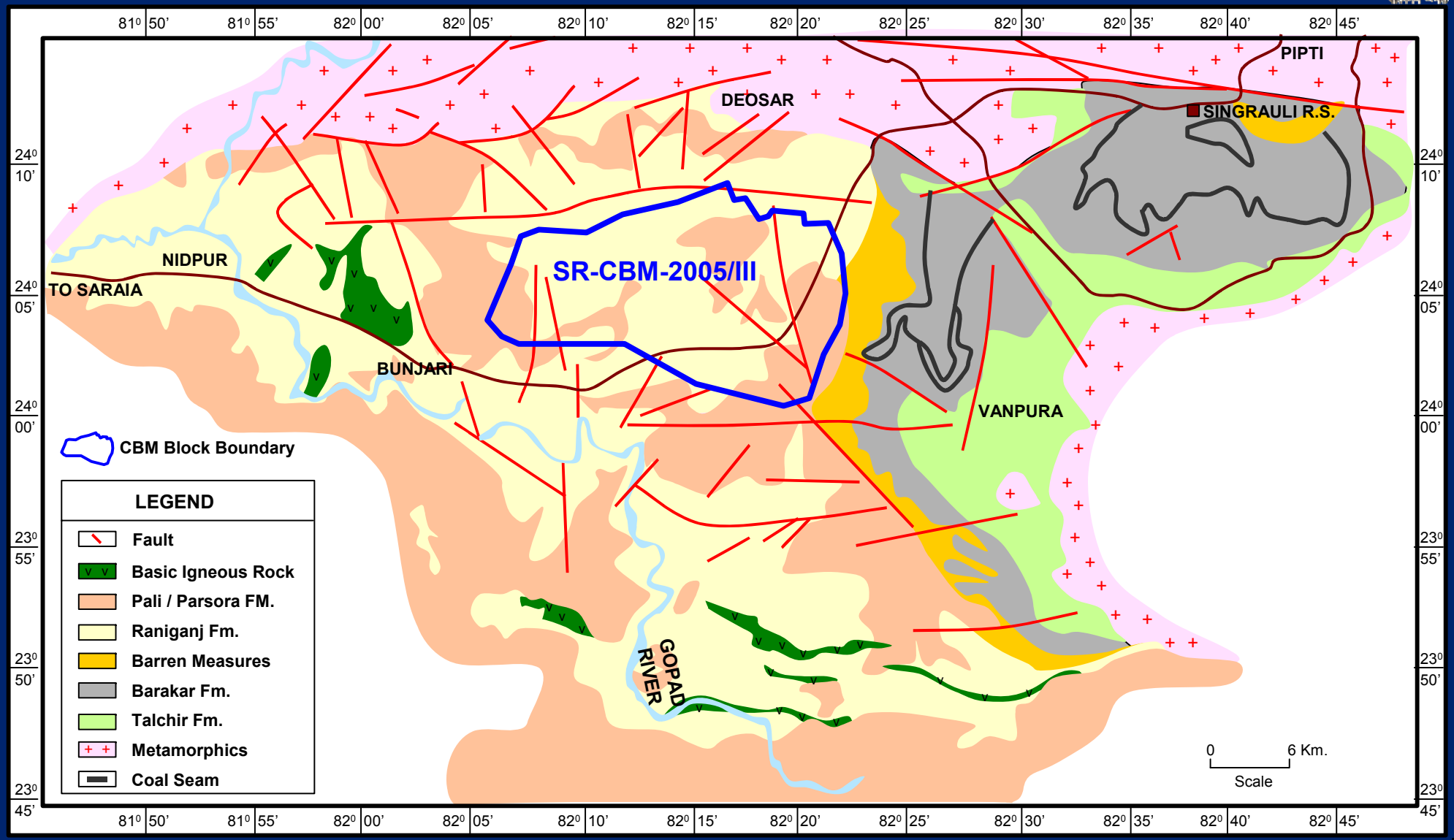
1) Exploratory drilling activities in the two CBM blocks awarded under CBM-I round of bidding located in the central part of this coalfielda block in the north-northwestern part of this coalfield.

2) The northern part of Sohagpur coalfield has a complex history of dolerite intrusion, which may influence the generation of gas.

3) The exploration in Nigwani-Bakeli area within the proposed block revealed the occurrence of Barakar coal measures below 300m cover of Barren Measure and Raniganj formation.

4) The cumulative coal thickness in the block varies from 6-12m.

