

KALLOIN

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At least fifty countries produce in excess of 40 Mt/y of kaolin (Table 1) ranging from relatively low-cost unprocessed 'common clays' to processed grades of kaolin.

The latter so-called refined kaolin may be processed dry (via air flotation) for use in ceramics, paint, rubber, adhesives, and the like, or wet (by water washing) for use as a filler in high-quality mainly in paper, plastics, and paint. Still more sophisticated processing such as high-intensity magnetic separation, delamination, ozonisation, and/or calcination yield various specialised grades.

The production of refined kaolin is concentrated in a handful of countries - the US, UK, Brazil, Germany, the Czech Republic and Ukraine - that constitute less than half of the world kaolin production in tonnage terms, yet contribute more than three quarters of the value. Because of the limited geographical distribution of production, a significant percentage enters international trade: almost half of the approximately 13 Mt/y of refined kaolin produced in the US, the UK and Brazil enters deep-sea trade.

In terms of general production trends in 2000, decreases in US production and the continued slow decline in the UK were offset by increases in Brazil. Australia has been slowly increasing production whereas German production has remained flat.

Takeover Tactics

This dominant position by a few producing regions is reflected more so in the distribution by company. In recent years the industry has undergone a rash of ownership changes that has resulted in greater globalisation, increased control by fewer but larger companies, and some production rationalisation.

Worldwide markets for kaolin are now dominated by international subsidiaries of Imerys of France plus Engelhard, J.M. Huber and Thiele Kaolin in the US, Caulim de Amazônia (Cadam) in Brazil, together with a number of smaller producers in Europe. However, undoubtedly the biggest recent newsmaker in kaolin and related white minerals has been the Imerys Group of France that has evolved into the world's leading producer of white minerals for paper. Hardly a month passes without news of another mineral acquisition by Imerys.

The groundwork was set through the acquisition of Dry Branch Kaolin (including Nord Kaolin Co.) in 1997 in the US and its subsidiary, Rio Capim in Brazil. A major coup was the 1999 purchase of ECC International plc that included ECC America, the largest kaolin producer in the US. (In order to obtain US Department of Justice approval, ECC's kaolin operations at Sandersville and Wrens, Georgia, were transferred to J.M. Huber.) Most recently, Imerys USA Inc. purchased Kentucky-Tennessee Clay Co. and K-T Feldspar for US\$62.5 million, a deal that included airfloated kaolin plants in Georgia and South Carolina, as well as ball-clay operations in Tennessee and Kentucky and feldspar in North Carolina.

Other acquisitions have included C.E. Minerals in the US, AGS-BMP and Damrec in France, and New Zealand China Clays Ltd., in New Zealand (see below).

The Americas

Just four companies operating in Georgia and South Carolina in the eastern US - Imerys USA Inc., Engelhard Corporation, J. M. Huber Corp. and Thiele Kaolin Co. - have a combined annual production capacity of almost 8 Mt of hydrous water-washed kaolin plus an additional 0.9 Mt of calcined kaolin

and thus control by far the bulk of the 10 Mt/y of regional production capacity.

Imerys produces about 1 Mt/y at its Deepstep, Georgia, operation and an additional 1.2 Mt/y at its Dry Branch and Jefferson operations. However, in an effort to improve prices and restore profitability to the refined kaolin business, Imerys retired 0.8 Mt/y of its hydrous kaolin capacity at the beginning of 2001. Rich Ryan, senior vice president and general manager of Imerys' Americas Paper Group commented, "Due to a steady decline in prices over the last ten years, and despite dramatic cost savings initiatives and process improvements, a portion of our present Middle Georgia hydrous kaolin output is not commercially viable."

Engelhard Corp.'s Pigments and Additives Division is a major player operating a number of mines in central Georgia feeding processing plants located at McIntyre and Gordon. Total production capacity exceeds 2 Mt/y of high-quality water-washed clays plus calcined grades.

The privately owned J.M. Huber Corp. operates kaolin-processing plants at Huber, Sandersville, and Wrens in Georgia. The company has traditionally taken a multi-mineral approach producing a range of white filler/coating products including ground calcium carbonate, precipitated calcium carbonate, alumina trihydrate, precipitated silicas and silicates, highly dispersible silicas, magnesium hydroxide, and zeolites.

Thiele Kaolin Co. at Sandersville and Wrens in Georgia has a production capacity of 1.3 Mt/y including calcined grades. A major air-floated kaolin producer is Albion Kaolin Co., owned by Unimin Corp., with operations in Hephzibah and McIntyre in Georgia serving the ceramics, fiberglass, rubber, building materials, adhesives, and paper industries.

