

The Mineral Industry of Florida

This chapter has been prepared under a Memorandum of Understanding between the Bureau of Mines, U.S. Department of the Interior, and the Florida Bureau of Geology, for collecting information on all nonfuel minerals.

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The value of nonfuel mineral production in 1982 in Florida was \$1.2 billion, a decrease of \$504.5 million from that of 1981. The decrease was the first drop in value since 1977. Florida ranked fourth nationally in total value of nonfuel minerals produced, and nonmetals accounted for over 97% of the value of the State's mineral output. The State ranked first in the production of phosphate rock; second in crushed stone, fuller's earth, and peat; and third in masonry cement. Staurolite and zircon concen-

trates were produced only in Florida. Principal nonmetals, in order of value, were phosphate rock, stone, cement, sand and gravel, and clays.

Of the 37.4 million tons of phosphate rock produced in the United States, Florida remained the predominant producer and, for the 89th consecutive year, supplied more than any other State. Florida and North Carolina supplied 84.8% of the domestic phosphate rock output, and Florida supplied most of the exports.

Table 1.—Nonfuel mineral production in Florida¹

Mineral	1981		1982	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Masonry	thousand short tons	288	\$20,757	231
Portland	do	3,518	199,064	2,651
Clays	do	731	235,319	672
Gem stones		NA	6	NA
Lime	thousand short tons	191	11,343	103
Peat	do	157	2,885	120
Sand and gravel:				
Construction	do	14,910	30,600	13,749
Industrial	do	349	4,419	341
Stone (crushed)	do	65,067	226,192	53,100
Combined value of clays (kaolin), magnesium compounds, phosphate rock, rare-earth metal concentrate, staurolite, titanium concentrates (ilmenite and rutile), and zircon concentrates	XX	1,197,304	XX	815,155
Total	XX	1,727,889	XX	1,223,398

¹Estimated. ²Preliminary. ³Revised. NA Not available. XX Not applicable.

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

²Excludes kaolin; value included with "Combined value" figure.

The recession impacted on Florida's economy in 1982, resulting in an unemployment rate at yearend of 9.5% compared with 7.3% at yearend 1981. Phosphate workers experienced an unemployment rate of nearly 25% at midyear, dropping to 18% in December. Florida, the fastest growing State in the southeast in terms of popula-

tion, had maintained a high level of residential construction until 1982. During the year, most construction activity decreased, adversely affecting the minerals industry, especially in the southern part of the State. Although Florida's business climate was rated one of the best in the Nation, new plant openings dropped sharply in 1982.

Table 2.—Value of nonfuel mineral production in Florida, by county¹
(Thousands)

County	1980	1981 ²	Minerals produced in 1981 in order of value
Alachua	\$4,391	\$3,429	Stone.
Bay	1,021	(*)	
Brevard	W	W	Stone, clays.
Broward	28,587	29,778	Stone.
Calhoun	46	(*)	
Charlotte	717	1,850	Stone.
Citrus	7,594	4,248	Stone, phosphate rock.
Clay	27,858	31,954	Titanium, zircon, staurolite, monazite.
Collier	8,839	9,500	Stone.
Dade	W	W	Cement, stone.
Escambia	617	(*)	
Gadsden	20,839	20,290	Clays.
Gaines	W	W	Sand and gravel (industrial).
Gulf	W	W	Magnesium compounds, lime.
Hamilton	W	W	Phosphate rock.
Hardee	W	W	Do.
Hendry	534	319	Stone.
Hernando	W	W	Cement, stone, lime, clays.
Hillsborough	W	189,401	Peat.
Jackson	W	W	Phosphate rock, cement, stone, peat.
Lake	W	W	Stone.
Lee	W	14,484	Peat, clays.
Leon	W	(*)	Stone.
Levy	3,986	4,127	Stone.
Manatee	W	W	Cement, phosphate rock, stone.
Marion	W	W	Stone, clays, phosphate rock.
Monroe	4,020	W	Stone.
Oklaloosa	17	(*)	
Orange	58	42	Stone.
Palm Beach	6,819	8,196	Do.
Pasco	3,437	2,883	Do.
Polk	784,741	869,928	Phosphate rock, sand and gravel (industrial), stone, peat.
Putnam	W	W	Sand and gravel (industrial), clays, peat.
St. Lucie	W	902	Stone.
Sarasota	W	660	Do.
Sumter	W	W	Lime, stone.
Suwannee	777	957	Stone.
Taylor	3,922	2,591	Do.
Walton	W	(*)	
Undistributed ³	601,988	557,312	
Sand and gravel (construction)	XX	*30,600	
Total ⁴	1,509,258	1,727,889	

¹Estimated. W Withheld to avoid disclosing company proprietary data; included with "Undistributed." XX Not applicable.

