Indian Minerals Yearbook 2020

(Part- I)

59th Edition

STATE REVIEWS (Madhya Pradesh)

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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MADHYA PRADESH

Mineral Resources

Madhya Pradesh is the only diamond producing State in the country and is the leading producer of copper conc., diaspore, pyrophyllite, manganese ore, limestone and clay (others). The State hosts the country's 90% diamond, 74% diaspore, 55% laterite, 48% pyrophyllite, 41% molybdenum, 27% dolomite, 19% copper ore, 18% fireclay, 12% manganese and 8% rock phosphate ore resources.

Important mineral occurrences in the State are: **bauxite** in Balaghat, Guna, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol, Shivpuri, Sidhi & Vidisha districts; **calcite** in Barwani, Jhabua, Khandwa & Khargone districts; **china clay** in Betul, Chhatarpur, Chhindwara, Gwalior, Hoshangabad, Jabalpur, Khargone, Narsinghpur, Raisen, Satna, Shahdol & Sidhi districts; **copper** in Balaghat, Betul & Jabalpur districts; **coal** in Betul, Shahdol & Sidhi districts; **diamond** in Panna district; **diaspore & pyrophyllite** in Chhatarpur, Shivpuri & Tikamgarh districts; **dolomite** in Balaghat, Chhindwara, Damoh, Dewas, Harda, Hoshangabad, Jabalpur, Jhabua, Katni, Mandla, Narsinghpur, Sagar & Seoni districts; **fireclay** in Betul, Chhindwara, Jabalpur, Katni, Narsinghpur, Panna, Sagar, Shahdol & Sidhi districts; **iron ore (haematite)** in Betul, Gwalior, Jabalpur & Katni districts; **limestone** in Balaghat, Chhindwara, Damoh, Dhar, Hoshangabad, Jabalpur, Jhabua, Khargone, Katni, Mandsaur, Morena, Narsinghpur, Neemach, Rewa, Sagar, Satna, Sehore, Shahdol & Sidhi districts; **manganese ore** in Balaghat and Jhabua districts; **ochre** in Dhar, Gwalior, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol & Umaria districts; **pyrophyllite** in Chhatarpur, Sagar, Shivpuri & Tikamgarh districts; **quartz/silica sand** in Balaghat, Dewas, Dhar, Jabalpur, Khandwa, Khargone, Morena, Rewa & Shahdol districts; **talc/steatite/soapstone** in Dhar, Jabalpur, Jhabua, Katni, Narsinghpur & Sagar districts and **vermiculite** in Jhabua district.

Other minerals that occur in the State are: **barytes** in Dewas, Dhar, Shivpuri, Sidhi & Tikamgarh districts; **calcareous shales** (used in slate pencil) in Mandsaur district; **felspar** in Jabalpur & Shahdol districts; **fuller's earth** in Mandla district; **gold** in Jabalpur & Sidhi districts; **granite** in Betul, Chhatarpur, Chhindwara, Datia, Jhabua, Panna, Seoni & Shivpuri districts; **graphite** in Betul & Sidhi districts; **gypsum** in Shahdol district; **lead-zinc** in Betul district; **molybdenum** in Balaghat district; **potash** in Panna district; **quartzite** in Sehore district; **rock phosphate** in Chhatarpur, Jhabua & Sagar districts; and **sillimanite** in Sidhi district (Table - 1). The reserves/resources of coal along with various coalfields in Madhya Pradesh are furnished in Table - 2.

Exploration & Development

The details of exploration activities conducted by GSI and other various agencies during 2019-20 are furnished in Table - 3.

