

STATE REVIEWS



Indian Minerals Yearbook 2015 (Part- I)

54th Edition

**STATE REVIEWS
(Tamil Nadu)**

(FINAL RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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July, 2017

TAMIL NADU

Mineral Resources

Tamil Nadu is the leading holder of country's resources of vermiculite, molybdenum, dunite, rutile, garnet and ilmenite. The State accounts for the country's 75% vermiculite, 63% dunite, 59% garnet, 52% molybdenum, 30% titanium mineral, 27% sillimanite and 16% fire clay resources.

Important minerals that are found to occur in the State are: **bauxite** in Dindigul, Namakkal, Nilgiris & Salem districts; **dunite/pyroxenite** in Salem district; **felspar** in Coimbatore, Dindigul, Erode, Kanchipuram, Karur, Namakkal, Salem & Tiruchirapalli districts; **fireclay** in Cuddalore, Kanchipuram, Perambalur, Pudukottai, Sivaganga, Thiruvallur, Tiruchirapalli, Vellore & Villupuram districts; **garnet** in Ramanathapuram, Tiruchirapalli, Tiruvarur, Kanyakumari, Thanjavur & Tirunelveli districts; **granite** in Dharmapuri, Erode, Kanchipuram, Madurai, Salem, Thiruvannamalai, Tiruchirapalli, Tirunelveli, Vellore & Villupuram districts; **graphite** in Madurai, Ramnathapuram, Sivaganga & Vellore districts; and **gypsum** in Coimbatore, Perambalur, Ramnathapuram, Tiruchirapalli, Tirunelveli, Thoothukudi & Virudhunagar districts. Similarly, occurrences of minerals, such as, **lignite** deposits are located in Cuddalore, Ariyalur, Thanjavur, Thiruvarur, Nagapattinam, Ramnad, Sivaganga & Ramanathapuram districts; **limestone** in Coimbatore, Cuddalore, Dindigul, Kanchipuram, Karur, Madurai, Nagapattinam, Namakkal, Perambalur, Ramnathapuram, Salem, Thiruvallur, Tiruchirapalli, Tirunelveli, Vellore, Villupuram & Virudhunagar districts; **magnesite** in Coimbatore, Dharmapuri, Karur, Namakkal, Nilgiri, Salem, Tiruchirapalli, Tirunelveli & Vellore districts;

quartz/silica sand in Chennai, Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Kanchipuram, Karur, Madurai, Namakkal, Periyar, Perambalur, Salem, Thiruvallur, Thiruvarur, Nagapattinam, Tiruchirapalli, Villupuram, Virudhunagar & Vellore districts; **talc/steatite/soapstone** in Coimbatore, Salem, Tiruchirapalli & Vellore districts; **titanium minerals** in Kanyakumari, Nagapattinam, Ramanathapuram, Thiruvallur, Tirunelveli & Thoothukudi districts; **vermiculite** in Dharmapuri, Tiruchirapalli & Vellore districts; and **zircon** in Kanyakumari district have been established.

Other minerals that occur in the State are: **apatite** in Dharmapuri & Vellore districts; **barytes** in Erode, Madurai, Perambalur, Tirunelveli & Vellore districts; **bentonite** in Chengai-Anna district; **calcite** in Salem district; **china clay** in Cuddalore, Dharmapuri, Kanchipuram, Nilgiris, Sivaganga, Thiruvallur, Tiruvannamalai, Tiruchirapalli & Villupuram districts; **chromite** in Coimbatore & Salem districts; **copper, lead-zinc** and **silver** in Villupuram district; **corundum** and **gold** in Dharmapuri district; **dolomite** in Salem & Tirunelveli districts; **emerald** in Coimbatore district; **iron ore (magnetite)** in Dharmapuri, Erode, Nilgiris, Salem, Thiruvannamalai, Tiruchirapalli & Villupuram districts; **kyanite** in Kanyakumari & Tirunelveli districts; **molybdenum** in Dharmapuri, Dindigul & Vellore districts; **pyrite** in Vellore district; **sillimanite** in Kanyakumari, Karur & Tirunelveli districts; **tungsten** in Madurai & Dindigul districts; and **wollastonite** in Dharmapuri & Tirunelveli districts (Table-1). District-wise reserves/resources of lignite are provided in Table-2.

In addition to the above, Petroleum and natural gas deposits are found to be located in Cauvery basin area.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010/1.4.2013* : Tamil Nadu

Mineral	Unit	Reserves				Remaining Resources				Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
			STD121	STD122							
		Pre-feasibility		Feasibility		Reconnaissance		Total			
		STD221	STD222	STD211	STD212	STD333	STD334	STD335	STD336	STD337	
Apatite*	tonne	-	-	-	-	-	-	240000	-	240000	240000
Barytes*	tonne	-	-	-	-	500	-	221919	-	222419	222419
Bauxite*	'000 tonnes	565	-	565	1141	3564	10084	8363	-	24112	24677
Bentonite	tonne	-	-	-	-	-	3725333	5818519	-	9543852	9543852
Calcite*	tonne	-	-	-	-	-	-	116632	-	116632	116632
China clay*	'000 tonnes	-	-	-	-	-	327	56570	-	56897	56897
Chromite*	'000 tonnes	-	-	-	-	-	7	276	-	282	282
Copper*											
Ore	'000 tonnes	-	-	-	-	-	200	590	-	790	790
Metal	'000 tonnes	-	-	-	-	-	1.08	2.73	-	3.81	3.81
Corundum**	tonne	-	-	-	-	-	-	4000	-	4000	4000
Dolomite**	'000 tonnes	-	-	-	-	-	2010	135	-	2145	2145
Dunite	'000 tonnes	7466	-	1450	8916	-	-	5773	-	107963	116879
Felspar*	tonne	613184	6450	31302	650936	2328227	70156	69822	5447875	8351112	9002048
Fireclay*	'000 tonnes	322	3269	423	4014	4833	171	1561	-	110245	114259
Garnet	tonne	334469	1511397	10595388	12441254	-	-	1408995	19871019	-	33828319
Gold*											
Ore (primary)	tonne	-	-	-	-	-	-	67000	-	67000	67000
Metal(primary)	tonne	-	-	-	-	-	-	1.00	-	1.00	1.00
Granite											
(Dim. stone)	'000 cu m	-	1448	238	1686	-	45690	8234	7	503818	557749
Graphite*	tonne	2656889	-	810450	3467339	28708	39486	29136	647500	3866390	4613707
Gypsum*	'000 tonnes	-	-	64	64	313	469	25	249	19540	27255
Iron ore*											
(Magnetite)	'000 tonnes	-	-	-	-	-	-	-	169388	110728	226921
Kyanite	tonne	-	-	-	-	-	-	-	167000	81359	248359