²The following counties are not listed because no nonfuel mineral production was reported: Baker, Bradford, Columbia, De Soto, Dixie, Duval, Flagler, Franklin, Gilchrist, Holmes, Indian River, Jefferson, Lafayette, Liberty, Madison, Martin, Nassau, Okaloosa, Osceola, Pinellas, St. Johns, Santa Rosa, Seminole, Union, Volusia, Wakulla, and Washington.

³County distribution for construction sand and gravel is not available; total value shown separately under "Sand and gravel (construction)."

⁴Construction sand and gravel was produced; data not available by county.

⁵Includes gem stones and values indicated by symbol W.

⁶Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Florida business activity

		1981	1982 ^P	Change, percent
Employment and labor force, annual average:				
Total civilian labor force	thousands	4,504.0	4,728.0	+5.0
Unemployment	do.	307.0	386.0	+25.7
Employment (nonagricultural):				
Mining ¹	do.	11.8	9.6	-15.0
Manufacturing	do.	472.2	459.9	-2.6
Contract construction	do.	288.1	258.6	-10.4
Transportation and public utilities	do.	229.8	230.4	+.3
Wholesale and retail trade	do.	987.2	999.6	+1.3
Finance, insurance, real estate	do.	274.3	280.5	+2.3
Services	do.	858.9	901.0	+4.9
Government	do.	620.1	627.4	+1.2
Total nonagricultural employment ¹	do.	3,736.9	3,762.0	.7
Personal income:				
Total	millions	\$108,502	\$118,273	+9.4
Per capita	do.	\$10,165	\$10,375	+2.0
Construction activity:				
Number of private and public residential units authorized		146,557	103,735	-29.2
Value of nonresidential construction	millions	\$2,941.5	\$2,768.4	-5.9
Value of State road contract awards	do.	\$416.0	\$391.0	-6.0
Shipments of portland and masonry cement to and within the State	thousand short tons	5,724	4,898	-23.2
Nonfuel mineral production value:				
Total crude mineral value	millions	\$1,727.9	\$1,223.4	-29.2
Value per capita, resident population	do.	\$177	\$117	-38.9
Value per square mile	do.	\$29,467	\$20,891	-29.1

^PPreliminary.¹Includes oil and gas extraction.

Sources: U.S. Department of Commerce, U.S. Department of Labor, Highway and Heavy Construction Magazine, and U.S. Bureau of Mines.

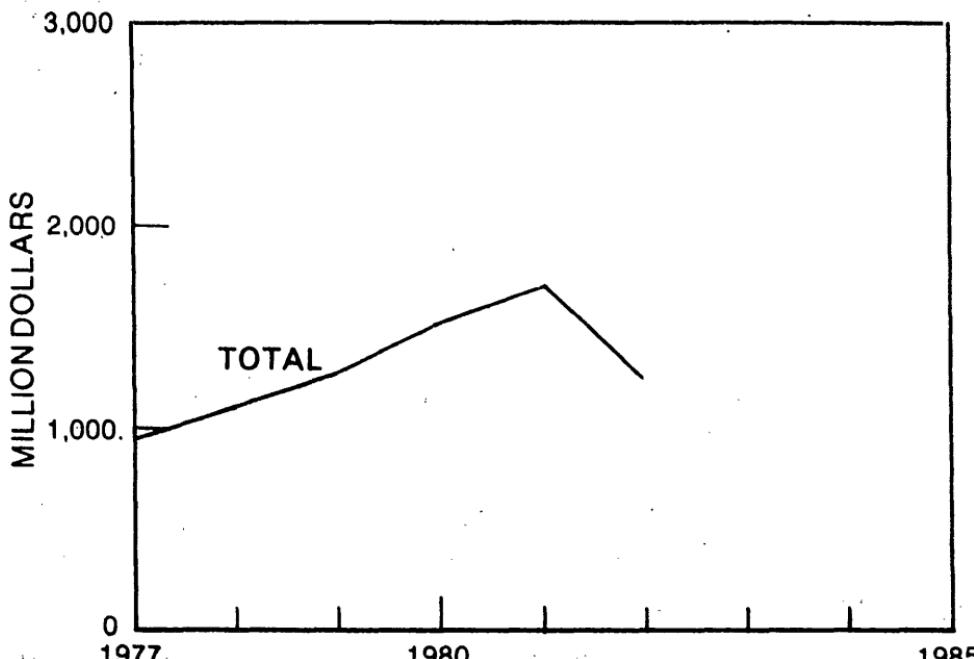


Figure 1.—Total value of nonfuel mineral production in Florida.

Trends and Developments.—The Port of Tampa, which handled nearly 40 million tons of cargo in 1982, shipped the major portion of exported phosphate. Phosphate rock and processed phosphate exports totaled nearly 13 million tons, about the same as in 1981. Exports of phosphate through Jacksonville totaled 557,000 tons, down from 585,000 tons in 1981. Port Manatee's phosphate shipments totaled nearly 2 million tons, mostly from Beker Phosphate Inc.'s new mine. Beker sent rock to its plant in Taft, La., for processing and distribution. Beker took delivery of a 42,000-deadweight-ton, self-unloading barge for transportation of phosphate rock. Reportedly, the largest self-unloading barge in the world, it is capable of discharging 4,000 tons per hour.

