Asbestos

By J. M. West [1] and Victoria R. Schreck [2]

ALTHOUGH the United States consumed 24 percent of the world production of asbestos, it supplied only 8 percent of its own requirements. The Nation ranked seventh among world producers, contributing 2 percent of the total output.

LEGISLATION AND GOVERNMENT PROGRAMS

Nearly one-half of the Arizona No. 2 fiber scheduled under contract with General Services Administration for the national stockpile was delivered by one producer. Contracts signed in 1960 for the purchase of 500 short tons were extended into 1962 to permit the completion of deliveries. Testing followed a simplified procedure and was carried out by Arizona Testing Laboratories, Phoenix, Ariz. Shipments were accepted at the Globe, Ariz., inspection depot as meeting requirements of National Stockpile Purchase Specification P–3–R2, dated June 10, 1953, which called for a minimum of 85 weight-percent of fiber ⅜ inch in length. This specification was superseded by a revised issue of June 2, 1961, which provided for more uniform grading requirements and more rigid testing; the source of fiber was not designated.

TABLE 1.—Salient asbestos statistics

	1952–56 (average)	1957	1958	1959	1960	1961
United States:						
Production (sales)—short tons	48,364	43,653	43,979	45,459	45,223	52,814
Value—thousands	$4,699	$4,918	$5,127	$4,391	$4,231	$4,347
Imports for consumption (unmanufactured)—short tons	702,087	682,732	644,331	713,047	[1] 669,496	616,552
Value—thousands	$60,023	$60,104	$58,314	$65,006	$63,345	$58,942
Exports (unmanufactured) [2] short tons	4,286	2,893	3,026	4,461	5,525	3,799
Value—thousands	$839	$350	$424	$793	$857	$759
Exports of asbestos products (value) [2] thousands	$12,436	$15,223	$13,233	$12,921	$13,703	$13,825
Consumption, apparent [3] short tons	746,165	723,492	685,284	754,045	[1] 709,194	665,567
World: Production—do	1,750,000	2,080,000	[1] 2,055,000	[1] 2,270,000	[1] 2,440,000	2,770,000

[1] Revised figure.
[2] Includes reexports.
[3] Measured by quantity produced, plus imports, minus exports.

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Minerals Yearbook: Asbestos Chapters, 1961
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DOMESTIC PRODUCTION

Asbestos production in the United States increased 17 percent in quantity compared with 1960, but it gained only 3 percent in value. Most of the increased production was from California deposits, where short-fiber and waste grades were recovered. An estimated 1.1 million tons of rock was mined to produce the 53,000 tons of fiber sold.

Vermont Asbestos Mines Division of Ruberoid Co., at Belvedere Mountain near Hyde Park, Vt., continued as the major domestic producer of asbestos. The small quantity of spinning-length fiber recovered was used in electrolytic cells.

Four companies reported shipments of asbestos from mines in the Globe district of Arizona: Jaquays Mining Corp., Metate Asbestos Corp., Pan American Fiber Corp., and Phillips Asbestos Mines. Jaquays was the principal Arizona producer. Best fiber from one plant was sold in Switzerland to be made into filter pads.

California production and shipments of fiber were reported by Asbestos Bonding Co., from the Phoenix Mine, Napa County, and by Todd Industries, Inc., from a mine in San Benito Co., near Coalinga. Two companies reported small amounts of asbestos produced for experimental purposes: Union Carbide Nuclear Co., from a deposit near Coalinga in Fresno County; and Rawhide Asbestos Corp., from the Chaparral Hill mine in Tuolumne County. Jefferson Lake Asbestos Corp., a subsidiary of Jefferson Lake Sulphur Co., completed exploration and clearing of its chrysotile deposit near Copperopolis in Calaveras Co. in preparation for mining. Construction was begun on a $5 million mill with a planned initial annual capacity of 15,000 tons of fiber. Coalinga Asbestos Co., Inc., neared completion of a mill on Pine Creek near Coalinga; it was expected to produce 12,000 or more tons of asbestos annually. Hidden Splendor Mining Co. announced plans to construct a 15,000-ton-per-year asbestos plant at its deposit in San Benito County, also near Coalinga.

Powhatan Mining Co. produced amphibole asbestos from its Burnsville mine, Yancey County, N.C.

Coast Asbestos Co. reported a small production of chrysotile from its property in Grant County, Oreg.

CONSUMPTION AND USES

Consumption of chrysotile asbestos decreased from 670,000 tons in 1960 to 633,000 tons. Part of the decrease was attributable to a slowdown of business activities early in the year. More than 97 percent of the chrysotile consumed was short fiber used mainly in asbestos-cement and asbestos-asphalt building materials. Nearly 9 percent of the short-fiber chrysotile consumed was from domestic mines.

Consumption of crocidolite, as represented by imports, decreased from 20,000 tons in 1960 to 18,000 tons.

Manufacture of asbestos-cement pipe was augmented by the opening of a new plant at Denison, Tex.,[3] and plans were announced for another plant to be built at Ravenna, Ohio.[4]

[3] Hegarty, A. Asbestos-Cement Pipe Plant. Min. Mag. (London), v. 104, No. 3, March 1961, pp. 152–155.
[4] Mining Engineering. Flintkote to Build Cement Pipe Plant. V. 13, No. 9, September 1961, p. 1023.