Production

Madhya Pradesh was the sole producer of diamond. Apart from this, Coal, Bauxite, Copper Ore & Concentrate, Iron Ore, Manganese Ore, Phosphorite and Limestone are the principle minerals produced in Madhya Pradesh State. The value of minor mineral's production is estimated as ₹ 5646 crores for the year 2019-20. There were 220 reporting mines in 2019-20 in case of MCDR of minerals (Table-4).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important large and medium-scale mineral-based industries in the Organised Sector in the State are furnished in Table-5.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2015: Madhya Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Barytes	tonne	-	-	-	-	-	18500	4472	-	35000	233940	-	291912	291912
Bauxite	'000 tonnes	11979	3313	8299	23591	12566	15084	6013	11061	54484	50590	-	149797	173388
Calcite#	tonne	-	-	5175	5175	215327	35077	160421	20250	180226	358636	97476	1067412	1072587
China clay#	'000 tonnes	357	474	902	1733	2882	406	3774	621	415	12017	-	20115	21848
Copper														
Ore	'000 tonnes	141950	-	12580	154530	17400	-	-	31560	550	79389	-	128899	283429
Metal	'000 tonnes	1887.93	-	148.44	2036.37	189.66	-	-	320.84	4.13	867.5	-	1382.13	3418.5
Diamond	carat	959500	-	159	959659	-	-	-	104118	-	27645359	-	27749477	28709136
Diaspore#	tonne	2380710	341047	2814601	5536358	96241	488094	460808	13696	109792	810667	46068	2025365	7561723
Dolomite#	'000 tonnes	23765	10078	18714	52557	33685	94599	102857	33030	295222	1584534	114799	2258839	2311395
Felspar#	tonne	-	-	-	-	10330	-	6610	-	-	339851	-	356791	356791
Fireclay#	'000 tonnes	390	4192	3020	7603	2139	7164	4975	1551	2129	100977	100	119036	126639
Fullers Earth##	tonne	-	-	-	-	-	-	-	-	-	117200	-	117200	117200
Gold														
Ore (Primary)	tonne	-	-	-	-	-	-	-	-	5841000	1947000	-	7788000	7788000
Metal (Primary)	tonne	-	-	-	-	-	-	-	-	6.18	2.22	-	8.4	8.4
Granite##														
(Dim. Stone)	'000 cu. m	-	160	-	160	-	-	-	-	-	1885924	108000	1993924	1994084
Graphite	tonne	-	-	-	-	-	-	-	-	-	3456660	2280000	5736660	5736660
Gypsum#	'000 tonnes	-	-	-	-	-	-	-	-	-	69	-	69	69
Iron Ore														
(Haematite)	'000 tonnes	44203	3635	14225	62063	48412	3650	36774	23243	9008	146803	10	267900	329963
Laterite#	'000 tonnes	12534	3355	7917	23807	8715	1631	16077	3189	1519	167527	169678	368336	392143
Lead-Zinc													-	-
Ore	'000 tonnes	-	-	-	-	129	117	-	1510	4006	5930	3150	14841	14841
Lead Metal	'000 tonnes	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc Metal	'000 tonnes	-	-	-	-	5.2	4.71	-	114.76	41.93	186.02	101.12	453.74	453.74
Limestone	'000 tonnes	816293	1093490	545321	2455103	419938	256187	498590	566011	830331	4045838	269859	6886754	9341858
Manganese Ore	'000 tonnes	20227	6760	2904	29891	5802	2779	6421	325	10481	2015	-	27823	57713
Marble##	'000 tonnes	-	-	4551	4551	-	-	-	-	-	-	-	-	4551

(contd)

Table – 1 (concld)

Mineral	Unit	Reserves				Remaining Resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Molybdenum														
Ore	tonne	-	-	-	-	-	-	-	-	-	8000000	-	8000000	8000000
Contained MoS_2	tonne	-	-	-	-	-	-	-	-	-	5020	-	5020	5020
Ochre#	tonne	1605342	194757	1895247	3695346	681904	1653225	5402710	356344	2577575	3732142	749250	15153150	18848495
Potash	Million tonnes	-	-	-	-	-	-	-	-	1206	-	-	1206	1206
Pyrophyllite#	tonne	9786485	2242501	1907116	13936102	1860354	2976581	2738198	520801	3294772	2984100	248405	14623211	28559313
Quartzite#	'000 tonnes	-	-	-	-	-	-	-	-	-	832	-	832	832
Quartz-Silica Sand#	'000 tonnes	129	30	1781	1940	516	-	920	791	316	2717	-	5261	7201
Rock Phosphate	tonne	5999399	5179	1492370	7496948	6460616	14981336	15702042	-	2730000	10629258	50625	50553877	58050825
Shale#	'000 tonnes	55	9	2	66	295	-	1459	-	-	33	-	1787	1853
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	0	101600	101600	101600
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	2096000	1120000	-	3216000	3216000
Metal	tonne	-	-	-	-	-	-	-	-	150.61	9.25	-	159.86	159.86
Talc-Steatite-Soapstone#	'000 tonnes	185	20	79	283	179	378	1609	-	1679	6107	-	9952	10235
Vermiculite	tonne	-	-	-	-	197	-	66	-	-	66	-	329	329

Figures rounded off

Note: *The proved and indicated balance recoverable reserves of Natural Gas in the State as on 01.04.2019 were 31.55 billion cu. m*