GEOLOGICAL MAP OF SINGRAULI COALFIELD



GEOLOGICAL SETUP

SINGRAULI COALFIELD:

1) Singrauli coalfield is a major repository of coal in the heartland of the country and is well known for prolific coal development where extensive mining operation is in progress.

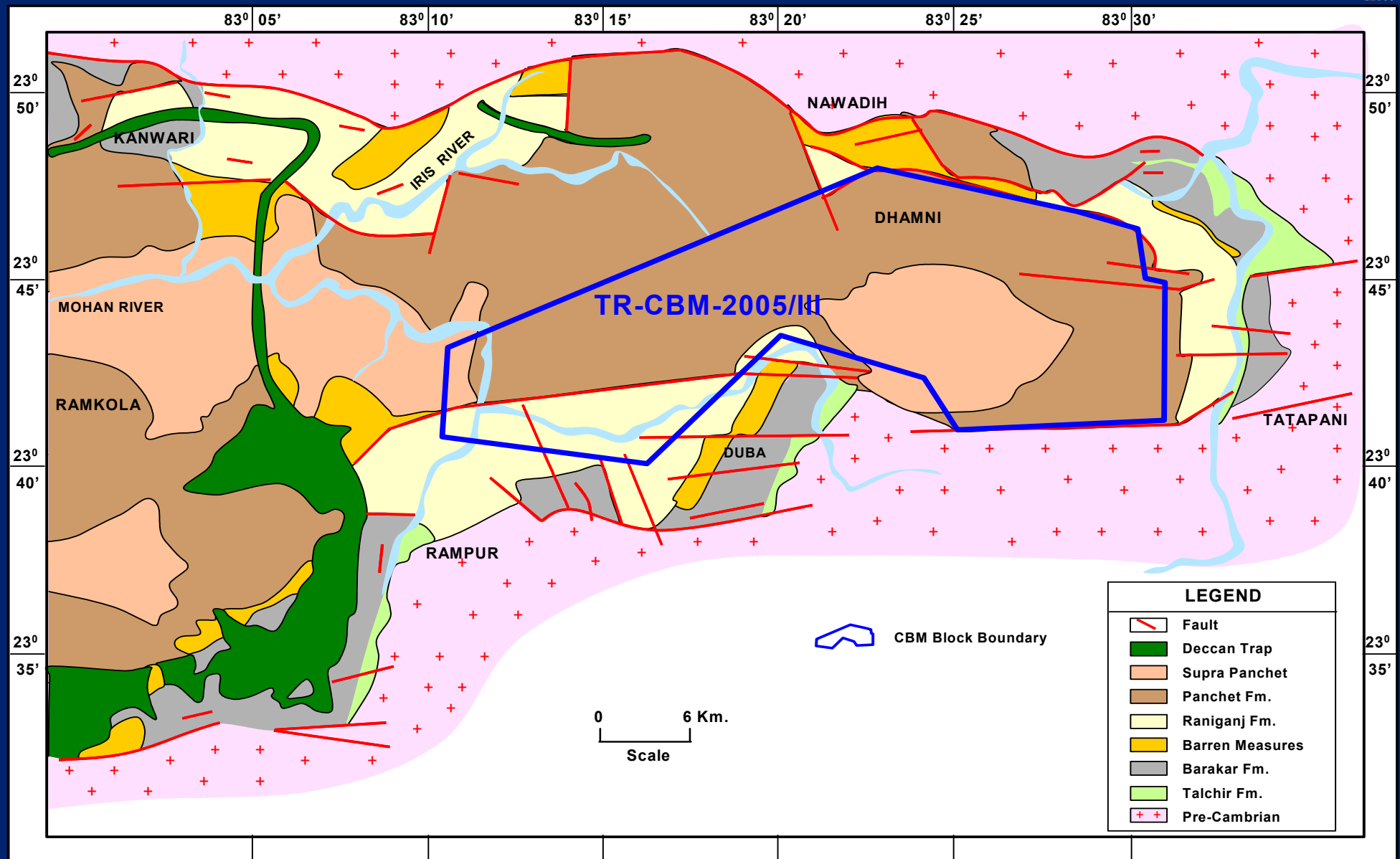
2) The Singrauli main basin, where a CBM block has been carved out, is an integral part of the master South Rewa basin containing Sohagpur-Johilla coalfields

3) It has large unrecognized Coalbed Methane potential in moderately thick Barakar seams with a gas content of 5 m3/t

4) 300-500m thick cover over the coal measures, (iii)the rank of coal reaching the threshold of early thermogenic methane generation and

5) localized supply of heat from igneous intrusions, All these in combination are likely to contribute to CBM gas generation and storage in seams.