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Main intended uses for newly established asbestos production from expanding California facilities included vinyl and asphalt tiles, asbestos-cement products, and stuccos. Foreign and domestic markets west of the Mississippi River were being contemplated.

STOCKS

Government stockpiles contained 25,000 tons of amosite and 8,800 tons of chrysotile at yearend—20,000 and 2,200 tons, respectively, less than maximum strategic objectives. Of the stockpiled material, 12,000 tons of amosite and 6,000 of chrysotile were in the national strategic stockpile; the remainder was in Commodity Credit Corporation (CCC) and supplemental stockpiles. Nonstrategic crocidolite held on inventory was 10,900 tons.

Deliveries in 1961 to the supplemental stockpile on contracts back to 1959 were as follows: Amosite, 6,562 tons; crocidolite, 3,999 tons; and chrysotile, 1,010 tons. CCC let contracts under the barter program in 1961 for 5,000 tons of amosite and 10,000 tons of crocidolite to be delivered by 1963 in exchange for surplus agricultural commodities.

PRICES

Canadian (Quebec) chrysotile asbestos prices, f.o.b. mine, were unchanged as follows:

Grade:	*Per short ton*
Crude No. 1	Can$1,410–Can$1,475
Crude No. 2—Crude run of mine and sundry	610– 875
No. 3—Spinning fiber	350– 650
No. 4—Shingle fiber	180– 245
No. 5—Paper fiber	120– 150
No. 6—Waste, stucco, or plaster	86
No. 7—Refuse or shorts	40– 80

British Columbia chrysotile asbestos prices, f.o.b. Vancouver, quoted by Bell Asbestos Mines, Ltd., sales representative of Cassiar Asbestos Corp., Ltd., were as follows:

Grade:	*Per short ton*
No. 1 crude	Can$1,522
AAA (C&G 1)	787
AA (C&G 2)	625
A (3K)	470
AC (C&G 3)	325
AK (4K)	220
AS (4T)	181
AX (5D)	142

Vermont asbestos prices, f.o.b. Hyde Park or Morrisville, changed in May as follows:

Grade:	*Per short ton*	
	Jan. 1	*May 10*
Group No. 3—Spinning and filtering	$353–440	$345–402
Group No. 4—Shingle fiber	181–218	181–320
Group No. 5—Paper fiber	120–142	120–142
Group No. 6—Waste, stucco, or plaster	86	86
Group No. 7—Refuse or shorts	41– 75	40– 75

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Quotations in Asbestos magazine for Arizona asbestos, f.o.b. Globe, were changed from 1960 as follows:

Grade:	Per short ton 1960	Jan. 10, 1961
No. 1 soft	$1,475–$1,800	$1,650–$1,800
No. 2 soft	830– 1,050	800– 1,000
Group 3—Filtering and spinning	350– 450	375– 450
Group 4—Plastic and filtration	190– 250	225– 250
Group 5—Plastic and molding	125– 177	190– 225
Group 7—Refuse and shorts	60– 100	58– 90

Market quotations were not available for African, Australian, and South American asbestos, as sales were negotiated individually. U.S. Department of Commerce reports showed the following average values per short ton for imports:

Imports:	Per short ton 1960	1961
Amosite	$152	$163
Crocidolite:		
Bolivia	---	182
Australia	211	209
Union of South Africa	219	202

FOREIGN TRADE [5]

Imports of amosite, crocidolite, and chrysotile decreased 24, 9, and 7 percent, respectively, from 1960, resulting in a net decrease of 8 percent in total imports in 1961.

Low-iron chrysotile imports of spinning length from British Columbia decreased from 6,254 tons in 1960 to 5,374 tons. Ninety-seven percent of all chrysotile imported was short fiber of less than spinning length.

The Union of South Africa supplied crocidolite and chrysotile and was the only source of amosite. Imports from Australia consisted solely of crocidolite. The total crocidolite imported from the two countries and a small tonnage from Bolivia was 17,863 tons. Only chrysotile was imported from other countries.

Exports of unmanufactured asbestos decreased from 5,525 tons in 1960 to 3,799 tons.

WORLD REVIEW

NORTH AMERICA

Canada.—Technical and research facilities were established at the University of Sherbrooke in cooperation with the Quebec Asbestos Mining Association to meet expanding needs of the asbestos mining industry in the eastern townships of Quebec. Maintenance of product uniformity under increasingly complex grading requirements was a primary function of the new establishment.[6]

[5] Figures on imports and exports compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census.

[6] Canadian Mining and Metallurgical Bulletin (Montreal). Asbestos Fibre Standards Laboratory Established at the University of Sherbrooke. V. 54, No. 589, May 1961, p. 380.