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Table -1(Concl.d.)

Mineral	Unit	Reserves						Remaining Resources						Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance			Total (B)
			STD121	STD122			STD221	STD222				STD334	STD334		
Lead-zinc*															
Ore	'000 tonnes	-	-	-	-	-	-	200	590	-	-	-	790	790	
Lead metal	'000 tonnes	-	-	-	-	-	-	2.26	5.48	-	-	-	7.74	7.74	
Zinc metal	'000 tonnes	-	-	-	-	-	-	11.76	24.76	-	-	-	36.52	36.52	
Limestone	'000 tonnes	199243	115705	55165	370112	19229	55984	69951	32169	460412	-	-	679759	1049871	
Magnesite*	'000 tonnes	5797	132	1791	7721	2219	4808	17	737	7441	-	-	25498	33218	
Molybdenum*															
Ore	tonne	-	-	-	-	-	1500000	36000	569304	7777694	167800	10050798	10050798	10050798	
Contained MoS ₂	tonne	-	-	-	-	-	1050	83	287	4459.33	50.34	5929.67	5929.67	5929.67	
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	24	-	-	24	24	
Quartz-															
silica sand#	'000 Tonnes	60063	9	93	60166	29644	4892	3387	95837	271150	-	-	168433	228598	
Sillimanite	tonne	331800	-	561766	893566	-	4000	-	-	3529577	-	-	17058900	17952466	
Silver*															
Ore	tonne	-	-	-	-	-	-	-	330000	460000	-	-	790000	790000	
Metal	tonne	-	-	-	-	-	-	-	15.87	26.68	-	-	42.55	42.55	
Talc-steatite/ soapstone#	'000 tonnes	-	-	333	333	194	210	-	-	524	-	-	2328	2661	
Titanium minerals**	tonne	1181486	-	2367410	3548896	-	-	76454	19687147	93466694	-	-	113230295	116779191	
Tungsten*															
Ore	tonne	-	-	-	-	-	-	-	-	-	-	250000	250000	250000	
Contained WO ₃	tonne	-	-	-	-	-	-	-	-	-	-	50	50	50	
Vermiculite	tonne	1526417	-	-	1526417	-	-	-	-	343051	-	-	343051	1869468	
Wollastonite	tonne	-	-	-	-	-	-	-	-	3533	-	-	3533	3533	
Zircon	tonne	53318	-	175443	228761	-	-	-	-	-	-	-	-	228761	

Figures rounded off.

Note: The proved and indicated balance recoverable reserves of crude oil and natural gas in the State as on 1.4.2015 are 10.80 million tonnes and 47.59 billion cu m, respectively.

* Reserves/Resources as on 1.4.2013.

** Resources as per Department of Atomic Energy are provided in the respective Mineral Reviews.

Declared as minor mineral vide Gazette notification dated 10.02.2015.

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Table – 2 : Reserves/Resources of Lignite as on 1.4.2015 : Tamil Nadu

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	3735.23	22900.05	8573.62	35208.90
Cuddalore	2831.00	2530.74	1199.78	6561.52
Ariyalur	904.23	302.50	481.07	1687.80
Thanjavur	-	2290.71	72.66	2363.37
Thanjavur & Thiruvarur	-	17248.06	3123.46	20371.52
Thanjavur & Nagapattinam	-	359.21	926.62	1285.83
Thiruvarur & Nagapattinam	-	-	574.05	574.05
Ramanathapuram	-	168.83	1210.77	1379.60
Ramnad	-	-	964.97	964.97
Ramnad & Sivaganga	-	-	20.24	20.24

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

The details of exploration activities conducted by GSI & various agencies for lignite and other minerals during 2014-15 are furnished in Table - 3.

During 2014-15, National Oil Companies (NOC) continued their seismic survey and acquired seismic data in the state.

Production

The value of mineral production (excludes atomic mineral and value for February and March in respect of 31 minerals declared as minor mineral vide Gazette notification dated 10.02.2015) in Tamil Nadu at ₹ 7,574 crore in 2014-15 increased by 12% as compared to that in the previous year. The State contributed about 3% to the total value of mineral production in the country. The principal minerals produced in the State were lignite, natural gas (utilised), limestone, petroleum

(crude), magnesite, dunite, garnet (abrasive), graphite (r.o.m.), silica sand, bauxite, fireclay, lime kankar, felspar, quartz and vermiculite which together accounted for about 95% of the total value of the minerals produced in the State in 2014-15. The State was the sole producer of lime kankar and leading producer of dunite (99%), magnesite (78%), graphite (r.o.m.) (63%) and lignite (52%).

