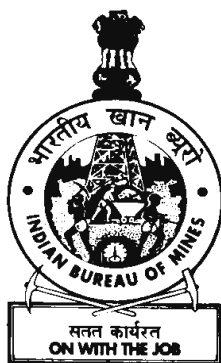


KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE



# Indian Minerals Yearbook 2012

(Part- III : Mineral Reviews)

51<sup>st</sup> Edition

**KAOLIN, BALL CLAY, OTHER CLAYS  
AND SHALE**

(FINAL RELEASE)

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# 29 Kaolin, Ball Clay, Other Clays and Shale

## 1. Kaolin (China Clay)

**K**aolin, also known as china clay, is a natural clay formed by weathering of felspars. It is relatively pure clay predominantly consisting of kaolinite ( $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ ), 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

Details of exploration carried out by different exploration agencies during 2010-11 are given in Table-2.

## PRODUCTION, STOCKS & PRICES

The production of kaolin at 2734 thousand tonnes in 2011-12 increased marginally as compared to previous year.

There were 71 reporting mines during 2011-12 as against 81 mines in the previous year. Besides, the production of kaolin was also reported as an associated mineral by one mine in both the years.

Ten principal producers accounted for about 75% of the total output of kaolin in 2011-12. The private sector mines reported 99% of the total production and the remaining was reported by 5 public sector mines. The contribution of natural and processed kaolin in 2011-12 was 98% and 2%, respectively.

During 2011-12, thirty mines each producing more than 10,000 tonnes annually accounted for 98% of the total production of kaolin (natural) while 5 mines each in the annual production range of 5,000 to 10,000 tonnes accounted for one percent and the remaining production of kaolin (natural) was shared by 18 small mines, each producing upto 5,000 tonnes annually.

Contribution of five kaolin mines along with one associated mine producing more than 5,000 tonnes of kaolin(processed) was about 66% and remaining 34% production of kaolin (processed) was shared by 13 small mines.

Gujarat was the leading producing state of kaolin accounting for 48% of the total production in 2011-12 followed by Kerala (23%), Rajasthan (17%), Jharkhand (5%) and West Bengal (3%). The remaining 4% was shared by Andhra Pradesh, Karnataka and Madhya Pradesh.

Mine-head stocks of kaolin at the end of 2011-12 were 426 thousand tonnes as against 407 thousand tonnes at the beginning of the year (Tables - 3 to 8).

The average daily employment of labour during 2011-12 was 1501 as against 2078 in the preceding year.

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**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						
<b>All India : Total</b>	<b>124118</b>	<b>11034</b>	<b>42006</b>	<b>177158</b>	<b>24543</b>	<b>22980</b>	<b>71270</b>	<b>284781</b>	<b>412852</b>	<b>1651286</b>	<b>60338</b>	<b>2528050</b>	<b>2705208</b>
<b>By Grades</b>													
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
<b>By States</b>													
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	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.

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 2 : Details of Exploration Activities for Kaolin and other Clays, 2011-12**

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
<b>China Clay</b>							
<b>DMG</b>	Alapadambu	-	-	05	142.5	73	The average thickness of clay horizon was 13 m. The clay is yellow, red, pink patches and yellowish in colour. Resources were not estimated.
<b>Kerala</b> Kannur	Areranchal						
- do -	Perinthatta	-	-	04	82	-	The average thickness of clay is 0.6 m. The clay is yellow, red, pink patches and yellowish, which is underlain by gneissic charnockite. Resources are yet to be estimated.
Kollam	Kundara Pattamukku	-	-	06	167.5	-	The average thickness of clay is 6 m and that of overburden is 6 m. and the tentative reserve of clay 0.25 million tonnes.
- do -	Kundara Kakkolil	-	-	02	83	-	The average thickness of clay is 20 m. The clay is pale white, dull white, yellowish white & black in colour. The investigation programmes for locating china clay will be continued.
<b>Clay</b> <b>DMG</b> <b>Rajasthan</b> Bikaner	N/v Kenya ki-Basti	1:50,000	200	-	-	50	Occurrences of lignite and grey-black clay were noticed. Grey-black clay deposits were intersected in BH-2.
- do - Chandi,	N/v Kodam desar, Golari	1:50,000	200	-	-	04	Clay was noticed in some old pits at a depth of 8-10 m below bajri and Kankar. Resources were not estimated.

**KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE**

**Table – 3 : Principal Producers of Kaolin, 2011-12**

(Table - 3 Concl.)

Name & address of producer	Location of mine		Name & address of producer	Location of mine	
	State	District		State	District
Shri Ram Mine Chem International, Near Kutch Dairy, G.I.D.C. Area, Madhapur-370 020, Dist. Kachchh, Gujarat.	Gujarat	Kachchh	Mohd. Sher Khan Pathan, P.O - Sawa - 312 613, Dist. - Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
Vinod P. Solanki, Main Bazm Junavas. P.O. Madhapar, Bhuj, Dist. Kachchh, Gujarat.	Gujarat	Kachchh	D.B.H. International (P) Ltd, N-75, Connaught Circus, New Delhi-110 001.	Kerala	Thiruvananthapuram
EICL Limited, TC -79/4, Thiruvananthapuram - 605 021, Kerala.	Kerala	Thiruvananthapuram	Dalmia Agencies Private Ltd, 4, Scindia House, New Delhi - 110 001	Jharkhand	Sahebaganj
Manoj P. Solanki, Near Thakar Mandir, Junavas, P.O. Madhapar, Bhuj, Dist. Kachchh - 370 020, Gujarat.	Gujarat	Kachchh	Patel Nagar Minerals & Industries Pvt. Ltd, P. O. Md. Bazar-731 132, Dist. Birbhum, West Bengal.	West Bengal	Birbhum
H.D. Enterprise Pvt. Ltd, Silver Point H.D. House, Pooja 'A', Above ICICI Bank Ltd, P.O. Bhuj - 370 001, Dist. Kachchh, Gujarat.			Dr. M. Sahura Beevi, Vill-Mel thonnakkal, P.O. Thonnakkal, Dist. Thiruvananthapuram, Kerala - 695 317.	Kerala	Thiruvananthapuram