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TABLE 2.—U.S. imports for consumption of asbestos (unmanufactured), by classes and countries

Year and country	Crude (including blue fiber)		Mill fibers		Short fibers		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1960:								
North America:								
Canada	357	$64,989	148,584	$29,055,547	467,860	$24,998,784	616,801	$54,119,320
Guatemala	2	400					2	400
South America: Venezuela	15	2,100			46	6,210	61	8,310
Europe:								
Finland					165	8,250	165	8,250
Italy	[1] 4	[1] 5,490	[1] 2	[1] 2,295	2	338	8	8,123
Portugal	22	2,800					22	2,800
Yugoslavia	4,578	157,122					4,578	157,122
Africa:								
Rhodesia and Nyasaland, Federation of [2]	1,865	494,055	110	24,209	464	99,476	2,439	617,740
Union of South Africa [3]	36,644	6,771,421	523	90,024	3,627	583,382	40,794	7,444,827
Oceania: Australia	4,626	977,959					4,626	977,959
Total	[1] 48,113	[1] 8,476,336	[1] 149,219	[1] 29,172,075	5,472,164	25,696,440	669,496	63,344,851
1961:								
North America: Canada	437	60,097	143,382	27,978,572	426,234	22,898,349	570,053	50,937,018
South America: Bolivia	50	9,090					50	9,090
Europe:								
Finland					164	14,500	164	14,500
Italy [3]	1	1,530	2	4,590	110	16,530	113	22,650
Portugal [3]	8	645					8	645
Yugoslavia	5,194	173,260					5,194	173,260
Africa:								
Rhodesia and Nyasaland, Federation of [2 3]	2,071	531,435	41	12,633	940	171,210	3,052	715,278
Union of South Africa [3]	33,393	6,181,852	116	20,872	2,155	384,144	35,604	6,586,868
Oceania: Australia	2,314	482,764					2,314	482,764
Total	43,408	7,440,673	143,541	28,016,667	429,603	23,484,733	616,552	58,942,073

[1] Revised figure.
[2] All believed to be from Southern Rhodesia.
[3] Data reported by the Bureau of the Census has been adjusted by the Bureau of Mines.

Source: Bureau of the Census

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TABLE 3.—U.S. imports for consumption of asbestos, from specified countries, by grades

(Short tons)

Grade	1960			1961		
	Canada	Southern Rhodesia [1]	Union of South Africa	Canada	Southern Rhodesia [1]	Union of South Africa [2]
Chrysotile:						
Crude:						
No. 1		353		[3]	29	118
No. 2	28	18		56	284	
Other	329	1,494	2,164	381	1,758	2,738
Spinning or textile	19,172	110	[2] 220	16,903		18
Shingle	88,475		301	86,070	40	97
Paper	40,937		[2] 2	40,409	1	1
Short fiber	467,860	464	[2] 3,627	426,234	940	2,155
Crocidolite (blue)			[2] 14,899			15,499
Amosite			[2] 19,581			14,978
Total	616,801	2,439	40,794	570,053	3,052	35,604

[1] Reported by the Bureau of the Census as Federation of Rhodesia and Nyasaland. Believed to be from Southern Rhodesia. Excludes data adjusted by the Bureau of Mines.
[2] Includes data adjusted by the Bureau of Mines.
[3] Less than 1 short ton.

Source: Bureau of the Census.

TABLE 4.—U.S. exports [1] and reexports [2] of asbestos and asbestos products

Product	1960		1961	
	Quantity	Value	Quantity	Value
Exports:				
Unmanufactured:				
Crude and spinning fibers, short tons	1,524	$339,996	1,064	$281,444
Nonspinning fibers, do	867	150,557	1,084	256,261
Waste and refuse, do	3,070	354,054	1,424	170,755
Total unmanufactured, do	5,461	844,607	3,572	708,460
Products:				
Brake lining and blocks—molded, semimolded and woven	[3]	4,488,132	[3]	4,192,908
Clutch facing and lining, number	1,461,015	1,149,765	1,452,435	1,149,299
Construction materials, n.e.c, short tons	9,961	2,237,444	11,300	2,980,726
Pipe covering and cement, do	3,488	1,906,238	2,627	1,485,640
Textiles, yarn, and packing, do	1,323	3,128,870	1,288	3,106,542
Manufactures, n.e.c	[4]	776,905	[4]	889,625
Total products		13,687,354		13,804,740
Reexports:				
Unmanufactured:				
Crude and spinning fibers, short tons	40	7,290	108	24,175
Nonspinning fibers, do	24	4,972	106	26,003
Waste and refuse, do			13	594
Total unmanufactured	64	12,262	227	50,772
Products:				
Brake lining and blocks—molded, semimolded and woven, short tons	[3]	1,251	[3]	1,580
Construction materials, n.e.c, do	[5]	1,154	63	18,353
Textiles, yarn, and packing, do	56	13,720	1	228
Total products		16,125		20,161

[1] Materials of domestic origin, or foreign material that has been milled, blended, or otherwise processed in the United States.
[2] Material that has been imported and later exported without change.
[3] Values have been summarized; quantities not shown.
[4] Quantity not recorded.
[5] Less than 1 ton.

Source: Bureau of the Census.