The Port of Tampa also imported about 650,000 tons of aragonite from The Bahamas for use in the manufacture of cement, down from 750,000 tons in 1981. Gypsum imports increased slightly, while those of coal and liquid sulfur decreased.

Family Lines Rail Systems completed a \$21 million expansion of its Rockport phosphate export facility at Tampa. Capacity was increased 30% to 9.1 million tons per year.

Mobil Chemical Corp. plans to build a phosphate loading terminal in Tampa. The Tampa Port Authority authorized the sale of up to \$85 million in bonds to finance construction. Bond payments will be covered by Mobil's lease arrangements with a guarantee of \$300,000 per year in fees. Capacity will be 250,000 tons, and the facility may be shared with another company. Over one-half of Mobil's output was shipped out of Tampa.

Early in the year, The Anaconda Company was considering the Tampa Bay area as one of several sites nationwide for a copper and precious metals refining facility. The main advantage to the site would be a market for recovered sulfuric acid in the Florida phosphate industry. The required capital expenditure of \$1.5 billion makes the project unlikely, considering the present state of the copper industry.

Mineral Aggregates Co. Inc. started construction of a multimillion dollar slag processing facility in southeastern Hillsborough County. The slag, a byproduct of Tampa Electric Co.'s coal-fired powerplants, will be processed for use as sandblasting grit and roofing materials.

Total oil and gas production declined, with oil and gas down 27% and 28.5%,

respectively, from that of 1981.

Legislation and Government Programs.—The U.S. Bureau of Land Management, after competitive bidding, leased 80 acres of federally owned phosphate lands to W. R. Grace & Co., which presently mines phosphate on adjoining lands. The bonus bid was \$140 per acre, with a 5% royalty rate, and an annual rental rising from \$0.25 to \$2.00 per acre over the first 4 years. Under the Mineral Leasing Act of 1920, the State received 50% of all revenues from Federal lands in the State. In fiscal year 1982, this amounted to \$17,453.

During 1982, the U.S. Geological Survey published several open file reports pertaining to the State. The reports included "Potentiometric Surface of the Floridan Aquifer, Southwest Florida" (open file report 82-0753) and "Data on Subsurface Storage of Liquid Waste Near Pensacola, Fla." (open file report 82-0689).

Since 1972, the U.S. Bureau of Mines Tuscaloosa Research Center has been involved with various projects related to phosphate waste slimes, upgrading of marginal ores, and environmental problems. In-house Bureau project activity during the year included research on beneficiation of dolomitic phosphate ores, dewatering of mineral processing slime by flocculation, recovery of phosphate from dewatered slimes, uses for phosphogypsum wastes, and methodology for mining and reestablishment of wetland ecosystems.

Bureau Reports of Investigations (RI) issued during the year pertaining to the mineral industry of Florida included RI 8609, "Beneficiation of High-Magnesium Phosphate From Southern Florida"; RI 8611, "Large-Scale Dewatering of Phosphatic Clay Waste From Central Florida"; RI 8639, "Assessment of Environmental Impacts Associated With Phosphogypsum in Florida"; RI 8661, "Anion Characterization of Florida Phosphate Rock Mining Materials and U.S. Cement Kiln Dust by Ion Chromatography"; RI 8681, "Beneficiation of a Phosphate Ore Produced by Borehole Mining"; RI 8718, "Method for Producing Zirconyl Sulfate Solution From Zircon Sand"; and RI 8731, "Recovery of Phosphate From Florida Phosphate Operations Slimes."

In association with Agrico Chemical Co., the Bureau completed research on borehole mining in deep phosphate ore in St. Johns County. The research concluded that deep phosphate ores could be mined in an envi-

ronmentally compatible manner. Agrico planned to conduct additional borehole mining tests in 1983.

The Bureau had several contracts in Florida totaling over \$400,000. The studies involved the development of engineering and cost data for foreign graphite, potash, and sulfur properties.

During the year, the Florida Bureau of Geology completed seven studies for publication or open file. Among the studies were a summary of Florida peat deposits and a history of the Bureau of Geology commemorating its 75th anniversary. Projects underway concerned the stratigraphy, lithostratigraphy, and geomorphology of specific formations in geographic areas. Included were a summary of Florida karst and a summary of the economic minerals of Florida. The Bureau of Geology, involved in mined land reclamation, adopted a Master Reclamation Plan, Chapter 16C-17, Florida Administrative Code. Approval was given to begin reclamation activities in 2,704 acres of non-mandatory land. Seven publications were issued during the year; the publications covered geology, minerals, guidebooks, and two map series. During the year, the Bureau added the Office of Reclamation Research, which will be responsible for evaluating the interrelationships of current mining processes and reclamation and to encourage reclamation research. Research is being encouraged on the restoration of wetlands mined for heavy minerals and hydrologic research needs related to phosphate mining and reclamation.