(Contd.)

**Table – 4 : Production of Kaolin (Total) 2009-10 to 2011-12  
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>2798340</b>	<b>676728</b>	<b>2727946</b>	<b>737101</b>	<b>2734349</b>	<b>634795</b>
Andhra Pradesh	108395	9937	10431	1440	72371	11287
Gujarat	1306539	207944	1251890	204177	1318937	234918
Jharkhand	106828	102218	93001	84327	141527	79714
Karnataka	19543	12015	9785	8796	3214	7697
Kerala	698915	214303	704360	228105	641203	153755
Madhya Pradesh	17350	1209	6106	484	6950	426
Odisha	4558	2165	2601	2692	-	-
Rajasthan	436773	83958	559927	169143	463310	109239
West Bengal	99439	42979	89845	37937	86837	37759

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table - 5 : Production of Kaolin, 2010-11 and 2011-12**  
(By Sectors/States/Districts/Grades)

State/District	No. of mines	2010-11						2011-12(P)					
		Natural		Processed		Total		Natural		Processed		Total	
		Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
<b>India</b>	<b>81(1)</b>	<b>2651448</b>	<b>598095</b>	<b>76498</b>	<b>139006</b>	<b>2727946</b>	<b>737101</b>	<b>2667219</b>	<b>520244</b>	<b>67130</b>	<b>114551</b>	<b>2734349</b>	<b>634795</b>
Public sector	6	27000	5100	12341	47278	39341	52378	5	16664	2500	27685	27444	30185
Private sector	75(1)	2624448	592995	64157	91728	2688605	684723	66(1)	2650555	517744	86866	2706905	604610
<b>Andhra Pradesh</b>	<b>8</b>	<b>10431</b>	<b>1440</b>	<b>-</b>	<b>-</b>	<b>10431</b>	<b>1440</b>	<b>8</b>	<b>72371</b>	<b>11287</b>	<b>-</b>	<b>72371</b>	<b>11287</b>
Adilabad	1	1807	181	-	-	1807	181	-	-	-	-	-	-
Cuddapah	1	200	30	-	-	200	30	2	63709	9557	-	63709	9557
East Godavari	4	5204	1041	-	-	5204	1041	4	8372	1674	-	8372	1674
Visakhapatnam	1	3000	144	-	-	3000	144	-	-	-	-	-	-
West Godavari	1	220	44	-	-	220	44	2	290	56	-	290	56
<b>Gujarat</b>	<b>22</b>	<b>1222631</b>	<b>170395</b>	<b>29259</b>	<b>33782</b>	<b>1251890</b>	<b>204177</b>	<b>17</b>	<b>1293036</b>	<b>203013</b>	<b>25901</b>	<b>31905</b>	<b>1318937</b>
Kachchh	14	1201351	167159	-	-	1201351	167159	10	1289484	202304	-	1289484	202304
Mahesana	2	-	-	8910	9356	8910	9356	2	-	-	8217	8628	8628
Patan	1	8970	897	-	-	8970	897	-	-	-	-	-	-
Sabarkantha	5	12310	2339	20349	24426	32659	26765	5	3552	709	17684	23277	21236
<b>Jharkhand</b>	<b>11(1)</b>	<b>65911</b>	<b>33291</b>	<b>27090</b>	<b>51036</b>	<b>93001</b>	<b>84327</b>	<b>8(1)</b>	<b>116709</b>	<b>30732</b>	<b>24818</b>	<b>48982</b>	<b>79714</b>
Sahebganj	4(1)	29716	3914	13828	27321	43544	31235	3(1)	91269	5022	17850	37237	42259
Singbhum (West)	7	36195	29377	13262	23715	49457	53092	5	25440	25710	6968	11745	37455

(Qty. in tonnes; value in ₹ '000)

(Contd.)

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

Table - 5 : (Concl'd.)