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TABLE 5.—World production of asbestos, by countries [1] [2]

(Short tons)

Country [1]	1952–56 (average)	1957	1958	1959	1960	1961
North America:						
Canada (sales) [3]	968,546	1,046,086	925,331	1,050,429	1,118,456	1,173,695
United States (sold or used by producers)	48,364	43,653	43,979	45,459	45,223	52,814
Total	1,016,910	1,089,739	969,310	1,095,888	1,163,679	1,226,509
South America:						
Argentina	412	319	285	320	[4] 330	[4] 330
Bolivia—(exports)	283	121		168	66	57
Brazil	2,495	2,654	3,816	12,325	14,590	[4] 16,500
Venezuela	1,633	8,390	9,152	5,095	4,333	650
Total	4,823	11,484	13,253	17,908	19,319	[4] 17,500
Europe:						
Bulgaria	1,146	1,100	1,100	[4] 1,100	[4] 1,100	[4] 1,100
Finland [5]	11,664	10,979	7,932	9,579	10,534	10,339
France	12,107	16,008	20,742	23,360	28,111	30,865
Greece	8	9				
Italy	30,479	40,361	42,500	49,778	56,672	62,816
Portugal	83	64	98	40	144	[4] 110
Spain	42			19	4	
U.S.S.R [4]	375,000	500,000	550,000	600,000	660,000	880,000
Yugoslavia	3,792	6,128	5,960	4,748	5,970	6,709
Total [4]	435,000	575,000	630,000	690,000	765,000	990,000
Asia:						
China [4]	16,500	33,000	66,000	88,000	88,000	88,000
Cyprus	16,024	15,028	16,494	14,424	23,369	[4] 22,000
India	1,031	1,925	1,302	1,464	1,886	1,618
Japan	6,325	13,192	11,187	13,633	17,042	18,799
Korea, Republic of	71	96	22	88	740	341
Taiwan	142	268	47	150	485	44
Turkey	188	99	839	411	238	496
Total [4]	40,000	64,000	96,000	118,000	132,000	131,000
Africa:						
Bechuanaland	973	1,582	2,265	1,410	1,849	1,924
Kenya	220	109	120	43	117	151
Morocco: Southern zone	569	132				
Mozambique	140	152	198	37	22	162
Rhodesia and Nyasaland, Federation of:						
Southern Rhodesia	95,353	132,124	127,115	119,699	133,963	161,610
Swaziland	31,501	30,727	25,261	24,807	32,026	30,793
Union of South Africa	118,805	157,474	175,644	182,405	175,867	194,834
United Arab Republic (Egypt Region)	57	22	485	502	496	[4] 500
Total	247,618	322,322	331,088	328,903	344,340	389,974
Oceania:						
Australia	5,117	14,670	15,570	17,875	15,613	16,746
New Zealand	261	230	454	640	319	[4] 330
Total	5,378	14,900	16,024	18,515	15,932	17,076
World total (estimate) [1] [2]	1,750,000	2,080,000	2,055,000	2,270,000	2,440,000	2,770,000

[1] Asbestos also is produced in Czechoslovakia, Eritrea, Iran, North Korea, Rumania, and Uganda. No estimates for these countries are included in the total, as production is believed to be negligible.

[2] This table incorporates some revisions. Data do not add to totals shown because of rounding where estimated figures are included in the detail.

[3] Exclusive of sand and gravel and stone (waste rock only), production of which is reported as follows: 1952–56 (average), 31,375 tons; 1957, 13,652 tons; 1958, 18,449 tons; 1959, 29,532 tons; 1960, 51,624 tons; 1961, 41,696 tons.

[4] Estimate.

[5] Includes asbestos flour.

Compiled by Helen L. Hunt Division of Foreign Activities.

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TABLE 6.—Canada: Sales of asbestos by grades

Grades	1960			1961		
	Short tons	Value		Short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
Crude No. 1, 2, and other	330	$341	$1,034	163	$132	$810
Milled group:						
3	32,190	14,272	443	29,296	10,619	362
4	294,092	54,757	186	339,082	56,874	168
5	156,901	19,709	126	179,852	20,359	113
6	179,361	14,763	82	193,467	14,461	75
7	445,509	18,794	42	423,116	15,916	38
8	10,073	208	21	8,719	164	19
Total, all grades	1,118,456	122,844	110	1,173,695	118,525	101
Waste rock	51,625	46	1	41,696	35	1

Source: Dominion Bureau of Statistics.

A series of articles containing descriptions of asbestos mining operations at most of the Canadian deposits was published.[7]

An inclined skipway with a capacity of 30,000 tons per day and designed for an eventual depth of 1,200 feet was being installed at the Jeffrey mine, Asbestos, Quebec, as transition from underground to open-pit mining continued. A smaller skipway was installed at the Flintkote Mines, Ltd., pit near Thetford mines.

Fiber recovery from the Black Lake mine of United Asbestos Corp. increased to 5.46 percent in the first 9 months of 1961, compared with 5.04 percent in the same period of 1960, while production increased from 62,000 to 71,000 tons.

Downward continuation of the main ore zone at the Munro mine of Canadian Johns-Manville Co., Ltd., was explored at the 900-foot level. Deeper drilling was planned from this level. A third stope was opened during 1961, and another was in preparation above the main 637-foot haulage level. Grouting around the edges of the abandoned open pit was necessary to reduce inflow of surface water to underground workings. Mill output was 2,500 tons of asbestos per month, all classified as M–100, a new grade designation replacing the former 4Y. The harsh fiber was used exclusively in asbestos-cement products. A new milling stage increased capacity 20 to 25 percent by preconcentration.[8]

The proposed milling rate at Advocate Mines, Ltd., Baie Verte property, under development in northern Newfoundland, was increased from 3,000 to 5,000 tons of ore per day as production plans were expanded. Ore reserve estimates rose to 40 million tons. Con-

[7] Precambrian-Mining in Canada (Winnipeg). Bell Asbestos Mines, Ltd., British Canadian Mine, Carey-Canadian Mines, Cassiar Asbestos Corporation Limited, Jeffrey Mine, Johnson's Asbestos Company, Johnson's Company Ltd., King-Beaver Mine, Munro Mines Ltd., Lake Asbestos of Quebec, Ltd., National Asbestos Mines Ltd., Nicolet Asbestos Mines, Ltd., Normandie Mine, Advocate Mines Ltd., Murray Mining Corporation Limited. V. 34, No. 5, May 1961, pp. 10–31.