The Governor of Florida signed a law designed to prohibit phosphate mining in the Osceola National Forest. The bill prohibits the issuance of State permits for any

activity that would degrade the air, water quality, or wildlife habitat of State or national forests.

The Florida Department of Revenue announced that the severance tax rate for phosphate was increased by 10% in 1982. The new rate, \$1.84 per ton, was determined by a formula that reflects the change in ore value. The tax reportedly is the highest of any phosphate producing area in the world.

The Governor signed into law a bill that would return portions of the severance tax monies collected to counties. Each county where phosphate is mined will recover approximately 5% of the tax from the phosphate mined in the county. The measure, which went into effect July 1, also allows the Land Reclamation Trust Fund to be used to purchase mined lands.

The U.S. Geological Survey conducted mineral, energy, geochemical, geophysical, and marine geology studies in and offshore Florida. The studies included mineral potential in several Roadless Area Review and Evaluation (RARE II) areas, heavy minerals, offshore petroleum, peat in the Everglades, and measurement of stratigraphic sections in the phosphate districts.

The Florida Institute of Phosphate Research funded 25 projects for research and development with respect to mining and processing phosphate rock and reclamation of disturbed lands. The projects, all funded to some extent during the year, totaled over \$3 million, and included utilization of by-product gypsum, reduction of slime pond areas, evaluation of waste clay handling techniques, reclamation of phosphate lands, and innovative beneficiation and mining concepts.

REVIEW BY NONFUEL MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of both portland and masonry cement decreased 24.6% and 19.8%, respectively, from that of 1981. Cement was the third leading commodity in value in the State. Production of masonry cement in Florida ranked third nationally, while portland cement ranked eighth. Four companies produced portland cement at five plants; masonry cement was also produced at five plants. A fifth company operated a grinding plant to produce portland cement from imported clinker. Most of the shipments of both cement types were to users

within the State; Florida was a net importer of cement, with about 700,000 tons being imported, down from about 1 million tons in 1981. Portland cement shipments, mainly in bulk form, were made by truck and rail. Principal consumers were ready-mix concrete dealers, highway contractors, building materials dealers, and concrete products manufacturers, with the remainder being consumed by other contractors and government agencies.

Most raw materials used to manufacture cement were mined within the State and included limestone, clays, sand, and staurolite. Oolitic aragonite imported from

The Bahamas was used, as well as small amounts of gypsum, clinker, fly ash, clays, iron ore, and slag; most were obtained from out-of-State sources.

Ten rotary kilns were operated at five plants. Of the 10, 8 were wet process and 2 were dry process. About 384 million kilowatt-hours of electrical energy, in addition to natural gas, fuel oil, and coal, were consumed in the manufacture of cement.

Reduced construction activities impacted severely on cement manufacturers in southern Florida, with companies operating at a loss or breaking even. Reduced workweeks and temporary closures of plants occurred during the year. Despite reduced output, the industry was optimistic on an economic recovery in 1983.

Moore McCormack Resources Inc., Brooksville, dedicated a second kiln in June. The new 1,700-ton-per-day kiln increased plant capacity to 1.2 million tons per year. The \$68 million expansion included a grinding mill, heat exchanger, finish mill, packaging plant, and modification of its dust collection system.

Florida Crushed Stone Co. announced plans to build a cement plant in Brooksville. The \$80 million facility would have a capacity of 600,000 tons per year. The proposal was under consideration by the State with action expected in 1983.

Clays.—Clays mined in Florida included common clay, fuller's earth, and kaolin. Total clay production and value decreased 59,000 tons and \$4 million, respectively.

Common clay output and value increased for the fourth consecutive year. Common clay was produced by four companies at four pits in Clay, Gadsden, Hernando, and Lake Counties in the northern part of the State. The clay was used in the manufacture of cement and lightweight aggregate.

Florida ranked second in the Nation in the production of fuller's earth, but output and value decreased from that of 1981. Fuller's earth was mined by four producers at four pits in Brevard, Gadsden, and Marion Counties. Main end uses were for pet waste absorbents and oil and grease absorbents, and in fertilizers, pesticides, and saltwater drilling muds. Material mined was a montmorillonite-stapulgite product, which was trucked to the plant where it was crushed, sized, and dried. End products were shipped nationwide.

Kaolin was produced by one company at one pit in Putnam County; production decreased for the first time since 1975.

Material was dredged and slurried about 6,000 feet to the processing plant. Principal uses for kaolin were electrical porcelain, whiteware, and wall tile; major markets were in the southeast. Byproduct industrial sand was recovered for glass and other industrial uses. Glass sand was shipped to plants in Alabama, Florida, and Tennessee.

Fluorine.—Fluorine in the form of fluorosilicic acid was recovered as a byproduct of wet-process phosphoric acid manufacture. Fluosilicic acid was used to produce cryolite, aluminum fluoride, sodium silicofluoride, and was also used in water fluoridation.

