

# THE MINERAL INDUSTRY OF NORTH CAROLINA

**This chapter has been prepared under a Memorandum of Understanding between the U.S. Department of the Interior, and the Division of Land Resources, North Carolina Department of Environment, Health, and Natural Resources, for collecting information all nonfuel minerals.**

In 1996, North Carolina ranked 18th nationally in total nonfuel mineral production value,<sup>1</sup> according to the U.S. Geological Survey (USGS). The State was 17th in 1995. The estimated value for 1996 was \$731 million, a less than 1% decrease from that of 1995. This followed a gain of about 4.6% from 1994 to 1995 (based on final 1995 data). The State accounted for 2% of the U.S. total nonfuel mineral production value.

In 1996, the combined values of construction and industrial sand and gravel and crushed stone increased the State's nonfuel mineral value by more than \$17 million. But decreases in phosphate rock and gemstone values more than offset those increases, resulting in a small net loss for the year. Compared with 1995, the other mineral commodity values that increased in 1996 were those of feldspar, dimension stone, crude mica, and talc and pyrophyllite. Other nonfuel minerals that decreased in value in 1996 included lithium minerals, common clays, olivine, and peat. In 1995, the values of crushed stone, lithium minerals, and gemstones, from the largest increase to the smallest, led the way in the year's increase, which was moderated somewhat by decreases in phosphate rock and industrial sand and gravel.

Compared with USGS estimates of the quantities produced in the other 49 States, North Carolina remained the leading State in feldspar and crude mica; first of two States that produced lithium minerals and olivine; second in phosphate rock; fifth in talc and pyrophyllite; seventh in kaolin; and ninth in dimension stone. While the State rose

from seventh to sixth in industrial sand and gravel, it decreased from first to third in common clays, and from eighth to ninth in crushed stone. In addition, significant quantities of construction sand and gravel were produced in the State. North Carolina mines have been producers of industrial minerals exclusively since the early 1970's, particularly since the 1971 closing of the Tungsten Queen Mine, an underground tungsten mine in Vance County. Metal production in the State, especially that of primary aluminum, resulted from the processing of recycled materials or raw materials received from other domestic and foreign sources.

The following narrative information was provided by the North Carolina Geological Survey (NCGS) and includes mineral industry information and news for both 1995 and 1996 (Reid, 1997). Common clays mined from residual soils (saprolite) developed on crystalline rocks and mudstones from Triassic basins provide the basis for the State's brick industry. According to the Brick Association of North Carolina, North Carolina ranks first in brick production. Thirteen companies produced more than 950 million units in 1995, worth approximately \$126 million. These manufacturers supply 16% of all the brick used in the United States. Material preferences for new home construction in North Carolina in 1995 were as follows: brick (33%), wood siding (26%), vinyl (13%), artificial stucco (11%), and other (17%).

According to the North Carolina Division of Land Resources (DLR), the State recorded overall increases in most phases of mining activity in 1995. These included increases in the number of mining permits issued, number of hectares permitted, and the total number of mines. In 1995, there were 795 permitted active and inactive mines. Sixty-two percent of these mines was sand and gravel, 16% crushed stone, 5% brick clay, 3% dimension stone, and the remaining 14% was from a variety of other commodities. By the end of 1995, 41,790 hectares were permitted: 32% phosphate, 31% crushed stone, 23% sand and gravel, 5% brick clay, and the remaining 9% was composed of various other commodities. Forty-nine new mining permits were issued in 1995: sand and gravel (40), sand dredging (3), crushed stone (2), dimension stone (2), gemstone (1), and clay (1).

In 1995, the NCGS, the Minerals Research Laboratory

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1996 USGS mineral production data published in this chapter are estimates as of February 1997. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at <http://minerals.er.usgs.gov/minerals/contacts/comdir.html>

(MRL) of North Carolina State University, and the Carolinas' section of the Society of Mining Engineers provided an exhibit entitled "Mining and Minerals in Society" at the State Science Teachers Meeting. More than 18 metric tons<sup>2</sup> of rock and mineral specimens were distributed to the attendees. In a similar program entitled "Down to Earth," the MRL made more than 40 presentations to nearly 500 students in western North Carolina schools. Approximately 400 mineral kits, used for education purposes in the classrooms, were distributed. In 1996, the MRL and the NCGS received a grant of \$10,000 to produce and distribute up to 800 additional rock kits for use in the public schools. The Colburn Gem & Mineral Museum, Asheville, NC, contains photographic murals on historical mining and on gold mining in North Carolina, covering the major mineral industries. The museum also has ore and product samples and photographs of mining operations.