Precambrian-Mining in Canada (Winnipeg). Cassiar Asbestos Mine, Flintkote Mines Limited. V. 34, No. 6, June 1961, pp. 23–26, 42.

[8] Northern Miner (Toronto). Start Deep Block Development as J.-M's Munro at Capacity. V. 47, No. 24, Sept. 7, 1961, pp. 1, 5.

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struction of docks and other facilities was underway as part of the $20 million asbestos project scheduled for production in 1963.[9]

Continued drilling at the Ungava deposit of Murray Mining Corp., Ltd., in northern Quebec, brought increased ore estimates to 20.1 million tons, grading 8 to 9 percent fiber, mainly in group 4. Lying within a partially explored asbestos-bearing zone at least 1½ miles long, the ore body outlined was 2,200 feet long, 200 feet wide, and 465 feet or more deep. The 12-inch cores from drilling were substituted for the usual bulk sampling by adit. Progress was sufficient to permit the planning of a mill to produce 100,000 tons of fiber annually.[10]

At the Cassiar Asbestos Corp., Ltd., mine in British Columbia 675,000 tons of ore was mined and 582,000 tons milled; 19 percent of the rock mined was rejected ahead of the tramline. Sales of short cement-grade fibers continued to rise, as in 1960, with stronger trade in European markets. Development on the 5,700-foot level showed persistent size and grade of ore body. Exploration holes on the northern extension of the deposit went as deep as 105 feet. Additional equipment was installed in the mill to improve recoveries of AK and AX grades.

Construction of a 40-ton-per-day pilot mill began at the Hedman Mines asbestos property east of Matheson, near Lake Albititi, eastern Ontario, while exploration and stripping of overburden continued. The main zone reportedly contained more than 8 million tons of ore, and bulk samples indicated an average fiber content of 15.6 percent, all group 5 and shorter grades.[11] Exploration by McAdam Mining Corp., at Roberge Lake, northeast of Chibougamau, northwestern Ontario, outlined an ore body 1,000 feet long, 600 feet wide, and 450 feet deep, averaging 8.4 percent asbestos. Magnetic anomalies found in earlier work were investigated.[12]

Geophysical surveys were conducted in the Matheson area, McCool Township, Ontario, by Desjardins Mines and Young-Davidson Mines. A brief report by the British Columbia Department of Mines and Petroleum Resources on the Letain Asbestos property near Cassiar, British Columbia, was made available for inspection.[13]

Mexico.—Manufacture of pipe insulation utilizing amosite was scheduled to start in the new plant of Aislantes Industriales, S.A. de C.V., north of Mexico City. Construction began on a US$1 million asbestos-cement pipe plant in Chihuahua by Mexalit del Norte, S.A. de C.V.

SOUTH AMERICA

Brazil.—Deliveries of chrysotile to Brazilian ports from the Minevacão de Amianto, S.A., mine at Djalma Dutra (Pocões), Bahia, decreased from 1,580 tons in 1960 to 1,292 tons in 1961.

Colombia.—Imports of asbestos in the first 11 months of 1961 totaled 11,299 tons, compared with 7,635 tons for all of 1960. The ad

[9] Canadian Mining Journal (Quebec). Asbestos Deposits Development Started. V. 82, No. 12, December 1961. p. 97.
[10] Northern Miner (Toronto). Bulk Samples from Murray Mining Confirm High Asbestos Content. V. 47, No. 12, June 15, 1961, pp. 1, 9.
[11] Northern Miner (Toronto). Install Pilot Plant to Determine Grade of Hedman Deposit. V. 47, No. 25, Sept. 14, 1961, pp. 17, 22.
[12] Northern Miner (Toronto). Cut Good Asbestos in Initial Boring at McAdam Mining. V. 47, No. 13, June 22, 1961, pp. 1, 12.
[13] Northern Miner (Toronto). Letain Asbestos Deposit. V. 47, No. 18, July 27, 1961, p. 6.

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valorem tax of 10 percent on such imports was continued, but a specific duty of 0.1 peso per gross kilogram (about US$11 per ton) was dropped.

EUROPE

Belgium.—Construction was scheduled by Johns-Manville Corp. on the first of three asbestos manufacturing plants to be built near Ghent.

Germany, West.—Of the 146,125 tons of asbestos imported in 1960, Canada supplied 55 percent and the U.S.S.R. 21 percent. Sixty to 70 percent of the imports were utilized in asbestos-cement products. Overall consumption of asbestos products was reportedly increasing 10 percent yearly.[14]

Greece.—Asbestos was imported from Canada for use in a new asbestos cement pipe and sheet plant on the island of Euboea. Asbestos deposits said to be the largest in Europe were being developed in northern Greece.