State/District	No. of mines	2010-11				2011-12(P)																
		Natural		Processed		Natural		Processed														
		Qty	Value	Qty	Value	Qty	Value	Qty	Value													
<b>Karnataka</b>	<b>3</b>	<b>6500</b>	<b>1920</b>	<b>3285</b>	<b>6876</b>	<b>9785</b>	<b>8796</b>	-	-	<b>3214</b>	<b>7697</b>	<b>3214</b>	<b>7697</b>	<b>3214</b>	<b>7697</b>	<b>3214</b>	<b>7697</b>	<b>3214</b>	<b>7697</b>	<b>3214</b>	<b>7697</b>	
Hassan	1	-	-	3285	6876	3285	6876	-	-	3214	7697	3214	7697	-	-	-	-	-	-	-	-	
Kolar	1	1500	120	-	-	1500	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Shimoga	1	5000	1800	-	-	5000	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<b>Kerala</b>	<b>15</b>	<b>695304</b>	<b>187703</b>	<b>9056</b>	<b>40402</b>	<b>704360</b>	<b>228105</b>	<b>14</b>	<b>633637</b>	<b>133767</b>	<b>19988</b>	<b>7566</b>	<b>19988</b>	<b>641203</b>	<b>153755</b>	<b>641203</b>	<b>153755</b>	<b>641203</b>	<b>153755</b>	<b>641203</b>	<b>153755</b>	
Kannur	2	-	-	8010	36432	8010	36432	2	-	-	6336	17682	6336	17682	6336	17682	6336	17682	6336	17682	6336	17682
Kasaragode	1	-	-	1046	3970	1046	3970	1	-	-	1230	2306	1230	2306	1230	2306	1230	2306	1230	2306	1230	2306
Kollam	2	30072	4914	-	-	30072	4914	1	16664	2500	-	-	16664	2500	-	-	16664	2500	-	-	16664	2500
Thiruvananthapuram	10	665232	182789	-	-	665232	182789	10	616973	131267	-	-	616973	131267	-	-	616973	131267	-	-	616973	131267
<b>Madhya Pradesh</b>	<b>3</b>	<b>6106</b>	<b>484</b>	<b>-</b>	<b>-</b>	<b>6106</b>	<b>484</b>	<b>2</b>	<b>6950</b>	<b>426</b>	<b>-</b>	<b>-</b>	<b>6950</b>	<b>426</b>	<b>-</b>	<b>-</b>	<b>6950</b>	<b>426</b>	<b>-</b>	<b>-</b>	<b>6950</b>	<b>426</b>
Katni	2	6006	469	-	-	6006	469	2	6950	426	-	-	6950	426	-	-	6950	426	-	-	6950	426
Satna	1	100	15	-	-	100	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Odisha</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>2601</b>	<b>2692</b>	<b>2601</b>	<b>2692</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Mayurbhanj	1	-	-	2601	2692	2601	2692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Rajasthan</b>	<b>15</b>	<b>559927</b>	<b>169143</b>	<b>-</b>	<b>-</b>	<b>559927</b>	<b>169143</b>	<b>16</b>	<b>463310</b>	<b>109239</b>	<b>-</b>	<b>-</b>	<b>463310</b>	<b>109239</b>	<b>-</b>	<b>-</b>	<b>463310</b>	<b>109239</b>	<b>-</b>	<b>-</b>	<b>463310</b>	<b>109239</b>
Bhilwara	5	212528	66675	-	-	212528	66675	7	156309	31410	-	-	156309	31410	-	-	156309	31410	-	-	156309	31410
Chittorgarh	6	251209	75057	-	-	251209	75057	6	243050	65512	-	-	243050	65512	-	-	243050	65512	-	-	243050	65512
Jaipur	1	84155	24405	-	-	84155	24405	1	63951	12317	-	-	63951	12317	-	-	63951	12317	-	-	63951	12317
Pali	1	55	11	-	-	55	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sikar	1#	-	-	-	-	-	-	1#	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Udaipur	1	11980	2995	-	-	11980	2995	1#	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>West Bengal</b>	<b>3</b>	<b>84638</b>	<b>33719</b>	<b>5207</b>	<b>4218</b>	<b>89845</b>	<b>37937</b>	<b>5</b>	<b>81206</b>	<b>31780</b>	<b>5631</b>	<b>5979</b>	<b>5631</b>	<b>81206</b>	<b>31780</b>	<b>5631</b>	<b>5979</b>	<b>5631</b>	<b>81206</b>	<b>31780</b>	<b>5631</b>	<b>5979</b>
Birbhum	3	84638	33719	5207	4218	89845	37937	5	81206	31780	5631	5979	5631	81206	31780	5631	5979	5631	81206	31780	5631	5979

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

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 6: Production of Kaolin (Natural), 2010-11 and 2011-12(P)**  
(By Frequency Groups)

(Qty in tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
<b>All Groups</b>	<b>64</b>	<b>53</b>	<b>2651448</b>	<b>2667219</b>	<b>100.0</b>	<b>100.0</b>	–	–
Up to 500	9	6	1576	1320	++	++	++	++
501-1000	3	1	1875	1000	0.1	++	0.1	++
1001-2000	3	5	4519	7460	0.2	0.3	0.3	0.3
2001-3000	6	2	14828	5102	0.6	0.2	0.9	0.5
3001-4000	1	4	3518	13771	0.1	0.5	1.0	1.0
4001-5000	3	-	13781	-	0.5	-	1.5	1.0
5001-10000	10	5	75675	34763	2.9	1.3	4.4	2.3
10001-15000	6	2	76841	23907	2.9	0.9	7.3	3.2
15001 & above	23	28	2458835	2579896	92.7	96.8	100.0	100.0

++: Negligible.