During the year under review, increase in production was observed in magnesite (48%) and petroleum (crude) (6%). However, decrease in the production was reported for limestone (8%), natural gas (ut.) (9%), graphite (r.o.m.) (18%), limekankar (20%), bauxite (22%) and garnet (abrasive) (97%) as compared to the previous year (Table - 4).

The value of production of minor minerals was estimated at ₹ 409 crore for the year 2014-15.

The number of reporting mines was 292 in 2014-15 as against 377 in the previous year.

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Table -3 : Details of Exploration Activities in Tamil Nadu, 2014-15

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI Dunite Namakkal		-	-	8	614.85	38	G4 stage investigation for reappraisal of dunite was taken up. The area of investigation forms a part of Palghat Cauvery Suture Zone (PCSZ), bounded by two major lineaments called Moyar-Bhavani-Attur Lineament (MOBL) in the north and the Palghat-Cauvery Lineament (PCL) in the south. The charnockite group of rocks including charnockite, pyroxene granulite ± garnet and banded iron formations, form the oldest group of rocks and covers majority of the area. The ultramafic rocks include, linear bands of dunite and pyroxenite occurring as small pods and lenses within gneissic charnockite and hornblende bioite gneiss as intrusives. The dunite band under investigation occurs as a linear band between Ichchavari in the west and Kalingappatti in the east over a strike length of about 20 kms and average width of 60 m. For the convenience of exploration, the area was classified as Valasiramani West Block and Valasiramani East Block. Detailed investigation with scout drilling of 614.85 m have been carried out in Valasiramani East Block. In this block, altered/ weathered dunite with magnesite veins extend as a linear body with a near ENE-WSW trend from east of Valasiramani to Urakkarai for a strike length of ~6 kms. The inferred outcrop width of the weathered dunite varies from 90 m to 125 m. The well section in Andipatti clearly exhibits the sharp contact of dunite with the hornblende gneiss, where the gneissic planes truncate abruptly against the dunite indicating the intrusive behaviour of dunite. Also, from the well sections it is inferred that the depth of weathering of dunite ranges from 15 m to 20 m. To delineate the depth of weathering / depth of intersection of fresh dunite, depth persistence of dunite and sampling of fresh dunite and to assess their potentiality for industrial application, drilling was carried out with a total meterage of 614.85 m, in boreholes VLS-1 to 8. The analytical data of 22 nos. of core samples belonging to BH. No. VLS-1, show the presence of SiO ₂ (33.5-41.5%; Avg. 37.38%), MgO (36.62-44.26%; Avg. 40.47%), Al ₂ O ₃ (0.30-1.26%; avg 0.51%), CaO (0.64-2.76%;

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							Avg. 1.13%), Fe ₂ O ₃ (5.90-8.27%; Avg. 7.07%) and LOI (6.58-14.90%; Avg. 11.91%). Similarly, the analytical data of 16 nos. of core samples belonging to BH. No. VLS-3, show the presence of SiO ₂ (28.70-41.50%; Avg. 35.30%), MgO (28.00-47.20%; Avg. 38.97%), Al ₂ O ₃ (0.30-6.00%; avg 1.39%), CaO (0.64-12.80%; Avg. 2.43%), Fe ₂ O ₃ (5.90- 11.00%; Avg. 7.58%) and LOI (6.58 – 19.30%; Avg. 12.66%). The MgO/SiO ₂ of the rock types is ≥ 1 indicating higher Mg content, with exception to pyroxenite bands occurring within the dunite/peridotite which is marginally less than 1 (i.e. higher silica, and lower MgO).
Graphite Sivaganga	Arsanur block	-	-	7	-	398	G3 stage investigation for reappraisal of Graphite was carried out by drilling. The drilling has commenced on 16.06.14 with borehole GRAR-1 and so far GRAR-7 is completed and the geological cross section of the intersected lithology for completed boreholes have been prepared. Core sampling is carried out in boreholes GRAR-1, 2, 3, 4, 5, 6, 7 to know the fixed carbon, volatile matter, ash and moisture content and thus 398 nos. of core samples are generated. In general the sample length is kept 0.5 m but it varies from 0.30 m to 1.5 m depending upon the rock types, mineralisation, core recovery etc. Within the biotite gneiss, the quartzite and quartzofeldspathic gneiss parting having graphite mineralisation are sampled separately. Thus core samples pertaining to borehole GRAR-1, 2, 3, 4, 5 and trench samples are sent and remaining borehole samples (GRAR-6, 7) are under processing. Total four trenches are opened north of 0/W500 & 0/E100 station and fall in segment-C (western part) and in segment-B (eastern part) of the block to expose the graphite gneiss band. The main reason for excavating these trenches are for surface to sub surface correlation for borehole GRAR-3 since there is no trench/surface data available for GRAR-3 as well as to have a better understanding of the behaviour (physical continuity and chemical content) correlation of the mineralised zones on the surface. The pitting and trenching samples are collected mainly from graphite gneiss, quartzofeldspathic

