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(Part- III : Mineral Reviews)

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KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

(ADVANCE RELEASE)

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29 Kaolin, Ball Clay, Other Clays and Shale

1. Kaolin (China Clay)

Kaolin, also known as china clay, is a natural clay formed by chemical weathering of aluminium silicate minerals like felspars. It is relatively pure clay predominantly consisting of kaolinite ($Al_2Si_2O_5(OH)_4$), associated with other clay minerals like dickite, halloysite, nacrite and anauxite. Kaolin is commercially valued for its whiteness and fine particle size which distinguish it from other clays, such as, ball clay and fireclay. Other physical characteristics that influence commercial utility include brightness, glossiness, abrasiveness and viscosity. It often contains small amounts of impurities in the form of rock fragments, hydrous oxides and colloidal materials. Kaolin is produced and consumed in the country in crude & processed forms. The major use of crude china clay in the country is in Cement Industry and of processed china clay is in Ceramic Industry. The clay formed in situ in India is often soft and easily extracted with no blasting required.

RESOURCES

China clay resources in the country as per UNFC system as on 1.4.2010 have been placed at 2,705.21 million tonnes. The reserves constitute only about 7% of the resources at 177.16 million tonnes. Out of the total reserves, 70% (about 124 million tonnes) reserves are under proved category whereas 30% (about 53 million tonnes) reserves fall under probable category.

The resources are spread over in a number of states of which Kerala holds about 25%, followed by West Bengal and Rajasthan (16% each) and Odisha and Karnataka (10% each).

Out of total resources, about 22% or 608 million tonnes fall under ceramic/pottery grade, 4% are classified under chemical, paper filler and cement grades and about 73% or 1,980 million tonnes resources fall under mixed grade, others, unclassified & not-known categories. The details of reserves/ resources are given in Table - 1.

EXPLORATION & DEVELOPMENT

DMG, Kerala carried out exploration for kaolin in the districts of Kannur and Kollam. The details of exploration carried out during 2012-13 are given in Table-2.

PRODUCTION, STOCKS & PRICES

The production of kaolin at 3,679 thousand tonnes in 2012-13 increased by 20% as compared to previous year.

There were 131 reporting mines during 2012-13 as against 105 mines in the previous year. Besides, the production of kaolin was also reported as an associated mineral by seven mines in the year 2012-13 and four mines in the previous year. Ten principal producers accounted for about 70% of the total output of kaolin in 2012-13. The private sector mines reported 99.64% of the total production and the remaining 0.36% was reported by 5 public sector mines. The contribution of natural and processed kaolin in 2012-13 was 97.04% and 2.96%, respectively.

During 2012-13, twenty two kaolin mines and seventeen associated mines each producing more than 15,000 tonnes annually accounted for 93.75% of the total production of kaolin (natural) while 6 kaolin mines and two associated mines each in the annual production range of 10,001 to15,000 tonnes accounted for 2.80 % and the remaining production of kaolin (natural) was shared by seventy five kaolin mines and four associated mines producing up to ten thousand tonnes annually.

Contribution of five kaolin mines along with one associated mines producing more than 5,000 tonnes of kaolin (processed) was about 73.4% and remaining 26.6% production of kaolin (processed) was shared by sixteen kaolin mines.

Gujarat was the leading producing state of kaolin accounting for 54% of the total production in 2012-13 followed by Kerala (24%), Rajasthan (16%), West Bengal (3%) and Jharkhand (2%). The remaining 1% was shared by Andhra Pradesh, Karnataka and Madhya Pradesh.

Mine-head stocks of kaolin at the end of 2012-13 were 728 thousand tonnes as against 356 thousand tonnes in the beginning of the year.

The average daily employment of labour during 2012-13 was 2437 as against 2148 in the preceding year.

Table –1 : Reserves/Resources of China Clay as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade / State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**124118**	**11034**	**42006**	**177158**	**24543**	**22980**	**71270**	**284781**	**412852**	**1651286**	**60338**	**2528050**	**2705208**
By Grades													
Chemical	-	-	-	-	-	600	-	-	-	33945	-	34545	34545
Ceramic/Pottery	48028	2948	19564	70540	5957	10837	34695	100846	21283	337834	25788	537240	607780
Mixed Grade	7926	525	1330	9781	256	1784	2725	884	607	199355	18373	223984	233765
Filler	5793	181	2892	8866	2699	992	3671	11	665	30035	2804	40877	49743
Cement	14275	4324	2981	21580	1211	321	4637	730	1286	2565	409	11159	32739
Others	17796	1563	10234	29593	9464	6606	13651	180195	2758	41709	676	255059	284652
Unclassified	22924	506	1801	25231	3888	1161	3820	850	68338	30644	1289	109990	135221
Not-known	7376	987	3205	11568	1068	677	8071	1264	317915	975199	11000	1315194	1326762
By States													
Andhra Pradesh	2524	339	2205	5068	683	1490	1147	126	691	61883	3088	69108	74176
Assam	-	-	-	-	-	131	-	392	-	3520	-	4043	4043
Bihar	-	-	-	-	-	-	-	104	39	1296	-	1439	1439
Chhattisgarh	834	-	344	1178	480	765	1076	-	-	11512	-	13833	15011
Delhi	-	-	-	-	-	-	-	857	630	3802	-	5289	5289
Goa	-	-	-	-	-	-	16	-	-	-	-	16	16
Gujarat	34290	240	6232	40762	4654	856	24135	-	878	40904	-	71427	112189
Haryana	-	-	-	-	2367	789	3377	13	34	5485	-	12065	12065
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	28122	-	28122	28122
Jharkhand	8554	325	8731	17610	209	2031	1565	1936	7363	149957	18019	181080	198690
Karnataka	943	835	280	2058	819	738	3390	220360	443	24685	6030	256465	258523
Kerala	3352	792	-	4144	2447	463	2985	43930	20439	569226	20200	659690	663834
Madhya Pradesh	-	-	-	-	942	-	61	-	415	11741	-	13159	13159
Maharashtra	-	-	-	-	418	256	856	11	184	5523	-	7248	7248
Manipur	-	-	-	-	-	-	-	2520	-	-	-	2520	2520
Meghalaya	-	-	-	-	-	-	-	1410	6266	76032	5167	88875	88875
Odisha	2376	715	811	3902	-	1252	2476	223	35393	236421	1259	277024	280926
Puduchery	-	-	-	-	-	-	-	-	-	2940	-	2940	2940
Rajasthan	70012	7603	22497	100112	11524	14008	29483	1260	4067	271314	749	332405	432517
Tamil Nadu	-	-	-	-	-	-	-	-	327	56570	-	56897	56897
Uttar Pradesh	-	-	-	-	-	-	-	11600	3447	10018	-	25065	25065
West Bengal	1232	185	906	2323	-	202	703	38	332236	80335	5826	419340	421663

Figures rounded off.