**Table – 7 : Production of Kaolin (Processed), 2010-11 and 2011-12 (P)**  
(By Frequency Groups)

(In tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
<b>All Groups</b>	<b>21(1)</b>	<b>18(1)</b>	<b>76498</b>	<b>67130</b>	<b>100.0</b>	<b>100.0</b>	–	–
Up to 500	4	3	309	618	0.4	0.9	0.4	0.9
501-1000	2	3	1182	2025	1.5	3.0	1.9	3.9
1001-2000	2	3	2501	4988	3.3	7.4	5.2	11.3
2001-3000	4	-	10148	-	13.3	-	18.5	11.3
3001-4000	1	2	3285	6752	4.3	10.1	22.8	21.4
4001-5000	1	2	4646	8489	6.1	12.6	28.9	34.0
5001-10000	6(1)	5(1)	42806	44258	55.9	66.0	84.8	100.0
10001 & above	1	-	11621	-	15.2	-	100.0	100.0

Figures in parentheses indicate the number of associated mines.



KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 8 : Mine-head Stocks of Kaolin, 2011-12 (P)  
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
<b>India</b>	<b>407332</b>	<b>426311</b>
Andhra Pradesh	25199	12717
Gujarat	111529	150859
Jharkhand	14458	13505
Karnataka	16136	15117
Kerala	29466	18104
Madhya Pradesh	13254	11276
Odisha	4715	1755
Rajasthan	172967	183968
West Bengal	19608	19010

## 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) (220,000 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, Gujarat (80,500 tpy capacity; a new plant of 33,600 tpy is also installed); Amrapali China Clay Washing Plant, Nadapa, Bhuj district, 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 180,000 tpy paper coating and filler grades of processed china clay (hydrous), besides 30,000 tpy of calcined clays. It is in the process of increasing capacity of calcined clay to 60,000 tpy. Popular Minerals are reported to be developing its mine and plant in Chittorgarh, Rajasthan. Ashapura is also

establishing new production unit in Kerala with a 200,000 tpy kaolin capacity of various grades - air floated, lumps, hydrous and hydrous calcined.

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 Hibrite, Cerefel - K.C.G. Spray dried, K.C.G. Lumps, B.C.K. Spray dried, etc. Grading is based primarily on white colouration and grit content. Improved processing techniques could further the prospects of Indian kaolin in the international markets.

## 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.

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).

## 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 increased to 1,489 thousand tonnes in 2011-12, from 1,488 thousand tonnes in 2010-11. 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%.

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**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 <sub>2</sub> O <sub>3</sub>	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 <sub>2</sub> O <sub>3</sub>	–	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: Reported Consumption of Kaolin (China clay), 2009-10 to 2011-12 (By Industries)**

Industry	(In tonnes)		
	2009-10	2010-11(R)	2011-12(P)
<b>All Industries</b>	<b>1484600</b>	<b>1488100</b>	<b>1489100</b>
Cement <u>1/</u>	642100(6)	664700(8)	665300(8)
Ceramic <u>2/</u>	645000(237) <sup>e</sup>	624800(237) <sup>e</sup>	625200(237) <sup>e</sup>
Cosmetic	2300(5)	2200(5)	2200(5)
Glass	700(3)	700(3)	700(3)
Paint	111000(25)	111300(25)	111400(25)
Paper	21700(23)	21700(23)	21700(23)
Pesticide	24800(21)	24800(21)	24800(21)
Refractory	33000(28)	33600(30)	33400(28)
Rubber	2400(31)	2400(31)	2400(31)
Others (abrasives, asbestos-products, chemical, dry cell battery, electrical, electrode and textile).	1600(36)	1900(39)	2000(38)

Figures rounded off.

Figures in parenthesis denote the number of units in organised sector reporting\* consumption.

(\*Includes actual reported consumption and/or estimates made wherever required).

1/ Relates to raw/unprocessed china clay.

2/ Includes 2 units which processed crude china clay to the tune of about 65,285 tonnes, during 2009-10, 2010-11 & 2011-12 each.

## 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 25.7 million tonnes in 2011 showed 2% increase over the previous year. Six countries, namely, USA, Germany, China, Brazil, UK and Iran accounted for about 70% world production. The share of USA in total world production was about 21%, followed by Germany (19%), China (12%), Brazil (9%), Iran (6%) and Republic of Korea and UK (4% each) (Table-11).

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

Country	(In '000 tonnes)		
	2009	2010	2011
<b>World : Total</b>	<b>23800</b>	<b>25200</b>	<b>25700</b>
Brazil	1987	1900	2200
China <sup>(e)</sup>	3000	3000	3000
Czech Republic	488	636	660
France	350	350	350 <sup>(e)</sup>
Germany	4513	4578	4898
Iran	907	1480	1500 <sup>(e)</sup>
Korea, Rep. of	890	962	1051
Malaysia	488	530	442
Mexico	406	517	372
Spain	270	311	303
Turkey	235	787	650 <sup>(e)</sup>
UK	1060	1000 <sup>(e)</sup>	1000 <sup>(e)</sup>
USA	5290	5370	5480
Vietnam	650	650	650
Other countries	3266	3129	3144

Source : World Mineral Production, 2007-2011.

## USA

New project I Minerals made progress with its Bovill kaolin deposit in Idaho. The deposit has inferred resources of 38.4 million tonnes of primary clay with 8.9 million tonnes in the main area of focus. I-Minerals has estimated a

production rate of 900 tpd and a minimum mine life of over 50 years. In the United States industrial production of paper the leading market for kaolin declined 2.9% through July 12 as compared to the same period in 2011.

