

GEOLOGIC NOTES

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GEOLOGIC ACTIVITIES IN SOUTH CAROLINA DURING 1962

By

H. S. Johnson, Jr. ^{1/}

During 1962 the Division of Geology, S. C. State Development Board, continued its basic program of investigations of the geology and mineral resources of the State. Personnel consisted of one full time geologist, one geologic secretary, a ceramic consultant, two part time draftsmen, one part time field assistant, and six part time project geologists. In addition, a cooperative program of ground water investigations was carried on under the direction of G. E. Siple, U. S. Geological Survey.

According to a preliminary statement issued by the U. S. Bureau of Mines, mineral production in South Carolina in 1962 totaled about \$30,839,000, a 2 percent increase over value in 1961 and an all time high record. Table 1 gives comparative figures for 1961 and 1962. The 1961 data are based on complete returns and the 1962 data on preliminary reports from the mineral producers of the State. These preliminary reports indicate increased production of cement, sand and gravel, kyanite, and barite in 1962. Decreases are indicated for stone, vermiculite, miscellaneous clay, and pyrite. Production of feldspar, peat, and sheet mica remained about the same as for 1961. The decrease in stone production was due primarily to the closing of several temporary quarries which had been supplying materials for construction under the Interstate Highway Program.

Table 1.--Mineral production in South Carolina ¹

Mineral	1961		1962 ²	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays.....thousand short tons.....	1,346	\$6,168	1,362	\$6,965
Mica (sheet).....pounds.....	12	(3)	10	(3)
Sand and gravel.....thousand short tons.....	2,304	1,067	3,407	1,137
Stone.....do.....	6,752	9,827	6,263	6,650
Value of items that cannot be disclosed: barite, cement, feldspar, kyanite, scrap mica, peat, pyrites, and vermiculite.....	- - -	12,311	- - -	13,004
Total South Carolina (4).....	- - -	30,136	- - -	30,939

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

(2) Estimated from producers' reports and other sources.

(3) Value less than \$500.

(4) Total adjusted to eliminate duplicating the value of clays and stone in cement.

^{1/} State Geologist, Division of Geology, S. C. State Development Board.

PROJECTS

The following remarks serve as an index to projects carried on during 1962 by the Division of Geology or with its cooperation and support.

(1) Mineral industry of South Carolina (Mrs. Camilla McCauley). -- Continuing library research to assemble available information on the mineral industry of South Carolina from the Colonial Period to the present. Commodity reports are published in the bulletin series. A report on barite (Bull. 27) has been released; and work is in progress on corundum, gem stones, manganese, and mica.

(2) Geology and mineral resources of Pickens County, S. C. (C. O. Brown). -- Field and laboratory work essentially complete. Report in preparation for bulletin series.

(3) Geology and mineral resources of Newberry County, S. C. (J. F. McCauley). -- Field and laboratory work complete. Report in preparation for bulletin series.

(4) Montmorillonite and "fullers earth" clays of South Carolina (S. D. Heron, Jr., and G. C. Robinson). -- Field work essentially complete. Laboratory investigations and report writing in progress.

(5) Geology and mineral resources of Orangeburg County, S. C. (W. K. Pooser). -- Field and laboratory work essentially complete. Report in preparation for bulletin series.

(6) Geology of the Blythewood 7 1/2' quadrangle, S. C. (W. D. Paradise and J. F. McCauley). -- Field work complete. Map and text in preparation for publication in MS series.

(7) Geology of the Blaney 7 1/2' quadrangle, S. C. (D. C. Ridgeway and J. F. McCauley). -- Field work complete. Map and text in preparation for publication in MS series.

(8) Geology and mineral resources of Edgefield County, S. C. (W. T. McCutchen and H. S. Johnson, Jr.). -- Field work about 90 percent complete.

(9) Geology of the SW quarter of the Eutawville 15' quadrangle, S. C. (D. A. Duncan). -- Field work essentially complete. Map and report in preparation for publication in Geologic Notes.

(10) Geology of the Eutawville 15' quadrangle, S. C. (D. J. Colquhoun). -- Field work essentially complete. Map and text in preparation for publication in MS series.

(11) Geology of the SE quarter of the St. Matthews 15' quadrangle, S. C. (Phoebe Bernat). -- Field and laboratory work in progress. Emphasis on sedimentary petrology and heavy mineral distribution.