Table – 2 : Details of Exploration Activities for Kaolin and other Clays, 2012-13

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
China Clay							
DMG							
Kerala Kannur	Aravanchal area	-	-	02	41.5	-	Object of exploration was to assess the resource for the development of clay based industries. The average thickness of variegated clay was found out to be about 9 m. Resources were not estimated.
- do -	Thaliparambu	-	-	40	791.5	-	The average thickness of china clay/ variegated clay was about 11 m and that of overlaid laterite was about 7 m. The estimation of resources will be made after completion of drilling & chemical analysis.
Kollam	Kundara Kanjiracode area	-	-	09	407	-	Area is partly covered with laterite which is underlain by sedimentary formation of cross bedded ferruginous sandstone variegated clay to sandy clay, pinkish clayey sand, pale white clay, dull white clay, yellowish white sandy clay, black carbonaceous clay. The residual clay vary in colour from dull white to yellow. A tentative resource of 0.97 million tonnes of dull white to slightly greyish sandy clay were estimated in North-East & North-West areas of Kanjiracode clay mine.
- do -	Pattamukku area	-	-	01	17	-	The average thickness of sandy clay/variegated clay is about 8 m. A tentative resource of 0.25 million tonnes of sandy clay were estimated.

Table – 3 : Principal Producers of Kaolin, 2012-13

Name & address of producer	Location of mine	
	State	District
Vinodbhai P. Solanki, Sevansheri, Baladiya, Bhuj-370 427, Distt. Kachchh Gujarat.	Gujarat	Kachchh
EICL Limited, TC -79/4, Veli, Thiruvananthapuram-695 021, Kerala.	Kerala	Thiruvanantha-puram
H.D. Enterprises Pvt. Ltd, 101, H.D. House, Pooja Complex 'A', Station Road, Bhuj - 370 001, Distt. Kachchh, Gujarat.	Gujarat	Kachchh
Satish Valji Chhanga, Survey No.483, Paiki, Village-Mamuara, Bhuj - 370 020 Distt. Kachchh, Gujarat.	Gujarat	Kachchh
Manoj P. Solanki, Near Thakar Mandir, Junavas, Madhapar, Bhuj - 370 020, Distt. Kachchh, Gujarat.	Gujarat	Kachchh
Mohd. Sher Khan, Khwaja Bagh, P.O - Sawa, Distt. Chittorgarh-312 613, Rajasthan.	Rajasthan	Chittorgarh

(Contd.)

(Table - 3 Concld.)

Name & address of producer	Location of mine	
	State	District
Shree Ram Minechem International, G.I.D.C Area, Madhapar, Bhuj- 370 020, Distt. Kachchh, Gujarat.	Gujarat	Kachchh
J.K. White Cement Works, PO- Gotan-342 902 Distt. Nagaur, Rajasthan.	Rajasthan	Chittorgarh
Laherchand Gangaram Thakkar, D.B.Z.S.-157 Zanda Chowk, Gandhidham-370 201, Distt. Kachchh, Gujarat.	Gujarat	Kachchh
Sreekumar S, Koustuba,T.C. 2/1913, Veerabhadra Garden, Thiruvananthapuram-695 004, Kerala.	Kerala	Thiruvanan-thapuram

Table – 4 : Production of Kaolin (Total) 2010-11 to 2012-13
(By States)

(Qty in tonnes; Value in ₹'000)

State	2010-11		2011-12		2012-13 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2727946**	**737101**	**3076795**	**652368**	**3678930**	**991168**
Andhra Pradesh	10431	1440	75115	11775	50236	8370
Gujarat	1251890	204177	1517504	278365	1989949	363655
Jharkhand	93001	84327	122412	61210	66235	31369
Karnataka	9785	8796	3214	8678	2836	7657
Kerala	704360	228105	747307	149883	870713	190288
Madhya Pradesh	6106	484	6950	621	11200	672
Odisha	2601	2692	-	-	-	-
Rajasthan	559927	169143	512145	104587	592154	335982
West Bengal	89845	37937	92148	37249	95607	53175

Table – 5 : Production of Kaolin, 2011-12 and 2012-13 (P)
(By Sectors/States/Districts/Grades)

(Qty. in tonnes; value in ₹'000)

State/District	2011-12							2012-13(P)						
	No. of mines	Natural		Processed		Total		No. of mines	Natural		Processed		Total	
		Qty	Value	Qty	Value	Qty	Value		Qty	Value	Qty	Value	Qty	Value
India	**105(4)**	**3000661**	**518389**	**76134**	**133979**	**3076795**	**652368**	**131(7)**	**3569979**	**684413**	**108951**	**306755**	**3678930**	**991168**
Public sector	5	16664	2500	10331	33168	26995	35668	5	4594	689	8739	37923	13333	38612
Private sector	100(4)	2983997	515889	65803	100811	3049800	616700	126(7)	3565385	683724	100212	268832	3665597	952556
Andhra Pradesh	**11**	**75115**	**11775**	**-**	**-**	**75115**	**11775**	**8**	**50236**	**8370**	**-**	**-**	**50236**	**8370**
Adilabad	1#	-	-	-	-	-	-	-	-	-	-	-	-	-
Cuddapah	2	63709	9556	-	-	63709	9556	2	44520	7227	-	-	44520	7227
East Godavari	6	11116	2163	-	-	11116	2163	5	5716	1143	-	-	5716	1143
West Godavari	2	290	56	-	-	290	56	1#	-	-	-	-	-	-
Chhattisgarh	**1#**	-	-	-	-	-	-	-	-	-	-	-	-	-
Rajnandgaon	1#	-	-	-	-	-	-	-	-	-	-	-	-	-
Gujarat	**35(1)**	**1482871**	**231866**	**34633**	**46499**	**1517504**	**278365**	**50(2)**	**1956020**	**317414**	**33929**	**46241**	**1989949**	**363655**
Kachchh	24(1)	1427378	221284	-	-	1427378	221284	37(2)	1870791	299221	-	-	1870791	299221
Mahesana	4	36570	6948	16413	23326	52983	30274	4	42763	8773	15208	22171	57971	30944
Patan	2#	-	-	-	-	-	-	4	25199	5830	-	-	25199	5830
Sabarkantha	5	18923	3634	18220	23173	37143	26807	5	17267	3590	18721	24070	35988	27660
Jharkhand	**9(1)**	**96869**	**11456**	**25543**	**49754**	**122412**	**61210**	**6(1)**	**53121**	**5154**	**13114**	**26215**	**66235**	**31369**
Sahebganj	3(1)	91269	5016	18073	37682	109342	42698	3(1)	52621	4579	12879	25648	65500	30227
Singhbhum (West)	6	5600	6440	7470	12072	13070	18512	3	500	575	235	567	735	1142

(Contd.)

Table - 5 : (Concld.)