## Australia

W.A. Kaolin a new producer of high quality kaolin products, based in Perth, Western Australia was in the planning stages for a capacity expansion of 350,000 tpy. The initial installed capacity would be 150,000 tpy for its mine near Wickepin, Western Australia.

## FOREIGN TRADE

### Exports

Exports of kaolin increased to 184,734 tonnes in 2011-12 from 112,016 tonnes in 2010-11. UAE (74%) and Bangladesh (11%) were the major importing countries in 2011-12 (Table - 12).

### Imports

Imports of kaolin increased drastically to 73,647 tonnes in 2011-12 from 52,663 tonnes in 2010-11. Major suppliers were USA (48%), China (21%) and UK (8%) (Table - 13).

**Table – 12 : Exports of Kaolin  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>112016</b>	<b>423070</b>	<b>184734</b>	<b>582117</b>
UAE	64245	86822	137296	127193
Bangladesh	22040	62305	19787	68404
Germany	4768	60507	3215	47498
USA	332	8079	2272	32923
Saudi Arabia	578	7589	1876	27628
Russia	49	715	1016	26514
Malaysia	2829	29981	1837	23952
Sri Lanka	1163	13218	1638	22604
Philippines	609	12153	732	17390
Nepal	1548	9204	2029	16131
Other countries	13855	132497	13036	171880

## KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 13 : Imports of Kaolin  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>52663</b>	<b>636698</b>	<b>73647</b>	<b>1078287</b>
USA	25350	330473	35681	529428
China	7737	90486	15735	181134
UK	3335	61726	5576	98428
Germany	888	12252	3187	50113
Bulgaria	66	443	2287	36988
New Zealand	1006	26485	1139	30932
Indonesia	50	272	1003	22761
France	700	9343	845	15711
Thailand	2094	17581	1494	15453
Italy	2	48	1054	14714
Other countries	11435	87589	5646	82625

### 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 Planning Commission of India.

## 2. Ball Clay

Ball clay and china clay are used for similar purposes in ceramic and pottery. 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

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 1595 thousand tonnes in 2011-12 increased by 47% as compared to that in the previous year.

During the year under review, there were 53 reporting mines as against 40 in 2010-11. Besides, production of ball clay was also reported as an associated mineral by eleven mines during 2011-12. Six principal producers accounted for about 62% of total production. The share of public sector mines in the total production was 6% as compared to about 12% in the preceding year.

Rajasthan continued to be the leading state in production, accounting for 83% of the total production followed by Andhra Pradesh with 16%. The remaining 1% production was from Gujarat and Tamil Nadu (Tables - 15 to 17).

Mine-head stocks of ball clay at the end of the year 2011-12 were 691 thousand tonnes as against 487 thousand tonnes at the beginning of the year (Table -18).

The average daily employment of labour in 2011-12 was 559 as against 422 in the previous year. Domestic prices of ball clay are furnished in the General Review on Prices.

## KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

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

Grade/State	Reserves			Remaining resources					Total resources (A+B)	
	Proved STD111	Probable STD121    STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221    STD222	Measured STD331	Indicated STD332	Inferred STD333		Total (B)
<b>All India : Total</b>	<b>12292820</b>	<b>350832    4134190</b>	<b>16777842</b>	<b>6122450</b>	<b>3906958    12387575</b>	<b>268486</b>	<b>2279330</b>	<b>41650863</b>	<b>66615662</b>	<b>83393504</b>
<b>By Grades</b>										
Ceramic Pottery	12252380	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
<b>By States</b>										
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.*

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 15 : Principal Producers of Ball Clay, 2011-12**

(Table - 15 Concl'd.)

Name & address of producer	Location of mine		Name & address of producer	Location of mine	
	State	District		State	District
Shanta Sales Corpn., House of Mohanlal Mathur, Behind Rajasthan Pan Bhandar, Rani Bazar, Bikaner - 334 001, Rajasthan.	Rajasthan	Bikaner	Jaichandlal Daga, 1st Floor, Labhuji ka Katla Kotegate Bikaner-334 001, Rajasthan.	Rajasthan	Bikaner
Sunder Lal Daga, Bagree Mohalla, Bikaner - 334 001, Dist. Bikaner, Rajasthan.	Rajasthan	Bikaner	Harish Clays, P.B.No.57, Harasar House, Near M.N.Hospital, Bikaner - 334 001 Rajasthan.	Rajasthan	Bikaner
Tahlaram & Sons, Ramnath Sadan, Rathkhana Colony, Bikaner-334 001, Rajasthan.	Rajasthan	Bikaner	Andhra Pradesh Mineral Dev. Corp. Ltd , House No. 6-2-915 3rd Floor, Rear Block, Post HMWSSB, Khairatabad, Ameerpet, Hyderabad -500 016. Andhra Pradesh.	Andhra Pradesh	West Godavari

(Contd.)