Potash Co. of Saskatchewan Inc. (formerly Texasgulf Inc.), in Aurora, operated the largest single-site, vertically integrated phosphate mine and chemical processing complex in the world. Phosphate is an important raw material for the fertilizer industry.

FMC Corp., Lithium Division, mines spodumene, a lithium ore near Bessemer City, NC. FMC is developing a large lithium brine operation in Argentina. Upon completion of this project, FMC intends to phase out its mining operation in North Carolina. Portions of FMC's chemical plant in Gastonia will continue to operate.

Unimin Corp. is spending more than \$50 million on new construction in the Spruce Pine area. The kaolin plant, once owned by Blue Diamond Coal Co., has been demolished, and a new modern floatation plant and quartz leaching plant now occupies the site on which the kaolin plant stood. This plant is slated for startup sometime in January 1997.

Feldspar Corp., a division of Zemex Corp. (Canada), continues to renovate and expand its plant at Spruce Pine. New dry gravity facilities have been installed, and a new floatation plant has been erected.

Exploration for gold and base metals remained at low levels. The U.S. Forest Service reports that the drilling activity begun in 1994 by Battle Mountain Gold Co./Cominco Ltd. and ASARCO Incorporated in the Uwharrie National Forest has been completed. There have been no new requests for drilling in this area. BHP Minerals Ltd. conducted stream sediment geochemical surveys on U.S. Forest Service lands in western North Carolina during 1995.

Becker Minerals Inc. received the North Carolina Mining Commission's annual reclamation award for its reclamation project on a 485-hectare site which included previously mined areas, future mineral reserves, the plant site, waste areas, and buffer areas. During the life of the sand and gravel operator, 172 hectares were mined; only 97 hectares were required to be reclaimed according to the State's mining law. Becker has completed reclamation of all land affected by mining with the exception of a 4-hectare area, which was scheduled for completion by early 1997. The company was selected for the award because of its initiative to upgrade its reclamation plan through innovative land planning. The company's reclamation efforts included a variety of land uses such as agriculture, forestry, residences, wildlife habitat, and recreation at the site. The project also received an honorable mention from the Interstate Mining Compact Commission's national annual awards program.

There are currently no proposed mineral exploration projects in National Forests in North Carolina. Most of the Bureau of Land Management (BLM) prospecting permits on the Uwharrie have been dropped. Vengeance Creek Stone Co. has been approved for a 5-year plan of operation to mine quartzite building stone in Cherokee County. The company expects to remove approximately 3,600 tons per month. There was no production in 1995. One lease applicant dropped his BLM lease request to mine gold at the site of the old Tebe Saunders Mine in the Uwharrie National Forest and has reclaimed his exploration worksite.

During fiscal year 1996 (July 1 to June 30), the National Forests in North Carolina sold 75,657 tons of crushed stone and dimension stone for a value of \$33,927. Most of this came from two long-term use sites: the Massey Branch quarry in Graham County produced crushed aggregate (72,000 tons), and the Hall Mine in Montgomery County produced building stone. Several other quarries were still in the permit approval process at yearend.

The DLR Land Quality Section (LQS), in cooperation with the Mining Commission, recently published the Surface Mining Manual, a guide for permitting, operation, and reclamation. The manual is meant to help mining permit applicants to properly complete applications so that the applications can be processed in a more timely manner. It is also meant to help mine operators understand the operation and reclamation conditions of their permits. The manual contains easily understandable information regarding (1) North Carolina State laws and rules, (2) mining applications and operating permits, (3) reclamation plans and bonds, (4) State inspections and monitoring, (5) recordkeeping, (6) compliance and penalties, and (7) Federal and State agency contacts and reference guides.

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<sup>2</sup>All tons are metric unless otherwise specified.

The manual is available and may be purchased from the LQS. Its price for in-state addresses is \$50.00; for out-of-State addresses, the price is \$70.00.

