Indian Minerals Yearbook 2020

(Part- I)

59th Edition

STATE REVIEWS (Arunachal Pradesh)

(ADVANCE RELEASE)

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INDIAN BUREAU OF MINES

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October, 2022

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 2019-20 are furnished in Table-3.

Production

Petroleum (crude) and natural gas (utilised) were the important minerals produced in Arunachal Pradesh. The value of minor minerals production was estimated at ` 46 crore for the year 2019-20 (Table - 4).

Table – 1 : Reserves/Resources of Minerals as on 1.4.2015 : 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	-	-	-	0 .02	0.02	0.02
Metal	'000 tonnes	-	-	-	10	10	10
Dolomite#	'000 tonnes	-	204	77633	-	77837	77837
Fuller's earth##	tonne	-	10700	20000000	-	20010700	20010700
Graphite	tonne	-	-	-	72758257	72758257	72758257
Limestone	'000 tonnes	-	49220	433575	1	482795	482795
Quartzite#	'000 tonnes	-	-	5270	-	5270	5270

Figures rounded off.

Note: *The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2019 in the State are 3.36 million tonnes and 63.57 billion cu. m. respectively.*

 # Declared as Minor Mineral vide Gazette Notification dated 10.02.2015.

##: Minor Mineral before Gazette Notification dated 10.02.2015.

Table – 2 : Reserves/Resources of Coal as on 1.4.2020: Arunachal Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**31.23**	**40.11**	**18.89**	**90.23**
Namchik-Namphuk	31.23	40.11	12.89	84.23
Miao Bum	–	–	6.00	6.00

Source: *Coal Directory of India, 2019-20.*

Table – 3 : Details of Exploration Activities in Arunachal Pradesh, 2019-20

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)							
Papum Pare	Lodoso East block,	1:2000	1.0	-	1000.0	100	Preliminary exploration (G3) for REE and associated precious & base metal was carried out by detail mapping of 1.0 sq km area on 1:2000 scales with 1,000.0 m of drilling, 100.0 cu. m of pitting/trenching and collection of 100 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 forest areas of the block. The particular mineralised zone is about 1,000 m in strike length with outcrop thickness of about 30 m to 40 m was noticed in the study area. Dendritic shaped native copper, magnetite, brochantite and pyrite were some of the minerals recorded in the zone of interest. The samples collected from the mineralised zone yielded maximum 3% REE in channel sample, 4,808 ppm value of REE with avg. of about 2,385 ppm from trench sample, Cu value of 1,620 ppm, Au value of 120 ppb from spot samples.
Vanadium							
Subansiri	Saiya area	1:2000	1.0	-	-	-	Preliminary exploration (G3) for vanadium and associated minerals was carried out by detailed mapping of 1.0 sq km area on 1:2000 scales with 50 cu. m of pitting/trenching.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							In the study block, vanadium mineralisation and fixed carbon values were seen hosted in carbonaceous phyllite/ schist bands. A cumulative strike length of 2,650 m of carbonaceous phyllite bands with thickness ranging between 20-200 m has been confirmed in the mapped area. The vanadium mineralisation in the area has been considered as strata bound bedded deposit. Initial chemical results indicated vanadium values ranging from 978 ppm to 5,851 ppm and Fixed Carbon values from 10.96% to 11.48%.
Vanadium, Graphite, Gold & associated minerals							
Dibang valley	Pyunli, Yachambra & Karo	1:12500	50.0	-	-	-	Reconnaissance survey (G4) for vanadium, graphite, gold and associated minerals in this area was carried out. An area of 50.0 sq km was mapped on 1:12500 scale. Two samples of peridotite body yielded MgO values of 46.59% & 44.93% of ; 1,118 ppm & 2,469 ppm of Cr and 2,191 ppm & 2,235 ppm of Ni.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Gold, Molybdenum, Vanadium and associated minerals							
Subansiri	Phop area	1:2000	1	-	-	-	Preliminary exploration for gold, molybdenum, vanadium and associated minerals was carried out in Phop area of Lower Subansiri District of Arunachal Pradesh (G3) Detailed mapping (1:2000 scale) over an area of 1 sq km along with systematic drilling was conducted. The banded magnetite quartzite and carbonaceous phyllite was targeted for gold, vanadium and molybdenum mineralisation, respectively. Banded magnetite quartzite in the study area was found to extend for about 400 m along NE-SW strike. Width of the band varied from 6 m in the east to 17 m in the west. In Borehole ARLSP-01, the banded magnetite quartzite was intersected from 74 to 81 m along the length of the hole. Zone of sulphide mineralisation associated with granitic and calcite vein was intersected from 51 m to 59 m along the length of the borehole. Out of the four carbonaceous phyllite bands mapped in field, the southern band was found to be consistent and was seen extending for a strike length of 250 m. Width of the band varied from 10 m in the east to 17 m in the west.
Copper, Gold, Silver and associated minerals							
Papum Pare	Dedollo Block	1:2000	1.8	-	-	-	Preliminary investigation for copper, gold, silver and associated minerals was carried out in the Dedollo Block, Papum Pare District 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		
							Arunachal Pradesh (G3) Detailed mapping of 1.8 sq km on 1:2000 scale was carried out. Mineralisation was found to occur in quartz mica phyllite, quartz mica schist, biotite schist and also in granitic gneiss. The mineralised zone is well-exposed in the east of Dedollo along the road section with strike length of 360 m trending NE-SW, dipping moderately towards north-westerly position. Sulphide-bearing biotite schist, quartz mica phyllite plus malachite and quartz vein associated with sulphide within gneiss in sheared contact forms the mineralised zone. Two zones of 30 m and 12 m were observed on the road section east of Village Dedollo . Malachite and azurite stain were observed in quartz mica phyllite, biotite schist and also in quartz vein within sheared granitic gneiss. Analytical results received showed Cu to be 3,056 ppm and 1,401 ppm for BRS-47 and BRS-48 respectively, while other samples showed values less than 1,000 ppm.
Copper, Cobalt and associated minerals							
Papum Pare	Phop area	1:2000	-	-	-	-	Reconnaissance Survey for copper, cobalt and associated minerals in Balapu–Niyamlo area, Papum Pare district, Arunachal Pradesh (G4): The survey was carried out to delineate copper and associated mineralisation. A mafic rock unit with sulphide mineralisation was identified in Kheel-Geram area, having a strike length 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		
							about 2 km (approx.) in NE-SW direction and width of about 500~600m. Sulphide mineralisation was found occur in the form of pyrite, pyrrhotite, chalcopyrite and bornite in quartz-mica schist and Augen gneiss was seen 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 showed 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 Village Tashi shows 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 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 further detailed geochemical study. One out of the received samples results showed value of copper at 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 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 were found extending for about 20~50 m each along the strike continuity and were discontinuous in nature. Sulphide mineralised zone, SZ-I with strikes towards NE-SW was over a width of about 30 m. The host rock in this zone was siliceous phyllite with bands of chloriteamphibole schist. (contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							One 3 m thick band of chlorite-amphibole schist on the southern end of the Zone hosts the main mineralisation. SZ-II was seen with strike of NE-SW and appeared as lensoidal body with a width of 5 m. The outcrop was seen as highly limonitised and ferruginised. Mineralisation was found hosted within the amphibole schist and quartz vein. The quartz vein quartz vein was noted as 1~1.5 m wide. In the SZ-I, 02 trenches and channel in each were made. Cu values ranged from 10 ppm to 445 ppm in Trench no. 1, and 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 were made and sample collected showed 25 to 175 ppm Cu and 2,500 to 11,000 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 of Tiding (contd)