(12) Geology and mineral resources of York County, S. C. (J. R. Butler). -- Field and laboratory work in progress. Mapping about 75 percent complete.

(13) Geology and mineral resources of Oconee County, S. C. (C. J. Cazeau). -- Field and laboratory work essentially complete. Report in preparation for bulletin series.

(14) Geology of the Clemson 7 1/2' quadrangle, S. C. (C. Q. Brown and C. J. Cazeau). -- Field work complete. Map and text in preparation for publication in MS series.

(15) Geology of the Sumter West 7 1/2' quadrangle, S. C. (C. Q. Brown). -- Field work and power auger drilling about two-thirds complete.

(16) Geology and mineral resources of Horry County, S. C. (J. R. Du Bar). -- Field work about 75 percent complete.

(17) Geology of the Irmo NE 7 1/2' quadrangle, S. C. (D. T. Secor and W. E. Bright). Field work about 50 percent complete.

(18) Geology of the LaFrance 7 1/2' quadrangle, S. C. (C. J. Cazeau). -- Field work about 50 percent complete.

SHORTER INVESTIGATIONS

(1) Magnetometer survey, Locality 36-1 (Newberry County). -- A number of ground magnetometer readings across a hematite-bearing bed of the Carolina Slate Group showed no anomaly.

(2) Heavy minerals. -- Several power auger holes drilled in sands of the "Dorchester Bar" (Pleistocene?) in Dorchester and Colleton Counties found no anomalous heavy mineral content.

(3) Hawthorne(?) Formation (Miocene). -- Wide-spaced power auger drilling in Colleton, Beaufort, and Jasper Counties shows green clay and weakly phosphatic sand of the Hawthorne(?) Formation to be present beneath thin (less than 50 feet) Pleistocene cover south of a pinchout line extending approximately through Charleston, Dorchester, and Smoaks.

(4) Lightweight aggregate. -- Residual Eocene clays from the Wedgefield Railroad Cut (Loc. 43-2), Sumter County, were tested superficially as a raw material for lightweight aggregate. Results indicated this clay is a marginal material.

(5) Little Mountain, Newberry County. -- Brief reconnaissance and laboratory investigations of reported Cb-Ta occurrences indicate these elements are present in ilmeneo-rutile or a related brown to black heavy mineral associated with kyanite-quartzite in this area.

REPORTS

During 1962 the Division of Geology released the following reports:

(1) MS-4, Contours drawn on top of the Cooper Marl in the Ladson quadrangle, S. C. Map (scale, 1:24,000) and short text. Price 25¢.

(2) MS-6, Generalized geologic map of South Carolina (after Overstreet and Bell, 1961). Scale 1" = approx. 28 mi. Mailing charge 5¢.

(3) Bulletin 27, Barium resources of South Carolina. 22 pages. Price 50¢.

During 1962 the following papers were published in Geologic Notes:

Vol. 6, no. 1. -- (1) Geologic activities in South Carolina during 1961- (January-February) H. S. Johnson, Jr.

(2) Newly developed sinkholes in Horry County, South Carolina - Ottie G. Johnson

(3) A neglected geologic map of South Carolina - W. C. Overstreet and Henry Bell III

Vol. 6, no. 2. -- (1) Ground-water investigations in South Carolina, 1961 - (March-April) G. E. Siple

(2) New radiocarbon dates for the Pamlico Formation of South Carolina and their stratigraphic significance - J. R. Du Bar

Vol. 6, no. 3. -- Check list of Waccamaw and Croatan (Pliocene?) macrofossils of North and South Carolina - J. R. Du Bar

Vol. 6, no. 4. -- (1) Value of heavy mineral investigations in the Coastal Plain of South Carolina - C. J. Cazeau

(2) Leaching of Santee Limestone, Calhoun County, South Carolina - C. J. Cazeau

(3) Contours drawn on top of the Cooper Marl in the Ladson Quadrangle, South Carolina (Abstract) - D. J. Colquhoun.

(4) Economic mineral localities in South Carolina (Abstract) - L. L. Smith

(5) Generalized geologic map of South Carolina (Abstract) - W. C. Overstreet and Henry Bell III

Vol. 6, no. 5 -- (1) South Carolina materials for floor tile - G. C. Robinson
(September-October)

- (2) Recent lead-alpha age determinations on zircon from the Carolina Piedmont (Reprint) - W. C. Overstreet, Henry Bell III, Harry J. Rose, Jr., and Thomas W. Stern.