 # 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 : Madhya Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**12597.25**	**12888.39**	**3799.31**	**29284.95**
Johilla	185.08	104.09	32.83	322.00
Umaria	177.70	3.59	–	181.29
Pench-Kanhan	1536.86	991.93	1166.36	3695.15
Pathakhera	290.80	88.13	68.00	446.93
Gurgunda	–	84.92	53.39	138.31
Mohpani	7.83	–	–	7.83
Sohagpur	2129.18	5659.25	293.47	8081.90
Singrauli	8269.80	5956.48	2185.26	16411.54

Source: *Coal Directory of India, 2020*

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

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Manganese Ore							
Alirajpur	Vav-Ringola-MotaKutaja-Bhabra area	1:12500	100	-	-	-	Reconnaissance survey G4 for Manganese Mineralisation in Vav-Ringola-MotaKutaja-Bhabra area in Alirajpur District was carried out on a LSM of 100 sq km on 1:12500 scale. Manganese occurs in quartzite of Kalinjara Formation of Meghnagar Group within Aravalli Supergroup. A new occurrence of high grade manganese was noticed in a dump material of a well section near Kansat. The new find of manganese in Kansat is encouraging because of high value of Mn (36.64%) and appears to be the subsurface extension in SE direction of the known near surface old pit of manganese in Vav area which gave 13.69 % Mn in bedrock sample. Both locations of manganese are aerially 6 km apart and falling well within the regional trend of NNW-SSE. It was observed that in Kansat area, sandstone of Bagh beds are exposed on the surface. These are underlain by manganese bearing lenses within quartzite at a depth of

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							7 m below the ground surface. The reconstruction of depositional basin by lithologging of the well and mapping of study area indicate that Kalinjara Formation runs relatively deeper near Kansat, due to which, it even accommodates younger Bagh Group of rocks having older unit i.e., Mn bearing Kalinjara Formation beneath. Old working at Vav area show no trace of Bagh Group of rocks indicating that the basin on western and north western side is shallower with respect to eastern and south eastern part of the study area. It is speculated that Kansat area may show extensions of Mn bearing lenses/bands of high grade.
Manganese Ore							
Khargone Agarwara-	Nandiya-Narsinghpur-Jethwai area	1:12,500	52	-	-	22	Reconnaissance survey G4 for Manganese mineralisation in Nandiya-Agarwara-Narsinghpur-Jethwai area, Khargone district, was carried out on a LSM 1:12,500 scale covering an area of about 52 sq km followed by 4.5 sq km of detailed mapping (1:4,000 scale). Geophysical Survey (Magnetic & Gravity) of about 32 L km area has also been carried out in the Agarwara-Nandiya area. Geological mapping reveals that the study area is covered by the rocks of Bijawar Group, Bagh Group and Deccan trap. Dolomite (siliceous) of Lobar Formation and Chert breccia of Mehdikhera Formation belonging to the Bijawar Group are mainly exposed in and around Agarwara and Nandiya areas. Surface evidence of manganese mineralisation has been found mainly in and around Agarwara and Nandiya areas in the form of ferruginisation as well as old workings within the scanty exposures of Chert breccia. 04 old workings northeast of Agarwara, 01 old working near Nandiya school and 01 old working towards the

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							northwest of Nandiya area have also been demarcated. Manganese mineralisation also occurs as fracture/cavity fillings, detached pockets, small lenticular bodies and patches within the ferruginised/ calcareous Chert breccia. Mn dendrites have also been observed within the Chert breccia at places. The chemical results of 22 spot BRS samples collected from old workings shows promising MnO values. Two channel samples from channel viz. AGR_CH-A show 10.6% & 14.9% MnO and channel AGR_CH-B shows 7.6% and 1.6% MnO respectively. 8 BRS samples collected from the old workings shows values of MnO above 10% with a maximum value of 32.98% MnO.
Chromium, Nickel and PGE							
Jhabua	Ranapur-Bhutkhedi-Salarpada-Matasula areas	1:12500	50	-	-	-	Reconnaissance survey for Chromium, Nickel and PGE Mineralisation in parts of Jobat Mafic/Ultramafic suite of rocks in Ranapur-Bhutkhedi-Salarpada-Matasula areas, Jhabua, Madhya Pradesh: Large Scale Mapping of 50 sq km on 1:12,500 scale was carried out. The area is characterised by marbles of Badi Sardi Group overlain by phyllite-quartzite inter-banded sequence of Anas Formation of Meghnagar Group belonging to Aravalli Supergroup. The metasediments are intruded by older intrusive i.e. ultramafics of Jobat Mafic/Ultramafic Complex, represented by meta-pyroxenite and meta-gabbro in the central part of the study area. The values for Cr ranges from 345 to 1500 ppm with highest value (1500 ppm) recorded in meta-pyroxenite near Chhan Semal Khedi with MgO content as 6.64 wt%. Ni ranges from 145 to 690 ppm, with highest value (690 ppm) recorded in meta-gabbro near Ranapur with MgO content as 12.47 wt%. Few pyrite crystals were