**Table – 16 : Production of Ball clay, 2009-10 to 2011-12 (By States)**

(Qty in tonnes; Value in ₹'000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>932993</b>	<b>218174</b>	<b>1086714</b>	<b>390238</b>	<b>1594634</b>	<b>635665</b>
Andhra Pradesh	202796	26700	259380	70384	252892	51277
Gujarat	31053	1477	31140	2025	15523	1708
Rajasthan	676559	184938	776193	301368	1321734	578182
Tamil Nadu	22585	5059	20001	16461	4485	4498

**Table – 17 : Production of Ball clay, 2010-11 and 2011-12 (By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2010-11			2011-12 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India</b>	<b>40(3)</b>	<b>1086714</b>	<b>390238</b>	<b>53(11)</b>	<b>1594634</b>	<b>635665</b>
Public sector	2(1)	130798	25396	2	100821	10182
Private sector	38(2)	955916	364842	51(11)	1493813	625483
<b>Andhra Pradesh</b>	<b>12</b>	<b>259380</b>	<b>70384</b>	<b>13(1)</b>	<b>252892</b>	<b>51277</b>
Chittoor	1	792	40	1	700	34
West Godavari	11	258588	70344	12(1)	252192	51243
<b>Gujarat</b>	<b>2(1)</b>	<b>31140</b>	<b>2025</b>	<b>3</b>	<b>15523</b>	<b>1708</b>
Banaskantha	-	-	-	1	1390	153
Bharuch	(1)	22580	1084	-	-	-
Kachchh	1	10	1	1	352	39
Patan	1	8550	940	1	13781	1516
<b>Rajasthan</b>	<b>25(2)</b>	<b>776193</b>	<b>301368</b>	<b>36(10)</b>	<b>1321734</b>	<b>578182</b>
Bikaner	25(1)	708949	217179	35(9)	1288223	527812
Nagaur	(1)	67244	84189	1(1)	33511	50370
<b>Tamil Nadu</b>	<b>1</b>	<b>20001</b>	<b>16461</b>	<b>1</b>	<b>4485</b>	<b>4498</b>
Cuddalore	1	20001	16461	1	4485	4498

Figures in parentheses indicate associated mines of ball clay with silica sand & fireclay.



KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

**Table – 18 : Mine-head Stocks of Ball Clay  
2011-12(P)  
(By States)**

State	(In tonnes)	
	At the beginning of the year	At the end of the year
<b>India</b>	<b>486776</b>	<b>690943</b>
Andhra Pradesh	122306	132512
Gujarat	532	977
Rajasthan	345900	550399
Tamil Nadu	18038	7055

**Table – 19 : Reported Consumption of Ball clay  
2009-10 to 2011-12(P)  
(By Industries)**

Industry	(In tonnes)		
	2009-10	2010-11 (R)	2011-12(P)
<b>All Industries</b>	<b>561200</b>	<b>589500</b>	<b>578600</b>
Abrasive	100(2)	100(2)	100(2)
Ceramic <sup>(e)</sup>	547600(222)	576000(222)	565000(222)
Refractory	113500(22)	13400(26)	13500(26)

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).

## 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 decreased from 589,500 tonnes in 2010-11 to 578,600 tonnes in 2011-12. About 98% 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 decreased slightly to 18,037 tonnes in 2011-12 from 19,611 tonnes in 2010-11. Exports were mainly to Bangladesh (89%) (Table - 20).

### Imports

Imports of ball clay also increased considerably to 191,310 tonnes in 2011-12 as compared to 126,695 tonnes in the previous year. Imports were mainly from Ukraine (60%), Indonesia (20%), UK (9%) and Malaysia (7%) (Table -21).

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>19611</b>	<b>63288</b>	<b>18037</b>	<b>62387</b>
Bangladesh	16178	52365	16045	54544
Nepal	15	18	1197	3497
UAE	2711	8767	400	2760
Oman	104	543	185	786
Kenya	142	367	141	501
Thailand	1	2	30	180
Iran	312	775	26	69
Canada	-	-	6	27
South Africa	9	9	7	22
China	-	-	++	1
Other countries	139	442	-	-



KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>126695</b>	<b>637682</b>	<b>191310</b>	<b>1023647</b>
Ukraine	61296	315930	114269	618897
UK	15379	141200	17774	182727
Indonesia	28650	65131	37397	94095
Malaysia	6575	15283	12612	37534
China	2229	16101	5142	35332
USA	11184	61955	2012	32994
Germany	154	2062	572	7814
Portugal	168	1319	912	7801
Thailand	90	877	255	2476
Spain	245	3919	185	2193
Other countries	725	13905	180	1784

### 3. Clay(others)

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

## PRODUCTION, STOCKS & PRICES

The production of clay (others) at 745 thousand tonnes in 2011-12 increased by about 2% as compared to that in the previous year due to more demand.

There were 18 mines reporting production in 2011-12 as against 13 mines in the previous year. Besides, production of Clay (others) was reported by 13 mines as associated mineral. About 61% of the total production of clay (others) was reported as an associated mineral. Entire production of clay(others ) was in private sector. About 92% of the total production was contributed by six principal producers.

Madhya Pradesh, the major producing state, accounted for about 57% of the total production during the period under review, followed by Gujarat 32%, Andhra Pradesh 11 percent, and Rajasthan with meagre production.

Six mines and three associated mines having annual production more than 10,000 tonnes contributed about 95% of the total production.

Mine-head stocks of clay (others) was 179 thousand tonnes at the end of 2011-12 as against 52 thousand tonnes at the beginning of the year.

The average daily employment of labour was 140 during 2011-12 as against 93 in the previous year. Domestic prices of clay (others) are furnished in the General Review on Prices.