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							gneiss with graphite, biotite gneiss with graphite. All the rock types are mostly fine to medium grained, partly weathered and at places limonitised, ferruginised and epidotised. Well to crude foliations are also noticed within the rock types. Petrological studies of borehole samples indicate that the area has suffered intense deformation; graphite mineralisation occurs both as primary and secondary. From the core logging and sampling of borehole GRAR-1, 2, 3, 4, 5, 6 it is inferred that the graphite mineralisation is not strata bound and occurs in all rock types namely biotite gneiss, quartzofeldspathic gneiss and quartzite. Graphite occurs mostly as flakes along foliation/schistosity planes in biotite gneiss and quartzofeldspathic gneiss and sometimes fine grained within the ground mass of the quartzite. It mostly occurs parallel to gneissosity/schistosity. Minor folds show the remobilisation of graphite along gneissosity plane and also along the fracture/ fault planes indicating that it occurs as primary as well as secondary in the form of remobilised graphite. In general, the lithologies encountered in all boreholes, so far drilled (GRAR- 1, 2, 3, 4, 5, 6) are highly epidotised, sheared, fractured and faulted which are evidenced by grain size reduction, rotation of porphyroblast, minor fault with drag effect, brecciation, presence of mylonite/ mylonitisation etc. All these indicate that the area has undergone both brittle and ductile deformation. Apart from this, the graphite mineralisation also shows fault, dragging along with "C" plane which indicate that the mineralisation have been formed pre tectonic and thus suffered the tectonic effect during deformation. The concentration of graphite is more in the shear zone/deformed part of the host rocks which also indicate that the deformation helps in remobilisation/ concentration/ accentuate the concentration of graphite. Thus, the graphite mineralisation is structurally controlled in Arasanur block. Rare specks of sulphides, mostly pyrite, occur both in primary and secondary form mainly in quartzofeldspathic gneiss, quartzite and in biotite gneiss also indicate reducing environment was prevailing while deposition of host rock. Megascopically,

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							the garnetiferous biotite gneiss shows garnet aggregates which are subrounded to rounded and sometimes with well developed crystal faces. At places, 2 to 5 mm thick garnet rich zones parallel to foliation are present within biotite gneiss indicate that garnet/garnet rich zones were formed during deposition itself.
Lignite							
Ramanathapuram	Kalari West Sector (East Coast Lignite field)	-	-	7	2454.5	-	During exploration, a total of 2454.50 m was drilled in seven boreholes in the Kalari West Sector during the Field Season 2014-15, which includes 753.00 m of Quaternary sediments, 1197.60 m of Cuddalore/Tittacheri Formation and 503.90 m of Neyveli Formation. The thickness of Quaternary sediments intersected during the period including alluvium ranges between 95.00 m (TRKW-3) and 117.00 m (TRKW- 1) in the Kalari West Sector. The thickness of Cuddalore/ Tittacheri Formation intersected during the period varies between 177.00 m (TRKW 1) and 231.00 m (TRKW-3). The thickness of Neyveli Formation intersected during the period ranges between 105.00 m (TRKW-4) to 130.60 m (TRKW-3). Lignite was intersected in all the completed (4 nos.) boreholes (TRKW-I to TRKW-4) between depths of 374.00 m and 442.00 m. The cumulative thickness of lignite seams varies between 12.00 m and 22.00 m. The occurrence of lignite has been proved in the entire explored area of about 30 sq km. Lignite samples have been sent to Chemical Laboratory at N.L.C, Neyveli for Proximate and ultimate analysis. The investigation is in progress.
Ramnad	Uttarkosamangai sector, (East Coast Lignite field)	-	-	6	1936.15	-	In regional exploration, a total of 1936.15 m have been drilled in six boreholes (RUL-22 to RUL-27) during the Field Season 2014-15 which includes 286 m of Quaternary Formation, 955.75 m of Cuddalore/Tittacheri Formation and 694.40 m of Neyveli formation. The thickness of these Quaternary sediments including alluvium intersected during the period ranges between 94.00 m (RUL-27) and 96.00 m (RUL-25 & RUL-26), whereas the thickness of Cuddalore/ Tittacheri Formation intersected during the period ranges from 177.00 m (RUL-25) to 204.00 m (RUL-22). The thickness of Neyveli Formation intersected in

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							boreholes during the period varies from 87.00 m (RUL-25) to 134.50 m (RUL-23). All the six boreholes intersected lignite seams and the cumulative thickness of lignite seams intersected in boreholes drilled during the field season varies from a minimum of 6.00 m (RUL-26 & RUL-27) to a maximum of 16.50 m (RUL-24) within a depth range of 311.00 m to 395.00 m. A total of 27 boreholes have been drilled for a total meterage of 11,141.35 m in the Uttarakosamangai Sector in an area of 56 sq km. Geophysical logging was carried out in twenty three out of the twenty seven boreholes for total of 9,174.00 m. The investigation is completed.
Platinum Group of Elements (PGE)							
Namakkal	Central part of Tasampalaiyam Block (T3 Sector)	-	-	7	517.15	162	G3 stage investigation was taken up to prove the depth persistence of the PGE mineralisation. The PGE mineralised zones delineated in T3 sector shows considerable variation in grade and width both along the strike and dip directions and the chromitite bands which host the PGE mineralisation occur as discontinuous bodies which show pinch and swell structure. In T3 sector, the Northern Zone is delineated for a cumulative strike length 700 m and close spaced trenching and systematic drilling is being carried out to check the strike continuity and depth persistence of the PGE mineralised zones and also to see the western extension of this zone. First level drilling to test the PGE mineralised zones at 30 m vertical depth is taken up during the period. Seven boreholes T3BH-1 to T3BH-7 were drilled in segments A, B, C & D, (two boreholes in each segment) for the first level intersection of Northern Zone and drilling quantum of 517.15 m has been achieved. Planning of boreholes systematically at 100 m interval is not possible due to the discontinuous nature of the chromitite bands and the spacing between the boreholes varies from 70 m to 284 m. Close spaced trenching was also carried out along the borehole profiles for borehole planning, surface to subsurface correlation of PGE mineralised zones and also to see the strike extension of the chromitite bands. A total of 115 core samples from seven boreholes and 47 trench samples were processed and submitted for PGE analysis. In T3 sector, Segment-A