Gypsum.—Imported gypsum was calcined at two plants in Duval County and one plant in Hillsborough County. United States Gypsum Co., Jim Walter Corp., and National Gypsum Co. calcined gypsum in kettles, a rotary kiln, and holoflite unit, respectively, prior to wallboard manufacture. Production and value increased 12.6% and 4.4%, respectively, from that of 1981. Florida gypsum wallboard was marketed primarily in southern Georgia and Florida. Byproduct gypsum was recovered by Occidental Petroleum Corp. at its plant in Hamilton County; output decreased from that of 1981.

Lime.—Quicklime and hydrated lime were produced in Florida. Quicklime was produced by Basic Magnesia Inc., Gulf County; Chemical Lime Inc., Hernando County; and Dixie Lime & Stone Co., Sumter County. Hydrated lime was also produced by Chemical Lime. Production and value decreased 46.1% and 48.6%, respectively, from that of 1981. Lime was used for water treatment, paper and pulp, magnesia, and sewage treatment systems.

Magnesium Compounds.—Florida ranked second nationally in the recovery of magnesium compounds from seawater. Basic Magnesia, Gulf County, produced caustic calcined magnesia and refractory-grade magnesia from seawater. Shipments and value decreased 30.9% and 26.2%, respectively, from that of 1981.

Peat.—Florida ranked second nationally in peat sales in 1982. Production and value decreased from that of 1981. Six plants produced moss, reed-sedge, and humus peat from five counties. Most of the peat, shipped in bulk, was used for general soil improvement and for potting soils. Late in the year, the State Department of Environmental Regulations denied permits for a proposed 148-acre peat mine in Putnam County. Georgia-Pacific Corp. had applied for per-

mits to mine the peat in Cow Bay Swamp on an experimental basis. The denial of permits was based on possible water quality degradation in Cow Bay Swamp and nearby Simms Creek.

Perlite (Expanded).—Four companies produced expanded perlite from crude ore shipped into the State. Production decreased to 28,360 tons, while value increased to nearly \$4 million. Perlite was expanded at plants in Broward, Duval, Escambia, and Indian River Counties and was used for construction aggregate, horticultural purposes, insulation, and fillers.

Phosphate Rock.—Florida ranked first in the Nation in the production of phosphate rock. The phosphate industry continued to be the principal mineral industry of the State. Marketable production of phosphate rock in 1982 dropped 29.3% in quantity and 32.7% in value from that of 1981. Phosphate rock production remained at a low level during the year, continuing a trend started late in 1981, and resulting in temporary closure or reduction of output from most of the area's mines. The decrease in demand was caused by reduction in both domestic fertilizer sales and exports. At midyear, nearly 25% of the work force was unemployed, with nine mines and six plants temporarily shut down. The industry started a mild recovery in the fall, but by year-end, unemployment was at 18%. Decreased demand and large inventories of processed phosphates resulted in prices frequently below stated production costs. The Florida Phosphate Council reported that the industry spent \$34 million on air quality monitoring and \$146 million to protect and conserve water during 1982. The severance tax increased to \$1.84 per ton, with approximately 5% returned to the individual producing counties.

Land-pebble phosphate was produced at 20 mines by 12 companies in Hamilton, Hardee, Hillsborough, Manatee, and Polk Counties. In 1982, agricultural uses accounted for about 72%; exports, 27%; and industrial uses, less than 1%. Normal superphosphate, triple superphosphate, wet-process phosphoric acid, and defluorinated phosphate rock were produced for agricultural purposes. Industrial chemicals were produced from the production of elemental phosphorus.

Agrico Chemical Co. operated the Fort Green and Payne Creek Mines during the year. At midyear the two mines and the South Pierce chemical complex were tempo-

rarily closed owing to the depressed market. In September, the Fort Green Mine was reopened. The Hardee County Commission approved Agrico's plan to expand its mining operations in the county by 3,741 acres. The new plan will result in the mining of 5,257 acres and extend the life of the mine about 9 years.

AMAX Phosphate Inc. operated one mine, the Big Four, during the year. In April, the mine and the Piney Point chemical plant closed temporarily. Capacity of the Big Four Mine was to be increased from 1.6 to 2.5 million tons per year with the addition of a new dragline. AMAX's Pine Level Mine development in De Soto and Manatee Counties was delayed. The mine, originally scheduled for startup in 1984, was expected to be in operation in the early 1990's.

Beker operated its Wingate Creek Mine in Manatee County with two floating dredges removing overburden and matrix. The 12,000-acre mine supplies a chemical plant in Louisiana, shipping through Port Manatee. Expansion plans were limited because of the dispute with county officials over truck transportation to the port. An agreement early in the year with the county limited production to 1.2 million tons per year for 12 months, pending construction of a rail system.

Brewster Phosphates, a partnership between American Cyanamid Co. and Kerr-McGee Corp., operated the Haynsworth and Lonesome Mines. Most of the output was shipped to an acid plant in Louisiana through the Port of Tampa. Brewster closed its mines for several months during the year because of weak demand.