Vol. 6, no. 6 --On surficial sediments in central South Carolina - a progress report - D. J. Colquhoun
(November-December)

BARIUM RESOURCES OF SOUTH CAROLINA 1/

By

Camilla K. McCauley 2/

ABSTRACT

Barite ($BaSO_4$) and witherite ($BaCO_3$) are the principal sources of barium and barium compounds. Of the two, barite is the more important. It was first mined in the United States about 1845 in Fauquier and Prince William Counties, Virginia. The principal producing states are now Arkansas and Missouri with lesser production from Nevada, Georgia, California, South Carolina, Tennessee, North Carolina, Montana, Idaho, New Mexico, and Washington. About 900,000 tons of barite having a value of about \$10,000,000 was produced in the United States in 1959.

South Carolina barite deposits are clustered in a narrow northeastward trending belt extending a few miles either side of Kings Creek in Cherokee County. These deposits were first prospected and mined in the early 1880's. Small scale intermittent mining was carried on in this area until 1949 when Industrial Minerals, Incorporated, began continuous operations. Barite in this district occurs as massive ore in discontinuous veins and as disseminated materials in quartz-sericite schist in a zone near the contact of the Battleground Schist and the Bessemer Granite. Reserves are thought sufficient for many years of operation.

The three general categories of barium products are (1) ground and crushed barite (used chiefly in oil well drilling muds), (2) lithopone (a white pigment), and (3) barium chemicals.

United States barite production has declined in recent years from an all time high of 44 percent of world production in 1956 to 29 percent in 1959. This decline has been due largely to a drop in well drilling and to competition from foreign sources.

1/ Published as Bulletin 27 by Division of Geology, S. C. State Development Board, 1962

2/ Project Geologist, Division of Geology, S. C. State Development Board

SPECTRO-GEOCHEMICAL EXPLORATION NEAR DONALDS, S. C. —
A TEST

By
C. Q. Brown^{1/}

INTRODUCTION

Possibly ore deposits lie undiscovered in South Carolina because they cannot be detected by conventional geologic field methods. Recognizing this fact, and realizing the economic potential which the detection of unknown deposits may yield to South Carolina, more specialized techniques were considered. To qualify, a technique had to be rapid, inexpensive and possess a high degree of sensitivity and accuracy.

If the average content of the various metallic elements present in an area is known, then any deviation from this average value is anomalous. A positive anomaly (a value greater than the average) may represent an ore body. At least it may lead an investigator to an area where more intensive exploration may be most fruitful.

A practical way of establishing this average value, or background, for several elements as well as detecting anomalous values was considered. The emission spectrograph was selected as the analytical tool which would best yield the data desired. Reasons why it was selected were several. (1) Extremely small concentrations are detectable with the instrument. (2) The exposure is on a glass plate which can be easily stored as a permanent record. (3) Many elements are detected. Unusual lines not common to all samples would be observed by the analyst and identified, which gives rise to the next advantage. (4) The same plates could be used if interest in other elements should arise later, which would eliminate the need for collecting additional samples and/or the analysis of the samples. (5) And probably the greatest advantage is that elemental spectra are specific and unique, thereby affording positive identification. This is an important consideration for it is known that many metal ions interfere in many of the wet chemical methods. That is, an analysis for one element may actually be sensitive to the presence of several other different elements. Because these elements interfere with the analysis the value obtained is that of the sum of the several elements rather than that of the one element in question.

After determining the analytical method to be used the next questions to arise were (1) how shall we sample the areas of interest?, and (2) will potential ore deposits be detected? To test the entire procedure, an area near Donalds, S. C., known by H. S. Johnson, Jr., State Geologist, to have sulfide mineralization within it, was selected. The author and Mr.

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Johnson collected the samples, but the location of the deposit was not divulged to the author. The analytical data were interpreted by the author without knowledge of the deposit locality. Results are reported here.

FIELD PROCEDURES

After the methods of Overstreet and Bell (1960), 16 samples of alluvium were collected from a 42 sq. mi. area in the northernmost part of Abbeville County near the town of Donalds (Figure 1). The sample sites indicated in Figure 2 were restricted to the channel or flood plain of streams with one or two sq. mi. drainage basins. This was done to control closely the source of the sediments. The most argillaceous sediments obtainable were always selected, based upon the premise that the elements in question were adsorbed on the clay mineral surfaces.

