Indian Minerals Yearbook 2021

(Part- I)

60th Edition

STATE REVIEWS (Arunachal Pradesh)

(ADVANCE RELEASE)

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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ARUNACHAL PRADESH

Mineral Resources

The most important mineral resource of the State is **petroleum & natural gas** and its chief occurrence is reported in Ningru and Dam Duma areas. These hydrocarbon deposits are located in the Assam Arakan Fold Belt (AAFB) and Upper Assam basin in the State. The State also reports resources of **coal** in Namchick Namphuk and Miaobum Coalfields; **Copper** in East Kameng district, **dolomite** in West Kameng district; **fuller's earth** in Tirap district; **graphite** in Lohit, East Siang and Upper Subansiri districts; **limestone** in Dibang Valley, Lohit, East Siang and Upper Subansiri districts and **quartzite** in West Kameng district (Tables-1 and 2).

Exploration & Development

Exploration activities carried out by GSI for REE, copper, gold and vanadium during the year 2020-21 are furnished in Table-3.

Production

Petroleum (crude) and Natural gas (ut.) were the important minerals produced in Arunachal Pradesh. The value of minor minerals' production was estimated at ₹ 40 crore for the year 2020-21 (Table - 4).

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020 : Arunachal Pradesh

Mineral	Unit	Total Reserves (A)	Remaining resources				Total resources (A+B)
			Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
Copper							
Ore	'000 tonnes	-	-	-	10	10	10
Metal	'000 tonnes	-	-	-	0 .02	0.02	0.02
Graphite	tonne	-	-	3200000	73118257	76318257	76318257
Limestone	'000 tonnes	-	49220	433575	1	482796	482796

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2021: Arunachal Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**31**	**40**	**19**	**90**
Namchik-Namphuk	31	40	13	84
Miao Bum	–	–	6	6

Source: *Coal Directory of India, 2020-21.*

Table – 3 : Details of Exploration Activities in Arunachal Pradesh, 2020-21

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Rare Earth Element (REE) and rare metal							
Papum Pare	Lodoso East block,	1:2000	-	-	-	40	Preliminary Exploration for REE and associated precious and base metal in Lodoso East Block, Papum Pare District, Arunachal Pradesh (G3): Detailed geological mapping was carried out on 1:2000 scale with an objective to delineate REE-bearing zones. A mineralised zone 1000 m in strike length with 30m to 40m outcrop thickness was delineated. The zone was confined within Garnetiferous–quartz–biotite schist of Khetabari Formation. The samples collected from the respective zone yielded max 3.0% REE as a channel sample, 4,808 ppm value of REE with wt. Avg. value of about 2,385 ppm from a 10 m long trench sample, 1.3% max. value of REE with wt. Avg. value of about 0.69% from a 05 m long trench sample. About 23 pit samples out of 40 samples collected from the area yielded TREE values >0.2% with maximum of 2.0%TREE. Apart from REEs, encouraging values of Copper up to 2,790 ppm (max.) and Au value of 280 ppb (max.) were also reported. All the samples from mineralised zone yielded high Fe_2O_3% ranging from 32 to 82% along with anomalous P_2O_5% (up to 1.56%). REE-bearing mineral phases like monazite, allanite, xenotime, zircon, thorite, scheelite and euxenite were identified in EPMA analysis. Peaks of elements viz. lanthanum, cerium, neodymium, dysprosium, yttrium, tungsten, tantalum, antimony, lead, silver & tin were also identified during scanning electron microscopy (SEM) studies.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Garphite							
West Kameng	Kalaktang-Amatulla	1:12500	50	-	-	-	Reconnaissance survey for graphite and vanadium mineralisation in Kalaktang-Amatulla area, West Kameng district, Arunachal Pradesh (G4) was carried out. A total of 50 sq. km were covered by large-scale mapping on 1:12500 scale. Near Village Paljor , a 50-60 m thick band of carbonaceous shale alternating with siliceous sandstone was mapped with steep dips on either sides. Near 900 chain PWD Camp, a 180–200 m thick band of interbanded dark grey phyllite and carb phyllite was mapped for a strike length of about 1.5 km. The available chemical results did not show promising values of vanadium, graphite and base metals but the silica values obtained from quartzite sample were >90%.
West Siang	Kalamati area	1:2000	-	-	-	-	Reconnaissance survey for graphite and vanadium mineralisation in Kalamati area, West Siang district, Arunachal Pradesh (G4) was taken up. On the basis of detailed mapping on 1:2000 scale, a carbonaceous phyllite band was identified and delineated with variable exposure thickness of 250 to 370 m having strike extension up to 700 m in Kalamati area and one carbonaceous phyllite band with exposure thickness of about 7 m having 170 m strike length in Yomgam area. Samples from carbonaceous phyllite of Kalamati area showed vanadium values up to 3,105 ppm with Fixed Carbon up to 8.6 %. Analytical results showed Zn values up to 3,017 ppm and Ni upto 788 ppm. The carbonaceous phyllite showed a positive correlation with vanadium, which increased with the increase of Fe_2O_3. Similarly, Zn also showed a positive correlation in the carbonaceous phyllite.