CF Industries Inc.'s operations in Hardee County operated throughout the year. At yearend, CF Industries shut down its chemical complex at Bartow. Development at its South Pasture tract continued with construction of a 55-cubic-yard dragline. Construction of a new plant has been delayed pending improved market conditions.

Estech Inc. operated the Silver City and Watson Mines in Polk County. The mines operated intermittently during the year because of reduced market demands. Estech's proposed Duette Mine in Manatee County continued to be delayed because of environmental considerations; the company estimates an expenditure of about \$10 million to date in attempts to develop the mine. The company has revised the anticipated startup to the late 1980's or early 1990's. During the year, the Royster Co., which had

a 20% interest in the mine, dropped out of the venture because the mine would not open in 1983 as originally planned. Royster obtained rock from International Minerals & Chemical Corp. (IMC).

Farmland Industries Inc. continued on the permitting stage for its proposed Hickory Creek Mine in Hardee County. Farmland started construction of 45-cubic-yard dragline early in the year, but stopped because of the weak market for phosphate. If the decision is made to proceed, date for startup for the 2-million-ton-per-year operation would be after 1986.

Gardinier Inc. produced phosphate ore at its Fort Meade Mine in Polk County. The company planned to expand its mining operations into Hardee County by 1990 if permits are approved. At the Fort Meade Mine, \$20 million was being invested to install a waste slime dewatering system to eliminate slime ponds.

W. R. Grace operated its Bonny Lake and Hookers Prairie Mines in Polk County intermittently during the year. The Bonny Lake Mine was scheduled to close in 1983 because of depleted ore reserves. The mines were closed several months because of depressed markets. The development of W. R. Grace's Four Corners Mine, a joint venture with IMC, was postponed until late 1983 or early 1984. W. R. Grace will operate the 5-million-ton-per-year mine with 50% of the production going to IMC.

Hopewell Land Co., a subsidiary of Noranda Inc., planned to develop a 500,000-ton-per-year mine in Hillsborough County by 1984. The County Commission approved the rezoning of nearly 2,400 acres in southeastern Hillsborough County to permit mining. Hopewell will supply a Noranda fertilizer plant in Canada.

IMC, the world's largest private producer of phosphate and phosphate chemical products, operated the Clear Springs, Noralyn, and Kingsford Mines. The mines were closed for 6 weeks early in the year and a week at yearend. IMC completed a nearly \$200 million project to increase capacity at its New Wales chemical complex by 50%. Included were two sulfuric acid plants, a diammonium phosphate plant, and storage facilities. IMC signed an agreement with

Mississippi Chemical Corp.; Mississippi Chemical swapped 15,000 acres of phosphate land in exchange for a 22-year contract to buy phosphate rock. At one time, Mississippi Chemical planned to open a \$225 million facility by 1985 at a site in Hardee County. IMC reportedly will not develop the area for 10 to 20 years.

Mobil operated the Nichols and Fort Meade Mines in Polk County. Mobil proceeded with the permitting process to develop the South Fort Meade Mine, scheduled for operation in 1988. The 3-million-ton-per-year mine will replace the Fort Meade and Nichols Mines as they are phased out over the next 20 years.

Occidental Chemical Co. produced phosphate ore from its Suwannee River and Swift Creek Mines, which operated intermittently during the year. About 70% of the output went to the Soviet Union in the form of superphosphoric acid in exchange for ammonia and other nitrates, under the terms of a 20-year trade agreement.

Sand and Gravel.—Florida produced both construction and industrial sand and gravel in 1982. Production was from 27 companies operating 47 operations in 18 counties. Total output decreased about 8% from that of 1981.

Construction.—As a result of the new canvassing procedures implemented by the U.S. Bureau of Mines in 1980, no annual survey of construction sand and gravel producers was conducted for 1981. Based on partial production information for 1981, collected with the 1982 survey, final estimates of construction sand and gravel production in 1981 were generated and are given in table 1.

Production of construction sand and gravel decreased for the third straight year. During 1982, 25 companies operated 40 pits in 18 counties; leading producing counties were St. Lucie, Lake, and Polk. Transportation was primarily by truck, with the balance shipped by railroad and waterway. Principal uses included concrete aggregate and fill. One company produced over 1 million tons; the top 11 companies, with 24 operations, mined 89% of the total construction sand and gravel mined in the State.

Table 4.—Florida: Sand and gravel sold or used by producers

	1981			1982		
	Quantity (thousand short tons)	Value (thous- ands)	Value per ton	Quantity (thousand short tons)	Value (thous- ands)	Value per ton
Construction:						
Sand	NA	NA	NA	8,675	\$22,242	\$2.56
Gravel	NA	NA	NA	W	W	6.87
Sand and gravel (unprocessed)	NA	NA	NA	W	W	1.17
Total or average	*14,910 349	*\$30,600 4,419	*\$2.05 12.66	13,749	30,481 341	2.22 12.47
Industrial sand						
Grand total or average	*15,259	*\$35,019	*2.29	*14,091	34,738	2.47

*Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Total or average."

