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(Part- I)

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STATE REVIEWS
(Assam)

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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ASSAM

Mineral Resources

Coal, petroleum & natural gas, limestone, fuller's earth, sillimanite and minor minerals are the chief mineral resources of the State. **Coal** occurs in Mikirs Hills, Dilli-Jeypore, Makum and Singrimari coalfields. Coal extracted from the State is friable and contains high sulphur. **Petroleum & natural gas** occurs in Digboi oilfields, Lakhimpur district and Moran and Rudrasagar oilfields in Sivasagar district located in Assam Arakan Fold Belt (AAFB), Upper Assam and Assam basins. **Limestone** occurs in Karbi Anglong, North Cachar Hills and Nagaon districts. Besides, **china clay** occurs in Karbi Anglong and Lakhimpur districts; **fireclay** in Dibrugarh, Karbi Anglong, North Cachar Hills and Lakhimpur districts; **fuller's earth** in Nalbari district; **granite** in Goalpara, Kamrup and Karbi Anglong districts, **iron ore (haematite)** in Kokrajhar district; **iron ore (magnetite)** in Dhubri, Goalpara & Kokrajhar districts; **quartz/silica sand** in Nagaon district, and **sillimanite** in Karbi Anglong & Nagaon districts (Tables - 1 and 2).

Exploration & Development

GSI carried out exploration for coal and tungsten in Assam during 2014-15 and the details of its activities are furnished in Table-3.

ONGC and OIL continued their seismic survey and drilling for exploration of petroleum & natural gas. Significant discoveries of oil/gas struck by OIL at various districts in Assam during 2014-15 are as below:

i) Nadua-1 (Loc. CH): The Well Nadua-1 is located in Nadua structure under Chabua PML and has been drilled down to 3,693 m to probe the hydrocarbon prospects within Paleocene-Eocene Formations. The Well has encountered a few prospective sand ranges within Paleocene-Eocene Formations and is presently producing oil from one of the tested sands. This discovery of oil has opened up new avenues for exploration and exploitation of hydrocarbon in Paleocene-Eocene Formations in Nadua and adjoining area.

ii) Rangmala-1 (Loc. TAJ): The Well Rangmala-1 is located in Balijan-II structure under Tinsukia PML and has been drilled down to 3,930 m to probe the hydrocarbon prospects within the Paleocene-Eocene Formations. The Well has encountered a few prospective sand ranges within Paleocene-Eocene Formations and is presently producing gas from one of the tested sands. The discovery of gas in this Well has opened up new avenue for exploration and exploitation of hydrocarbon within the Paleocene-Eocene Formations in Balijan-II and adjoining structures.

iii) Mechaki-3 (Loc. MKA): The Well Mechaki-3 is located in the West Mechaki structure under Mechaki Extension PML and has been drilled down to 5,636 m to probe the hydrocarbon prospects within Paleocene-Eocene Formations. The Well encountered a few prospective sand ranges within Paleocene-Eocene Formations and produced oil from one of the tested sand within Narpuh Formation. The discovery of oil in this Well has opened up new avenue for exploration and exploitation of hydrocarbon within the Paleocene-Eocene Formations in West Mechaki and adjoining area.

iv) NHK-616 (Loc. NLB): The Well NHK-616 is located in Balagaon Structure within Nahorkatiya Extension PML and has been drilled down to 3,005 m to probe the hydrocarbon prospects within the Barail and Tipam Formations. The Well has encountered a few prospective sand ranges within Barail Formations and one of the tested sands produced oil intermittently during testing. However, commercial oil production could not be sustained and the Well is presently kept shut-in.

v) NHK-466 (Loc. HHW): The Well NHK-466 is located in Langkasi area of Greater Jorajan Oilfield under Hugrijan PML and was drilled and

completed during year 1991. During 2014-15, oil has been discovered in new/unappraised Kopili sand through workover operations. The discovery of oil in this sand has opened up a new play for exploration and exploitation of oil in Kopili Formation of Langkasi and adjoining areas.

vi) Balimara-2 (Loc. BF): The Well Balimara-2 is located in Balimara structure under Borhat PEL and was drilled and completed during the year 2012. During 2014-15, oil has been discovered in new/unappraised Barail sand through work-over operations. The discovery of oil in the Barail Formation has opened up a new reservoir for exploration and exploitation of oil in Balimara and adjoining areas.