Dubbed the 'Georgia of the 21st century', Brazil has emerged as a major player in the kaolin business based on the rapid development of large, uniform and excellent

quality kaolin deposits. Much of the 2.5 Mt/y produced by the country's three main producers - Cadam, Pará Pigmentos SA, and Rio Capim Caulim - is exported to markets in Europe, Asia, and more recently the US. Once again ownership is noteworthy - Rio Capim Caulim is owned by Imerys via Dry Branch and at the time of writing Mitsui looks likely to take a stake in Caemi that would include a 62% share of Cadam.

Europe

In the southwest of England deposits of kaolin, known locally in Cornwall as china clay, are the most important in Europe. Commercial exploitation is dominated by

World Production of Kaolin ('000 t)			
	1998	1999	2000 ^e
Australia (includes ball clay) ^e	220	250	270
Belgium ^e	300	300	300
Brazil (beneficiated)	1,381	1,400	1,500
Bulgaria ^e	110	110	110
Colombia (inc. common clay)	8,000	8,000	8,000
Czech Republic	3,049	5,183	5,000
Egypt	285	290	290
France (marketable)	330	325	325
Germany	1,800	1,800	1,800
India: Processed	148	150	150
India: Salable crude	402	520	520
Iran	600	600	600
Korea, Republic of	2,260	1,858	1,858
Malaysia	177	209	209
Mexico	339	490	490
Nigeria	110	110	110
Portugal	180	180	180
South Africa	130	120	120
Spain (marketable)	300	300	300
Thailand (beneficiated)	255	250	250
Turkey	404	400	400
Ukraine	850	850	850
UK (sales)	2,392	2,304	2,200
US	9,640	9,160	9,000
Uzbekistan ^e	5,500	5,500	5,500
Other	939	841	1,368
Total	40,100	41,500	41,700

^e Estimated

Source: US Geological Survey

Imerys (formerly English China Clays) with smaller contributions from Watts Blake Bearne & Co. plc and Goonvean Ltd.

In France, Imerys is the dominant ceramic kaolin producer with a production rate of 1 Mt/y in the Provins Basin, southwest of Paris, as well as in west- and east-central France. Kaolin deposits like those of Cornwall extend into Brittany where production is controlled by subsidiaries of Denain-Anzin Minéraux - namely Kaolins du Morbihan (80,000 t/y), Kaolins d'Arvor (70,000 t/y), and Société des Kaolins du Finistère (60,000 t/y) - as well as Société des Kaolins de Beauvoir (30,000 t/y) in central France. DAM also owns Kaolins d'Arvor and Société des Kaolins de Beauvoir.

Across the Pyrenees, kaolin is produced in Spain by Caolines de Vimianzo SA at Vimianzo, Galicia (100,000 t/y), Explotaciones Ceramics Españoles SA at Burela, Lugo Province (90,000 t/y), and Cia Española de Caolines and Caobar SA (50,000 t/y) and Silices y Caolines SA/Arenas de Arijá SA (50,000 t/y), both in Poveda, Guadalajara. In neighbouring Portugal the main producer is Saibra, a subsidiary of DAM, at Mosteiros.

The centre of kaolin production in Germany is the Hirschau and Schnaittenbach district near Munich, Bavaria, where 'kaolinsand' production is dominated by Amberger Kaolinwerke Eduard Kick GmbH (AKW). The corporate capacity is estimated to be 600,000 t/y including output from subsidiaries Caminauer Kaolinwerk GmbH and Kemmlitzer Kaolinwerk in Saxony plus Quarzwerke GmbH and Gebrüder Dorfner GmbH & Co. (120,000 t/y).

The Czech Republic produces about 500,000 t/y of washed kaolin in the Karlovy Vary area due west of Prague, and in the Znojmo district, midway between Prague and Bratislava. Leading producers are Sedlecký Kaolin AS near Božicany (100,000 t/y) and Zapadoceske Kaolinove a Keramike Zavody AS (ZKZ) near Horní Brzy (275,000 t/y). To the east in Ukraine, Dnipro Kaolin, a 50:50 joint venture between Engelhard Corp. of the

US and Prosyano Mining and Enrichment Combine of Ukraine, is developing Prosyano's kaolin mining and processing facilities in the southeastern part of the country.

In Uzbekistan an Uzbek-German joint venture has commissioned a 200,000 t/y-kaolin plant near Angren City, Tashkent.