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							observed within the meta-gabbro unit, but the meta-pyroxenite unit does not exhibit sulphide stains, so it can be interpreted, that the ultramafic magma was sulphide undersaturated. Highest concentration of ©ÕPGE as 35 ppb (Pt 6 ppb and Pd 20 ppb) was recorded from a BRS collected from meta-pyroxenite near Samoi Baba Dev village (Fig. 3.6) with 810 ppm Cr and 420 ppm Ni. Values for Cr as 360-585 ppm and Ni as 150-260 ppm have been recorded from a trench near Chhan Semal Khedi. Two distinct bands of BIF have been recorded near Baldimal and Chhoti Matasula areas with Fe content around 45 wt% in visual estimation.
Gold							
Jabalpur	Chargwan-Hinota area	1:12500	100	-	-	-	Reconnaissance Survey for Gold and Associated elements in Chargwan-Hinota area, Dist. Jabalpur, Madhya Pradesh (G4): Large scale mapping on 1:12,500 scale was carried out in 100 sq km area. The area is characterised by the presence of volcanosedimentary succession of Agori Formation belonging to Paleoproterozoic age, Lameta Formation from Cretaceous age, Upper cretaceous to Palaeocene age Deccan basalt, recent age Laterite capping and Quaternary sediments in the area. Mineralisation is marked by the presence of sulphide minerals such as pyrite, arsenopyrite and chalcopyrite present as disseminations and fracture-fillings respectively in quartz veins, BHQ and garnetmica schist. In Maramao area, specks of arsenopyrite and pyrite are observed within 3 m thick, E-W-trending intermediate to smoky quartz veins and BHQ. Similarly, in the S of Jamuniya, strings of pyrite and chalcopyrite were observed within white-coloured quartz vein. This quartz vein intruded within garnetmica schist. During trenching in Semra area, specks of pyrite were observed within garnetmica schist.

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Platinum Group of Element (PGE), Chromium (Cr) and Nickel (Ni)							
Betul	Padhar, Chikhli, Dhappa, Temra and Gondra villages	-	-	-	-	-	Reconnaissance survey for Platinum Group of Element (PGE), Chromium (Cr) and Nickel (Ni) bearing magmatic rocks of the Padhar mafic-ultramafic suite, in and around Padhar, Chikhli, Dhappa, Temra and Gondra villages, Betul Belt, Madhya Pradesh (G4): Large scale mapping in 100 sq km area on 1:12,500 scale was carried out in the study area. Seven possible mafic and ultramafic bodies have been demarcated within the Padhar mafic and ultramafic complex. XRD studies has also been carried out for 04 nos. of selected rock samples and determined nickel bearing mineral: Welleseite (Ni, Mg silicate hydrate) in the serpentinized clinopyroxenite, and Fe-Mgspinel, Chromite, corundum and diaspore bearing magnetite were found in the gabbro located to the NW of Temra. Olivine-websterite records Copper (Cu) values up to 180 ppm, Nickel (Ni) values up to 975 ppm and Chromium (Cr) values up to 2200 ppm. Altered and unaltered clinopyroxenite records Copper (Cu) values up to 210 ppm, Nickel (Ni) values up to 1100 ppm and Chromium (Cr) values up to 2000 ppm. Gabbro records Copper (Cu) values up to 195 ppm, nickel (Ni) values up to 930 ppm and chromium values up to 690 ppm. Stream sediment samples (25 nos) were collected from 1st order drains of selected mafic and ultramafic bodies in the mapped area.
Diamonds							
Panna and Satna and Banda District	Shahpur Block	-	-	-	-	-	Reconnaissance survey G4 was carried out of Kimberlite/ Lamproite and secondary diamonds in Shahpur Block in parts of Panna and Satna districts, Madhya Pradesh and Banda District of Uttar Pradesh (G4): 101 nos. of regional and detailed stream sediment samples were collected from appropriate