vii) Barekuri-2 (Loc. TR): The Well Barekuri-2 is located in the central part of Barekuri Structure under Tinsukia PML and was drilled and completed during the year 2005. During 2014-15, gas has been discovered in new/unappraised Narpuh sand through work-over operations. The discovery of gas in the Narpuh Formation has opened up a new reservoir for exploration and exploitation of oil in Barekuri and adjoining area.

viii) Hapjan-24 (Loc. HKC): The Well Hapjan-24 is located in the North Hapjan Structure under Hugrijan PML and was drilled and completed during the year 1993. During 2014-15, oil has been discovered in new/unappraised Narpuh-Barail sand through work-over operations. The discovery of oil in the Barail Extra Sand has opened up a new reservoir for exploration and exploitation of oil in Hapjan and adjoining area.

ix) Hapjan-28 (Loc. HNP): The Well Hapjan-28 is located in Hapjan area under Hugrijan PML and was drilled and completed during the year 1997. During 2014-15, gas/condensate has been discovered in one sand within Lakadong+Therria Formation through work-over operations. The discovery of gas/condensate has opened up a new reservoir for exploration and exploitation of gas in Hapjan and adjoining area.

x) Baghjan-7 (Loc. BGE): The Well Baghjan-7 is located in Baghjan Structure under Baghjan PML and was drilled and completed during the year 2008. During 2014-15, gas/condensate has been discovered from new/unappraised sand within Narpuh Formation through work-over operations. The discovery of gas in Narpuh Formation has opened up a new reservoir for exploration and exploitation of gas in Baghjan and adjoining area.

xi) Moran-78 (Loc. MBT): The Well Moran-78 is located in Moran area under Moran PML and was drilled and completed during the year 1981. During 2014-15, oil has been discovered in new/unappraised Barail sand through work-over operations. The discovery of gas in Barail Sand has opened up a new reservoir for exploration and exploitation of gas in Moran area.

Table – 1: Reserves/Resources of Coal as on 1.4.2015 : Assam

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**464.78**	**46.85**	**3.02**	**514.65**
Singrimari	-	4.13	-	4.13
Makum	432.09	20.70	-	452.79
Dilli-Jeypore	32.00	22.02	-	54.02
Mikir Hills	0.69	-	3.02	3.71

Source: *Coal Directory of India, 2014-15.*

Table – 2 : Reserves/Resources of Minerals as on 1.4.2010/1.4.2013* : Assam

Mineral	Unit	Reserves				Remaining Resources								
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total Resources (A+B)
			STD121	STD122			STD221	STD222						
China Clay#	'000 tonnes	-	-	-	-	-	131	-	392	-	3520	-	4043	4043
Fireclay#	'000 tonnes	-	-	-	-	-	-	-	-	-	3161	-	3161	3161
Fuller's earth	tonne	-	-	-	-	-	-	-	-	-	18860000	-	18860000	18860000
Granite (Dim. stone)	'000 cum	-	-	-	-	-	-	-	-	800	583150	-	583950	583950
Iron Ore* (Haematite)	'000 tonnes	-	-	-	-	-	-	-	-	8600	4000	-	12600	12600
Iron Ore* (Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	-	15380	-	15380	15380
Limestone	'000 tonnes	183788	152562	-	336350	10902	9828	4257	154644	34200	897161	-	1110992	1447342
Quartz-silica sand#	'000 tonnes	-	-	-	-	-	-	-	-	-	1790	-	1790	1790
Sillimanite	tonne	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700

Figures rounded off.

** Reserves/Resources as on 1.4.2013.*

 # Declared as minor mineral vide Gazette notification dated 10.02.2015.

Note: The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2015 are 169.42 million tonnes and 151.40 billion cu m, respectively.

