

## KYANITE AND RELATED MINERALS

(Data in thousand metric tons, unless otherwise noted)

**Domestic Production and Use:** One firm in Virginia with integrated mining and processing operations produced kyanite from hard-rock open pit mines. One company produced synthetic mullite in Georgia. Of the kyanite-mullite output, 90% was estimated to have been used in refractories and 10% in other uses. Of the refractory usage, 50% to 60% was estimated to have been used in iron and steelmaking and the remainder in the manufacture of chemicals, glass, nonferrous metals, and other materials.

<b>Salient Statistics—United States:</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001<sup>e</sup></b>
Production:					
Mine	W	<sup>e</sup> 90	<sup>e</sup> 90	<sup>e</sup> 90	90
Synthetic mullite	W	<sup>e</sup> 39	<sup>e</sup> 39	<sup>e</sup> 40	40
Imports for consumption (andalusite)	8	10	6	6	5
Exports <sup>e</sup>	35	35	35	35	35
Shipments from Government stockpile excesses	1	—	—	—	—
Consumption, apparent	W	<sup>e</sup> 104	<sup>e</sup> 100	<sup>e</sup> 101	100
Price, average, dollars per metric ton:					
U.S. kyanite, raw	154	157	158	165	165
U.S. kyanite, calcined	262	267	268	279	279
Andalusite, Transvaal, South Africa, 57% <sup>1</sup> Al <sub>2</sub> O <sub>3</sub>	190	190	200	161	162
Andalusite, Transvaal, South Africa, 58% <sup>2</sup> Al <sub>2</sub> O <sub>3</sub>	230	230	225	189	210
Stocks, producer	NA	NA	NA	NA	NA
Employment, kyanite mine and plant, number <sup>e</sup>	150	150	150	150	150
Net import reliance <sup>3</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (1997-2000):** South Africa, 100%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/01</b>
Andalusite, kyanite, and sillimanite	2508.50.0000	Free.
Mullite	2508.60.0000	Free.

**Depletion Allowance:** 22% (Domestic), 14% (Foreign).

**Government Stockpile:**

<b>Material</b>	<b>Stockpile Status—9-30-01<sup>4</sup></b>				
	<b>Uncommitted inventory</b>	<b>Committed inventory</b>	<b>Authorized for disposal</b>	<b>Disposal plan FY 2001</b>	<b>Disposals FY 2001</b>
Kyanite, lump	0.1	—	0.1	—	—

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**Events, Trends, and Issues:** Kyanite, on conversion to mullite at high temperature, expands irreversibly by up to 18%, thereby offsetting the firing shrinkage of other raw materials, especially clay, in ceramic bodies and refractories. Andalusite expands from 4% to 6%; it imparts high-temperature creep resistance in refractories.<sup>5</sup>

The steel industry continued to be the largest user of refractories in general, consuming an estimated 55% to 60% of total refractory output. For the first 8 months of 2001, U.S. crude steel shipments were 11.5% less than in the comparable period of 2000, according to the International Iron and Steel Institute. Output in the 15 European Union countries for the comparable period was 1.9% less than in 2000. For the 64 countries reporting to the Institute, total crude steel output was about the same for the first 8 months of 2001 as it was for the comparable period of 2000.

### **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves and reserve base <sup>6</sup>
	2000	2001 <sup>e</sup>	
United States	<sup>e</sup> 90	90	Large in the United States. South Africa reports reserve base of about 51 million tons of aluminosilicates ore (andalusite and sillimanite).
France	65	65	
India	17	17	
South Africa	185	215	
Other countries	11	3	
World total	368	390	

**World Resources:** Large resources of kyanite and related minerals are known to exist in the United States. The chief resources are in deposits of micaceous schist and gneiss mostly in the Appalachian Mountain area and in Idaho. Other resources are in aluminous gneiss in southern California. These resources are not economical to mine at present, but some may be eventually. The characteristics of kyanite resources in the rest of the world are thought to be similar to those in the United States.

**Substitutes:** Two types of synthetic mullite (fused and sintered), superduty fire clays, and high-alumina materials are substitutes for kyanite in refractories. Principal raw materials for synthetic mullite are bauxite, kaolin and other clays, and silica sand.

<sup>e</sup>Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

<sup>1</sup>From 1997-99, 57.5% Al<sub>2</sub>O<sub>3</sub>.

<sup>2</sup>From 1997-99, 59.5% Al<sub>2</sub>O<sub>3</sub>.

<sup>3</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>4</sup>See Appendix B for definitions.

<sup>5</sup>Dixon, G., Jamerson, H., and Brown, J., 2001, Sillimanite minerals: Mining Engineering, v. 53, no. 6, June, p. 58-59.

<sup>6</sup>See Appendix C for definitions.