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							trap sites such as older alluvium, bed rock obstruction, joint crevasses, gravel layers in vertically cut river sections, manually dug pits in gravel and sand bed, channel floor, channel bar, point bar, uneven rocky floor, root trapping etc. Heavy Mineral Concentrates (HMC) was examined for kimberlite indicator minerals (Picro ilmenite, Pyrope garnet, Cr-spinel and micro diamonds) under stereo microscope. Through HMS, few suspected Kimberlite Indicating Minerals including garnets, spinels, chromites and ilmenites were identified which are yet to be confirmed though EPMA. During the search of diamond source rock, two ultramafic dykes were reported from Gudha Kalan. On the basis of petrological and geochemical studies, the altered ultramafic rocks show affinity towards lamprophyres. These dykes vary in dimension from 2-4 m in length and 15-20 cm in width. They are intruded within coarse-grained porphyritic granite. The detailed petrographic study of the ultramafic rock depicts presence of pyroxene porpyroclasts, some pseudomorph of olivine/pyroxene altered to talc/actinolite in a fine groundmass of alkali glass, pyroxene and amphibole. Mineral chemistry plots show its close affinity towards lamproites. Geochemical plots show its subalkaline- calcalkaline magmatic affinity and lamprophyric nature.
Diamond							
Panna and Kalyanpur Satna district block of Madhya Pradesh Banda and Chitrakoot districts of Uttar Pradesh		-	-	-	-	113	Reconnaissance survey (G4) was carried out for kimberlite/ lamproite in Kalyanpur block in parts of Panna and Satna districts, Madhya Pradesh and Banda and Chitrakoot districts of Uttar Pradesh. The block is situated in the northern and north-eastern part of Panna Diamond Belt (PDB). The respective block covered by the rocks of

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							Bundelkhand Granitoid Complex and older metamorphics intruded by dykes and quartz veins. Rocks of Vindhyan Supergroup are also exposed in the eastern and southern part while the remaining parts of the area are covered by Quaternary sediments. A total 113 nos. of regional and detailed stream sediment samples were collected from appropriate trap sites. Through HMS, few suspected Kimberlite Indicating Minerals including garnets, spinels, chromites and Ilmenites were identified but are yet to be confirmed though EPMA. During field traverses, variety of mafic/ultramafics/basic rocks are encountered in the study area. From the bipolar anomaly delineated from aeromagnetic anomalous map of OGP -02, 10.8 sq km area was identified. A total of 30 L. km geophysical magnetic survey with an interval of 350 m x 20 m was carried out. A hidden anomalous zone demarcated which is exactly corroborating with the OGP-02 map indicative of indirect clue of Kimberlite Clan Rocks (KCR). Depth persistence of aeromagnetic anomaly of OGP-02 calculated was 150-200 m. The magnetic anomaly in the survey block varies from 525 nT to 1250 nT a total variation of 725 nT. Based on detailed geophysical mapping and geological traverses in Singhpur Block, it can be concluded that the area covered by Baghain sandstone with sporadic capping of laterite shows high magnetic anomaly varies from 525 nT to 1250 nT. The magnetic data generated through modeling by Keating analysis (Keating, 1995) which is known globally for locating concealed kimberlite/ Lamproites. The reference model used assumed uniformly magnetized, vertically dipping cylinders, having diameter of 100 to 500 m and having depth of 140 to 300 m. The information is matching with the shape of kimberlites/lamproites i.e, conical/ funnel shaped pipes.

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Basemetal							
Dewas	Tamkhan and Bagda Sawasri	-	-	-	-	-	Reconnaissance survey (G4) was carried out for Basemetal mineralisation in area between Tamkhan and Bagda Sawasri, Dewas district. The study area primarily comprises rocks of Harda granitoids. A new potential zone of basemetal mineralisation was observed near Saktia village during the study. The host rock of basemetal is grey smoky quartz vein extends for approximately 600 m in length in NW-SE direction. The surface manifestation for copper mineralisation is observed over a strike length of 140 m having 2-3 m thickness in the form of stains of malachite along the fracture planes, fibrous malachite and variegated alteration along with fresh sulphides. The sulphides include pyrite, chalcopyrite and galena in dissemination is also observed. The chemical analysis of bedrock and channel samples from Saktia area yielded good results showing Cu value up to 8885 ppm, Pb value up to 2430 ppm, Zn up to 385 ppm, Ag- 30 ppm and Au 70-80 ppb. E-W trending quartz vein near Biloda and Chichli shows pyrite, chalcopyrite and galena association in dissemination form and BRS sample shows Cu values upto 1600 ppm along with Pb upto 5430 ppm and one samples yielded gold value of 630 ppb. NW-SE trending quartz vein near Bagda shows galena mineralisation in dissemination form yielded Cu-395 ppm, Pb-575 ppm, Zn- 2620 ppm and Au-360 ppb.
Copper							
Hoshangabad	Ratatalai-Mangrul-Bhadugaon-Jhugariya area	-	-	-	-	-	Reconnaissance survey (G4) was carried out for Copper mineralisation in Ratatalai-Mangrul- Bhadugaon-Jhugariya area, Hoshangabad district. Geologically, the area comprise of Harda Granitoids and Bijawar Group of rocks. The rocks exposed in this area