The Mining Act of 1971 (G.S. 74-46 to G.S. 74-74) requires that any person or firm wishing to engage in mining that will affect 0.4 hectare (1 acre) or more in surface area must first obtain a valid State mining permit. The LQS administers the Mining Act. It also administers the Dam Safety law of 1967 and Sedimentation Pollution Control Act of 1973. Other permits that may pertain to mineral extraction and processing, including air and water permits, are issued by North Carolina's Divisions of Air Quality and Water Quality, respectively. Questions about the Mining Act of 1971 and permit fees should be directed to the State Mining Specialist, Land Quality Section, Division of Land Resources, Department of Environment, Health, and Natural Resources (DEHNR), P.O. Box 27687, Raleigh, NC 27611-7687. The telephone number is (919) 733-4574. The fax number is (919) 733-2876.

The DEHNR published a guide to environmental regulations entitled "the 1994 North Carolina Environmental Permit Directory," a general introduction to environmental regulations and an overview of requirements governing the wise use and protection of the state's natural resources." It is available from DEHNR's Small Business Ombudsman/Environmental Permit Center (EPIC), P.O. Box 27626-0583, Raleigh, NC 27611-7687 at a cost of \$7.00 (plus 6% sales tax for sales in the State). The telephone number is (919) 733-1267; the toll free helpline is (888) 368-2640. A free summary brochure contains a permit matrix. EPIC is a center for environmental permit information. Its staff helps businesses and people identify the permits they need and refers them to the appropriate DEHNR agency to help get them started. The staff also coordinates preapplication conferences, where many permit questions can be answered. EPIC can be reached by e-mail at [epic@owr.ehnr.state.nc.us](mailto:epic@owr.ehnr.state.nc.us).

The NCGS provides basic geologic information. Current studies include geologic mapping, stratigraphic framework studies, mineral resource investigations, and environmental and engineering studies. The NCGS maintains a sample repository which includes drill core, cuttings, and geophysical bore hole records. Descriptions of the repository contents are in a computer database to facilitate information retrieval. The NCGS has a modern heavy-minerals laboratory. Reports of investigations are available from the NCGS. A new index to topographic maps was published in 1996.

The NCGS has various publications on mineral commodities including asbestos minerals and talc,

building stone, clay, feldspar, gold, heavy minerals, high-alumina-minerals, limestone, lithium, other industrial minerals, phosphate, silica, and titanium. Current investigations are in progress for feldspar, gold, and mica. These reports and guidebooks focus on different mineral producing districts in North Carolina. The NCGS also has geologic maps at several scales but only about 6% of the State is covered by 1:24,000-scale geologic mapping. Limited funding from the recent passage of the National Geologic Mapping Act will help marginally to accelerate the rate of geologic mapping of the State at the scale of 1:24,000.

Funds were identified recently to authorize work to complete digital quarterquad (DOQQ) coverage for the entire State. The leaf-off black and white photography was taken in 1993. Pixel resolution is about 1 to 3 meters. By yearend 1996, more than 1,000 DOQQ's, or about 33% of the State, had been received. The initial focus has been the coastal counties and the Piedmont crescent; these are being converted to a format compatible with a broader number of geographic information systems as time and resources permit.

Applied minerals research is conducted by the MRL. It develops new and improved processes to extract minerals from ore deposits and conducts research for the development of mineral resources in North Carolina, other States, and foreign countries. Projects are undertaken as sponsored (fee basis) or State-supported projects. The laboratory conducts sponsored and unsponsored beneficiation projects on many commodities, especially industrial minerals. The laboratory can conduct a wide variety of mineral dressing and pilot-plant studies. Its facilities include mineral processing equipment and analytical support facilities for batch and continuous pilot-plant research to develop workable flowsheets and to produce large samples for customer evaluation.

The MRL has been active in several major research projects investigating deposits in the State containing quartz, feldspar, and mica. Activity on mica has been especially heavy, indicating an increase in its use and shortage of sources. Two cooperative investigations between the MRL and the NCGS were recently published. These include investigation of muscovite mica in greisen rock of the Sims granitoid intrusive, Wilson County, North Carolina (NCGS Information Circular 30), and potential feldspar resources in north-central North Carolina (NCGS Open-File Report 95-1).