¹Data do not add to total shown because of independent rounding.

Table 5.—Florida: Construction sand and gravel sold or used in 1982, by major use category

Use	Quantity (thousand short tons)	Value (thous- ands)	Value per ton
Concrete aggregate	7,198	\$18,026	\$2.50
Plaster and gunite sands	757	2,519	3.33
Concrete products	382	968	2.53
Asphaltic concrete	639	3,452	5.40
Road base and coverings	74	119	1.61
Fill	4,699	5,397	1.15
Total or average	13,749	30,481	2.22

Industrial.—Six companies produced industrial sand, one as a byproduct of kaolin operations; production decreased slightly from that of 1981. Industrial sand was used for glass manufacture and for foundry sands; markets were in Alabama, Florida, and Tennessee.

Staurolite.—Florida was the only State with a recorded production of staurolite. Staurolite was recovered as a byproduct of ilmenite processing in Clay County by E. I. du Pont de Nemours & Co. Inc. and by Associated Minerals (USA) Ltd. Inc. The staurolite was removed by electrical and magnetic separation from heavy minerals concentrates. Production and value decreased for the second straight year.

Stone.—To reduce reporting burdens and costs, the U.S. Bureau of Mines implemented new canvassing procedures for its surveys of stone producers in 1981. The survey of stone producers will be conducted for odd-numbered years only, and only preliminary estimates for crushed and dimension stone production will be published for even-numbered years. The preliminary estimates will be revised and finalized the following year.

Florida ranked second in the Nation in

crushed stone production, which included limestone, marl, and oyster shell. Output decreased for the second straight year; construction activity decreased, adversely affecting crushed stone and other aggregate output. Most quarries operated at reduced levels during the year, with no reported closures. Crushed stone was transported mainly by truck and railroad, and was used for dense-graded road base, concrete, bituminous aggregate, and cement manufacture. Oyster shell was used primarily for roadbed material.

Sulfur (Recovered).—Florida ranked seventh in the Nation in the production of byproduct elemental sulfur. Recovered sulfur from Exxon Corp.'s natural gas desulfurization plants in Santa Rosa County decreased for the fourth straight year.

Vermiculite (Exfoliated).—Exfoliated vermiculite was produced by two operations at four plants in Broward, Duval, and Hillsborough Counties from crude ore shipped into the State. Production and value decreased 20.9% and 2.7%, respectively, from that of 1981. Principal uses were for concrete aggregate, horticulture, and insulation.

METALS

Iron and Steel.—Florida Steel Corp.'s minimills were adversely affected by economic conditions. Early in the year, the company closed its Indiantown operation and reduced production at its Jacksonville and Tampa operations. Output, mainly rebars, was shipped to markets within 300 miles of the plants. Two companies produced ferrophosphorus in 1982. Shipments of ferroalloys decreased 20%, while value decreased 54% from that of 1981.

According to the Directory of Florida Industries, nine gray iron foundries and eight steel foundries operated intermittently during the year. With the exception of one steel foundry in Jacksonville, all foundries were relatively small.

Rare-Earth Minerals.—Florida was the only domestic producer of rare earth from mineral sands mining. Associated Minerals

recovered monazite concentrate as a byproduct from its operations in Clay County. Production and value increased over that of 1981.

Titanium.—Du Pont and Associated Minerals produced concentrates from their heavy minerals operations in Clay County. Both rutile and ilmenite shipments increased over that of 1981.

Zircon.—Production and value of zircon concentrate from Du Pont and Associated Minerals operations in Clay County decreased 22.6% and 15.2%, respectively. Florida was the only producer of zircon concentrate in the United States. Zircon was recovered as a byproduct of mineral sands operations and was used in the foundry, ceramic, and refractory industries.

¹State Liaison Officer, Bureau of Mines, Tuscaloosa, Ala.