GEOLOGICAL MAP OF TATAPANI-RAMKOLA COALFIELD



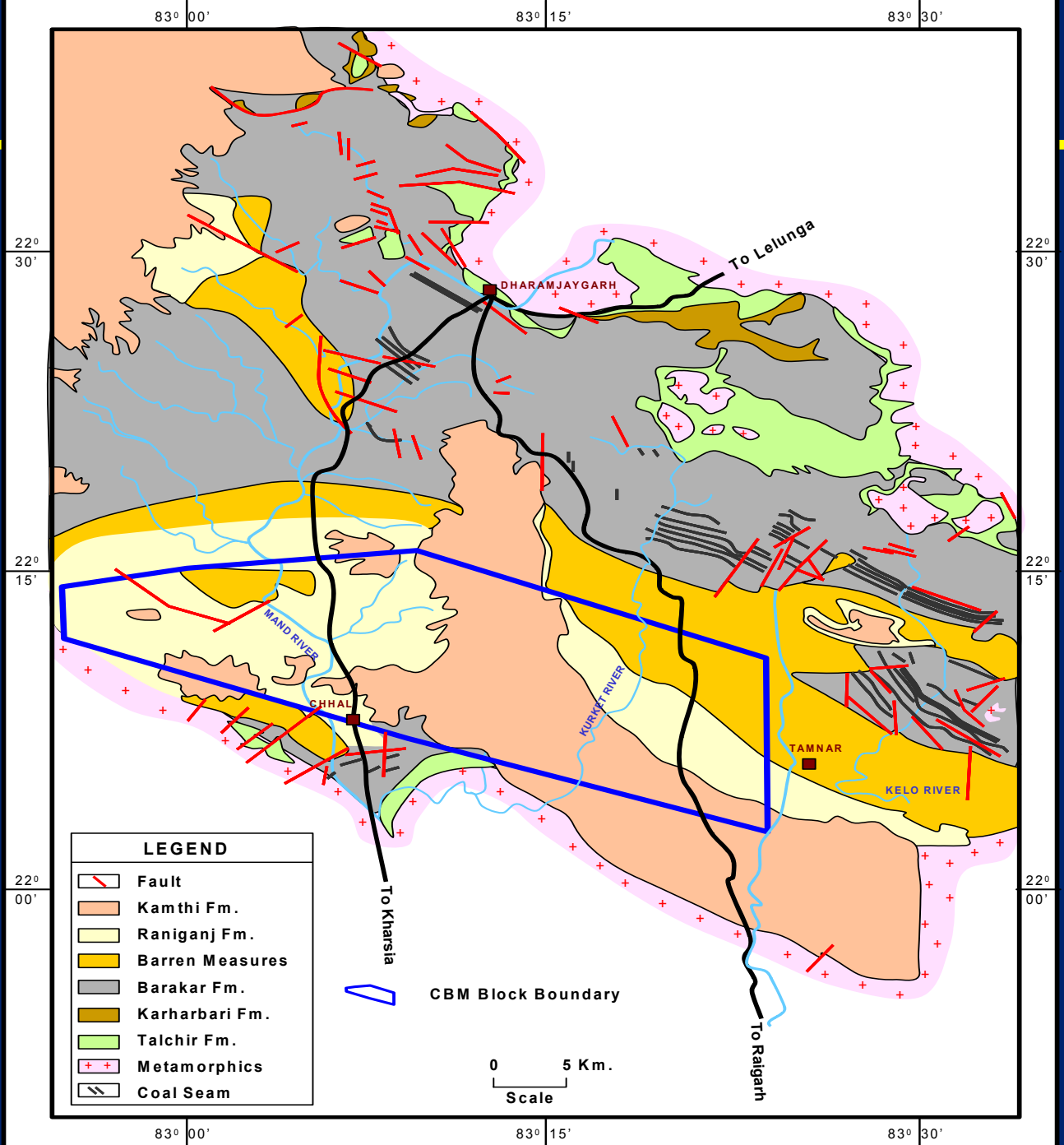
GEOLOGICAL SETUP

TATAPANI-RAMKOLA

- Tatapani-Ramkola Coalfield occurs in the structure junction between the Damodar valley and the Son valley Gondwana basin belts. The basin depicts structural and stratigraphic similarity with that of adjacent Gondwana basin of the Damodar valley whereas the pattern of Coal Formation and sandstone dominated cycles of Barakar Coal measures are more characteristic of the Son valley belt. Because of the close similarity of its basinal history with that of the Damodar valley belt which is a major store house of CBM, it is logical to look for CBM potentiality in the virgin Tatapani-Ramkola Coalfield.