**Table – 22 : Principal Producers of Clay  
(Others), 2011-12**

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, 10 <sup>th</sup> Floor, Kataria Arcade, Opp. S. H. Highway, Post : Makaraba Ahmedabad - 380 051, Gujarat.	Gujarat	Kachchh
Narmada Cement Ltd, P.B. No. 10, Post: Jafarabad-365 540, Taluk : Jafarabad, Dist : Amreli, Gujarat.	Gujarat	Amreli
Rajesh Sadulbha Ker, Ashapura Society, Surarkaradi, Tah : Okha Mandal, Gujarat.	Gujarat	Jamnagar
Regency Ceramics, No. 5-8-356, N. N. House, Chirag Ali Lane, ABIDS, Hyderabad - 500 001, Andhra Pradesh.	Andhra Pradesh	Vishakapatnam
** Hemadri Cement Ltd, 8-3960/11, Near SBI, Hyderabad-500 073 Andhra Pradesh.	Andhra Pradesh	Krishna

\*\* Producing clay (others) with limestone.

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**Table – 23 : Production of Clay (Others), 2009-10 to 2011-12  
(By States)**

(Qty in tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>1056273</b>	<b>71294</b>	<b>730752</b>	<b>70342</b>	<b>744561</b>	<b>51117</b>
Andhra Pradesh	237220	26240	84875	8402	84127	6478
Gujarat	420598	7040	203291	12775	238731	14569
Madhya Pradesh	235027	20453	434722	48025	421653	30058
Rajasthan	163428	17561	7864	1140	50	12

**Table – 24: Production of Clay (Others), 2010-11 and 2011-12(P)  
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India</b>	<b>13(10)</b>	<b>730752</b>	<b>70342</b>	<b>18(13)</b>	<b>744561</b>	<b>51117</b>
Private sector	13(10)	730752	70342	18(13)	744561	51117
<b>Andhra Pradesh</b>	<b>6(7)</b>	<b>84875</b>	<b>8402</b>	<b>10(8)</b>	<b>84127</b>	<b>6478</b>
Adilabad	1	2128	228	1	12951	1036
Anantapur	(3)	9000	1071	(4)	9219	1443
Krishna	(1)	12400	347	(1)	14000	714
Kurnool	5(2)	36347	3756	7(3)	33180	2728
Ranga Reddy	(1)	25000	3000	-	-	-
Vishakhapatnam	-	-	-	2	14777	557
<b>Gujarat</b>	<b>3</b>	<b>203291</b>	<b>12775</b>	<b>3</b>	<b>238731</b>	<b>14569</b>
Amreli	1	45273	2354	1	44007	4502
Bhavnagar	1	4270	427	-	-	-
Jamnagar	-	-	-	1	22703	3405
Kachchh	1	153748	9994	1	172021	6662
<b>Madhya Pradesh</b>	<b>(3)</b>	<b>434722</b>	<b>48025</b>	<b>(5)</b>	<b>421653</b>	<b>30058</b>
Katni	(2)	432722	47905	(2)	416233	29287
Jabalpur	-	-	-	(2)	920	95
Satna	(1)	2000	120	(1)	4500	676
<b>Rajasthan</b>	<b>4</b>	<b>7864</b>	<b>1140</b>	<b>5</b>	<b>50</b>	<b>12</b>
Bikaner	4	7864	1140	5	50	12

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

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**Table – 25 : Production of Clay (Others), 2010-11 and 2011-12  
(By Frequency Groups)**

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
<b>All Groups</b>	<b>13(10)</b>	<b>18(13)</b>	<b>730752</b>	<b>744561</b>	<b>100.00</b>	<b>100.00</b>	-	-
Upto 5000	7(5)	11(10)	24455	31290	3.35	4.20	3.35	4.20
5001 to 10000	4(1)	1	37154	6085	5.08	0.82	8.43	5.02
10001 to 20000	(1)	3(1)	12400	52222	1.70	7.01	10.13	12.03
20001 to 30000	(1)	1	25000	22703	3.42	3.05	13.55	15.08
30001 & above	2(2)	2(2)	631743	632261	86.45	84.92	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), 2011-12 (P)  
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
<b>India</b>	<b>52312</b>	<b>178851</b>
Andhra Pradesh	42522	39613
Madhya Pradesh	297	43287
West Bengal	1633	454
Rajasthan	7860	95497

## FOREIGN TRADE

### Exports

Exports of clay (others) decreased sharply to 17 thousand tonnes in 2011-12 from 53 thousand tonnes in 2010-11. Exports were mainly to Bangladesh (30%), Nepal (11%), Kenya (10%), Saudi Arabia and Sri Lanka (8%) each, and UAE (7%) (Table-27).

### Imports

Imports of clay (others) increased to 13,013 tonnes in 2011-12 from 11,610 tonnes in 2010-11. Ukraine (61%), USA (17%), and China (10%) were the main suppliers (Table - 28).