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Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Subansiri	Radhpu block	-	-	-	-	-	Preliminary exploration for graphite and vanadium mineralisation in Radhpu block, Lower Subansiri district, Arunachal Pradesh (G3) was taken up. A cumulative strike length of 3,300 m of carbonaceous phyllite bands was demarcated having a variable thickness ranging between 5 m and 25 m. The western carb phyllite extending for 850 m was delineated having variable thickness of 8 m to 25 m. The eastern crab phyllite band with a cumulative strike length of 2,450 m was delineated having variable thickness between 5 m and 15 m. Carbonaceous phyllite was characterised by high carbon content ranging from 4.39% to 16.69% and vanadium value ranging from 525 ppm to 2,820 ppm. The vanadium mineralisation in the area was considered as strata bound bedded deposit.
Gold							
West Siang	Siyom Valley	1:12500	50	-	-	-	Reconnaissance survey for Orogenic Gold mineralisation in Siyom Valley, West Siang District, Arunachal Pradesh, with aid of large-scale mapping (1:12500 scale) over an area of 50 sq. km. Two bands of sulphide mineralisation along quartz veins within the gneisses was delineated in the area. Band-I was about 200–300 meters in strike length with a thickness of 20-30 meters. Band-II was 10-20 m with strike extension of approximately 100 m. The quartz veins running parallel to the S_1foliation were sulphide enriched with mineralisation in the form of pyrite, chalcopyrite and arsenopyrite. Chemical results show tungsten value ranging from 303–511 ppm. The values for LREE ranged from 28–136.9 ppm and HREE ranged from 10.5–20 ppm. TREE ranged from 39–155 ppm. However, chemical analysis did not show encouraging values for gold as values were in range from 50–112 ppb.

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Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
West Siang	Siyom Valley	1:12500	50	-	-	-	Reconnaissance survey for orogenic Gold mineralisation in upper reaches of Siyom valley, West Siang district, Arunachal Pradesh: A Large-scale Mapping (1:12500) was carried out for an area of 50 sq. km. The garnetiferous mica schist exposed towards Manigong as well as Village Tadadege was generally oxidised imparting yellowish-orange colour to the surface. Marble was recorded with unmappable unit of graphitic schist body towards South of village Shiet which was found to be oxidised. A 25–30m thick banded magnetite quartzite was also recorded in the area. Samples of magnetite band yielded 27.71% to 52.21% of Fe_2O_3 and samples from garnetiferous mica schist yielded tungsten values ranging from 135.26 to 521.21 ppm.
Lower Subansiri	Phop area	1:2000	1	-	1000	-	Preliminary exploration for gold, molybdenum, vanadium and associated minerals in Phop area, Lower Subansiri district, Arunachal Pradesh was taken up with detailed mapping of 1 sq. km area on 1:2000 scale along with 1000 m drilling. The area was seen covered by meta-sedimentary rocks of Khetabari Formation of Bomdila Group. Late granitic, quartz and calcite veins were observed to have intruded in the rocks. Limonitisation and ferruginisation have commonly occurred along these veins, developed as a result of weathering of sulphides. Sulphides, mainly pyrite and pyrrhotite, in disseminated form were also observed in marble bands and grey quartzite. Banded magnetite quartzite along with bands of carbonaceous phyllite were studied for possible gold and vanadium–molybdenum mineralisation respectively. Banded magnetite quartzite in the study area extended for about 400 m along NE-SW strike with thickness up to 17 m. Four carbonaceous phyllite bands were also delineated in the area. (contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							about 2 km (approx) in NE-SW direction and width of about 500-600 m. Sulphide mineralisation occured in the form of pyrite, pyrrhotite, chalcopyrite and bornite in quartz-mica schist and augen gneiss occurring as dissemination, along foliation / fractures and also within quartz veins in Tashi, Laptap and Chiputa areas. Analytical results of surface bedrock samples from the mafic unit show vanadium values in the range from 593 to 904 ppm, Cr values from 427 to 715 ppm and Sn from 275 to 663 ppm in Geram area. Samples from augen gneiss near Laptap area showed 1,050 ppm of Cu. In Tashi area, samples from mafic band within augen gneiss showed 2,442 ppm of V, 438 ppm of Cr and 547 ppm of W. Sample from garnetiferous quartz-mica schist with quartz veins near Tashi village showed 4,700 ppm of Cu.
Copper, Molybdenum, and associated minerals							
Dibang Valley	Angolin–Etalin area	1:12500	-	-	-	-	Reconnaissance Survey for copper, molybdenum and associated minerals was carried out in Angolin–Etalin area, Dibang Valley district, Arunachal Pradesh (G4): LSM of a 50 sq km block on 1:12500 scale was carried out. Direct surface manifestation of copper, molybdenum mineralisation was evidenced from the malachite staining and direct visual perception of

