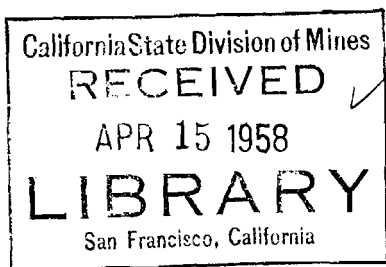


MONTHLY BULLETIN

DECEMBER 1957



MINERAL INDUSTRIES LABORATORY
1430 DEVINE STREET
COLUMBIA, SOUTH CAROLINA

DIVISION OF GEOLOGY
STATE DEVELOPMENT BOARD

DEPARTMENT OF GEOLOGY
UNIVERSITY OF SOUTH CAROLINA

MINERAL INDUSTRIES LABORATORY
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ROCK AND MINERAL COLLECTIONS
FOR THE PUBLIC SCHOOLS OF SOUTH CAROLINA

The Mineral Industries Laboratory plans to place 100 rock and mineral collections in the public schools of South Carolina this year. The collections are small and by no means complete. It is our hope, however, that each collection will serve as a nucleus for a continually growing collection.

At the present time thirty-five collections have been assembled, and many of these have already been placed in schools. Distribution is made in the order in which requests are received. Each school is urged to purchase one or more mineralogy books of the type designed for the collector.

The rock and mineral specimens are from South Carolina where possible. A few specimens from other states are included, however. A typical set is made up of the following:

Granite	Muscovite
Marble	Calcite
Amphibolite	Pyrite
Olivine	Vermiculite
Manganese ore	Fossil wood

The number of specimens in each set will be increased as more material becomes available.

REFERENCE COLLECTION

A reference collection of South Carolina rocks is housed in the Laboratory's quarters. This collection is keyed to a geological map of the State and at present contains sixty-five specimens. This material is from Oconee, Laurens, Cherokee, Union, and Lexington Counties. Most of the specimens were collected in connection with field studies conducted by the State Development Board. Petrographic thin sections have been prepared for thirty-six of these specimens.

CONTACT METAMORPHISM IN LAURENS COUNTY, SOUTH CAROLINA

BY

JAMES W. CLARKE
UNIVERSITY OF SOUTH CAROLINA

A small abandoned marble quarry in the western part of Laurens County, South Carolina, affords an excellent example of contact metamorphism produced by intrusion of granite into marble. A layer of diopside has developed next to the marble, and a layer of scapolite next to the granite. Clusters of actinolite and a little molybdenite occur where pegmatite invades the marble.

The quarry is about ten miles southwest of Laurens and is known locally as Master's Kiln. The marble is part of a belt that crops out in four places over a distance of nine miles. The trend is exactly on line with the Gaffney marble, which crops out at Gaffney, South Carolina, forty-five miles to the northeast.

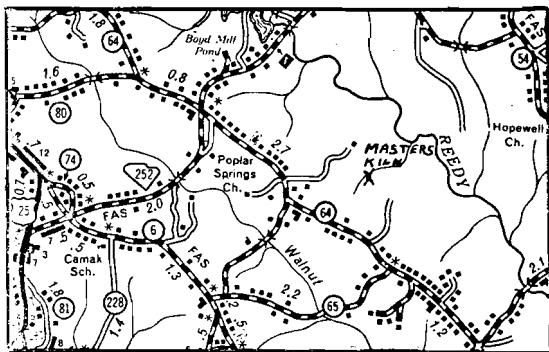
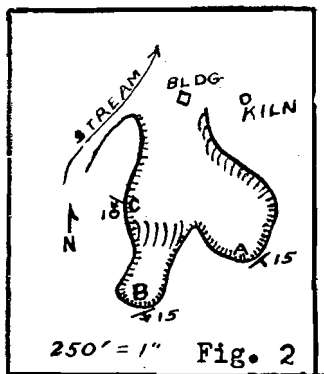


Fig. 1. Location of Master's Kiln, which is about nine miles south-west of Laurens.

Description of the Deposit

The quarry is about 80 feet wide and 100 feet long, extending back into a gently sloping hillside. The height of the quarry face ranges up to 20 feet. Operation ceased some 50 years ago, and mass wastage has obscured much of the bedrock that was once exposed. Fig. 2 shows the present configuration of the quarry. Marble crops out at three places; these are labeled A, B, and C. The material at A and B are part of the same layer, whereas that at C appears to be a separate layer about 25 feet below that of A and B.

The section at A consists of about 15 feet of muscovite quartzite underlain by a minimum of 6 feet of marble. The base is covered by debris. The muscovite quartzite is composed largely of quartz; muscovite makes up 5 to 10 percent. The average grain size is 0.5mm., and the grain boundaries are irregular to sutured and interlocking. The marble is generally white but contains darker lamellae in which phlogopite and tremolite are concentrated. This structure is made more prominent by weathering. Calcite is the principal mineral, although some dolomite is present. The grains are equant to flattened and are 2 to 3 mm. in diameter. The foliation and



bedding are parallel to one another. These structures are in turn parallel to the foliation in the overlying quartzite and to the contact between the quartzite and the marble.

The section at B consists of a minimum of 4 feet of marble (bottom not exposed), which is overlain by pegmatite, actinolite rock, and quartzite.

The rock at C is strongly deformed, and lenses of pegmatite occur as boudins within the marble. The bedding in the marble appears to flow around the boudins in some places and to be truncated by them in others. In cross-section the boudins range from 1 inch by 10 inches to 3 feet by 10 feet. There is also a layer of calcite marble 3 feet thick exposed here.