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							are mainly coarse- grained pink to dark coloured porphyritic granites. The overlying rocks of Bijawar Group are represented by quartzite, metabasic, ferruginous chert breccias and dolomite. The granitoids are intruded by basic dykes and quartz veins, whereas the Bijawar are intruded by quartz veins. Surface mineralisation of Copper occur in the form of malachite staining in Quartzite to the north of Dewas village. Fe encrustation, chalcopyrite and pyrite were observed in and around Teli Ki Sarai, Bhadugaon and Hirapur villages mainly in Zerruginous Quartzite of Bijawar Group. Near Mangrul village dissiminated sulphides were seen in calcite vein in metabasic. During the field work 50 cubic meter trenching and pitting work has been carried out. Sample collected from the quartzite shows Cu values ranging from 10 to 950 ppm and Zn from 10 upto 240 ppm. Sample no. BDGN -2 which was taken from quartzite with malachite stains near Bhadugaon village shows Cu values as 1950 ppm. Another sample HRPR-5 shows Zn value of 690 ppm within quartzite with scattered sulphides near Hirapur village. Pb values range from <10 to 60 ppm.
Basemetal							
Gwalior	Lakhnauti, Bilaua and Antri areas	-	100	-	-	-	Reconnaissance survey (G4) was carried out for Basemetal mineralisation around Lakhnauti, Bilaua and Antri areas of Gwalior district. The study area has been divided into two blocks -Lakhnauti Block and Bilaua Block. A total of 100 sq km area was mapped. Geologically, the area form part of Bundelkhand Granite Complex (BGC), Gwalior Group and Vindhyan Supergroup. Lakhnauti block reveals presence of a mineralised quartz reef within weathered granodiorite. BRS samples from quartz reef near Lakhnauti shows encouraging Cu values varying from 60 to 6500

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							ppm with overall average of 1550 ppm, Pb value from <10 to 210 ppm, Zn value from <10 to 1015 ppm, Cd value is less then 10 ppm, Ag value is less than 1 ppm. The chemical analysis of channel samples indicates presence of Cu values from 15 to 6700 ppm and helps to delineate a 250 to 300 m long zone with average 2 m width and average Cu values of 0.1%. The pit samples indicate Cu value from <10 to 5400 ppm in the area. The initial BRS samples from the quartz reef near Bhaggeh and Ainti is showing Cu value <10 to 120 ppm, Pb value ranges from <10 to 335 ppm, Zn value from <10 to 575 ppm, Cd value less than 10 ppm and Ag values less than 1 ppm. BRS samples collected from the quartz reef around Chirpura, Udalpara and Rafatpura villages are showing Cu value from <10 to 1800 ppm, Pb value from 15 to 515 ppm, Zn value from <10 to 95 ppm, Cd value is less than 10 ppm and Ag value is less than 10 ppm.
Basemetal							
Betul	Dehalwara Block	-	-	-	-	-	General exploration for (G2) was carried out Basemetal mineralisation in Dehalwara Block, Betul District. Dehalwara prospect is placed in the central part of Betul inlier which exposes a sequence of Precambrian rocks surrounded by Gondwana in the north and west and Deccan Trap in the south and east. Occurence of Sphalerite, galena, chalcopyrite, pyrite and pyrrhotite in the form of disseminations, Sub-massive thin bands, stringers, specks, and streaks, very fine veinlets along foliation plane, fracture and joint planes are the main repository sites of sulphide mineralisation in the study area. The basemetal mineralisation in Dehalwara block is disseminated one and the grade of the ore body is the function of the segregation of specks and blebs. Though the massive sulphide bands parallel to the foliation are common, however, their distant separation dilutes the grade.