State/District	2011-12							2012-13(P)						
	No. of mines	Natural		Processed		Total		No. of mines	Natural		Processed		Total	
		Qty	Value	Qty	Value	Qty	Value		Qty	Value	Qty	Value	Qty	Value
Karnataka	**1**	**-**	**-**	**3214**	**8678**	**3214**	**8678**	**1**	**-**	**-**	**2836**	**7657**	**2836**	**7657**
Hassan	1	-	-	3214	8678	3214	8678	1	-	-	2836	7657	2836	7657
Kerala	**17**	**740190**	**125393**	**7117**	**24490**	**747307**	**149883**	**20(1)**	**864810**	**160023**	**5903**	**30265**	**870713**	**190288**
Kannur	2	-	-	5887	19737	5887	19737	2	-	-	4400	23965	4400	23965
Kasaragode	1	-	-	1230	4753	1230	4753	1	-	-	1503	6300	1503	6300
Kollam	1	16664	2500	-	-	16664	2500	1	4596	689	-	-	4596	689
Thiruvanantha-puram	13	723526	122893	-	-	723526	122893	16(1)	860216	159334	-	-	860216	159334
Madhya Pradesh	**2**	**6950**	**621**	**-**	**-**	**6950**	**621**	**2**	**11200**	**672**	**-**	**-**	**11200**	**672**
Katni	2	6950	621	-	-	6950	621	2	11200	672	-	-	11200	672
Satna	-	-	-	-	-	-	-	1#	-	-	-	-	-	-
Rajasthan	**18(2)**	**512145**	**104587**	**-**	**-**	**512145**	**104587**	**31(3)**	**544586**	**148892**	**47568**	**187090**	**592154**	**335982**
Bhilwara	6	179970	39037	-	-	179970	39037	7(1)	158408	36102	-	-	158408	36102
Bikaner	(1)	11655	2564	-	-	11655	2564	(1)	39569	13092	-	-	39569	13092
Bundi	1	1514	176	-	-	1514	176	1	3515	541	-	-	3515	541
Chittorgarh	7	251095	47052	-	-	251095	47052	9	283385	83622	-	-	283385	83622
Jaipur	1	63951	15348	-	-	63951	15348	1	-	-	47568	187090	47568	187090
Karauli	-	-	-	-	-	-	-	1	2847	475	-	-	2847	475
Nagaur	1(1)	3960	410	-	-	3960	410	9(1)	47115	12336	-	-	47115	12336
Pali	-	-	-	-	-	-	-	2	8337	2438	-	-	8337	2438
Sikar	1#	-	-	-	-	-	-		-	-	-	-	-	-
Udaipur	1#	-	-	-	-	-	-	1	1410	286	-	-	1410	286
West Bengal	**11**	**86521**	**32691**	**5627**	**4558**	**92148**	**37249**	**13**	**90006**	**43888**	**5601**	**9287**	**95607**	**53175**
Bankura	2	5315	625	-	-	5315	625	3	5465	941	-	-	5465	941
Birbhum	9	81206	32066	5627	4558	86833	36624	10	84541	42947	5601	9287	90142	52234

Figures in parentheses indicate the number of associated mines.
 # Mines reporting dolomite.

Table – 6: Production of Kaolin (Natural), 2011-12 and 2012-13 (P) (By Frequency Groups)

(Qty in tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
All Groups	**90(3)**	**120(6)**	**3000661**	**3569979**	**100.00**	**100.00**	-	-
Up to 500	20(2)	38(2)	1540	3341	0.05	0.09	0.05	0.09
501-1000	3	3(1)	2880	3630	0.10	0.10	0.15	0.19
1001-2000	9	14(1)	14338	23065	0.48	0.65	0.63	0.84
2001-3000	3	5	7077	13414	0.24	0.38	0.87	1.22
3001-4000	7	4	24750	13376	0.82	0.37	1.69	1.59
4001-5000	3	4	12955	17820	0.43	0.50	2.12	2.09
5001-10000	6	7	42285	48393	1.41	1.36	3.53	3.45
10001-15000	4(1)	8	60354	100121	2.01	2.80	5.54	6.25
15001 & Above	35	37(2)	2834482	3346819	94.46	93.75	100.0	100.0

Figures in parentheses indicate the number of associated mines.

Table – 7: Production of Kaolin (Processed), 2011-12 and 2012-13(P) (By Frequency Groups)

(Qty in tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
All Groups‘	**24(1)**	**22(1)**	**76134**	**108951**	**100.00**	**100.00**	-	-
Up to 500	3	4	618	647	0.81	0.59	0.81	0.59
501-1000	4	-	2535	-	3.33	-	4.14	0.59
1001-2000	3	5	4912	6098	6.45	5.60	10.59	6.19
2001-3000	4	5	5627	13841	7.39	12.70	17.98	18.89
3001-4000	2	2	6752	3805	8.87	3.49	26.85	22.38
4001-5000	2	1	8170	4580	10.73	4.20	37.58	26.58
5001-10000	6(1)	4	47520	22160	62.42	20.34	100	46.92
10001 & Above	-	1(1)	-	57820	-	53.08	-	100.00

( ) : Figures in parentheses indicates no. of associated mines

Table – 8 : Mine-head Stocks of Kaolin (Total), 2012-13 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**498805**	**728007**
Andhra Pradesh	13112	14942
Gujarat	158593	203124
Jharkhand	14868	18762
Karnataka	11487	13175
Kerala	29003	36573
Madhya Pradesh	8190	6675
Odisha	3897	614
Rajasthan	227763	409892
West Bengal	31892	24250

MINING, PROCESSING & MARKETING

China clay deposits worked in India are mostly of pocket-type. Opencast manual mining is followed in most kaolin mines. The most common practice is to dig trial pits for locating clay pockets or beds which are gradually enlarged into pits of various dimensions. China clay is often soft and easily extracted with no blasting required. Clay and overburden are quarried in benches. In few mines, bulldozers and excavators are used to remove the overburden which is then transported through trucks/tractors/trailers.

Crude china clay is normally processed outside the leasehold area. Almost, all the china clay user industries except cement, insecticide and refractory units consume processed china clay. The natural china clay is processed in the country mostly by conventional method of levigation/washing. In addition, hi-tech processes, such as, Mozeley hydrocyclone separator, high-intensity magnetic separator, bleaching (chemical decolourisation), spray drying and calcination are in practice. There is a need to use more sophisticated processing techniques like ultra froth-flotation, cryo-filter, etc.

The recovery percentage of processed china clay from raw china clay ranges from as low as 14% to as high as 56%, depending upon the quality of china clay available in different states. Large number of levigation plants are installed in the country mostly in Kerala, Gujarat, Jharkhand, West Bengal and Rajasthan. Kerala has become a hub for India's processed kaolin production. The important plants in the country are English Indian Clays Ltd (EICL) (240,000 tpy capacity), Veli, Thiruvananthapuram, Kerala; Kerala Clays and Ceramic Products Ltd, (10,000 tpy capacity) Payangadi, Kannur district, Kerala; 20 Microns Ltd, Mamuara, Bhuj district Kachchh, Gujarat (80,500 tpy capacity; a new plant of 33,600 tpy is also installed); Amrapali China Clay Washing Plant, Nadapa, Bhuj, district Kachchh, Gujarat; Mokdumnagar China Clay Processing Plant of West Bengal Projects Ltd, Mohammad Bazar, Birbhum district, West Bengal and Hindalco's Beneficiation Plant at Bagru Plateau in Lohardaga district, Jharkhand. EICL has capacity to produce 240,000 tpy paper coating and filler grades of processed china clay (hydrous), besides 60,000 tpy of calcined clays. Popular Minerals are reported to be developing its mine and plant in Chittorgarh, Rajasthan. Ashapura is also establishing new production unit in Thiruvananthapuram, Kerala with a 180,000 tpa kaolin capacity of various grades - air floated, lumps, hydrous and hydrous calcined kaolin reserves with 96% kaolinite content. Ashapura International is planning to set up a kaolin powder making plant at Bhuj in Gujarat. The investment & capacity is not disclosed by the company. The new facility will be company's second facility after the one operational in Kerala, and make Ashapura one of the largest producer of kaolin in Asia. Ashapura has already acquired new mines reserves of about 2.5 to 3.0 million tonnes in Kerala to meet high demand for kaolin.