Table – 3 : Details of Exploration Activities in Assam, 2014-15

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Coal							
Dhubri (Singrimari coal field)	In and around Phatapara area in the down dip extension of Sukchar-Singrimari area	1:10000	2	2	715	-	Regional exploration for Gondwana coal was carried out at the border of Assam and Meghalaya (G3). Large Scale Mapping was carried out in and around Khopati-Baratila area, which is totally covered by alluvium. During the period under review, a total of 715 m was drilled in two boreholes, viz. SP-01 and SP- 02 in Phatapara area. Lower Barakar Formation (so called Karharbari Formation) lies unconformably over Precambrian gneissic basement and covered with a thick veneer of alluvium at the top. Lower Barakar Formation is coal bearing, consisting of assemblage of gritty quartzose, coarse to medium-grained sandstone, grey micaceous shale, grey mudstone, carbonaceous shale and coal. Sandstone is mineralogically mature, showing moderate to poor textural maturity and poor sorting. Several pebbly sandstone horizons made up of large angular fragments of feldspars, clasts of shale, gneissic rocks and sub-rounded to highly angular quartz set in a quartzo-feldspathic matrix have been intersected in the two boreholes. These horizons are generally associated with minor post and syn-sedimentary faults, fractures and slickensides. Borehole SP-01 has reached a depth of 340.00 m and intersected Lower Barakar Formation. One coal seam of 0.74 m thickness has been intersected at a depth of 214.26 m. The second Borehole SP-02 has been closed on 17.03.15 at a depth of 375.00 m within basement metamorphics. Three coal seams of 1 m, 5.45 m and 4.79 m thickness have been intersected at depths of 108.63 m, 191.73 m and 290.51 m respectively. Cumulative coal thickness is 11.24 m, which is, so far, the maximum thickness of coal recorded from a single borehole in Singrimari Coalfield since commencement of regional exploration in 1985-86. Coal samples have been sent for chemical analysis and coal petrographic study.
Dhubri (Singrimari coal field)	Adjacent to Sukchar-Singrimari area	-	-	1	188.55	-	Regional exploration for Gondwana coal was carried out at the border of Assam & Meghalaya (G3) (spill over item). A total meterage of 185.55 m was drilled in one borehole (SK-02 part) during F.S. 2014-15. Two thin coal bands ranging in thickness from 0.70 m (SK-02) to 0.90 m (SK-01) have been intersected within a depth range from 109.00 m (SK- 01) to

(Contd.)

Table – 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							254.60 m (SK-02). These coal seams are associated with carbonaceous shale-grey shale-mudstone intercalation. The recovery in coal-carbonaceous shale zones is very poor due to technical drilling difficulties. Proximate analysis show Moisture (1.55-7.91%), Ash (62.00%), Volatile Matter (15.46- 23.57%) and Fixed Carbon (6.52-20.99%). Ultimate analysis reveals Carbon (17.33-26.44%), Nitrogen (1.12-1.40%), Hydrogen (2.07-2.62%), Sulphur (2.34-2.92%), and Oxygen (16.5-26.14%). Overall analysis of the samples indicate Ash + Moisture content varying from 63.55% to 69.91% revealing that the samples are carbonaceous shale in nature. Coal petrographic study also reveals that the samples are of carbonaceous shale in nature with 70-88.88% of total shale + Mineral matter. Liptinite (8.0%) and Vitrinite (3.12-7%) are the main macerals present with inertinite (0-15%) present only in trace amounts. The sample has a R_0 range from 0.59- 0.40% with R_0 mean value of 0.46%. Therefore, from the borehole record, it may be inferred that the development of coal seams towards down dip direction of the earlier explored Sukchar-Singrimari area is significant. This finding has further strengthened the possibility of occurrence of potential coal seams in the northern deeper part of the basin. Therefore, from the borehole record, chemical and petrographic analysis of coal, it may be inferred that the development of coal seams towards northern side of the earlier explored Sukchar- Singrimari area is not significant.
Tungsten							
Bongaigaon, Dhubri and Kokrajhar	Chakrashila, Nadangiri and Bhumeswar area	-	-	-	-	-	G4 stage investigation was taken up for search of W, Sn & REE. The mapped area Chakrashila (T.S. No-78J/7) is occupied by the Precambrian basement gneissic complex and Quaternary alluvial sediments. The Precambrian basement gneissic complex is exposed in the isolated hillocks and comprises banded magnetite quartzite (BMQ), amphibolite, garnetiferous actinolite-tremolite schist, muscovite schist, augen-gneiss, quartzo-feldspathic gneiss, massive granite, lepidolite bearing pegmatite and thin pegmatite and quartz veins. The rocks at places are intruded by basic intrusive of doleritic composition. The PCS and BRS samples collected from the lepidolite-

(Contd.)