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							<p>delineated in the eastern most part over a strike length of 300 m, exposes the Northern Zone. The Northern Zone in this segment exposes several parallel bands/layers of chromitite/chromiferous meta-pyroxenite, meta-pyroxenite and mix zones of meta-pyroxenite and anorthosite. The individual bands are not traceable from one trench to another trench indicating pinch and swell nature. Scout borehole TBH-9 drilled earlier in the central part of the segment has intersected significant PGE mineralised zone and two first level boreholes were drilled to check the eastern and western extension of this zone. Segment-B, delineated for a strike length of 270 m exposes both Northern and Southern Zones. Scout boreholes TBH- 11 drilled earlier to check the Southern Zone and TBH-10 drilled earlier to test the Northern Zone. Two first level boreholes, T3BH-3 & 4 were drilled in this segment to see the extension of Northern Zone. Segment-C, delineated for a strike length of 385 m exposes the Northern Zone and two scout boreholes, TBH-12 & 13 drilled earlier to test the Northern Zone have intersected significant PGE mineralised zones. To trace the extension of these zones, two first level boreholes (T3BH-5&6) were drilled. Segment-D, delineated for a strike length of 330 m exposes the Northern Zone and scout borehole TBH-14 drilled earlier to test this zone has intersected lean PGE mineralisation. Two first level boreholes (T3BH-7&8) were drilled to see the western extension of the Northern Zone. Segment-E, delineated for a strike length of 300 m exposes only the Southern Zone and this zone is delineated for 70 m strike length. Close spaced trenching carried out to trace the strike extension of this zone clearly indicates pinching nature of the bands. Scout borehole TBH-15 drilled earlier to test the Southern Zone has proved the depth extension of this zone, but the strike extension of this zone is limited and no first level borehole is proposed in this segment. Segment-F delineated for a strike length of 700 m exposes the Northern Zone and scout borehole TBH-16 drilled in the western most part of the segment has not intersected any PGE mineralisation indicating pinching nature of the chromitite bands in the western part, but close spaced trenching carried out in</p> <p>(Contd.)</p>

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							<p>the eastern and central part of this segment has resulted in delineation of significant PGE mineralised zones at surface. Detailed geophysical surveys consisting of Magnetic (Total Field), Gravity, IP and Resistivity surveys including multielectrode dipole-dipole surveys were carried out, covering a strike length of 650 m in both 'A' and 'F' Sectors, to delineate the Chromiferous meta-pyroxenite bands within the anorthosite, the host rock for PGE mineralisation and also to prove the depth persistence of the PGE mineralisation in the central part of Tasampalaiyam block (T3 sector), Sittampundi Anorthosite Complex, Namakkal district, Tamil Nadu. Segment 'A' falls in the eastern part and Segment 'F' falls in the western part of T3 sector, are characterized by a group of rocks ranging in composition from chromitite, meta-pyroxenite, pyroxenite, garnetiferous pyroxene granulite and anorthosite. The chromitite and meta-pyroxenite bands hosting the PGE mineralisation occur within anorthosite. In Segment A, the magnetic contour map with 10nT contour interval shows a total variation of 450 nT. High dominant magnetic anomaly with a maximum value of +100nT recorded over anorthosite trending E-W direction in the northern part. Magnetic anomaly map has well brought out the structural step and lithological boundaries in the form of steep gradients and change in gradients. The contact between pyroxene granulite and anorthosite is well reflected with steep magnetic gradients trending ENE-WSW direction in the southern part. The chromiferous meta-pyroxenite bands exposed in the trenches are well reflected in the form subtle magnetic variations of the order of 10 to 20nT, trending E-W direction. Bouguer gravity map with a contour interval of 0.1 mGal brings out a total variation of around 1.60 mGal recording a minimum value of -89.2 mGal in the northwestern part of the area over anorthosite and a maximum value of -87.6 mGal noticed over coarse grained garnetiferous pyroxene granulite in the southern part. Moderate anomalies of the order of -88.2 to -88.6 noticed between traverses E100 to E300 and stations: 0 to N50 over chromiferous meta-pyroxenite bands within the anorthosite trending</p>

(Contd.)

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							<p>east-west direction. The resistivity contour map with contour interval of 100 Ohm m brings out a total variation of around 2300 Ohm m, recording maximum values upto 2600 Ohm m in the central part over massive anorthosite trending east-west direction, between stations 0 and S80. Low resistivity values of the order of 300-600 Ohm m noticed over kaolinised zones within anorthosite consists of chromiferous metapyroxenite bands, corroborating well with high chargeability anomaly zones in the northern part between stations 0 and N70. Multi-electrode dipole-dipole surveys carried out along Tr: E250 between stations S100 to N140, indicated the presence of thin, narrow chromiferous metapyroxenite bands extended up to 60 m depth. In Segment B, The magnetic contour map with 20nT contour interval shows a total variation of 1600 nT. High dominant magnetic anomaly with a maximum value of +200nT recorded over anorthosite trending ENE-WSW direction exposed in the central part. The contact between pyroxene granulite and anorthosite is well reflected with steep magnetic gradients trending ENE-WSW direction in both south and northern part (covered by soil). The chromiferous metapyroxenite bands exposed in the trenches/old workings are reflected in the form subtle magnetic variations of the order of 10 to 20nT, trending ENE-WSW direction. Bouguer gravity anomaly map with a contour interval of 0.1 mGal brings out a total variation of around 3.20 mGal recording a minimum value of -88.8 mGal in the northwestern part over soil cover and a maximum value of -88.8 mGal noticed over coarse grained garnetiferous pyroxene granulite in the southeastern part. Moderate anomalies of the order of -86.4 to -87.2 noticed between stations S100 to N50 over the anorthosite band trending ENE-WSW direction. The resistivity contour map with contour interval of 100 Ohm.m brings out a total variation of around 4400 Ohm m, recording maximum values upto 4800 Ohm.m in the southern part over pyroxene granulite. Low resistivity values of the order of 400-600 Ohm m noticed over kaolinised zones within anorthosite consists of thin and narrow chromiferous metapyroxenite bands, corroborating</p>

(Contd.)