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 showed presence of Cr ranging up to1,699 ppm. The samples from a channel cut across the litho-package of carbonaceous phyllite, amphibole-bearing chlorite schist and graphitic marble showed Cr value of 2,864 ppm and Ni values of 1,285 ppm. The Au concentration for the samples in the area ranged from 100 - 180 ppb. Also, one PCS sample yielded Cu value of 12,985 ppm. The chemical analysis of stream sediment samples showed presence of Au ranging from 50~220 ppb. The chemical analysis of trench samples showed presence of Cr ranging from 1,317~2,027 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 1,000 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 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 observed as a part of surface expression of high sulphidation system present within the garnetiferous biotite quartz schist of Bomdila Group. The particular mineralised zone with approximately 1,000 m in strike length with outcrop thickness of about 30 m to 40 m was observed and mapped accordingly. Furthur it was noticed to be composed of mixture of goethite, magnetite and haematite 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 mineralised zone yielded max. 3% REE in the channel sample, 4,808 ppm value of REE with average 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 scales 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 variable thickness ranging between 20 and 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, was more than 200 m. The vanadium mineralisation in the area was considered as strata bound bedded deposit with tabular geometry. Initial chemical results indicated 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 (1:12500) 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 belong to the Mayudia Ultramafic Complex was also observed in the area of investigation. Greenish coloured, medium to coarse-grained peridotite body was encountered which on rubbing was soapy in nature. 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 2,191 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, 2017-18 to 2019-20
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2017-18			2018-19			2019-20 (P)		
		No. of mines	Quantity	Value[$]	No. of mines	Quantity	Value[$]	No. of mines	Quantity	Value[$]
All Minerals		**-**		**382142**	**-**		**448300**	**-**		**455845**
Natural Gas (ut.)	m cu m	-	30	-	-	28	-	-	46	-
Petroleum (crude)	'000t	-	50	-	-	43	-	-	56	-
Minor Minerals[@]		-	-	382142	-	-	448300	-	-	455845

$ Excludes the value of Fuel minerals.