All samples were placed in labeled plastic freezer bags which were then placed in paper bags bearing a similar designation.

Collection of water samples for analysis from these streams was rejected because of the greater time involved in collecting water samples, the bulky nature of the samples, and increased costs of transportation as well as the cost of the sample containers themselves.

LABORATORY PROCEDURES

All samples were dried in aluminum dishes, disaggregated in an agate mortar, and sieved through a 200 mesh stainless steel screen. A portion of each minus 200 mesh fraction was analyzed using a B & L medium quartz spectrograph. Semiquantitative techniques were used for Be, Cu, Sn, and Zn after the methods of Oda et al. (USGS Open File Report) slightly modified. In this procedure a standard plate is made using mixtures of known concentrations of the elements to be determined. Care was taken to have the matrix similar in composition to that of the alluvium being analyzed. Quartz and kaolinite free of the sought-after elements were mixed in proportions to produce an X-ray diffraction pattern similar to that

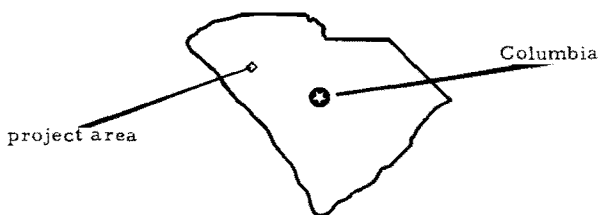


Fig. 1. Index map showing project area.

of the alluvium. To this mechanical mixture, spectrographically pure oxides of Be, Cu, Sn and Zn were added in measured proportions. A series of concentrations of Be, Cu, Sn and Zn from 10,000 ppm to 1 ppm was prepared in a geometric series whose common factor is the cube root of 10. The components were mixed for several hours in an agate mortar to insure homogeneity.

Like Oda et al., spectrographically pure preformed electrodes were used. To 10 mg of the sample, 20 mg of pure graphite was added and mixed with a toothpick which was then discarded. The mixture was then placed into the cavity of the electrode. A nylon cylinder was made to hold the electrode while the cavity was being filled, and a nylon piston was used to pack the contents tightly. Spectrographically pure calcium carbonate and graphite were mixed in a 1:5 ratio and 20 mg added to the electrode and packed with the nylon piston.

According to Oda, this mixture minimized differences in geologic materials and will therefore allow the standards to be used on a wider range of materials than previous methods. In addition the mixture is reported to give a smoother burning arc and minimize sample loss during arcing. It was learned in this study that even greater stability was afforded our samples by adding a drop of a saturated sugar-ethanol solution to the contents of each electrode after packing and allowing to evaporate at a low temperature in a drying oven.

Experimentation resulted in the adoption of Ilford Q3 high speed spectrographic plates because of sensitivity and clarity of the results. The rotating sector was set to permit a three minute exposure at 12 amps with a 10 micron slit setting. The plates were developed for two minutes in Kodak D-19, fixed in Kodak SB-5, dried, and compared to the standard plate on a Jarrell-Ash model 200 comparator-photometer.

RESULTS

Samples collected from the sites shown in Figure 2 were analyzed by the semiquantitative spectrographic methods described for Be, Cu, Sn and Zn. Of these elements, copper was the only one detected and it was present in all samples. Table 1 shows the copper concentration in each sample expressed in parts per million as interpreted from the spectrographic plate.