STATE REVIEWS

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							well with high chargeability anomaly zones of the order of 12-14.5 m. sec/V in the central part between stations 0 and S50. The investigation will be continued.
Namakkal and Tiru- chirapalli	Tattayangarpettai- Turaiyur area	1:12500	40	-	-	-	G4 stage investigation was taken up to delineate potential zones of PGE mineralisation and to bring out the nature and control of mineralisation. The area forms another potential zone of meta-ultramafites that is present in the eastern segment of the PCSZ, in the proximity of its southern boundary i.e., the Cauvery Shear Zone. An area of 40 sq km was mapped on 1: 12500 scale in parts of Tiruchirapalli district, Tamil Nadu around Tattayangarpettai, Devanur, Payattamparai, Valaiyeddupu, Serigudi, Arachhi and Krishnapuram to delineate the ultramafic rocks, to bring about their disposition and explore the possibility of PGE mineralisation in this area. The major rock types exposed in the area are hornblende gneiss and charnockite (\pm garnet). The other rock types exposed include garnet pyroxene granulite/gneiss, pyroxenite. Altered dunite with ramified magnesite veins occurs as a linear body with a near ENE-WSW trend 750 m west of Tattayangarpettai. This dunite band is traced for a strike length of 500 m with width varying from ~30 to 60 m. These outcrops are often covered by kankar. Thin and sporadic development of magnesite is seen at places within the dunite. Serpentinisation and development of vermiculite are found at the contact zone between gneiss and dunite. A number of pyroxenite and altered ultramafics (talc-tremolite) bands occur as discontinuous bands/lenses, which vary in width from 10 m to 70 m and in length from 100 m to 800 m and are exposed in a 10 km wide zone to the south of Tattayangarpettai and Kasturippatti. A total of 24 nos. numbers of pyroxenite bands and 07 nos. of altered ultramafics (talc-tremolite rock) were delineated. The pyroxenites are medium to coarse grained, granular and black to dark green in colour. In hand specimen, it is medium to coarse grained with bottle green pyroxene, honey yellow pyroxene and occasional feldspar. Talc and chlorite alterations are also observed. Petrographic studies indicate the presence of orthopyroxenes (Contd.)

STATE REVIEWS

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							(up to 40%) and clinopyroxenes (up to 25%), amphibole (up to 3%), epidote (up to 10%) and opaques (5%). Development of actinolite, tremolite and talc is commonly observed in the alteration zones. Under thin section, the pyroxenite is essentially composed of Opx (hypersthene) and Cpx (augite). The Opx exhibits strong pink pleochroism and the Cpx shows the lamellae of Opx (inverted pigeonite?). The pigeonite (high temperature low calcium Cpx) carries lot of Opx and hence the lamellae of Opx is seen in the Cpx. Epidote occurs as discrete grains and is in equilibrium with Opx and Cpx. Few amphiboles are seen within the epidote. The opaque minerals are magnetite and chrome spinel. The investigation is completed.
A2 and B2 quadrants of 58 I/4 toposheets	Sukkampatti, Chinnatambipalayam, Pallathur, Sembakavundanpudur- Surampatti, Seviturangampatti and Tannipandal	1:12500 1:1000	80 0.55	- -	- -	- -	REE investigation was taken up as the continuation of previous FSP assignment. This year, the area assigned for the investigation is covering mostly A2 and B2 quadrants of 58 I/4 toposheets. The large scale mapping completed in northern, eastern, central parts of the area covers a total area of 80 sq km. In general, the rocks trend in NW/SE direction with swings in the foliation locally. Micro folds are observed in the outcrops. Minor shear zones are noticed at places. In the study area, REE mineralisation occurs as disseminated or isolated spots in granitic gneiss, pink migmatite, pink grey gneiss and probably at the contact of these rocks with country rock hornblende gneiss. Disseminated grains of haematite are also present in certain leucogranites near Poyyeri where it has been assumed that the original magnetite grains might have oxidised to haematite. In a well dump east of Nochipatti, specks of pyrite, chalcopyrite, bornite and molybdenite are observed in a quartz vein associated with hornblende-biotite gneiss. The quartz vein hosting the sulphides is traced to a distance of 15 m up to an adjacent well. Thereafter, no outcrop is noticed and rather the body appears to be terminating. Even the depth penetration as observed in the well section appears to be negligible. In summary, areas covering Sukkampatti (Σ LREE ranges from 299.97 ppm to a maximum of 1203.57 ppm & Σ HREE ranging with a minimum of 10.58 ppm to a maximum of 83.40 ppm),

(Contd.)