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							molybdenite crystals in the form of veins within the pegmatites, quartz veins within the calc-silicate rock found at contact of granodiorite and amphibolite. Presence of sulphides was also seen in some parts of the amphibolites also. Chemical analyses of samples were awaited for the detailed geochemical study. One out of the received sample results had value of copper of 7,722 ppm.
Copper, Gold, Silver, and associated minerals							
Papum Pare	Khyate-Parang area	1:12500	50	-	-	-	Reconnaissance survey for copper, gold, silver and associated minerals was carried out in the meta-sedimentary sequence of Bomdila Group in Khyate-Parang Area, Papum Pare District, Arunachal Pradesh (G4): LSM of 50 sq km on 1:12500 scale along with pitting/trenching and other sampling was carried out. Two sulphide -bearing mineralised zones were delineated in the area. These zones were located south of Khyate, along the Gotopu–Khyate section. The zones extended for about 20–50 m each along the strike continuity and were discontinuous in nature. Sulphide mineralised zone, SZ-I strikes NE-SW over a width of about 30 m. The host rock in this zone was siliceous phyllite with bands of chloriteamphibole schist. One

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Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							3 m thick band of chlorite-amphibole schist on the southern end of the zone host the main mineralisation. SZ-II had a strike of NE-SW and appeared as lensoidal body with a width of 5 m. The outcrop was highly limonitised and ferruginised. Mineralisation was seen hosted within the amphibole schist and quartz vein. The quartz vein 1–1.5 m wide. In the SZI, 2 trenches and channel each were made. Cu values range from 10 ppm to 445 ppm in Trench no. 1and 30 ppm to 150 ppm in Trench no. 2. Channel no.1A yielded 35 to 275 ppm Cu. In SZ-II, one trench and channel each were made which sampled 25 to 175 ppm Cu from the trench samples and 2,500 to 1,1000 ppm Cu, 170 to 1,300 ppm Zn from the channel samples. One BRS sample from the sulphide-rich quartz vein from this zone also yielded 15,000 ppm Cu. The amphibolite rocks sampled from channel samples yielded 16.04 % to 49.01% of Fe_2O_3.
Basemetal, Graphite and associated minerals							
Dibang valley	Anelih-Endolin area	1:12500	50	-	-	-	Reconnaissance survey for Base metal, graphite and associated minerals in Isholin–Anelih–Endolin area, Dibang Valley District, Arunachal Pradesh (G4): LSM on 1:12500 scale was carried out for 50 sq km in the study area. The litho-package in the mapped area consisted mainly Tiding

