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GEOLOGIC MAPPING IN SOUTH CAROLINA

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South Carolina is one of the very few states of the Union that does not have a good geologic map of the state as a whole. Yet South Carolina was second among the states to organize a State Geological Survey (North Carolina was first in 1823; South Carolina was second in 1824). Naturally the question arises: Why not a geologic map of the entire state?

It is not because this state was slow in starting, nor simply because effort was not made toward this end in early times as well as in recent times. It is not because the geologic formations are not varied; the types of rock formations beneath the surface of South Carolina are of many strikingly different kinds. They include granite and lava, marbles and schists (mica rock), as well as soft clay shales and crumbly sandstones. It is not because the region is inaccessable, because the state is blessed with a network of good roads and highways.

In part the answer to the question probably is that so much of the surface of South Carolina is blanketed by a thick layer of soil. This material is 5 to 50 feet thick in most places, and it obscures the hard rock, which lies beneath it. This soil has been derived from the decay of the rocks (millions of years). The upper portions of the harder rocks have decomposed into soft material that little resembles the original rock. The name "saprolite" is given to this decomposed rock. The widespread occurrence of saprolite has certainly hindered detailed geologic mapping.

Certain types of rocks, of course, yield characteristic soils which, if present where they formed, aid the geologist to infer the underlying type of rock. But again an added difficulty presents itself in that over much of South Carolina the soils that now blanket the surface have been transported to their present resting place from some distant source of origin.

Still another hinderance in geologic mapping in the northwestern half of South Carolina is that the rocks of this area are devoid of fossils which, if present, would indicate the geologic age of the rocks. Northwest of the Fall Zone, which passes through Augusta, Columbia, and Chesterfield, the rocks beneath the soil are granite and lava, gneiss and schist, quartzite and marble. Collectively these rocks are known as the "metamorphic complex." Even though some of these rocks were once typical sediments, and as such no doubt contained many fossils, the "mountain-making processes" to which they have been subjected have destroyed even the faintest traces of fossils. Rocks that were once shale have been so greatly altered that they are now essentially a mass of mica flakes (mica schist).

Perhaps another factor is that South Carolina is not a large mineral producing state, and hence the demand for geologic maps is not as strong as in states where oil and metals are present within the rocks.

Relatively young sedimentary rocks that contain Cretaceous and Tertiary fossils are present eastward from the Fall Zone; this part of the state has been mapped geologically with a considerable degree of satisfaction. The area is described in United States Geological Survey Bulletin No. 867, "Geology of the Coastal Plain of South Carolina" by C. Wythe Cooke.

So much of the geologic mapping in South Carolina, both east and west of the Fall Zone, is dependent on exposures in railroad and highway cuts. Indeed these are a great aid. One may examine a road cut that shows an exposure of rock (generally saprolite) 100 or 200 feet long and perhaps 5 to 15 feet high. Surrounding it on all sides, however, are cotton and corn fields or patches of woodland, all blanketed deeply by soil. And the next road cut may be one or two or more miles away.

Exposures of rock also show along many creek and river channels. But again so many of the creek and river valleys in central and eastern South Carolina contain an alluvial fill, or else swamp lands, and perhaps the majority show no rock exposures. As one approaches the mountain area in northwestern South Carolina, rock exposures in creek beds become more and more plentiful, and also good exposures may be found on steep hill slopes. But the rocks in this part of the state are part of the metamorphic complex. This metamorphic complex, as well as the younger rocks of eastern South Carolina, has no "key bed" which can be traced continuously across the state. This adds to the difficulty of determining the relationship of one body of rock to another.

Although these conditions increase the

difficulty of geologic mapping, they do not mean that such mapping can not be done. They only increase enormously the length of time required to work out the geologic pattern of the exposures of the different kinds of rocks. With the annual yield from the mineral industry of South Carolina now on the order of $20,000,000, it would seem probable that further effort will be made to perfect such geologic maps as are in existance, because geologic maps are an aid in the search for mineral deposits.

A Normal Fault in Cherokee County, South Carolina

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A normal fault of large displacement is exposed in a road cut about three miles north of Blacksburg in Cherokee County, South Carolina. The location is indicated on Fig. 1. The strike of the fault is N 65° W and the dip is 60° SW.

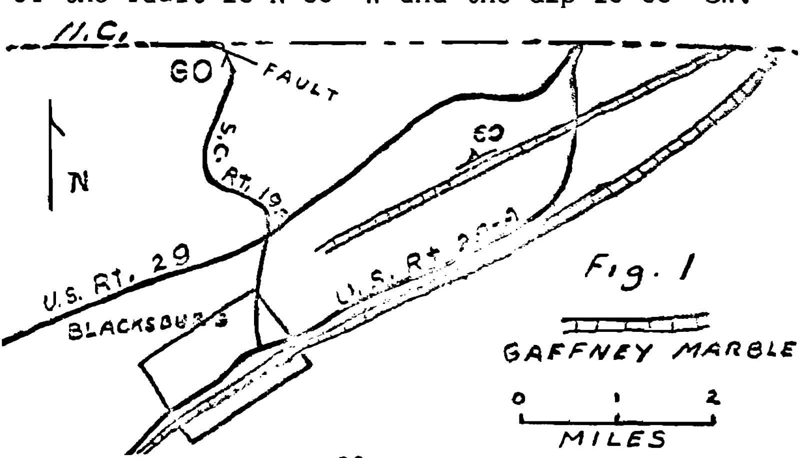

Fig. 1

The foot wall is dark gray, fine-grained dolomite marble; it appears to be Gaffney marble, which occurs in a belt about two miles to the south. The marble at the fault is intensely contorted and pervasively shattered. It is typical of rock close to a fault. Fresh rock extends to within about two feet of the surface; there is no zone of rotten rock between the soil cover and the fresh rock.

The hanging wall is an intensely sheared feldspathic rock, which is in part quartzite. It is deeply weathered, and therefore its composition and fabric are not determinable with any confidence.

Both the hanging wall and the foot wall exhibit a large amount of drag. This is illustrated in Fig. 2. The drag indicates that the

Fig. 2

hanging wall was displaced relatively downward and the foot wall relatively upward. Therefore, the fault appears to be normal.

According to the concept of the strain ellipsoid, tension fractures on this fault would be vertical if the fault is normal. The orientation of the strain ellipsoid is also indicated in Fig. 2. Although fractures of all orientations are present, those that are vertical predominate and thus support the interpretation that this is a normal fault.

The marble at this locality is petrographically the same as the Gaffney marble, which crops out in a band about two miles to the south. Only a normal fault can have brought Gaffney marble into the position it occupies along this fault. The calculated net slip along the fault is 11500 feet.

Since the fault is normal and the dip is 60°, the direction of greatest stress must have been vertical. This is based on the principle that for a normal fault the greatest principal stress axis lies at 30° from the fault plane and in the same direction as that in which the fault dips (Billings, 1954, p. 175). This fault is therefore compatible with the idea of a vertically directed stress that has resulted in an extension of the crust at this point.

The most probable time for this faulting to have occurred is the Middle Triassic. This is an Epoch during which high angle normal faulting took place extensively in the eastern part of North America. A "basin and range" topography of fault block mountains developed. The ranges have long since been eroded away, but the lower portions of the basin deposits are preserved in a belt that extends from eastern Canada to South Carolina. The suggestion is made that the fault described here is one of these Triassic faults. It may have been a border fault of a basin and range structure.

References

Billings, Marland P., 1954, Structural geology: Prentice-Hall, Inc.