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>52526</b>	<b>241610</b>	<b>16811</b>	<b>126294</b>
Bangladesh	6651	21628	5111	18285
Kenya	1307	11488	1630	14719
Nepal	1420	6603	1898	13378
Pakistan	237	4009	807	12445
Saudi Arabia	4184	23523	1272	10828
UAE	2179	14349	1184	9572
Sri Lanka	1062	8666	1277	9143
Vietnam	-	-	231	5316
Mozambique	23	358	323	4144
Kuwait	16	27	248	3472
Other countries	35447	150959	2830	24992

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>11610</b>	<b>103765</b>	<b>13013</b>	<b>144418</b>
USA	874	29222	2169	59727
Ukraine	9547	49592	8000	39776
China	498	6409	1336	11551
UK	58	1759	609	8444
Germany	308	6826	273	6914
Spain	4	478	81	4632
Thailand	50	1303	45	3720
France	147	4509	157	3299
Canada	-	-	72	1112
Belgium	-	-	50	1097
Other countries	124	3667	221	4146

## 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, which reportedly encumbered the stages at the captive mines of cement companies. 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 manufacture of cement at 3,339 thousand tonnes in 2011-12 increased by 8% over the previous year. There were 4 reporting mines in 2011-12 as compared to 2 reporting mines in 2010-11. About 97% of total production of shale was reported as an associated mineral by 19 limestone mines in 2011-12. Captive mines of cement plants contributed about 97% of total production during both the years. The share of public sector was 1% in both the years.

As regards to statewise production, Himachal Pradesh contributed 46% of the total production of shale followed by Karnataka (24%), Madhya Pradesh (16%), Maharashtra (11%) and Andhra Pradesh (3%) (Tables - 30 to 32).

Mine-head stock at the end of 2011-12 was 68 thousand tonnes as against 64 thousand tonnes in the previous year. The average daily employment of labour employed in shale mines in 2011-12 was 15 as against 5 in the previous year (Table - 33).

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

Figures rounded off.

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**Table – 30 : Principal Producers of Shale, 2011-12**

Name & address of producer	Location of mines	
	State	District
*The ACC Ltd, Cement House, 121, Maharshi Karve Road, Churchgate, Mumbai - 400 020.	Karnataka Himachal Pradesh Maharashtra	Gulbarga Bilaspur Yavatmal
* Jaypee Himachal Cement Plant, Sector-128, Noida-201 304, Uttar Pradesh.	Himachal Pradesh	Solan
*Ambuja Cements Ltd, Ambuja Nagar, Taluka-Kodinar, Dist. Junagarh, Gujarat - 362 715.	Himachal Pradesh	Solan
*Jaiprakash Associates Ltd, Sector-128, Noida-201 304, Uttar Pradesh.	Madhya Pradesh	Rewa
*Ultratech Cement Ltd, 'A' Wing, Ahura Centre, 1 <sup>st</sup> Floor, Mahakali Caves Road, Andheri (E), Mumbai - 400 093.	Maharashtra	Chandrapur

\* Producing as an associated mineral with limestone.

**Table – 31 : Production of Shale, 2009-10 to 2011-12  
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>3033948</b>	<b>89288</b>	<b>3081622</b>	<b>103993</b>	<b>3338919</b>	<b>128416</b>
Andhra Pradesh	130425	7092	123106	7941	97574	6427
Himachal Pradesh	924714	24700	1502873	55393	1535493	50066
Karnataka	936636	34304	559356	25710	809926	42234
Madhya Pradesh	637088	5734	598912	5349	543054	5270
Maharashtra	405085	17458	297375	9600	352872	24419

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**Table – 32 : Production of Shale, 2010-11 & 2011-12**  
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India</b>	<b>2(18)</b>	<b>3081622</b>	<b>103993</b>	<b>4(19)</b>	<b>3338919</b>	<b>128416</b>
Public sector	1	28800	1931	1	31636	2076
Private sector	1(18)	3052822	102062	3(19)	3307283	126340
<b>Andhra Pradesh</b>	<b>2(6)</b>	<b>123106</b>	<b>7941</b>	<b>2(8)</b>	<b>97574</b>	<b>6427</b>
Anantpur	(1)	150	23	(5)	6575	880
Kurnool	(4)	25970	3181	(3)	19363	1553
Nalgonda	1(1)	68186	2806	1	40000	1918
Ranga Reddy	1	28800	1931	1	31636	2076
<b>Himachal Pradesh</b>	<b>(3)</b>	<b>1502873</b>	<b>55393</b>	<b>(3)</b>	<b>1535493</b>	<b>50066</b>
Bilaspur	(1)	320800	18927	(1)	276533	10323
Solan	(2)	1182073	36466	(2)	1258960	39743
<b>Karnataka</b>	<b>(2)</b>	<b>559356</b>	<b>25710</b>	<b>(1)</b>	<b>809926</b>	<b>42234</b>
Gulbarga	(2)	559356	25710	(1)	809926	42234
<b>Madhya Pradesh</b>	<b>(5)</b>	<b>598912</b>	<b>5349</b>	<b>2(5)</b>	<b>543054</b>	<b>5270</b>
Rewa	(5)	598912	5349	(5)	541909	4857
Mandsaur	-	-	-	2	1145	413
<b>Maharashtra</b>	<b>(2)</b>	<b>297375</b>	<b>9600</b>	<b>(2)</b>	<b>352872</b>	<b>24419</b>
Chandrapur	(1)	228859	2517	(1)	130487	1606
Yavatmal	(1)	68516	7083	(1)	222385	22813

Figures in parentheses indicate associated mines with Limestone.

**Table – 33 : Mine-head Stocks of Shale, 2011-12(P)**  
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
<b>India</b>	<b>63849</b>	<b>68044</b>
Andhra Pradesh	38181	42326
Karnataka	25668	25668
Madhya Pradesh	-	50