STATE REVIEWS

Table - 3 (Concl.d.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
							Chinnatambipalaiyam (Σ LREE=205.36 to 1359.59 ppm with Σ HREE=25.19 to 85.44 ppm), Pallathur (Σ LREE=359 to 1459.70 ppm with Σ HREE=01.67 to 107.34 ppm), Sembakavundanpudur-Surampatti contact zone (Σ LREE = 505.36 ppm to 778.51 ppm with Σ HREE=36.62 to 76.77 ppm), Seviturangampatti (Σ LREE=240.10 to 1168.40 ppm & Σ HREE=35.19 to 117.90 ppm) and Tannipandal (Σ LREE=262.14 to 3282.23 ppm & Σ HREE=34.59 to 131.70 ppm) and have yielded relatively high values for REE in chemical analysis. Hence, an area of 0.55 sq km is taken for DM in three different blocks, namely Sukkampatti, Chinnatambipalaiyam and Ayyampalaiyam area. Detailed mapping is carried out on 1:1000 scale for an area of approximately 0.55 sq km. The main rocks type exposed in DM area are leached pink migmatite, pink migmatite, pink granite, hornblende granite gneiss, granite gneiss, pink pegmatite and hornblende-biotite gneiss. The alteration zones are closer or at the contact of pegmatitic or quartz-rich portions and at the contact with country rock hornblende biotite gneiss which could have contributed to the source of REE. In some places the alteration zones are along the foliation and gneissic bands in the pink migmatite. The detailed mapping is completed in all three blocks. Radiometric surveying is also carried in the DM. Scintillation count of 25 μ R/h and above in granite and its variants in the area is taken as background value above which all values are treated as anomaly prone area having plausible potential area. Rock chip samples were collected for thin polished section from the groove sample located in FSP area last year which have recorded higher values. The opaque mineral grains were collected as individual grains besides separating from crushed chip samples by hand picking and simple magnetic separation and a total of 13 nos. of samples were submitted to PPOD laboratory, Bengaluru for XRD studies to identify mineral phases and results are awaited.
Neyveli Lignite Corporation (NLC)							
Lignite							
Cuddalore	East of Sethiathope	-	-	41	12888	149	It is inferred that this block hosts substantial lignite resources.
-do-	Vayalampur	-	-	19	8786	29	Work was under progress.

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

(Value in ₹ '000)

Mineral	Unit	2012-13			2013-14			2014-15 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		368		61925152	377		67419325	292		75741359
Lignite	'000t	3	24900	37346600	3	25100	41992100	3	25200	51122400
Natural Gas (utilised)	m c m	-	1206	9973774	-	1304	10784247	-	1191	9849723
Petroleum (crude)	'000t	-	238	4325834	-	226	4107725	-	240	4362186
Bauxite	t	3	95442	30587	3	100895	48969	3	78372	44559
Ball Clay [#]	t	1	13333	13466	1	4464	3125	1	760	532
Clay (others) [#]	t	3	4770	692	2	-	-	2	-	-
Dunite* [#]	t	-	79524	91668	-	63939	97675	-	73927	108310
Felspar [#]	t	1	42666	14934	-	56061	19464	-	51884	20078
Fireclay [#]	t	16	145468	19768	8	181362	28232	10	169458	28359
Garnet (abrasive)	t	55	660053	298597	66	355344	174869	2	10397	69086
Graphite (r.o.m.)	t	2	69109	49792	2	88545	73064	2	72956	52799
Gypsum [#]	t	2	3190	1512	2	2140	854	1	-	-
Limestone	'000t	197	26442	5217805	206	24112	5538596	190	22205	5337446
Lime Kankar [#]	t	2	192151	43426	2	140088	28435	1	111382	21089
Limeshell	t	1	105	105	1	60	60	1	30	30
Magnesite	t	10	160450	339026	9	144991	363289	11	215254	562329
Marl**	t	-	96826	19018	-	37571	10407	-	2039	577
Quartz [#]	t	63	21367	28368	64	15783	18393	58	21268	15725
Silica Sand [#]	t	7	10916	13337	6	44533	31058	5	74268	46933
Talc/soapstone steatite [#]	t	1	991	297	1	1280	384	1	2750	825
Vermiculite	t	1	1373	3095	1	2201	4928	1	2201	4922
Minor Minerals [@]		-	-	4093451	-	-	4093451	-	-	4093451

Note: The number of mines excludes petroleum (crude), natural gas (utilised) and minor minerals.

* Associated with magnesite. ** Associated with limestone.

@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Declared as minor mineral vide Gazette notification dated 10.02.2015.

STATE REVIEWS

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in organised sector in the State are given in Table -5.

Table – 5 : Principal Mineral-based Industries in Tamil Nadu

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Chennai.	NA
Cutfast Abrasives Tools Pvt. Ltd, Chennai.	NA
Asbestos Products	
Hyderabad Industries Ltd, Kannigaiper.	100
Ramco Industries Ltd, Arakkonam, Distt. Vellore	NA
Southern Asbestos Cement Ltd, Arrakonam. Distt. Vellore	NA
Tamil Nadu Asbestos, Alangulam, Distt. Virudhunagar.	28.5
Cement	
ACC Ltd, Madukkarai, Distt. Coimbatore.	1180
Chettinad Cement Corpn. Ltd, Puliyar, Distt. Karur.	1700
Chettinad Cement Corpn. Ltd, Karikalli Distt. Dindigul.	4500
Chettinad Cement Corpn. Ltd, Ariyalur.	5500
Dalmia Cements, Dalmiapuram, Distt. Tiruchirapalli.	4000
Dalmia Cements, Ariyalur.	2500
India Cements Ltd, Sankarnagar, Distt. Tirunelveli.	2050
India Cements Ltd, Sankari, Distt. Salem (G).	860
India Cements Ltd, Dalavoi, Distt. Perambalur.	1850
India Cements Ltd, Vallur, Distt. Chennai (G).	1100
Ultra-Tech Cement Ltd, Reddipalayam, Distt. Ariyalur.	1400
Ultra-Tech Cement Works (ARCW), Arakkonam (G).	1100