A loose fragment of dolomite found in the quarry gives a strong odor when crushed with a hammer.

Sloan (1908, p. 232) gives the following analysis for material from this quarry:

CaCO ₃	63.56 percent
MgCO ₃	32.01 percent

Contact Metamorphism

The marble is invaded by a biotite granite, and a well-defined contact zone has developed in several places. This zone consists of two layers, each of which ranges from 1 to 5 cm. in thickness. Pale lavender, vitreous scapolite lies next to the granite, and green diopside next to the marble. Actinolite commonly accompanies the diopside.

Biotite flakes in the granite are aggregated in small tabular masses 2 to 3 mm. long; these have a preferred orientation, which gives the rock a foliation. This foliation is in turn parallel to a weak layering that is due to the concentration of these masses along planes. Further, both these structures are parallel to the contact with the marble.

Petrography. The granite is composed of about 70 percent microcline, 25 percent quartz,

and 5 percent biotite and chlorite. A small amount of sodic plagioclase, muscovite, apatite, and zircon is also present. The fabric is allotriomorphic granular, and the grain size is 0.5 to 1.0 mm. Microcline exhibits well-developed grid twinning. Some myrmekite is present. The grains of quartz show some strain but are nowhere shattered. Biotite is pleochroic from light brown to opaque. Some flakes are unaltered whereas others have been chloritized. Chlorite occurs as isolated flakes and as a replacement of biotite.

The scapolite is uniaxial negative and exhibits perfect 110 cleavage. It is pale lavender in hand specimen and colorless in thin section. N_o is 1.585, which corresponds to Meionite⁶⁵. This is the variety mizzonite, which is the commonest of the scapolite group. The average grain size is 2 mm. The grains are equant and anhedral; they produce a mosaic fabric.

The diopside is light green in hand specimen and colorless in thin section. Z:C is 40°, and birefringence is 0.028. The grains are equant and anhedral to subhedral; the average size is 1 mm.

Actinolite crystals are acicular to columnar and up to 10 cm. in length.

Origin of the Contact Zone

The position of the scapolite and diopside between the granite and marble leaves no doubt but that these minerals are a product of the reaction between the silicate and the carbonate rocks. It is not as clear, however, whether the process was pneumatolytic attendant on emplacement of the granite or whether it was a later hydrothermal effect accompanying a regional metamorphism.

There are many examples of the development of scapolite by pneumatolysis in contact zones; this arises as a direct result of intrusion of an igneous rock into carbonate rock. Stewart (1941, p. 511) attributes mizzonite at Manchester, New Hampshire, to a local contact effect of granite

on calcareous sandstone. Buddington (1939, p. 61, 88, 168) describes examples in the Adirondacks where scapolite has developed as a result of intrusion of gabbro, svenite, and granite into limestone.

Scapolite also develops during regional metamorphism. Edwards (1954, p. 1-33) states that in Queensland scapolitization appears to be the result of soda metasomatism of calcareous shales contemporaneous with regional metamorphism. Weiss (1947, p. 821-832) describes a scapolite-diopside rock that is associated in space with gabbro intrusive into limestone. Development of the scapolite-diopside rock, however, is regarded as a product of later regional deformation accompanied by hydrothermal activity. Buddington (1939, p. 260-267) attributes development of scapolite in metagabbro in part to regional metamorphism and in part to thermal solutions from younger granitic magma.

An hypothesis of origin for the contact zone in Laurens County, South Carolina, must take into account the following data:

(1) The diopside lies next to the marble and the scapolite next to the granite. Veins of scapolite cut across the diopside in some places.

(2) The foliation in the granite is parallel to the contact with the marble.

(3) Chlorite is present in the granite as individual flakes and as a replacement of biotite. The diopside of the contact zone is not altered.

Conclusions. The granite has been subjected to chloritization, whereas the diopside is fresh. This indicates that there was a hydrothermal activity that was confined to the granite; such an activity must have been deuteric. If, then, the scapolite and diopside had developed later than the time of intrusion, the conditions necessary to develop diopside would have destroyed the chlorite. Therefore the diopside and scapolite must have developed at the time of intrusion.

If the deuteric activity was the last

hypogene activity in the area, then the foliation of the granite must be primary; it must be a flow structure that developed during the process of emplacement.

That the diopside lies next to the marble suggests that it developed before the scapolite. The diopside probably replaced the calcite of the marble in the initial stage. Scapolite may then have developed somewhat later as a reaction zone between the granite and the diopside. This stage could be due to a lower temperature and/or a change in vapor pressure. It probably would have to take place in the solid state by action of thermal solutions. On the other hand, the scapolite and diopside may have developed simultaneously at the time of intrusion; diffusion of silica from the granite into the marble would have produced the diopside, and calcium from the marble into the granite would have produced the scapolite.

References

- Euddington, A. F., 1939, Adirondack igneous rocks and their metamorphism: Geol. Soc. Amer. Mem. 7.
- Edwards, A. B., 1954, Scapolitization in the Cloncurry district of north-west Queensland: Geol. Soc. Australia, J., v. 1, p. 1-33.
- Sloan, Earl, 1908, Catalogue of Mineral Localities of South Carolina: Ser. IV, no. 2, S. C. Geol. Survey.
- Stewart, Glen W., 1941, Idocrase and scapolite from Manchester, New Hampshire: Amer Mineral., v. 26, p. 509-511.
- Weiss, Judith, 1947, Origin of a scapolite metagabbro in Bucks County, Pennsylvania: Bull. Geol. Soc. Amer., v. 58, p. 821-832.