Processed kaolin is presently marketed under various trade names mostly in levigated and spray dried forms. A small quantity of crude kaolin is also marketed. The various trade names under which the levigated kaolin is marketed are Highest brightness calcined clays for coated paper, excellent partial replacement for TiO_2. Zeta-balanced kaolin, highest brigntness calcined clays for architectural decorative and industrial coatings/inks. High brightness finer hydrous clays

for all kinds of acqueous paints, excellent functional clays for all paints formulations. Calcined lumps for refractory grade materials non-calcined lumps for refractories. Highly reactive pozzolan, Meta kaolin for RMC and cement application; kaolin for Agrochemicals, Rubber & Plastics, soaps & detergents, Fibre glass & ceramics. Improved processing techniques could further the prospects of Indian kaolin in the international markets. Uma group of kaolin located in Kachchh district, Gujarat engaged in mining, processing & trading of china clay. It possess mining area in Dagara & Mamuara. Koat manufacturing company is engaged in processing of hydrous kaolin, calcined kaolin & metakaolin, having plant of capacity 1000 mtpm at Kachchh, Gujarat. Hydrous Kaolin, Vadodara manufacturers Levigated/Water Washed/Deaminated/spray dried kaolin products available from 75% to 84%(ISO) brightness. Particle size 2 Micron-49% to 93% (packing options available - 25 kg/50 kg/500 kg jumbo bags). China clay powder manufacturers: Shree Umia Sales Corpn. in GIDC Ahmedabad are exporters, suppliers Indian china clay powder, ball clay.

USES AND SPECIFICATIONS

China clay (kaolin) is used in a number of industries in both crude and processed forms. The major use for crude china clay in India is in the Cement Industry, whereas Ceramic Industry accounts for consumption of a major share of processed form of china clay. Besides ceramics, processed china clay finds use in other industries in the country, such as sealants, paper coatings, as extender in fibre glass, paint and as a filler for paper, rubber, plastic, cosmetics, pharmaceuticals and textiles. Crude china clay also finds use in Insecticide and Refractory Industries. Other uses of china clay are in ink, ultramarine, synthetic zeolite, catalyst, water filter candles, soaps & detergents and explosives & pyrotechnic industries. Some of the areas where use of china clay is gaining importance are in the manufacture of plastic film, video and audio tapes where clays are used as anti-blocking agents, and in the field of biotechnology, where ceramics are widely in use for its light weight & high strength properties. EICL has been producing Metakaolin for the concrete industry for over a decade and now we have been exporting regularly to the UAE, Kuwait and Germany for the durability of concrete by lime fixation and arresting of deterioration of concrete by weathering. Himacem has high chemical resistance which makes the product suitable for construction of high span bridges, under-water structures and chemical plants.

The Bureau of Indian Standards (BIS) has prescribed specifications for china clay to be used in different industries. They are IS:505-1995 (Third Revision, Reaffirmed 2011) for paper coating and filler for paper, rubber, textile industries, IS:1463-1983 (Third Revision, Reaffirmed 2000) for cosmetics and IS:7589-1974 (Reaffirmed 2011) for Explosive & Pyrotechnic Industry. BIS has revised the specifications for china clay for Ceramic Industry to IS:2840-2002 (Second Revision, Reaffirmed 2008) and for paint industry to IS:68-2006. The whiteness, particle size, plasticity, contents of alumina, iron and titanium are some important factors which control the specifications of china clay for different end-uses. China clay for ceramic and refractory applications is analysed for grit, brightness, green and dry strength, fixed colour, iron and alumina contents. For filler and extender applications, it must meet very rigid specifications, such as, particle size, colour, brightness and viscosity (Table - 9). Production of kaolin from south-west England is now around 1 m tpa, just one third of totals seen in 1988. The dramatic decrease in kaolin production is due to a combination of factors, one of which has been the replacement of kaolin as a filler with precipitated calcium carbonate (PCC) and ground calcium carbonate (GCC). Some 87% of the paper market used kaolin in 1980,but by 2010, 65% of the market was using GCC due to a switch by paper makers from an acid-based processing route to an alkali-based route for production.

CONSUMPTION

The main consuming industry for raw china clay is the china clay processing/refining plants. The china clay processed by these plants in turn is consumed by various industries except cement, refractory and pesticide industries. The data on raw china clay consumption by various china clay processing plants are not readily available. However, the consumption of china clay by various industries is given in Table-10.

Consumption of china clay decreased slightly to 1,489 thousand tonnes in 2012-13, from 1,490 thousand tonnes in 2011-12. Cement Industry accounted for 45% consumption followed by ceramic (42%), the major consumer of raw china clay. Pesticide, paint, refractory, paper, cosmetic, rubber, abrasive, asbestos products, chemical, dry cell batteries, textile, electrical, electrode and glass industries together accounted for the remaining 13%.

Table – 9 : Specifications of China Clay Required in Different Industries

Sl. No.	Characteristics	Paper coating Grade I	Filler in paper, rubber, textile Grade II	Cosmetics	Explosives
1.	Bureau of Indian Standard Specification No.	505 (1995)	505 (1995)	1463 (1983)	7589 (1974)
2.	Fineness (by weight % material retained on:)				
	45 microns sieve	–	–	2.0	–
	53 microns sieve	0.8	1.0	–	–
	63 microns sieve	–	–	–	1.0
	90 microns sieve	–	–	0.1	–
3.	Larger than 10 microns in diameter (% by mass, max)	5.0	15.0	–	–
4.	Smaller than 10 microns in diameter (% by mass, min)	75.0	60.0	–	–
5.	Grit (% by mass, max)	–	–	–	0.001
6.	Loss on drying (% max)	2.0	2.0	1.5	1.5
7.	Loss on ignition (% max)	14-15.5	14-15.5	15	14.0
8.	Water Plasticity (%)	14.0	–	–	–
9.	Shrinkage linear				
	a) Dry shrinking	–	–	–	–
	b) Fired shrinking	–	–	–	–
10.	Relative/Bulk density	2.5-2.9	2.5-2.9	*	0.65-0.90(BD)
11.	Colour reflectance to blue light (%)	80-85	*	–	–
12.	Chemical (% by mass, max)	–	–	@	–
	Fe_2O_3	0.6	0.75	0.5	–
	Matter soluble in HCl	0.5-1	1.5-2.5	2.0	1.5
	CuO	–	0.007	–	–
	MnO	–	0.013	–	–
	Heavy metals (as Pb)	–	–	5 ppm	–
	As_2O_3	–	10 ppm	2 ppm	–
	pH value of aqueous extract	4.5-7.5	4.5-7.5	7.5	6.0-7.5
13.	Oil absorption (ml/100 g)	–	50 (min)	–	35-45
14.	Water soluble matter (%, max)	–	0.5	–	0.5