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Ramco Cement (formerly Madras Cement), R.S. Raja Nagar, Distt. Virudhunagar.	2000
Ramco Cement (formerly Madras Cement), Alathiyur Works, Distt. Ariyalur.	3050
Ramco Cement (formerly Madras Cement), Ariyalur Plant, Govindpuram, Distt. Ariyalur.	3500
Ramco Cement (formerly Madras Cement), Chengalpet Grinding Unit, Uthiramerur, Distt. Kanchipuram (G).	600
Ramco Cement (formerly Madras Cement), Valapady, Distt. Salem (G).	1600
Tamil Nadu Cements, Alangulam, Distt. Virudhunagar.	400
Tamil Nadu Cements, Ariyalur, Distt. Ariyalur.	500
Zuari Cements Ltd, Chennai Grinding Unit, Attipattu, Tiruvallur (G).	1000
Ceramics	
Carborandum Universal Ltd, Hosur.	NA
Murugappa Morgan Thermal Ceramics Ltd, Ranipet, Distt. Vellore.	5.44
Neycer India Ltd, Vadalur, Distt. Cuddalore.	9.0
Roca Bathroom Product Pvt Ltd, Ranipet, Distt. Erode.	12.6
Roca Bathroom Product Pvt Ltd, Perundurai, Distt. Vellore.	24
Spartek Ltd, Chennai.	NA
Copper Smelter	
Sterlite Industries (I) Ltd, Thoothukudi.	400 (Cu smelting) 205 (Cu cathode) 90 (wire rods) 1050 (H ₂ SO ₄)
Fertilizer	
Coimbatore Pioneer Fertilizer Ltd, Muthugoundanpudur, Distt. Coimbatore.	66 (SSP) 30 (H ₂ SO ₄) 3 (oleum)
Coramandal International Ltd, (Formerly EID Parry), Ranipet, Distt. N. Arcot.	132 (SSP) 33 (H ₂ SO ₄)
Coramandal International Ltd, Ennore, Distt. Thiruvallur.	330 (Complex)
Kothari Industrial Corp. Ltd, Ennore.	66 (SSP)
Madras Fertilizer Ltd, Manali, Distt. Thiruvallur.	486.8 (Urea) 840 (NP/NPKs)

(Contd.)

STATE REVIEWS

Table -5 (Contd.)

Industry/plant	Capacity (‘000 tpy)
Greenstar Fertilizers Ltd, Guindy.	115 (SSP)
Greenstar Fertilizers Ltd (acquired phosphate div. of SPIC), Thoothukudi.	115.5 (N) 211 (P ₂ O ₅)
Southern Petrochemical Industries Corpn. Ltd), Thoothukudi.	620 (Urea)
Chemicals	
Tanfac Industries Ltd, Cuddalore.	16.5 (anhydrous HF), 16.5 (AlF ₃) 67.5 (H ₂ SO ₄) 14 (Hydrofluoric acid) 3.4 (speciality fluorides)
Tuticorin Alkali Chemicals & Fertilizers Ltd, Thoothukudi	115 (soda ash) 105 (A/Cl)
Synthetic Rutile	
DCW Ltd, Sahapuram, Distt. Thoothukudi.	48
TiO₂ Pigment	
VVTi Pigments (P) Ltd, (formerly, Kilburn Chemicals) Distt. Thoothukudi.	13
Iron & Steel	
Salem Steel Plant (SAIL), Salem.	180 (Crude/ Liquid steel)
JSW Steel Plant (acquired Southern Iron & Steel Co. Ltd), Salem.	1180 (sinter) 180 (pig iron) 1000 (specialised alloy steel)
Sponge Iron	
Akshara Industries Ltd, Eguvarpalayam, Distt. Thiruvallur.	60
Kaushik Steel Industries Ltd, Pappen Kuppam Distt. Thiruvallur.	60
Agni Steels Pvt Ltd, Olappalayam Road, Ingur, Distt. Erode.	30

(Contd.)

Table -5 (Concl.)

Industry/plant	Capacity (‘000 tpy)
Refractory	
ABREF Pvt. Ltd, Gummidipoondi, Distt. Thiruvallur.	1.3
Sharda Ceramics Pvt. Ltd, Ambattur, Chennai.	9.9
Shri Natraj Ceramic & Chemical Industries Ltd, Dalmiapuram, Distt. Tiruchirapalli.	42
VRW Refractories, Vanagaram.	21.6
Zirconium Complex, Pazhakayal, Thoothukudi.	0.5 (Zr-Oxide) 0.25 (Zr sponge)
DBM & Calcined Magnesite	
SAIL Refractory Co. Ltd (formerly Burn (Standard Co. Ltd), Salem.	18 (calcined magnesite) 54 (DBM) 48 (refractory)
Dalmia Magnesite Corpn., Chettichavadi Distt. Salem.	72 (DBM)
Ramkrishna Magnesite Mines, Salem.	3 (calcined)
Tamil Nadu Magnesite Ltd, Kurumbapatty, Distt. Salem.	19.5 (calcined magnesite) 30 (DBM)
Sri Pon Kumar Magnesite Ltd, Salem.	26.5 (DBM)
Silicon Carbide	
Carborandum Universal Ltd, Tiruvottiyur.	NA
Petroleum Refinery	
CPCL, Manali, Dist. Thiruvallur.	10500
CPCL, Narimanam.	1000

(G): Grinding unit.

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