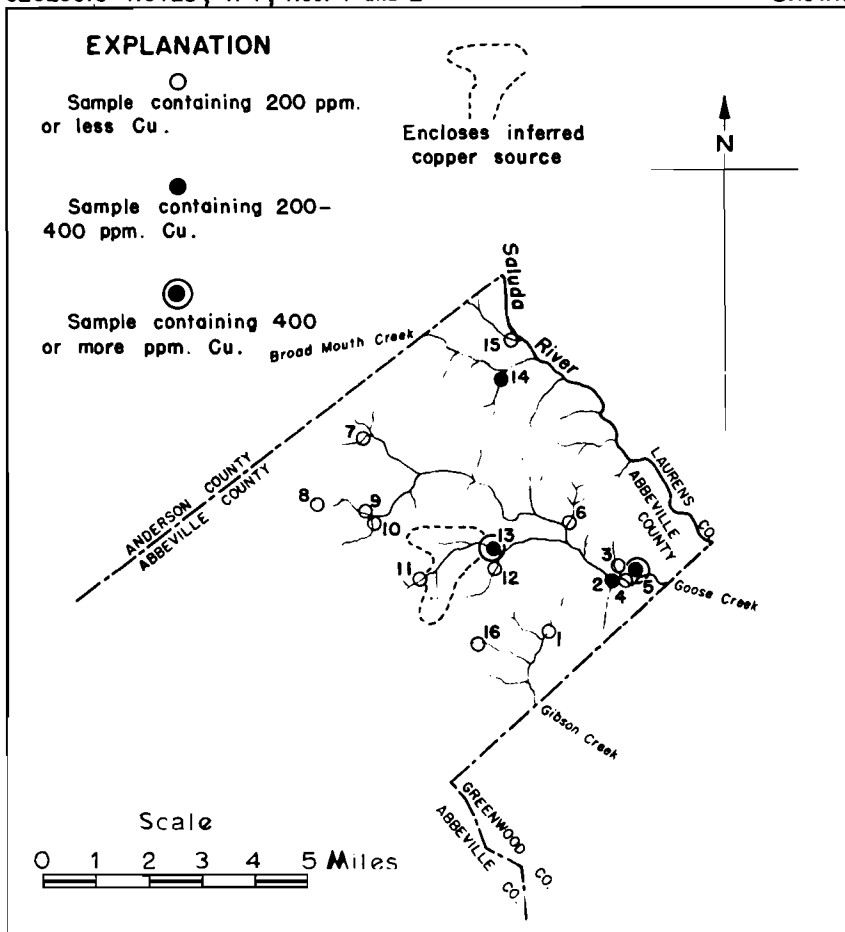


Fig. 2. Copper concentrations of alluvium at 16 sites in the Donalds area, South Carolina, as determined by semiquantitative spectrographic techniques.

Table 1. -- Copper concentration in parts per million

<u>Sample Number</u>	<u>Copper Concentration (ppm)</u>
1	1000*
2	200-400
3	200
4	200
5	400
6	100-200
7	200
8	100-200
9	100-200
10	200
11	200
12	200
13	400
14	200-400
15	100-200
16	200

*Confirmatory analysis shows this value is too high and should be about 200 ppm.

Of these values, number 1 was suspect because of its unusually high concentration. It proved to be inaccurate and actually is nearer 200 ppm. Other checks proved the analyses were within the expected limits of accuracy which is dependent upon the standard plate.

Values shown in Table 1 are shown symbolically at the corresponding sites on the map in Figure 2. It is obvious that most alluvium samples contained less than 200 ppm of copper. Only four samples contained more than this amount, and three of them are on the same drainage net. The two highest values are 400 ppm copper at sites 5 and 13. These highs along with the lesser high at site 2 probably emanate from the same source. The tributary which joins the high copper reach has no significant copper concentrations. Neither do any samples up stream from site 13. One is immediately led to the inference that the source of these anomalous values lies in the area of the drainage basin upstream from site 13 and downstream from site 11. The possible source should, as a reasonable interpretation of these data, fall within the dotted zone indicated on Figure 2.

An area of possible significance is indicated upstream from site 14. It lies north-northeast of the major high, and considering that the regional structure in the area shows northerly to northeasterly trends these areas may be related to the same general source.

It is worthy of note that the sample design in this pilot study shows that flood plain samples yield essentially the same values as samples from within the channel. Also indicated is the advisability of sampling trunk stream sediment in addition to the small basin sediment. Apparently the trunk streams reflect tributary influx in their trace element content.

CONCLUSIONS

Without knowledge of the location of the known sulfide deposit in this area the above conclusions seemed most probable and logical. This report was then submitted to Mr. Johnson who knew the location of the sulfide deposit. Its location is shown in Figure 3. As will be noted it falls within the area selected as most probable.

The successful completion of this experiment yielded results which suggest that this technique may be useful in locating copper and related deposits. Results of similar experiments for the other elements Be, Sn, and Zn would be extremely interesting but as yet no plans are underway to do this.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. Frederick Lindstrom, analytical chemist of the Clemson College Department of Chemistry and Geology, for his unselfish cooperation and advice during this study; Mr. B. G. Stephens, graduate student under Dr. Lindstrom, who prepared the standard plate and analyzed the alluvium; and Mr. H. S. Johnson, Jr., State Geologist of S. C. who financed the project, assisted the author in the field, and criticized the manuscript.