** As agreed.*
@ To pass test for iron and carbonate as well.

Table -10: Consumption of Kaolin (China clay)*, 2010-11 to 2012-13 (By Industries)

(In tonnes)

Industry	2010-11	2011-12(R)	2012-13(P)
All Industries	**1488100**	**1490400**	**1489300**
Cement 1/	664700(8)	665300(8)	664500(8)
Ceramic2/	624800(237)^e	625200(237)^e	626800(237)
Cosmetic	2200(5)	2300(6)	2300(6)
Glass	700(3)	700(3)	700(3)
Paint	111300(25)	111300(26)	111100(26)
Paper	21700(23)	21700(23)	21700(23)
Pesticide	24800(21)	24800(21)	24800(21)
Refractory	33600(30)	34700(30)	32800(31)
Rubber	2400(31)	2400(31)	2400(31)
Others (abrasives, asbestos-products, chemical, dry cell battery, electrical, electrode and textile).	1900(39)	2000(40)	2200(41)

Figures rounded off.
Figures in parentheses denote the number of units in organised sector reporting consumption.
1/ Relates to raw/unprocessed china clay.
2/ Includes 2 units which processed crude china clay of about 65,000, tonnes during each of the above three years.
** Includes reported consumption and/or estimates wherever required.*

TRADE POLICY

As per the Foreign Trade Policy (FTP) 2009-2014, there are no restrictions on exports and imports of china clay (kaolin).

WORLD REVIEW

The world production of kaolin at 26 million tonnes in 2012 showed 3% decrease over the previous year. Seven countries, namely, USA, Germany, China, Brazil, Iran,Turkey and UK accounted for about 74% world production. The share of USA in total world production was about 23%, followed by Germany (17%), China (12%), Brazil (7%), Iran (6%), Turkey (5%) and UK (4%) (Table-11).

Table – 11 : World Production of Kaolin (By Principal Countries)

(In ₹ '000 tonnes)

Country	2010	2011	2012
World : Total	**25500**	**26900**	**26000**
Belgium[(e)]	300	300	300
Brazil	1900	2200	1800
China[(e)]	3000	3000	3000
Czech Republic	636	660	624
Egypt	304	304	300
France	350	350	308
Germany	4578	4899	4399
Iran	1480	1500[(e)]	1500
Korea, Rep. of	962	1052	797
Malaysia	530	443	439
Mexico	517	372	515
Portugal	274	322	317
Spain	311	384	332
Turkey	787	1229	1300[(e)]
UK	1140[(e)]	1290[(e)]	1150[(e)]
USA	5370	5480	5900
Vietnam	650	650	650
Other countries	2411	2465	2369

Source : *World Mineral Production, 2008-2012.*

Australia

W.A. Kaolin holdings Pty. Ltd began developing a mine near Wickepin, Western Australia. The deposit has proven reserves of more than 100 Mt of kaolin weathered from a granitic matrix. The company planned to expand its initial 150,000 t/yr plant to 350,000 t/yr.

Brazil

KaMin llC, a leading U.S producer, purchased a majority share in CadaM Sa, a major Brazilian kaolin producer. The purchase made KaM in the second ranked world supplier of refined kaolin with an estimated 1.7 million metric tons per year production capacity. The purchase included a mine near Amapá and a beneficiation plant and port near Pará (Ollett, 2012a; KaMin, 2012a). The company planned to restructure the CadaM operation, primarily reducing production capabilities at the plant to coincide with a decreased demand for paper-grade kaolin for fine printing and writing paper.

Ukraine

Prosco Resources Ltd, a leading European producer of kaolin, planned construction of a spray-dried kaolin plant at its Prosyana deposit. Capacity will increase to 250,000 t/yr by 2014. Prosco, which accounts for as much as 90% of the kaolin market in the Confederation of Independent.

FOREIGN TRADE

Exports

Exports of kaolin increased marginally to 191,953 tonnes in 2012-13 from 184,734 tonnes in 2011-12. UAE (70%) and Bangladesh (13%) were the major importing countries in 2012-13 (Table - 12).

Imports

Imports of kaolin increased marginally to 87,865 tonnes in 2012-13 from 73,647 tonnes in 2011-12. Major suppliers were USA (37%), Indonesia (23%), China (16%) and France (6%) (Table - 13).

Table – 12 : Exports of Kaolin (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**184734**	**582117**	**191953**	**736840**
UAE	137296	127193	135125	172294
Bangladesh	19787	68404	24254	107418
Germany	3215	47498	4549	63901
Iran	1050	14762	4817	48818
Egypt	623	14384	1265	30252
Malaysia	1837	23952	1311	24342
Sri Lanka	1638	22604	1315	18687
South Africa	858	5044	2337	18389
Turkey	773	13554	939	17287
Indonesia	543	10506	810	17065
Other countries	17114	234216	15231	218387

Table – 13 : Imports of Kaolin (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**73647**	**1078287**	**87865**	**1095336**
USA	35681	529428	32789	577421
China	15735	181134	13924	149025
France	845	15711	5267	89950
Indonesia	1003	22761	20290	55879
Bulgaria	2287	36988	2473	39690
Thailand	1494	15453	2357	26823
Germany	3187	50113	1617	23675
New Zealand	1139	30932	630	20707
UK	5576	98428	1357	20570
Ukraine	794	8318	1469	13856
Other countries	5906	89021	5692	77740

FUTURE OUTLOOK

India has abundant resources of kaolin which can easily meet both the internal and the external demands. The processing of kaolin in the country is done mostly by conventional methods like levigation and washing. New capacities for High-tech processing have to be established and existing capacities in the country have to be augmented to meet the demand of processed kaolin in the future.

In the Indian kaolin market, good growth is expected both for hydrous and calcined clay particularly in paint, cables, plastics, rubber and ceramics. The apparent demand of china clay is estimated at 4.61 million tonnes by 2016-17 and that of ball clay at 1.82 million tonnes by 2016-17 at 9% growth rate by the Planning Commission of India.

2. Ball Clay

Ball clay commonly consists of 20-80% kaolinite, 10-25% mica & 6-65% quartz. Ball clay and china clay differ only in the degree of plasticity. China clay is less plastic than ball clay. Ball clay is a highly plastic variety of kaolin having high binding power, tensile strength and shrinkage. It is utilised generally after mixing with non-plastic clay to impart the desired plasticity in pottery, porcelain and refractory materials. It also helps in the preparation of glaze, enamels and for imparting a dense vitrified body.

RESOURCES

Deposits of ball clays are relatively scarce due to the combination of geological factors needed for their formation.The total resources of ball clay as on 1.4.2010 in the country are placed at 83.39 million tonnes. Out of these resources, the reserves are about 16.78 million tonnes and the remaining resources are 66.61 million tonnes. More than 62% resources are in Andhra Pradesh, followed by Rajasthan with 38%. Resources in Gujarat are nominal. Out of the total resources, ceramic/pottery grade constitutes 89%. All India reserves/resources of ball clay are given in Table-14.