With the closure of the U.S. Bureau of Mines in the region (Tuscaloosa Alabama Research Center) and the pending changes in the Minerals Department of the University of Alabama, the MRL emerges as one of the few

minerals processing research groups remaining in the Southeastern United States. To enhance its research capabilities, MRL has obtained laboratory and pilot-plant equipment from the former U.S. Bureau of Mines and the University of Alabama.

Examples of current MRL projects include a multiphase project to characterize fly ash produced by utilities, fly ash beneficiation, testing fly ash use in asphalt and concrete mixes, and economic analysis. Recently, a study of various glazed, decorative effects on artware using natural minerals for stains (chromite, dolomite, magnetite, etc.) to help small potters was completed. Further information can be obtained from the Office of the Director, North Carolina State University Minerals Research Laboratory, 180 Coxe Ave., Asheville, NC 28801. The telephone number is (704) 251-6155; the fax number is (704) 251-6381.

North Carolina State University's Analytical Instrumentation Facility (AIF), part of the Engineering Research Services Division, has a modern, well-equipped laboratory. It contains state-of-the-art analytical instruments which are available to characterize and to analyze a wide variety of materials. Prospective users should contact AIF at (919) 515-7501 to discuss material analysis and prices of analytical services. The address is Box 7531, Raleigh, NC 27695-7531.

For more information about the State's geology, mineral resources, topographic maps, orthophotoquadrangles, and remotely sensed data, contact the North Carolina Geological Survey, P.O. Box 27687, Raleigh, NC 27611-7687. The telephone number is (919) 733-2423; the fax number is (919) 733-0900.

The NCGS also has complete State coverage of topographic maps and orthophotoquadrangles; a publication list on the geology and mineral resources of the State is available upon request. An index showing map coverage is available. Maps may be ordered by telephone (919-733-2423), by mail (North Carolina Geological Survey, P.O. Box 27687, Raleigh, NC 27611-7687), or at the 5th floor Archdale Building office (512 North Salisbury St., Raleigh). Currently the NCGS' Internet site (<http://www.enhr.state.nc.us/EHNR/DLR/JEFF/rock.htm>) has more than 18 key areas of interest, including links to many earth science web sites and its entire publication list.

#### Reference Cited

Reid, J.C., Carpenter, R.H., Davis, T.E., and Sample, T.L., 1997, Permitted active and inactive mining operations in North Carolina as of November 1996: North Carolina Geological Survey Open File Report 97-1, 198 p.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN NORTH CAROLINA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1994		1995		1996 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays 3/	2,530	12,500	2,430	12,500	2,400	11,100
Feldspar	488	176	497	18,400	509	18,900
Gemstones	NA	565	NA	4,440	NA	680
Mica (scrap)	68	3,270	74	3,690	W	W
Peat	21	W	19 4/	340 4/	W	W
Sand and gravel:						
Construction	11,100	50,700	10,100	50,100	11,300	58,400
Industrial	1,460	24,200	1,330	21,900	1,640	26,900
Stone:						
Crushed	53,900 5/	351,000 5/	57,300	384,000	57,000	388,000
Dimension metric tons	33,700 5/	12,500 5/	41,100 5/	15,400 5/	48,500	16,000
Combined value of clays (kaolin), lithium minerals, olivine, phosphate rock, stone [dimension quartzite, sandstone, slate and miscellaneous (1994-95)], pyrophyllite, and values indicated by symbol W	XX	231,000 r/	XX	225,000	XX	211,000
Total	XX	703,000 r/	XX	735,000	XX	731,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

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

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Excludes certain clays; value included with "Combined value" data.

4/ Data series changed to production beginning in 1995; prior years shipment data may not be comparable.

5/ Excludes certain stones; value included with "Combined value" data.