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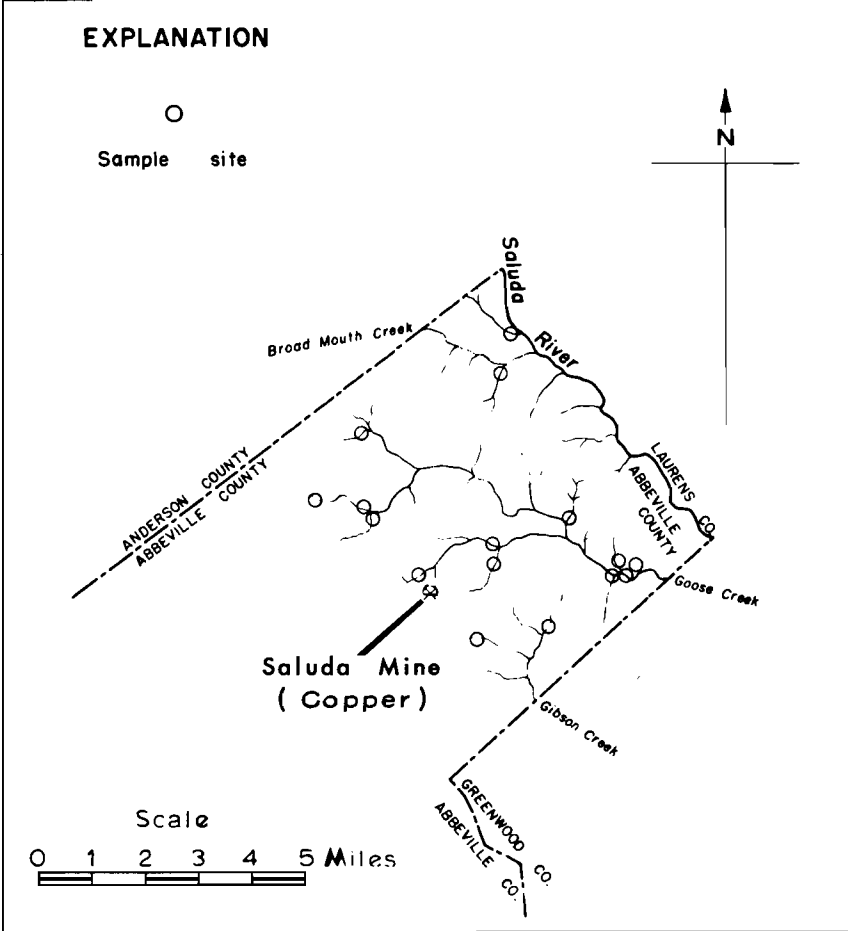


Fig. 3 Location of known sulfide deposit. Donalds area, South Carolina.

LIMESTONE RESOURCES OF THE COASTAL PLAIN OF SOUTH CAROLINA

By

S. D. Heron, Jr.^{1/}

ABSTRACT

There are five Coastal Plain geologic formations in South Carolina that contain appreciable quantities of calcium carbonate. Of these, the Santee Limestone of Eocene age has the highest potentiality as a source of high grade calcium carbonate suitable for industrial and chemical uses.

The results of holes drilled into the Santee Limestone by the Division of Geology, South Carolina State Development Board, and by many private concerns are given. Two hundred and fifty-two chemical analyses are presented, mostly of the Santee Limestone, but including the other carbonate-bearing formations.

The Santee Limestone occurs near the surface or at shallow depths in parts of eight South Carolina counties. The calcium carbonate content appears to be highest near the top of the formation. Near its westward extent and near the bottom of the formation the calcium carbonate content apparently decreases as the glauconite content increases.

Other calcium carbonate-bearing formations include the Peedee Formation (Cretaceous), the Cooper Marl (Eocene and Oligocene), the Duplin Formation (Miocene), and the Waccamaw Formation (Pliocene). The Cooper Marl's normal carbonate content is less than 60 percent, but it may be as high as 88 percent or as low as 24 percent. The Cooper Marl is not a marl, but a limestone (calclutite or calcarenite, often sandy). The Peedee, Duplin, and Waccamaw formations locally may contain up to 90 percent calcium carbonate, but generally these formations are too variable in quality to have high potential as a source of high grade limestone.

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