- Exploration in Barkagaon revealed the occurrence of twelve regional Barakar Coal seams at a depth of 300-750m and adsorption isotherms of coal show a sorption capacity of 6-8 m3/t of gas in the block. One CBM block is proposed to be offered in this coalfield.

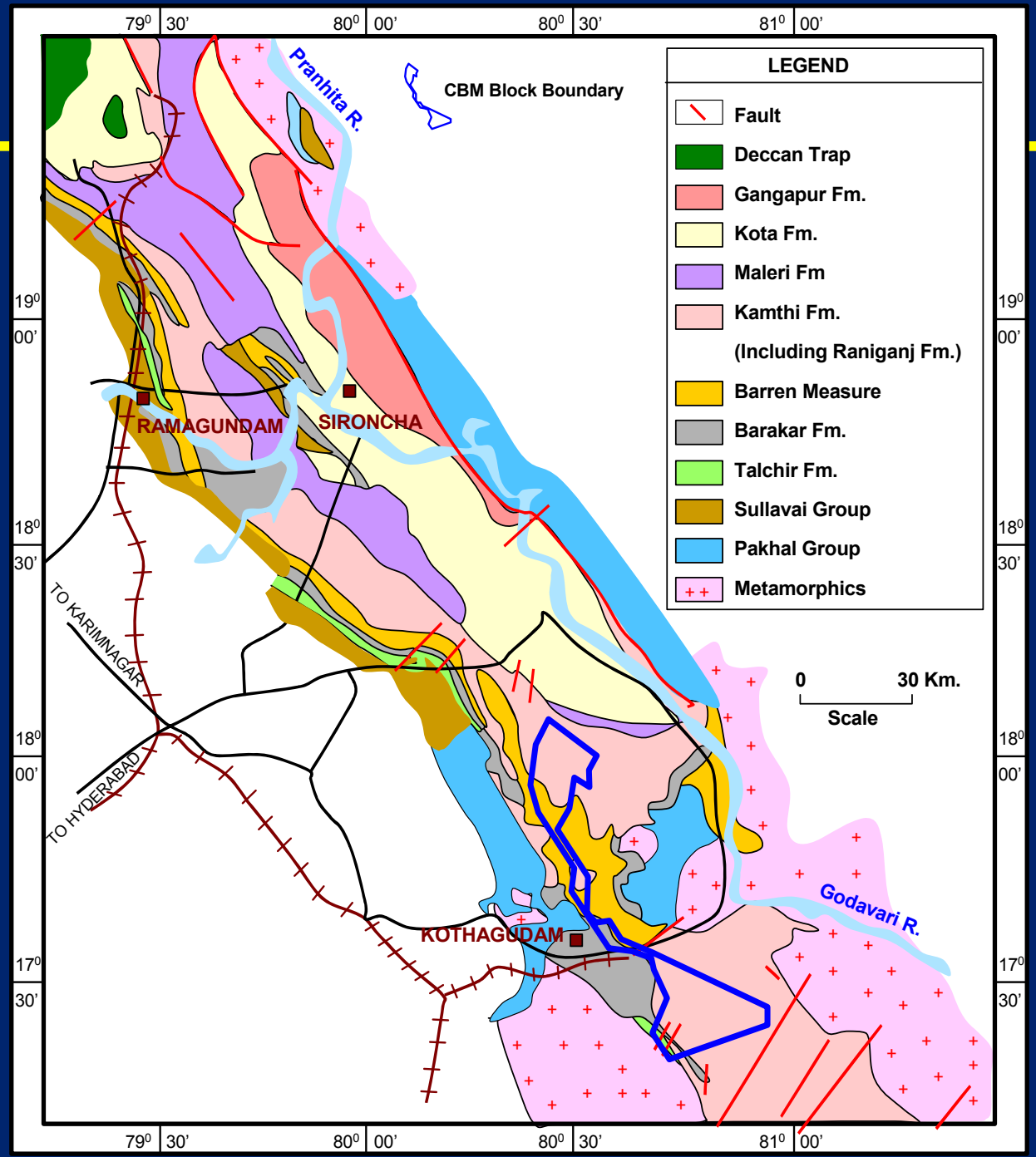
GEOLOGICAL MAP OF MAND-RAIGARH COALFIELD



GEOLOGICAL SETUP

MAND-RAIGARH COALFIELD:

- The Mand-Raigarh Coalfield occupies the central part of the upper Mahanadi valley Gondwana belt and extends over a large stretch lying between Ib valley in the east and Korba and Hasdo-Arand Coalfields in the west and north west. The Coalfield provides ample opportunity for exploring CBM in the deeper axial region of the basin. In the central part of the Coalfield where Barakar Coal measures lie at greater depth below the younger sediments a CBM block has been carved out.
- The cumulative Coal thickness in the CBM block varies from 30 to 35m with the increase of depth of burial the Coal seams are likely to store substantial amount of methane. (4.5-5.5 m3/t of gas)



GEOLOGICAL MAP OF GODAVARI VALLEY

GEOLOGICAL SETUP

SOUTHERN GODAVARI VALLEY COALFIELD:

- The Godavari valley Gondwana basin is a mosaic of main sub-basin in the north, Kothagudem sub-basin in the centre and chintalpudi sub-basin in the south. The Barakar Formation of Kothagudem sub-basin where a large part of the CBM block is located contains two Coal seams with cumulative thickness of about 30-40m. The coal of the Godavari CBM block belong to high volatile, Bituminious rank and hold on an area average 4-5m^3/t of gas at depth. One CBM block is proposed to offer in this coalfield.

INFORMATION AVAILABILITY

- Promotional "Road Shows" to be organized in January / February 2006 at USA, Canada, Australia, Russia, UK and India.

- All the road shows to be presided over by the Hon'ble Minister of Petroleum & Natural Gas, besides the senior officials of the Ministry of Petroleum & Natural Gas, Ministry of Coal and Directorate General of Hydrocarbons, Government of India.

- A brochure giving details on the blocks on offer, the Geographical Location on a map of India, the Terms & Conditions, Bid Format, a copy of the Modal CBM Contract and Price List will be made available free of cost.

- The Hard Copies & Digital Copies (on work stations) of the Basin Information Dockets and Data Packages will be made available for inspection at data viewing centers in India and abroad.

DEVELOPMENT OF CMM / AMM

DEVELOPMENT OF CMM / AMM

- AN IMPORTANT AREA OF CBM DEVELOPMENT IN INDIA IS THE RECOVERY OF COAL MINE METHANE (CMM) FROM OPERATIONAL MINES, DELINEATED MINING BLOCKS AND ABANDONED MINE METHANE (AMM) FROM DEPILLARED AND ABANDONED MINES WHICH CAN BE EASY SOURCE OF GAS STORAGE AND RECOVERY.

- THE MAJORITY OF CBM RELATED ACTIVITIES HAVE SO FAR BEEN TARGETED TO VIRGIN DEEP-SEATED HIGH RANK COALS WHERE NO MINING ACTIVITIES ARE CONTEMPLATED IN THE DISTANT FUTURE. A GREAT POTENTIAL EXISTS IN INDIA FOR EXPLOITATION OF CMM/AMM. CMM/AMM RESERVOIRS CONSIST OF GROUP OF COAL SEAMS THAT HAVE BEEN DE-STRESSED AND HAVE THEREFORE ENHANCED PERMEABILITY.

- ACCORDING TO PRELIMINARY ESTIMATES, A TOTAL OF 27000 SQ. KMS WITH 155 BILLION TONNES OF COAL RESOURCES ARE AVAILABLE FOR EXTRACTION OF CMM/AMM.

CONCLUDING REMARKS

WHY INDIA?

- India is set to emerge as one of the leading economies of the world in the next 2 decades.
- The country's GDP is expected to increase three fold by the year 2020
- Primary energy requirement would grow to be close to double the current level in order to fuel the needs of the growing economy.
- Excellent Geographical location

WHY INDIA?

- Large talent pool of Earth Scientists/Engineers emerging from Indian Universities
- Strong IT and Infrastructure virtually providing Global Access
- Strong growth Potential for E&P services.

CONCLUDING REMARKS

- Commercial exploitation of Coal Bed Methane (CBM) in India is no longer a myth but a reality
- The CBM gas flared in the test wells in Raniganj, Jharia and Sohagpur Coalfields in the eastern and central part of India bear ample testimony to the stories of success in the formative stage of CBM operation.
- India endowed with large resources base of coal and lignite contain sizable quantities of CBM gas. Initial test production in CBM fields of India shows encouraging results.
- India has adopted a time bound aggressive strategy for exploration and development of CBM.
- CBM an unconventional alternative source of natural gas has good future prospects in India.

Thank You