PRODUCTION, STOCKS & PRICES

The production of ball clay at 1,856 thousand tonnes in 2012-13 increased by 13 % as compared to that in the previous year.

During the year under review, there were 48 reporting mines as against 56 in 2011-12. Besides, production of ball clay was reported as an associated mineral by thirteen mines during 2012-13. Six principal producers accounted for about 59 % of total production. The share of public sector mines in the total production was near about 1%, as compared to about 6% in the preceding year.

Rajasthan continued to be the leading state in production accounting for 89% of the total production followed by Andhra Pradesh with 10%. The remaining one percent production was from Gujarat and Tamil Nadu.

Mine-head stocks of ball clay at the end of the year 2012-13 was 668 thousand tonnes as against 671 thousand tonnes in the beginning of the year.

The average daily employment of labour in 2012-13 was 509 as against 762 in the previous year.

Table – 14 : Reserves/Resources of Ball Clay as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources							Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibilty STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
		STD121	STD122			STD221	STD222					
All India : Total	**12292820**	**350832**	**4134190**	**16777842**	**6122450**	**3906958**	**12387575**	**268486**	**2279330**	**41650863**	**66615662**	**83393504**
By Grades												
Ceramic/Pottery	12252380	350832	4059390	16662602	3225279	3818040	11158607	268486	2279330	36989941	57739683	74402285
Others	40440	-	74800	115240	-	46134	67320	-	-	107800	221254	336494
Unclassified	-	-	-	-	2897171	42784	1161648	-	-	4553122	8654725	8654725
By States												
Andhra Pradesh	6017412	-	1288720	7306132	1821233	2806267	9512513	-	2279330	27555824	43975167	51281299
Gujarat	-	-	-	-	-	-	-	249810	-	49670	299480	299480
Rajasthan	6275408	350832	2845470	9471710	4301217	1100691	2875062	18676	-	14045369	22341015	31812725

Figures rounded off.

Table – 15 : Principal Producers of Ball Clay, 2012-13

Name & address of producer	Location of mine	
	State	District
Shanta Sales Corporation, House of Mohanlal Mathur, Behind Rajasthan Pan Bhandar, Rani Bazar, Bikaner-334 001, Rajasthan.	Rajasthan	Bikaner
Jaichand Lal Daga, 1st Floor, Labhuji Ka Katla, Kotegate, Bikaner - 334 001, Rajasthan.	Rajasthan	Bikaner
Harish Clays, Harasar House, P.B.No. 57, Near M. N. Hospital, Bikaner-334 001 Rajasthan.	Rajasthan	Bikaner
Sunder Lal Daga, Bagree Mohalla, Bikaner - 334 001. Distt.: Bikaner, Rajasthan.	Rajasthan	Bikaner
Tahlaram & Sons, Ramnath Sadan, Rathkhana Colony, Bikaner-334 001, Rajasthan.	Rajasthan	Bikaner
Anirudh Mines & Minerals, Near Ramdeo Park, Outside Nathusar Gate, Bikaner – 334 005, Rajasthan.	Rajasthan	Bikaner

(Contd.)

(Table - 15 Concld.)

Table – 16 : Production of Ball clay, 2010-11 to 2012-13 (By States)

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1086714**	**390238**	**1646516**	**693714**	**1855654**	**917005**
Andhra Pradesh	259380	70384	276799	88705	181870	92596
Gujarat	31140	2025	13527	1488	11402	1254
Rajasthan	776193	301368	1351705	598843	1649048	809803
Tamil Nadu	20001	16461	4485	4678	13334	13352

Table – 17 : Production of Ball clay, 2011-12 and 2012-13 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**56(12)**	**1646516**	**693714**	**48(13)**	**1855654**	**917005**
Public Sector	2	98421	22056	2	14294	13414
Private Sector	54(12)	1548095	671658	46(13)	1841360	903591
Andhra Pradesh	**14(1)**	**276799**	**88705**	**13(1)**	**181870**	**92596**
Chittor	1	700	125	-	-	-
West Godavari	13(1)	276099	88580	13(1)	181870	92596
Gujarat	**3**	**13527**	**1488**	**2**	**11402**	**1254**
Banaskantha	1	1390	153	-	-	-
Kachchh	1	352	39	1	800	88
Patan	1	11785	1296	1	10602	1166
Rajasthan	**38(11)**	**1351705**	**598843**	**32(12)**	**1649048**	**809803**
Bikaner	36(11)	1345365	597258	31(12)	1641002	808435
Nagaur*	1	-	-	-	-	-
Pali	1	6340	1585	1	8046	1368
Tamil Nadu	**1**	**4485**	**4678**	**1**	**13334**	**13352**
Cuddalore	1	4485	4678	1	13334	13352

Figures in parentheses indicate associated mines of ball clay with silica sand & fireclay.
** Only labour reported.*

Table – 18 : Mine-head Stocks of Ball Clay 2012-13(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**671202**	**668005**
Andhra Pradesh	136446	138656
Gujarat	931	-
Rajasthan	526770	518517
Tamil Nadu	7055	10832

SPECIFICATIONS

The specifications for plastic clay and washed plastic clay for use in Ceramic Industry are prescribed vide IS:4589-2002 (Third Revision, reaffirmed 2008).

CONSUMPTION

Consumption of ball clay increased from 579,600 tonnes in 2011-12 to 585,000 tonnes in 2012-13. About 97% consumption was accounted for by the Ceramic Industry. The remaining consumption was reported by the Refractory and Abrasive industries (Table - 19).

FOREIGN TRADE

Exports

Exports of ball clay increased marginally to 29,497 tonnes in 2012-13 from 18,037 tonnes in 2011-12. Exports were mainly to Bangladesh (89%) (Table - 20).

Imports

Imports of ball clay decreased considerably to 156,527 tonnes in 2012-13 as compared to 191,310 tonnes in the previous year. Imports were mainly from Ukraine (67%), Malaysia (15%), UK (9%), and China (6%) (Table -21).

Table – 19 : Consumption of Ball clay 2010-11 to 2012-13(P) (By Industries)

(In tonnes)

Industry	2010-11	2011-12 (R)	2012-13(P)
All Industries	**589500**	**579600**	**585000**
Abrasive	100(3)	100(3)	100(3)
Ceramic[(e)]	576000(222)	565000(222)	565200(222)
Refractory	13400(26)	14500(28)	19700(30)

Figures rounded off.
Figures in parentheses denote the number of units in the organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

Table – 20 : Exports of Ball Clay (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**18037**	**62387**	**29497**	**131329**
Bangladesh	16045	54545	26123	108649
UAE	400	2760	2322	17196
Malaysia	-	-	702	3533
Kenya	141	501	151	696
Nepal	1197	3497	94	432
Turkey	-	-	48	340
Chinese Taipei/ Taiwan	++	1	32	267
Egypt	-	-	20	181
USA	-	-	4	13
Italy	-	-	1	12
Other countries	254	1083	++	10

Table – 21 : Imports of Ball Clay (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**191310**	**1023647**	**156527**	**1044148**
Ukraine	114269	618897	104835	684369
UK	17774	182727	14258	160926
China	5142	35332	9818	78362
Malaysia	12612	37534	23867	74482
Germany	572	7814	585	13407
Portugal	912	7801	1216	11438
Japan	-	-	260	6352
France	25	381	267	3729
Australia	-	-	289	2295
Bangladesh	-	-	500	2030
Other countries	40004	133161	632	6758

3. Clay (others)

Clay under this category includes aluminous, ferruginous and tile & brick making clays.