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Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							Formation and Lohit Granitoids complex. The chemical analysis of bedrock samples of graphitic marble showed presence of CaO ranging from 50.5 to 55.04 % and fixed carbon up to 27.62%. The chemical analysis of bedrock samples of hornblende schist showsed presence of Cr, ranging up to 1,699 ppm. The samples from a channel cut across the litho-package of carbonaceous phyllite, amphibole - bearing chlorite schist and graphitic marble has showed Cr value 2,864 ppm and Ni values at 1,285 ppm. The Au concentration for the samples in the area ranged from 100 – 180 ppb. Also, one PCS sample has yielded Cu value of 12,985 ppm. The chemical analysis of stream sediment samples shows presence of Au ranging from 50–220 ppb. The chemical analysis of trench samples showed presence of Cr ranging from 1317–2,027 ppm, Zn value of 900 ppm and Cu values up to 740 ppm with an anomalous value of 11,439 ppm for Cu in Bedrock samples.
REE and associated precious and base metals							
Papum Pare	Lodoso East Block	1:2000	01	-	-	-	Preliminary Exploration for REE and associated precious and base metal in Lodoso East Block, Papum Pare District, Arunachal Pradesh (G3): The work component included detail mapping of 01 sq km area on 1:2000 scale with 1000 m of (contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							drilling, 100 cu. m of pitting/ trenching, collection of 50 BTS, 10 OM, 30 SS and 10 A samples for EMPA analysis to evaluate the occurrences and potential of REE and associated base metal mineralisation in the area. Gossanous zone was the first indication of major mineralised body present in heavily forested areas of the block. Prominent sponge style iron dominant limonitic gossan was a part of surface expression of high sulphidation system present within the garnetiferous biotite quartz schist of Bomdila Group. The particular mineralised zone, approximately 1,000 m in strike length with outcrop thickness of about 30 m to 40 m was observed and mapped accordingly. It was composed of mixture of goethite, magnetite and heamatite along with different oxides. Dendritic-shaped native copper, magnetite, brochantite and pyrite were some of the ore minerals present and observed in the respective zone of interest.The samples collected from the respective mineralized zone yielded max. 3% tREE as a channel sample, 4,808 ppm value of tREE with avg. value of about 2,385 ppm from trench sample, Cu value of 1,620 ppm, Au value of 120 ppb from spot samples.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Vandium and associated minerals							
Subansiri	Saiya area	1:2000	01	-	-	-	Preliminary exploration for vanadium and associated minerals around Saiya area, Lower Subansiri District, Arunachal Pradesh (G3): The work component under the investigation included detailed mapping of 1 sq km area on 1:2000 scale with 50 m^3 of pitting/trenching. In the DM block, vanadium mineralisation and fixed carbon values were seen hosted in carbonaceous phyllite/schist bands, and accordingly, they were mapped and sampled. A cumulative strike length of 2,650 m of carbonaceous phyllite bands was confirmed having a variable thickness ranging from 20-200 m. The individual thickness for each inter bands of carbonaceous phyllite count for more than 40 –50 m and inferred cumulative thickness based on pitting in black soil and discrete outcrops, is more than 200 m. The vanadium mineralisation in the area was considered as strata bound bedded deposit with tabular geometry. Initial chemical results indicate vanadium values ranging from 978 ppm to 5,851 ppm and Fixed Carbon values from 10.96% to 11.48%.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Vandium, Graphite, Gold and associated minerals							
Dibang Valley	Pyunli, Yachambra & Kano	1:12500	50	-	-	-	Reconnaissance Survey for Vanadium, Graphite, Gold and associated minerals in Pyunli, Yachambra and Kano villages, Lower, Dibang Valley district, Arunachal Pradesh (G4): LSM on 1:12500 scale was carried out of an area of 50 sq km in Pyunli, Yachambra and Kano area. The area comprised mainly of chlorite schist, carbonaceous phyllite, magnesite, marble, mica schist, garnetiferous amphibolite schist of Tidding Formation and biotite gneiss, orthoquartzite and amphibolite of Ithun Formation. Peridotite which belonged to the Mayudia Ultramafic Complex was also observed in the area of investigation. Greenish coloured, medium to coarse-grained peridotite body was encountered which gave soapy feeling on rubbing. Two samples of peridotite body yielded a value of 46.59% and 44.93% of MgO; 1,118 ppm and 2,469 ppm of Cr and 2191 ppm and 2,235 ppm of Ni. A band of garnetiferous amphibolite schist was also recorded which was grayish-black, medium grained foliated rock consisting of\ biotite, hornblende, muscovite, garnet and quartz. Garnet grains varied in size from <5 to 10 mm.

Table-4 : Mineral Production in Arunachal Pradesh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value[$]	No. of mines	Quantity	Value[$]	No. of mines	Quantity	Value[$]
All Minerals				**464903**			**455845**			**397944**
Natural Gas (ut.)	m cu. m		28	-		45	-		56	-
Petroleum (crude)	'000t		43	-		56	-		54	-
Minor Minerals			-	464903		-	455845		-	397944

$ Excludes the value of Fuel minerals.