²State geologist, Florida Bureau of Geology, Tallahassee, Fla.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
General Portland Inc. -----	12700 Park Central Pl. Suite 2100 Dallas, TX 75251	Plants -----	Dade and Hillsborough.
Lonestar Florida Pennsuco Inc. -----	Box 2035 PVS Hialeah, FL 33012	Plant -----	Dade.
Moore McCormack Resources Inc. -----	Box 23965 Tampa, FL 33622	--- do -----	Hernando.
Rinker Portland Cement Corp. -----	Box 650679 Miami, FL 33165	--- do -----	Dade.
Clay:			
Engelhard Minerals & Chemical Corp. -----	Manlo Park Edison, NJ 08817	Open pit mines and plant.	Brevard.
Mid-Florida Mining Co. -----	Box 68-F Lowell, FL 32663	--- do -----	Marion.
Pennsylvania Glass Sand Corp. -----	Berkeley Springs, WV 25411	--- do -----	Gadsden.
Gypsum (calcined):			
Jim Walter Corp. -----	1500 North Dale Mabry Tampa, FL 33607	Plant -----	Duval.
National Gypsum Co. -----	4100 First International Bldg. Dallas, TX 75270	--- do -----	Hillsborough.
United States Gypsum Co. -----	101 South Wacker Dr. Chicago, IL 60606	--- do -----	Duval.
Lime:			
Basic Magnesia Inc. -----	Box 160 Port St. Joe, FL 32456	--- do -----	Gulf.
Chemical Lime Inc. -----	Box 317 Leesburg, FL 32748	--- do -----	Hernando.
Dixie Lime & Stone Co. ¹ -----	Drawer 217 Sumterville, FL 33585	--- do -----	Sumter.
Magnesia:			
Basic Magnesia Inc. -----	Box 160 Port St. Joe, FL 32456	--- do -----	Gulf.
Peat:			
Peace River Peat Co. -----	Box 1192 Bartow, FL 33830	Bog -----	Polk.
Superior Peat & Soil Co. -----	Box 1688 Sabring, FL 33870	Bog -----	Highlands.
Perlite (expanded):			
Airlite Processing Corp. of Florida -----	Route 2, Box 740 Vero Beach, FL 32960	Plant -----	Indian River.
Armstrong Cork Co. -----	Box 1991 Pensacola, FL 32589	--- do -----	Escambia.
Chemrock Corp. -----	End of Omega St. Nashville, TN 37208	--- do -----	Duval.
W. R. Grace & Co. ² -----	62 Whitemore Ave. Cambridge, MA 02140	--- do -----	Broward.

Table 6.—Principal producers —Continued

Commodity and company	Address	Type of activity	County
Phosphate rock:			
Agrico Chemical Co -----	Box 3166 Tulsa, OK 74101	Open pit mines and plants.	Polk.
AMAX Phosphate Inc -----	402 South Kentucky Ave. Lakeland, FL 33801	Open pit mine and plant.	Hillsborough.
Beker Phosphate Inc -----	Box 9034 Bradenton, FL 33506	do -----	Manatee.
Brewster Phosphates -----	Bradley, FL 33835-----	do -----	Hillsborough and Polk. Hardee.
CF Industries Inc -----	Box 790 Plant City, FL 33566	do -----	Polk.
Estech Inc -----	Box 208 Bartow, FL 33830	Open pit mines	Polk.
Gardiner Inc -----	Box 3269 Tampa, FL 33601	Open pit mine and plant.	Do.
W. R. Grace & Co -----	Box 471 Bartow, FL 33830	do -----	Do.
International Minerals & Chemical Corp.	Box 867 Bartow, FL 33830	Open pit mines	Do.
Mobil Chemical Corp. ¹	Box 311 Nichols, FL 33863	do -----	Do.
Occidental Chemical Co -----	White Springs, FL 32096-----	do -----	Hamilton.
U.S.S. Agri-Chemicals Inc. -----	Box 867 Fort Meade, FL 33841	Open pit mine	Polk.
Sand and gravel:			
Florida Rock Industries Inc., Shands & Baker Div.	Box 6984 Fort Myers, FL 33901	Pits	Clay, Glades, Lake, Marion, Polk, Putnam.
General Development Corp -----	1111 South Bayshore Dr. Miami, FL 33131	do -----	Henry, St. Lucie, Sarasota.
E. R. Jahna Industries Inc., Ortona Sand Co. Div.	First & East Tillman Lake Wales, FL 33853	do -----	Glades, Hendry, Lake, Polk.
Silver Sand Co. of Clermont Inc. -----	Route 1, Box US 1 Clermont, FL 32711	Pit	Lake.
Staurolite:			
Associated Minerals (USA) Ltd. Inc.	Green Cove Springs, FL 32043	Mine and plant	Clay.
E. I. du Pont de Nemours & Co. Inc.	DuPont Bldg. D-10084 Wilmington, DE 19898	Mines and plants	Do.
Stone:			
Florida Crushed Stone Co -----	Box 317 Leesburg, FL 32748	Quarries	Hernando, Sum- ter, Taylor.
Florida Rock Industries Inc -----	Attn: Nat C. Hughes, Pres. Box 6984 Fort Myers, FL 33901	do -----	Collier, Hernando, Lee, Levy, St. Lucie.
Lone Star Florida Inc -----	Box 6097 Fort Lauderdale, FL 33310	Quarry	Dade.
Rinker Southeastern Materials Inc.	Box 5230 Hialeah, FL 33014	Quarries	Do.
Vulcan Materials Co -----	Box 7324-A Birmingham, AL 35223	do -----	Broward and Dade.
Titanium concentrates:			
Associated Minerals (USA) Ltd. Inc.	Green Cove Springs, FL 32043	Mine and plant	Clay.
E. I. du Pont de Nemours & Co. Inc.	DuPont Bldg. D-10084 Wilmington, DE 19898	Mines and plants	Do.

¹Also stone.²Also exfoliated vermiculite.³Also elemental phosphorus.

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