PRODUCTION, STOCKS & PRICES

The production of clay(others) at 1987 thousand tonnes in 2012-13 increased by about 40% as compared to that in the previous year due to more demand in the market and also increase of no. of reporting mines.

There were 51 reporting mines in 2012-13 as against 35 mines in the previous year. Besides production of clay (others) was reported by 37 mines as associated mineral. About, 58% of the total production of clay(others) was reported as an associated mineral. Entire production of clay(others) was by private sector. About 65% of the total production was contributed by eight principal producers.

Gujarat, the major producing state, accounted for about 64% of the total production during the period under review, followed by Madya Pradesh (21%), Andhra Pradesh (7%) and the remaining 8 percent was reported from Rajasthan and Tamil Nadu.

Nineteen mines and fourteen associated mines having annual production more than 10,000 tonnes contributed about 94% of the total production.

Mine-head stocks of clay(others) was 251 thousand tonnes at the end of 2012-13 as against 224 thousand tonnes in the beginning of the year.

The average daily employment of labour was 392 during 2012-13 as against 279 in the previous year.

Table – 22 : Principal Producers of Clay (Others), 2012-13

Name and address of producer	Location of mine	
	State	District
*The Associated Cement Co. Ltd 'Cement House', 121, Maharshi Karve Road, Mumbai – 400 020 Maharashtra.	Madhya-Pradesh	Katni
Sanghi Industries Ltd, 10th Floor, Kataria Arcade, Opp. S. G. Highway, Post: Makaraba, Ahmedabad - 380 051 Gujarat.	Gujarat	Kachchh
*Shankarlal Gangaram Thakkar, DBZ South-157, Zanda Chowk, Gandhidham-370 201 Distt. Kachchh, Gujarat .	Gujarat	Patan
*Sampat Lal Daga, Bagree Mohalla, Labhuji ka Katla,1st Floor, Bikaner-334 001 Rajashtan.	Rajasthan	Bikaner
*J.S. Jobanputra, DBZ South-157, Zanda Chowk, Gandhidham-370 201 Distt. Kachchh, Gujarat.	Gujarat	Kachchh
*G. V. Thakkar, DBZ South-157, Zanda Chowk, Gandhidham-370 201 Distt. Kachchh, Gujarat.	Gujarat	Patan
Bahadursing Velubhai Jadeja, Office No. 14/15, Plot No. 321, Ward No. 128, Gandhidham-370 201, Distt. Kachchh, Gujarat.	Gujarat	Kachchh
Ishwarlal Nanjibhai Bhavani, 113-114, Pooja-B, B/h ICICI Bank, Station Road, Bhuj-370 001, Distt. Kachchh, Gujarat.	Gujarat	Kachchh

** Producing clay (others) with limestone.*

Table – 23 : Production of Clay (Others), 2010-11 to 2012-13 (By States)

(Qty in tonnes; value in ₹'000)

Stat	2010-11		2011-12		2012-13 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**730752**	**70342**	**1417684**	**128017**	**1987136**	**228715**
Andhra Pradesh	84875	8402	99919	8502	146672	15400
Chhattisgarh	-	-	720	86	-	-
Gujarat	203291	12775	877579	85588	1271165	128919
Karnataka	-	-	12900	3019	-	-
Madhya Pradesh	434722	48025	426256	30776	410147	37264
Rajasthan	7864	1140	50	12	150232	45901
Tamil Nadu	-	-	260	34	8920	1231

Table – 24: Production of Clay (Others), 2011-12 and 2012-13(P) (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**35(28)**	**1417684**	**128017**	**51(37)**	**1987136**	**228715**
Private Sector	**35(28)**	**1417684**	**128017**	**51(37)**	**1987136**	**228715**
Andhra Pradesh	**10(11)**	**99919**	**8502**	**12 (9)**	**146672**	**15400**
Adilabad	1(1)	21805	1726	2	72965	7474
Anantapur	(6)	16257	2044	(6)	13062	2136
Cuddapah	-	-	-	3	11383	1672
Krishna	(1)	14000	714	(1)	15200	775
Kurnool	7(3)	33080	3457	5(2)	34062	3343
Visakhapatnam	2	14777	561	2*	-	-
Chhattisgarh	**(1)**	**720**	**86**	-	-	-
Rajnandgaon	(1)	720	86	-	-	-
Gujarat	**16(8)**	**877579**	**85588**	**26(18)**	**1271165**	**128919**
Amreli	1	49063	1423	2	70141	4979
*Bhavnagar	1	-	-	1	-	-
Jamnagar	1	68649	5149	1	43278	4760
Kachchh	13(6)	517001	50422	22(15)	982066	99855
Patan	(2)	242866	28594	(3)	175680	19325
Karnataka	**1**	**12900**	**3019**	-	-	-
Tumkur	1	12900	3019	-	-	-
Kerala	-	-	-	**1**	-	-
* Thiruvananthapuram	-	-	-	1	-	-
Madhya Pradesh	**(8)**	**426256**	**30776**	**(7)**	**410147**	**37264**
Katni	(3)	420655	29988	(2)	391256	33780
Jabalpur	(2)	920	95	(3)	15350	3071
Satna	(3)	4681	693	(2)	3541	413
Rajasthan	**6**	**50**	**12**	**9(2)**	**150232**	**45901**
Bikaner	5*	-	-	7(1)	146092	44056
Karauli	-	-	-	(1)	4050	1823
Nagaur	1	50	12	2	90	22
Tamil Nadu	**2**	**260**	**34**	**3(1)**	**8920**	**1231**
Cuddalore	-	-	-	(1)	4770	691
* Perambalur	-	-	-	1	-	-
Tiruchirapalli	2	260	34	2	4150	540

Figures in parentheses indicate number of Associated mines of Clay (Others) with ball clay, dolomite, kaolin,fire clay laterite,limestone, ochre & steatite.
** Production of associated mineral or labour reported.*

Table – 25 : Production of Clay (Others), 2011-12 and 2012-13 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
All Groups	**35(28)**	**51(37)**	**1417684**	**1987136**	**100.00**	**100.00**	-	-
Upto 5000	21(20)	29(20)	49389	66384	3.48	3.34	3.48	3.34
5001 to 10000	3(1)	3(3)	28320	50261	2.00	2.53	5.48	5.87
10001 to 20000	5(1)	7(2)	83590	137802	5.90	6.93	11.38	12.80
20001 to 30000	(1)	1(2)	28240	69665	1.99	3.51	13.37	16.31
30001 & above	6(5)	11(10)	1228145	1663024	86.63	83.69	100.00	100.00

Figures in parentheses indicate number of Associated mines of Clay (Others) with Laterite, Lime Stone, Steatite & Ochre.