Australasia

In Australasia, various quality kaolins are produced in Australia, India, Japan, China, Malaysia, New Zealand, Taiwan, and Thailand.

In Australia, Skardon River Kaolin Pty Ltd. is scheduled to start up production in August 2001 at its Skardon River deposit in northern Queensland (the operation is located north of Comalco's Weipa bauxite mine, which has closed its kaolin stream). Minerals Corp. Ltd. took the beleaguered operation over from Australian Kaolin Pty Ltd. and will produce 75,000 t/y each of calcined and hydrous kaolin for the paper, paint, plastics/polymer and ceramics markets in Asia. Sold under the trade name of Microbrite®, the processing line includes cryofilter magnets, membrane filters, and rotary calciners that yields an initial grade with a brightness of 92.5%.

In New Zealand, New Zealand China Clays Ltd, purchased last year by Imerys, produced some 15,000 t/y of halloysite at Matauri Bay in the northern part of the North Island. Sales are mainly in the Asian ceramics industry. Annual washed kaolin production in China is about 2 Mt, and in Japan the domestic output of 100,000 t/y is overshadowed by imports of 800,000 t/y.

In the Middle East the main producers are Egypt and Israel.

Consumption

Kaolin, calcium carbonate, and talc are the three big white mineral fillers feeding the big three consuming industries - paper, plastics, and paint. Lower brightness fillers such as air-floated kaolin are used extensively in

certain paints, rubber, adhesives, and as carriers for fertilisers and pesticides.

Because of its availability in Georgia, kaolin is the dominant filler mineral in the US whereas carbonate tends to dominate in Europe and talc plus imported kaolin in Asia.

Kaolin and other filler demand rely on construction activity and the production of durable goods that in turn depend on the state of the economy and market sophistication. In particular, filler- and coating-grade kaolin feeds on Printing and Writing (P+W) paper and coated board consumption that tracks the GNP of the country or region.

The demand for kaolin used in ceramics and refractories relies on construction activity and demand for durable goods. Demand in ceramics is linked to competition with plastics and fiberglass (sanitaryware, sewer pipe, etc.), population growth and demographics (chinaware and sanitaryware), and the popularity of various floor coverings and surface materials (floor and wall tile). Demand in fibreglass is related to construction activity (for insulation) and GNP (for fibreglass-reinforced polymers), and catalysts on petroleum refining capacity.

At the same time, technological advances are cutting refractory consumption per unit of steel production, and there is a trend away from commodity clay-based refractories in favour of high-quality refractories based on high-alumina materials like sillimanite minerals and bauxite, as well as magnesia- and carbon-based refractories.

Prices

Sales contracts for high-grade kaolin tend to be negotiated on an annual basis with shipments spread over the life of the contract. An indication of price levels for kaolin sold in Georgia calculated from US Geological

Survey volume and value sales data indicates that the per tonne fob Georgia price ranges from US\$9/t for unprocessed kaolin, US\$45/t for air-floated grades, US\$108/t for water-washed grades, US\$97/t for delaminated, over US\$300/t for low-temperature calcined pigment-grade kaolin. The average for imported and exported kaolin was between US\$170 and US\$190/t.

Overall, US kaolin prices have been flat for much of the 1990s and under pressure since about 1997 when new capacity in Brazil began to influence the market. However, in the second half of 2000 there was a concerted effort by producers in North America and Europe to increase kaolin prices which included the implementation of energy surcharges by US suppliers starting in December 2000.

In November 2000, Imerys increased prices for its kaolin (as well as ground calcium carbonate) products by 6-13% and cut production in Georgia in an effort to make price increases stick. In January 2001, prices for Brazilian paper-grade kaolin were increased between 5% and 12% making prices US\$173-216/t, c&f Europe, 5% moisture, and US\$195-238/t, same basis, slurry form, for paper coating grade kaolin (*Minerals PriceWatch*).

According to *Industrial Minerals* prices ex-Georgia in bulk are indicated at US\$80-100/t (compared with US\$82.5-104.5/t a year ago) for filler grade kaolin and (US\$65-185/t (US\$88-192/t) for coating grade, and US\$335-395/t (US\$352-412.50/t) for calcined kaolin.

In Cornwall, UK, fot (free-on-truck) prices compared to last year were up slightly in sterling but down in US dollars due to shifts in the exchange rate - £47-58/t (US\$67-81/t) for filler-grade kaolin and £63-90/t (US\$88-126/t) for coating grades.