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Basemetal							
Chhindwara	Borkhap Block	1:2000	0.50	-	-	-	Preliminary Exploration for Basemetal mineralisation in Borkhap Block Chhindwara District, Madhya Pradesh (G3): Detailed Mapping of 0.50 sq km area has been carried out on 1:2000 scale. The presence of gahnite is the only indicator of Zn mineralisation in the area. A total of 06 first level boreholes were drilled comprising 621.55 m drilling to check the depth persistence of mineralisation at 50 m vertical depth in discrete 04 nos. of soil geochemical anomaly for Zn and 02 geophysical chargeability anomalies demarcated in the Borkhap block. Besides, 50 cu. m pitting/trenching were carried out along profile line of 1st level of boreholes for surface and subsurface correlation of mineralisation zones. The detailed core logging revealed that the mineralisation in Borkhap area occurs in the form of small disseminated specks and thin stingers of sphalerite and occasionally chalcopyrite along the foliations and fractures. The mineralisation is discrete and patchy in nature. The borehole MPCB-02 shows the Zn values vary from 200 ppm to 1%. At 0.2% Zn cutoff and 2 m stoping width, four feeble mineralised zones having width of 4 m, 2 m, 5 m and 3 m with Zn value of 0.36%, 0.72%, 0.21% and 0.21% respectively can be inferred. In borehole no. MPCB-08, Zn values vary from 90 to 950 ppm, Pb from 230 to 530 ppm and other elements are in traces.
Basemetal							
Chhindwara	Gorakhpur-Toranwari-Bardhana area	-	-	-	-	-	Reconnaissance survey (G4) was carried out for Basemetal and other associated metals in Gorakhpur-Toranwari-Bardhana area in Chhindwara district. The mapped area consists of bimodal volcanic suite of rocks, i.e., both felsic volcanic and mafic volcanic.

(contd)

Table – 3 (concld)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							The felsic volcanic rocks are hydrothermally altered and metamorphosed. The hydrothermal alteration in the rocks is syngenetic in nature. Mineralization in the area is associated with volcanic hosted massive sulphide (VHMS) type deposit. The alteration zone is marked within the host rocks (altered rhyolite) having potential mineralisation and subsequently four alteration zones have been identified. These alteration zones have been chosen for soil sampling to find out the pattern and intensity of secondary dispersion of the base metal, if any, in soil of the potential areas of mineralisation. Malachite staining is observed in the altered rhyolite outcrop.
MECL							
Manganese ore							
Alirajpur	Udwara	1:12500	229.49	2	-	-	In Madhya Pradesh, a G4 stage exploration in Udwara area, Alirajpur district was carried out with the broad objectives to carry out geological mapping, collect and analyse different types of samples, scout drilling in potential areas and estimate reconnaissance category resources of manganese ore, graphite and phosphorus alongwith accessory minerals in the study area. The study involved mapping of 221.49 sq.km area on 1:12,500 scale, drilling of 2 scout boreholes to a depth of 240.60 m with collection of about 1714 samples including 250 pit/trench samples, 60 channel samples and 419 stream sediments samples. Resources in the area has not been estimated.
Satna	Jamodi-Maharnna Part-B Raghuraj Nagar tehsil	1:4000	9.00	36	1322.50	1392	-
	Naubasta-Kolard, Block, Nagod tehsil	1:4000	15.90	36	1674.00	1392	-

(contd)

Table – 3 (contd)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Neemuch	Nayagaon ML area of CCI, Jawad tehsil	1:4000	3.368	21	1968.00	1714	-
Neemuch	Khedarathore ML area of CCI, Jawad tehsil	1:4000	1.64	10	1021.50	1112	-

Table – 4 : Mineral Production in Madhya Pradesh, 2017-18 to 2019-20 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2017-18			2018-2019			2019-20 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**227**		**78042284**	**223**		**82555134**	**220**		**81522864**
Coal	'000t	-	112127	-	-	118661	-	-	125726	-
Natural Gas (ut.)+	m c m	-	200	-	-	357	-	-	345	-
Bauxite	t	19	593633	442907	20	750433	599967	20	685924	548489
Copper Ore	t	-	2339035	-	-	2542159	-	-	2544472	-
Copper Conc.	t	1	75604	3486098	1	70999	4000290	1	65094	4750125
Iron Ore	'000t	15	2743	1239712	18	2802	1448203	19	3333	1729975
Manganese Ore	t	42	837041	6760106	41	942738	7147719	41	958164	6160735
Phosphorite	t	4	113947	108783	5	98600	88543	5	99960	94422
Diamond	crt	2	39699	374110	2	38437	539062	2	28816	398070
Limestone	'000t	144	43060	10779367	136	50102	12271100	132	46969	11380798
Minor Minerals @		-	-	54851201	-	-	56460250	-	-	56460250

***Note**: The number of mines excludes Fuel and Minor minerals.*

$ Excludes the value Fuel minerals.