Table – 26: Mine-head Stocks of Clay (Others), 2012-13 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**224376**	**250804**
Andhra Pradesh	42981	26633
Chhattisgarh	1843	-
Gujarat	26774	106536
Karnataka	6001	6001
Madhya Pradesh	47334	72102
Rajasthan	95497	34143
Tamil Nadu	2313	3756
West Bengal	1633	1633

FOREIGN TRADE

Exports

Exports of clay (others) increased to 22 thousand tonnes in 2012-13 from 17 thousand tonnes in 2011-12. Exports were mainly to Saudi Arabia (30%), Bangladesh (17%), Nepal (13%), Kenya (12%) and UAE (5%) (Table- 27).

Imports

Imports of clay (others) increased to 14,637 tonnes in 2012-13 from 13,013 tonnes in 2011-12. Ukraine (55%), China (21%) and USA (15%) were the main suppliers (Table - 28).

Table – 27 : Exports of Clay (Others) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**16811**	**126294**	**22049**	**178899**
Saudi Arabia	1272	10828	6611	35104
Kenya	1630	14719	2655	31593
Bangladesh	5111	18285	3739	29483
Nepal	1898	13378	2858	19414
UAE	1184	9572	1112	8447
Pakistan	807	12445	202	7978
Sri Lanka	1277	9143	1072	7586
Malaysia	624	2287	648	3951
Iran	25	116	520	3611
Spain	120	2166	150	3403
Other countries	2863	33355	2482	28329

Table – 28 : Imports of Clay (Others) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**13013**	**144418**	**14637**	**194203**
USA	2169	59727	2200	72548
Ukraine	8000	39776	7997	55210
China	1336	11551	3124	30721
Spain	81	4632	527	15638
Germany	273	6914	122	5592
Thailand	45	3720	149	3208
Korea, Rep. of	-	-	47	2714
UK	609	8444	135	2466
France	157	3299	86	1937
Japan	19	257	2	1597
Other countries	324	6098	248	2572

4. Shale

Shale is a fine grained, clastic sedimentary rock comprised of mud that is a mixture of flakes of clay minerals and tiny fragments of minerals like quartz and calcite. The ratio of clay to other minerals is variable.

Shale which occurs with limestones as parting is rich in alumina content. Hitherto, shale was considered as implacable substance that reduced the quality of limestone due to presence of clay minerals. Now, with advancements and better knowledge, it is utilised as a source of alumina in cement making.

RESOURCES

The resources of shale were placed at 15.9 million tonnes as on 1.4.2010, comprising 15.3 million tonnes reserves and 0.6 million tonnes remaining resources. All the estimated resources are located in Andhra Pradesh (Table - 29).

PRODUCTION & STOCKS

Production of shale, primarily used in manufacturing of cement, at 3,048 thousand tonnes in 2012-13 decreased by 11% over the previous year. There were 6 reporting mines in both the year. About 97% of total production of shale was reported as an associated mineral by 23 limestone mines in 2012-13. Captive mines of cement plant contributed about 99% of total production in both the years.The share of public sector was only 1% in both the years.

As regards to State-wise production, Himachal Pradesh contributed 50% of the total production of shale followed by Karnataka 18%, Madhya Pradesh 17%, Maharashtra 11% and Andhra Pradesh 4%.

Mine-head stocks at the end of 2012-13 was 69 thousand tonnes in both the year.The average daily employment of labour in shale mines in 2012-13 was 30 as against 28 in the previous year.

Table – 29 : Reserves/Resources of Shale as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade / State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**14,992**	**76**	**263**	**15,331**	**-**	**-**	**245**	**-**	**-**	**252**	**83**	**580**	**15,911**
By Grade													
All grades	14,992	76	263	15,331	-	-	245	-	-	252	83	580	15,911
By State													
Andhra Pradesh	14,992	76	263	15,331	-	-	245	-	-	252	83	580	15,911

Figures rounded off.

Table – 30: Principal Producers of Shale, 2012-13

Name and address of producer	Location of mine	
	State	District
*The ACC Ltd, Cement House 121, Maharshi Karve Road, Churchgate, Mumbai – 400 020	Karnataka Himachal- Pradesh Maharashtra	Gulbarga Bilaspur Yavatmal
*Jaiprakash Associates Ltd, Sector-128, Noida-201 304, Uttar Pradesh	Madhya- Pradesh	Rewa
*Ambuja Cements Ltd, Elegant Business Park, MIDC Cross Road B, Off Andheri Kurla Road, Andheri East, Mumbai- 400 059	Himachal- Pradesh	Solan
*Cement Corp. of India Ltd, Core 5 Scope Complex 7 Lodhi Road, New Delhi -110 003	Andhra- Pradesh	Ranga- , reddy
*Ultratech Cement Ltd, Aditya Birla Cement, S.K Ahire Marg, Worli, Mumbai-400 030	Maharashtra	Chandrapur

** Producing as an associated mineral with limestone.*

Table – 31 : Production of Shale, 2010-11 to 2012-13 (By States)

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**3081622**	**103993**	**3439775**	**139066**	**3048568**	**155697**
Andhra Pradesh	123106	7941	115998	8833	124025	8789
Himachal Pradesh	1502873	55393	1535493	49648	1512507	69659
Karnataka	559356	25710	825027	42901	546026	37749
Madhya Pradesh	598912	5349	543481	6321	519551	5519
Maharashtra	297375	9600	419776	31363	346459	3398

Table – 32 : Production of Shale, 2011-12 & 2012-13 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**6(22)**	**3439775**	**139066**	**6(23)**	**3048568**	**155697**
Public Sector	1	34350	2303	1	39000	2564
Private Sector	5(22)	3405425	136763	5(23)	3009568	153133
Andhra Pradesh	**4(11)**	**115998**	**8833**	**4(12)**	**124025**	**8789**
Anantpur	1(6)	14005	1476	1(5)	7460	887
Kurnool	(5)	22643	1549	(7)	27565	2563
Nalgonda	2	45000	3505	2	50000	2775
Rangareddy	1	34350	2303	1	39000	2564
Himachal Pradesh	**(3)**	**1535493**	**49648**	**(3)**	**1512507**	**69659**
Bilaspur	(1)	276533	10232	(1)	404446	21947
Solan	(2)	1258960	39416	(2)	1108061	47712
Karnataka	**(1)**	**825027**	**42901**	**(1)**	**546026**	**37749**
Gulbarga	(1)	825027	42901	(1)	546026	37749
Madhya Pradesh	**2(5)**	**543481**	**6321**	**2(5)**	**519551**	**5519**
Rewa	(5)	540896	4851	(5)	517376	4649
Mandsaur	2	2585	1470	2	2175	870
Maharashtra	**(2)**	**419776**	**31363**	**(2)**	**346459**	**33981**
Chandrapur	(1)	130487	1566	(1)	37450	1844
Yavatmal	(1)	289289	29797	(1)	309009	32137

Figures in parentheses indicate associated mines with Limestone.

Table – 33 : Mine-head Stocks of Shale, 2012-13(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**69458**	**69055**
Andhra Pradesh	43740	43272
Karnataka	25668	25668
Madhya Pradesh	50	115