Table – 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							bearing pegmatite has been analysed by XRF and show a higher value of 15,337 ppm of Rb and 943 ppm of Y (Yttrium). ICPMS study of these samples show a high value of 287 ppm of Tantalum and 338 ppm of tin. The investigation will continue in FS 2015-16.
Tungsten							
Goalpara	Satali, Surya Pahar, Pancharatna, Bamundanga, Nalanga and Pandaba	-	-	-	-	-	A G4 stage investigation was taken up for search of W, Sn & REE. Most promising areas at Pandaba Pahar and Panchratna Hill were taken up for detalied mapping. Porphyritic granite is major lithounit. At places, sulphide mineralisation in disseminated form represented by pyrrhotite, azurite and bornite was reported. Pandaba Pahar consists of granite gneiss. Sulphide mineralisation, bornite, azurite and pyrrhotite are noticed in all the lithounits but are more prominent in veins of aplitic composition. Analytical results of the samples so far received are not encouraging. The investigation has been completed.

Production

The value of mineral production (excludes atomic mineral and value for February and March in respect of 31 minerals declared as minor minerals vide Gazette notification dated 10.02.2015) in 2014-15 in Assam at ₹ 10,989 crore decreased by 3% as compared to that in the previous year. Assam contributed about 4% to the total value of mineral production in the country during 2014-15. Petroleum (crude) was the principal mineral produced in the State followed by natural gas (utilised) with share of 74% and rest was accrued from coal, minor minerals and limestone in 2014-15 (Table-4).

Assam was the second largest producer of natural gas (utilised) and fourth largest producer of petroleum (crude) accounting for about 9% and 12% respectively in the total production of respective mineral items in the country. During 2014-15, the production of limestone increased to more than double and that of sulphur by 17% and coal by 14% while that of petroleum (crude) decreased by 5% as compared to the previous year.

The value of production of minor minerals was estimated at ₹ 31 crore for the year 2014-15.

The number of reporting mines in 2014-15 was six same as in the previous year.

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, as per the available information, the principal mineral-based industries in the organised sector in the State are furnished in Table - 5.

Table – 4 : Mineral Production in Assam, 2012-13 to 2014-15 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2012-13			2013-14			2014-15 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**9**		**116458740**	**6**		**113083701**	**6**		**109887663**
Coal	'000t	6	600	3591200	4	700	3392900	4	800	3819900
Natural Gas (ut.)	m c m	-	2910	24066072	-	2868	23718727	-	2958	24463039
Petroleum (crude)	'000t	-	4863	88388784	-	4710	85607891	-	4466	81173002
Limestone	'000t	3	384	98879	2	203	50378	2	665	117917
Sulphur[#]	t	-	3706	-	-	4950	-	-	5803	-
Minor Minerals[@]		-	-	313805	-	-	313805	-	-	313805

Note : The number of mines excludes petroleum (crude), natural gas (utilised) and minor minerals.
 # Recovered as by-product from oil refinery.
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table – 5 : Principal Mineral-based Industries in Assam

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Assam Roofing Ltd, Bonda, Distt. Kamrup.	58.4
Cement	
Barak Valley Cements Ltd, Jhoom Basti, Badarpurghat, Distt. Karimganj.	750 (TPD)
Calcom Cement (Dalmia Subsidiary), Distt. Nagaon.	1720
CCI Ltd, Bokajan, Distt. Karbi Anglong.	200
Cement Manufacturing Co. Ltd, Chamata Pathar, P. O. Sonapur, Distt. Kamrup (G).	1800
Purbanchal Cement, Vill. Sarutari, Distt. Kamrup.	360
Fertilizer	
Assam State Fertilizer & Chemicals Ltd, Chandrapur, Distt. Kamrup.	33 (SSP) 16.5 (H_2SO_4)

(Contd.)

Table – 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Brahmaputra Valley Fertilizers Corpn. Ltd, Namrup (Namrup II & III), Distt. Dibrugarh.	555 (Urea)
Progressive Fertichem Pvt. Ltd, Topatoli, Kamrup.	45 (SSP)
Iron & Steel	
Shri Ganapati Ispat Pvt Ltd, Tinsukia.	NA
Petroleum Refinery	
Indian Oil Corporation, Bongaigaon.	2350
Indian Oil Corporation, Moonmati, Guwahati.	1000
Indian Oil Corporation, Digboi.	650
NRL, Numaligarh, Golaghat.	3000

Note: *Data, not readily available for fertilizer and cement industries on respective websites, hence it has been taken from Indian Fertilizer Scenario, 2015/FAI Statistics, 2014-15 and Survey of Cement Industry & Directory, 2015 respectively.*