Poland.—Imports totaled 16,800 tons of asbestos in 1960; 39 percent came from the U.S.S.R.

U.S.S.R.—Asbestos exports showed yearly increases of 9 to 16 percent from 1956 to 1960. Free world markets, mainly those of West Germany, France, and Belgium, received 68 percent of the 161,000 tons exported in 1960.[15] Tuvaasbestos Trust was established for large-scale development of newly discovered chrysotile and amphibole deposits in Tuva, where some unusually long spinning-grade fiber was reported. Nearly all the 1960 production came from Ural Mountain deposits. A new deposit was discovered at Bazhenov. A two-fold increase in asbestos production from the 1960 level was expected by 1965.

Yugoslavia.—Plans were reported to increase asbestos output at the Stragari mine, 60 miles south of Belgrade, from 6,000 to 15,000 tons per year by 1965. Grades 3, 4, and 5 were expected to comprise 40 percent of the fiber. Four-fifths of the production was being exported to the United States. Ore reserves were 5 million tons.

ASIA

Cyprus.—Exports in 1960 were 17,167 tons valued at US$2,469,600, compared with 16,131 tons in 1959 valued at US$1,839,600. Production was from Cyprus Asbestos Mines, Ltd., at Pano Amiandos, where reserves were reported sufficient for 200 years' operation at the 1960 rate of production.

India.—The Geological Survey of India estimated chrysotile reserves in the Brahmanapalle and Chinnakudala areas of Andhra Pradesh at 300,000 tons of fiber. Investigations in the Chamoli district, Uttar Pradesh, disclosed small amounts of asbestos.

Indonesia, Republic of.—Plans to open small asbestos mines were part of an 8-year economic development program to start in 1961.

Philippines.—Results of laboratory tests on samples from several Philippine asbestos deposits were published.[16] Reserves blocked out

[14] Turcotte, R. F. West Germany Buys Asbestos. Foreign Trade (Ottawa). V. 116, No. 3, July 29, 1961, pp. 7–9.
[15] Bureau of Mines. Mineral Trade Notes. V. 54, No. 4, April 1962, 108 pp.
[16] Quicho, R. B., L. O. Pedron, and A. S. Malicsi. Recovery of Asbestos from Zambales and Pangasinan Ores. Philippine Bureau of Mines Rept. of Inv. 26, November 1960, 18 pp.; Min. Newsletter (Philippines), v. 12, No. 5, May–June 1961, pp. 8–14, 38–39.

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in Bocaclio, Pangasinan, totaled over 1½ million tons containing an estimated 3 percent of recoverable short-fiber chrysotile.

Taiwan.—All production, amounting to 485 tons valued at US$15,000 in 1960, was from the Feng-Tieu mine near Hualien. Imports in 1961 totaled 919 tons.

AFRICA

Bechuanaland.—The mine at Moshaneng produced 1,500 tons of chrysotile annually. Several asbestos occurrences were explored by core drill.

Nigeria.—Asbestos Cement Products Nigeria, Ltd., opened the country's first asbestos-cement plant at Ikeja, near Lagos. Another plant was planned for Emene, 7 miles from Enugu, eastern Nigeria; it was to be operated by Turners Asbestos Cement (Nigeria).

TABLE 7.—Southern Rhodesia: Asbestos production

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1957	132,124	$25,185	1960	133,963	$20,888
1958	127,115	24,147	1961	161,610	24,453
1959	119,699	20,735			

Rhodesia and Nyasaland, Federation of.—Asbestos exports increased 24 percent in 1960 over those in 1959 to 128,000 tons valued at US$23,430,400. Plants to recover grade 7 fiber were under construction in 1961 at the Serpentine mine, Belingwe, and the Boss mine, Mashaba. Rand Mines, Ltd., of Johannesburg acquired the Thornwood mine in the Gwanda area, explored ore extensions, and rebuilt the mill to produce fiber grades 3 to 7. The expanded plant at the Ethel mine in the northern Umvukwes area produced 2,500 tons of grades 3 and 4 fibers in 1960, all exported to Sweden.[17] Descriptions of operations and flowsheets were published.[18] A reportedly rich asbestos ore body was being explored at the Pangani mine, near Filabusi, east of Bulawayo.

Swaziland.—The Havelock mine at Emlembe continued to be the only producer in 1960; its total output of 32,026 tons valued at US$7,802,141 was exported, mainly to the United Kingdom. Measured ore reserves were set at 10 million tons. A reopened adit in the mine's west extension disclosed a vein 30 feet wide; it contained 3.5 percent fiber. Chrysotile production was over 2,500 tons monthly from ores averaging 4.7 percent fiber; grades ranged from 2 to 5, with most fiber in grades 3 and 4.[19]

Union of South Africa.—Crocidolite in the Cape Province and Transvaal and amosite in the eastern Transvaal were subjects of a thorough report.[20] A report was issued describing production of amosite by

[17] Bureau of Mines. Mineral Trade Notes. V. 53, No. 5, November 1961, pp. 6–8.
[18] Airey, N. M. Operations at the Ethel Asbestos Mine, Southern Rhodesia—Further Notes. Inst. of Min. and Met. Bull. (London), v. 70, No. 653, April 1961, pp. 407–413.
[19] Bureau of Mines. Mineral Trade Notes. V. 53, No. 5, November 1961, pp. 8, 9.
[20] Keep, F. E. Amphibole Asbestos in the Union of South Africa. 7th Commonwealth Min. and Met. Cong., Johannesburg, South Africa, April 1961, 27 pp.