+ Coal Bed Methane

@ Figures for earlier years have been repeated as estimates because of non-receipt of data for 2019-20.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Aluminium/Alumina	
Hindalco Industries Ltd, Mahan Aluminium, Bargwan, Distt Singrauli	360 (Aluminium)
Asbestos Products	
Everest Building Products Ltd, Kymore	NA
Kalani Industries Pvt. Ltd, Pitampur, Dhar	NA
Ramco Industries Ltd, Maksi, Distt Shajapur	NA
Calcined Lime	
Rekha Harlalka, Jukehi, Maihar	11
Padampani Tripathi, Mamalime Industries Rajarwara, Katni	9.6
Cement	
ACC Ltd, Kymore, Distt Katni	2720
Bhilai Jaypee Cement Ltd, Babupur, Satna	1300
Birla Corpn. Ltd, (Satna Cement Works & Birla Vikas Cement), Satna	2200
Birla Coorporation Ltd, (Erstwhile Reliance Cement Pvt. Ltd, Maihar, Distt Satna	3000
Century Textiles & Ind. Ltd, Maihar Cement, Maihar (unit I&II), Distt Satna	4200
Heidelberg Cement (I) Ltd, Narsingarh, Distt Damoh	2000
Jaiprakash Power Ventures, Singrauli (G)	2000
Jaypee Rewa Cement Plant, Distt Rewa	2500
Jaypee Bela Cement Plant, Distt Rewa	2600
KJS Cement, Rajnagar, Distt Satna	2200
Prism Cement Ltd, (Unit I & II), Satna	6600
Satguru Cement Pvt. Ltd, Ghursal, Gandhawani	95
UltraTech Cement Ltd, Sidhee	2300
UltraTech Cement, Dhar Cement Plant, Tonki, Temarni sounul, Golpura Manawar	3500
UltraTech Cement, Vikram Cement Plant, Khor, Distt Neemuch	4500 (OPC) 4500 (PPC)
UltraTech Cement Ltd, Majhigawan, Rampur Naikin	3000
Ceramic	
Roca Bathroom Products Ltd, Dewas	NA
Govind Tiles Pvt. Ltd, Garra, Distt Balaghat	NA
Calcined lime	
Som lime work, Jukehi, Katni	21.6
Jai Mata lime Industries Pathra, Katni	15.2
Dharampal Industries Pathra, Katni	6
Sampuran Singh Saluja Patra, Katni	6.07

(Contd.)

Table-5 (concld)

Industry/plant	Capacity ('000 tpy)
Fertilizer	
Agro Phos. (India) Ltd, Dewas	45 (SSP)
Arihant Ferts. & Chems. India Ltd, Kanawati, Neemuch	66 (SSP)
Basant Agro Tech (India) Ltd, Jawad, Neemuch	45 (SSP)
Coromandel International Ltd, (Formerly, Liberty Urvarak Ltd,), Nirmani Khargone	100 (SSP)
Indra Industries Ltd, (Formerly, Swastik Ferts & Chems Ltd,), Indore, Dhar	66 (SSP)
KMN Chemicals & Fertilizers Ltd, Diwanganj, Raisen	60 (SSP)
Khaitan Chemical & Fertilizers Ltd, Nimrani, Distt Khargone	400 (SSP) 115.5 (H_2SO_4)
NFL, Vijaipur (Unit I & II), Distt Guna	2066.1 (Urea)
Krishna Phoschem Ltd, Meghnagar, Jhabua	120 (SSP)
Madhya Bharat Agro Products Ltd, Rajoa, Sagar	60 (SSP)
Madhya Bharat Phosphate Pvt. Ltd, (Unit I), Diwanganj, Sanchi, Raisen	132 (SSP)
Madhya Bharat Phosphate Pvt. Ltd, (Unit II), Meghnagar, Jhabua	165 (SSP)
Mexican Agro Chemical Ltd, (Formerly, Asha Phosphates Ltd,), Jaggakhedi, Mandsaur	60 (SSP)
Mukteswar Fertilizers Ltd, Narayankhedi, Ujjain. Rama Phosphates Ltd, Indore	60 (SSP) 250 (SSP) 102 (H_2SO_4)
Suman Phosphates and Chemicals Ltd, Indore	330 (SSP)
Varun Fertilizers Pvt. Ltd, Dewas	100 (SSP)
Ferroalloys	
Crescent Alloys Pvt. Ltd, Seoni	4.5
Jalan Ispat Castings Ltd, Meghnagar, Distt Jhabua	12
MOIL Ferro Manganese Plant, Bharveli, Distt Balaghat	10
Petroleum Refinery	
Bharat Oman Refineries Ltd, Bina, Distt Sagar	6000
Refractory	
ACC Refractories, Katni	65
Calderys India Refractories Limited	78
Katni Refractory Works, Katni Murwara	30 (Binder) 9 (Grout)
Mahakoshal Refractories Pvt. Ltd, Katni	61.09
Mahakoshal Refractories Pvt. Ltd, Gudri, Bohariband	31
Premier Refractories India Pvt. Ltd, Katni.	50

G; Grinding Unit

Note: *Data souled from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory, respectively.*