TABLE 2  
NORTH CAROLINA: CRUSHED STONE 1/ SOLD OR USED BY PRODUCERS  
IN 1995, BY USE 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	\$7.05
Riprap and jetty stone	720	\$5,880	8.17
Filter stone	469	3,240	6.92
Coarse aggregate, graded:			
Concrete aggregate, coarse	4,580	33,700	7.36
Bituminous aggregate, coarse	2,320	18,600	8.00
Bituminous surface-treatment aggregate	336	2,210	6.57
Railroad ballast	1,460	7,140	4.90
Other graded coarse aggregate	W	W	7.56
Fine aggregate (-3/8 inch):			
Stone sand, concrete	139	794	5.71
Stone sand, bituminous mix or seal	600	3,160	5.26
Screening, undesignated	2,080	11,500	5.56
Other fine aggregate	W	W	4.83
Coarse and fine aggregates:			
Graded road base or subbase	10,300	57,200	5.54
Unpaved road surfacing	285	1,740	6.09
Terrazzo and exposed aggregate	W	W	11.12
Crusher run or fill or waste	845	4,900	5.79
Other coarse and fine aggregates	W	W	6.45
Other construction materials 3/	981	7,460	7.61
Agricultural:			
Agricultural limestone	(4/)	(4/)	5.56
Poultry grit and mineral food	(4/)	(4/)	5.00
Other specified uses not listed	(4/)	(4/)	6.46
Unspecified: 5/			
Actual	30,300	214,000	7.05
Estimated	1,400	9,410	6.74
Total	57,300	384,000	6.69

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

1/ Includes calcareous marl, dolomite, granite, limestone, miscellaneous stone, quartzite, slate, traprock, and volcanic cinder and scoria.

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Includes drain fields.

4/ Withheld to avoid disclosing company proprietary data; included in "Total."

5/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 3  
NORTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1994				1995			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	12	4,290	\$30,000	\$6.98	12	5,680	\$38,800	\$6.83
Dolomite	1	245	1,680	6.87	1	265	1,820	6.86
Calcareous marl	3	111	738	6.65	3	135	942	6.98
Granite	69 r/	41,700 r/	267,000 r/	6.40	71	43,100	285,000	6.62
Traprock	7	3,930	25,800	6.57	7	4,540	30,600	6.74
Slate	3	W	W	6.95	2	W	W	7.39
Volcanic cinder and scoria	1	W	W	7.04	1	W	W	7.21
Quartzite	2 r/	W	W	6.44 r/	2	W	W	6.70
Miscellaneous stone	1 r/	W	W	7.28 r/	2	W	W	7.28
Total	XX	53,900	351,000	6.51	XX	57,300	384,000	6.69

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 4  
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1995,  
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	445	3,530	W	W	W	W
Coarse aggregate, graded 3/	W	W	W	W	1,610	10,700
Fine aggregate (-3/8 inch) 4/	W	W	W	W	394	2,020
Coarse and fine aggregate 5/	3,830	23,000	W	W	W	W
Other construction materials 6/	3,530	23,300	12,500	79,700	2,800	15,300
Agricultural 7/	(8/)	(8/)	--	--	(8/)	(8/)
Other miscellaneous uses 9/	(8/)	(8/)	(8/)	(8/)	--	--
Unspecified 10/						
Actual	437	2,720	(8/)	(8/)	(8/)	(8/)
Estimated	258	1,820	151	1,070	988	6,530
Total	8,620	55,100	30,400	204,000	18,400	124,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes filter stone, macadam, and riprap and jetty stone.

3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.

4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.

5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.

6/ Includes drain fields.

7/ Includes agricultural limestone and poultry grit and mineral food.

8/ Withheld to avoid disclosing company proprietary data; included in "Total."

9/ Includes other specified uses not listed.

10/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 5  
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,  
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	3,980	\$14,900	\$3.75
Asphaltic concrete aggregates and other bituminous mixtures	590	1,970	3.34
Road base and coverings 3/	664	3,020	4.55
Fill	877	2,250	2.57
Snow and ice control	30	154	5.13
Other 4/	823	6,760	8.22
Unspecified: 5/			
Actual	2,130	17,100	8.05
Estimated	1,010	3,910	3.86
Total or average	10,100	50,100	4.96

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (lime).

4/ Includes filtration and railroad ballast.

5/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 6  
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,  
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	348	2,380	1,510	5,120	2,120	7,410
Asphaltic concrete aggregate and road base materials 3/	484	2,580	392	1,500	1,280	3,320
Other miscellaneous uses 4/	269	1,240	512	5,290	42	230
Unspecified: 5/						
Actual	--	--	1,130	11,700	993	5,400
Estimated	208	1,080	296	1,110	511	1,730
Total	1,310	7,290	3,840	24,700	4,950	18,100

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes fill, road and other stabilization (lime), and snow and ice control.

4/ Includes filtration and railroad ballast.

5/ Includes production reported without a breakdown by end use and estimates for nonrespondents.