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Amosa (Pty.), Ltd., and chrysotile by African Chrysotile Asbestos, Ltd.; detailed data on South African exports in 1959 and the first half of 1960 and a list of producers were included.[21] Sinking of a new vertical shaft at Penge progressed. The mine produced 5,000 tons of amosite monthly, with recoveries of 11 percent fiber from the ore. One-half the South African chrysotile output was from the Msauli mine, where production of grades 3, 4, and 5 totaled 1,300 tons monthly. Average fiber recoveries were 5 percent of the ore. Plans to produce grades 6 and 7 were reported.[22] Federale Mynbou Beperk acquired a one-half share in a venture to explore an extensive asbestos prospect in the Kuruman area of Northwestern Cape Province. Turner's Asbestos Products (Pty.), a subsidiary of Turner and Newall, Ltd., planned to build a $2 million asbestos-cement pipe and sheet plant at Durban.

TABLE 8.—Union of South Africa: Asbestos production by varieties and sources

(Short tons)

Variety and source	1957	1958	1959	1960	1961
Amosite (Transvaal)	56,798	69,773	71,720	68,630	69,234
Chrysotile (Transvaal)	25,646	27,403	29,326	29,471	31,726
Blue (Transvaal)	15,303	16,670	13,113	11,185	11,176
Blue (Cape)	59,549	61,520	68,024	66,567	82,624
Tremolite (Transvaal)	178	278	222	14	74
Total	157,474	175,644	182,405	175,867	194,834

TABLE 9.—Union of South Africa: Production and exports of asbestos

Year	Production (short tons)			Exports	
	Transvaal	Cape Province	Total	Short tons	Value (thousands)
1957	97,925	59,549	157,474	142,799	$25,278
1958	114,124	61,520	175,644	145,796	25,420
1959	114,381	68,024	182,405	151,515	25,971
1960	109,300	66,567	175,867	174,810	28,965
1961	112,210	82,624	194,834	180,684	29,830

OCEANIA

Australia.—Plans were announced by Australian Blue Asbestos Pty., Ltd., to nearly double production of crocidolite to 500 tons per week at Wittenoom Gorge in Western Australia.[23]

TECHNOLOGY

Several papers on asbestos, subsequently published, were given at the annual general meeting of the Canadian Institute of Mining and Metallurgy in Quebec in March 1961. One report emphasized the importance of asbestos export earnings to Canada's economy and

[21] Bureau of Mines. Mineral Trade Notes. V. 52, No. 4, April 1961, pp. 4–10.
[22] South African Mining and Engineering Journal (Johannesburg). Mining at Mamba Hill. V. 72, pt. 2, No. 3593, Dec. 15, 1961, p. 1407.
[23] Mining Journal (London). More Blue Asbestos from Australia. V. 257, No. 6580, Sept. 29, 1961, pp. 312–313.

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cautioned against imposing an export duty on asbestos in order to stimulate Canadian manufacture of finished products.[24] Another described problems in separating magnetite from asbestos for a true and accurate determination of magnetic rating. An improved procedure was presented whereby the rating was established as a function of fiber agitation required to release the magnetite.[25] Operations and equipment were described for treating asbestos samples in the newly established pilot plant of the Quebec Department of Mines at Quebec City.[26]

Asbestos marketing and methods of classification and testing practiced in the Canadian industry were discussed in a series of articles. A strong market was predicted for fibers in groups 4, 5, and 6, and, despite excessive overall mill capacity in Canada, demand for asbestos was expected to equal supply within 2 years.[27] A technical meeting in October at Ottawa included a symposium on the asbestos industry of the eastern townships of Quebec; three papers, covering geology, mining and milling, and testing and quality control were given.[28]

Selective mining at the Regal mine and mill operations of Jaquays Mining Corp. in Arizona were described.[29]

Studies on hydrothermal synthesis of crysotile showed fiber growth to be promoted by certain mineralizers, trace elements, and the control of pH. A test product, classified as mainly clinochrysotile, formed bundles averaging 100 microns or more which were composed of shorter fibers 15 to 20 microns long.[30] Thermal reactions in serpentine, not fully understood, were disclosed by studies of the effect of particle size on differential and thermal gravimetric analysis. Peak endothermic temperatures for chrysotile were found to decrease from 710° C with no grinding to 670° C with fine grinding.[31]

Analyses of South African crocidolite fibers taken from the weathered zone showed only slight differences in composition from fresh material, even though the asbestos-bearing ironstones were leached extensively to depths of 250 feet.[32] The chemical composition of fiber in the unweathered zone was almost constant.

Articles were published on the manufacture and use of asbestos-cement pipe and on the process of fiberizing asbestos.[33] For special purposes pipe was being made to withstand pressures up to 800 psi. It was noted that overmilling of asbestos, while possibly increasing

[24] Lindell, K. V. Asbestos and the Canadian Economy. Can. Min. and Met. Bull. (Montreal), v. 54, No. 595, November 1961, pp. 809–812.
[25] Badollet, M. S. and N. W. Edgerton. The Magnetite Content of Asbestos by Magnetic Separations. Can. Min. and Met. Bull. (Montreal), v. 54, No. 591, July 1961, pp. 547–550.
[26] Pelletier, P. E., B. J. Walsh, and J. P. Bolduc. The Pilot Plant and the Department of Mines of Province of Quebec. Can. Min. and Met. Bull. (Montreal), v. 55, No. 600, April 1962, pp. 224–227.
[27] Guimond, R. The Canadian Asbestos Industry. Precambrian-Mining in Canada, v. 34, No. 5, May 1961, pp. 6–9; pt. 2, v. 34, No. 6, June 1961, pp. 33–41.
[28] Pit and Quarry. Third Joint Meeting of Industrial Minerals Divisions of A.I.M.E. and C.I.M., Held in Ottawa, Ont. V. 54, No. 7, January 1962, pp. 146–149.
[29] Stewart, L. A. Mining Methods and Costs, Regal Asbestos Mine, Jaquays Mining Corp., Gila County, Ariz. BuMines Inf. Circ. 7986, 1961, 53 pp.
[30] Yang, J. C. S. The Growth of Synthetic Chrysotile Fiber. Am. Mineralogist, v. 46, Nos. 5, 6, May, June 1961, pp. 748–752.
[31] Martinez, E. The Effect of Particle Size on the Thermal Properties of Serpentine Minerals. Am. Mineralogist. v. 46, Nos. 7, 8, July, August 1961, pp. 901–912.
[32] Cilliers, J. J. LeR., A. G. Freeman, A. Hodgson, and H. F. W. Taylor. Crocidolite from the Koegas-Westerberg Area, South Africa. Econ. Geol., v. 56, No. 8, December 1961, pp. 1421–1437.
[33] Sinclair, W. E. Asbestos-Cement Piping in Industry and Mines. Asbestos, v. 43, No. 5, November 1961, pp. 4–16. Sinclair, W. E. Fiberization, A Critical Operation in Asbestos Processing. Asbestos, v. 43, No. 3, September 1961, pp. 2–10.

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the grade according to the Quebec Box Test, could severely damage and weaken the fiber. More positive control of fiberization was needed.

Experimentation continued on asbestos-asphalt paving mixtures, with road tests planned or underway in Delaware,[34] Colorado,[35] California, and elsewhere. A special asphalt mixture, containing 5-percent short-fiber asbestos, was said to offer increased resistance to jet blast erosion of airfield pavement.

Several patents were issued on asbestos-cement pipe-making machinery [36] and one on a system to compress and package asbestos fiber.[37] Other patents were issued on the use of asbestos in plastics,[38] with polymer latex for patching defects in plywood,[39] in a smoking tobacco mixture,[40] in drilling fluids,[41] and as insulation for rocket motors.[42]

Colored asbestos-cement sheets with acrylic baked-on finishes were marketed. Silicones increased the moisture resistance of sheeting and improved electrical insulation qualities. Asbestos-phenolic compounds were available for use at temperatures up to 6,000° F under ablation conditions. It was found that asbestos increased the life of cutting tools used in machining operations when placed at the entry of the cut.[43]

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[34] Roads and Streets. Delaware Builds Asbestos Asphalt Test Strip. V. 104, No. 6, June 1961, pp. 132–134.
[35] Roads and Streets. Colorado Will Test Asbestos Paving Fibers. V. 104, No. 2, February 1961, p. 138.
[36] Colliva, D. (assigned to Johns-Manville Corp.). Machine for Continuously Forming Tubes of Asbestos Cement. U.S. Pat. 3,003,553, Oct. 10, 1961.
Swensen, J. H. (assigned to Johns-Manville Corp.). Apparatus for Forming Asbestos-Cement Pipe. U.S. Pat. 3,000,776, Sept. 19, 1961.
[37] Roberts, J. W., H. Daum, and W. T. Donahue (assigned to Johns-Manville Corp.). Apparatus for Packing Asbestos Fibers and the Like. U.S. Pat. 2,984,172, May 16, 1961.
[38] Blake, C. L. Plastic Containing Composition and the Process of Making the Same. U.S. Pat. 2,993,799, July 25, 1961.
[39] Clock, G. E., W. E. F. Rupprecht, and I. J. Cummings (assigned to The Dow Chemical Co.). Process for Patching and Repairing Surface Defects in Plywood and the Like and the Article Resulting Therefrom. U.S. Pat. 3,011,903, Dec. 5, 1961.
[40] Shaw, R. J. Smoking Tobacco Mixture and Method of Making. U.S. Pat. 3,002,863, Sept. 3, 1961.
[41] Jordan, J. W., R. E. Offeman, and D. J. Weintritt (assigned to National Lead Co.). Oil Base Drilling Fluids. U.S. Pat. 2,995,514, Aug. 8, 1961.
[42] Kimmel, N. A. (assigned to Phillips Petroleum Corp.). Insulation for Rocket Motors. U.S. Pat. 2,987,880, June 13, 1961.
[43] Metalworking News. Asbestos Adds Tool Life, Cincinnati Milling Finds. V. 2, No. 54, Oct. 16, 1961, p. 10.

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