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Distribution of barium in heavy-mineral-concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina

by

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This map is a product of a geochemical survey of the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina, begun in 1978 that is part of a multidisciplinary study to determine the mineral potential of the area. Correlative studies are the completion of a geologic map of the quadrangle and aeromagnetic, aeroradiation, and gravity surveys (Wilson and Daniels, 1980).

The Charlotte quadrangle provides a nearly complete section across the Piedmont: its northwestern corner is in the Blue Ridge, its southwestern corner is over a basin of Triassic sedimentary rocks only a few miles from the Coastal Plain. All of the quadrangle except the southeastern corner is underlain by crystalline rocks of Precambrian and Paleozoic age metamorphosed to greenschist facies in the Slate Belt and to amphibolite facies farther west. Both premetamorphic and post metamorphic intrusive rocks are present. The rocks have been weathered to rather permeable saprolite reaching depths of 200 feet (60 meters) in the Inner Piedmont. Because of the thorough leaching, most soils are acidic.

In making the geochemical survey, we took samples of sediment within a few miles of the heads of major streams and of the tributaries of these streams. By keeping the size of the drainage basin small, we usually reduce the variety of rocks that contribute detritus to the sample, thus facilitating a correlation between sample composition and the geology of the drainage basin. At the same time, we reduce the chance that a localized cloudburst has buried the sample site with sediment from a small part of the drainage basin, thus reducing the validity of the sample as an approximate composite of the rocks of the whole basin. Nevertheless, the samples are not all geologically and geochemically identical. For instance, at some sites in the mountainous area in the northwestern part of the quadrangle, many clasts in the stream sediment are several yards (meters) across and collection of fine detritus suitable for a sample required a 1/2-hour search. Not far to the east, the finer sediment was abundant.

In the Piedmont, the usual procedure was to sample rather coarse sediment--pebble- or cobble-containing gravel--and to dig deeply to the bottom of the alluvial bed or to a compact clay layer. The coarsest particles in the gravel--boulders, cobbles, and coarse pebbles--were excluded from the sample, which then consisted of about 10 lbs (4 1/2 kg) of clay to granule or fine gravel sized material. The heavy minerals were extracted from this material at the sample site with a gold pan. Samples taken in the same manner on earlier projects were also used to get better coverage of the Inner Piedmont than we would have had otherwise.

The quartz, feldspar, and other minerals of specific gravity below 2.89 were removed from the pan concentrate by floating them with bromoform. The cleaned heavy-mineral concentrate was then separated magnetically into four fractions. The first was removed with a hand magnet, or an equivalent instrument, and not studied. The remaining concentrate was passed through a Frantz Isodynamic Separator at successive current settings of 0.5 ampere and 1 ampere with 15° side slope and 25° forward slope. The material removed from the sample at 0.5 ampere and 1 ampere will be referred to as the M.5 and M1 concentrates or fractions, respectively, and the nonmagnetic material at 1 ampere will be referred to as the NM concentrate or fraction. Most common ore minerals occur mainly in the NM fraction, making them and their contained metals easier to find and to identify. The NM fraction also contains zircon, sillimanite, kyanite, spinel, apatite, sphene, and the TiO_2 minerals. It is generally the most useful fraction. The M1 fraction is largely monazite in the Inner Piedmont. Because of interferences caused by cerium during spectrographic analysis and the high content of radiogenic lead in the monazite, it was necessary to remove it from the bulk concentrates to improve the quality of analyses and to permit recognition of lead possibly derived from mineral deposits in the NM and M.5 fraction. East of the Inner Piedmont the M1 concentrate contained very abundant epidote, clinozoisite, mixed mineral grains, including ilmenite partly converted to leucoxene, staurolite, and locally abundant spinel. The M.5 concentrate contains abundant garnet in the Inner Piedmont, dark ferromagnesian minerals in the Charlotte Belt, and ilmenite in most provinces.

Mineral proportions in each magnetic fraction were estimated using a binocular microscope. Minerals of special interest were identified optically or by X-ray diffraction. The time available did not permit a thorough mineralogic study of all concentrates. Metal-rich minerals were sought in all samples that were shown by the spectrograph to contain metal in unusually high concentrations. After establishing the presence of a metal-rich mineral, the variations in metal contents among the concentrates were inferred to indicate variations in the content of metalliferous minerals.

Each fraction was analyzed semiquantitatively for 31 elements using a six-step, D.C. arc, optical-emission spectrographic method (Grimes and Marranzino, 1968). The semiquantitative spectrographic values are reported as one of six steps per order of magnitude (1, 0.7, 0.5, 0.3, 0.2, 0.15, and multiples of 10 of these members) and the values are the approximate geometric midpoints of the concentration ranges. The precision of the method has been shown to be within one adjoining reporting interval on each side of the reported values 83 percent of the time and within two adjoining intervals on each side of the reported value 96 percent of the time (Motooka and Grimes, 1976).

All analytical data for samples other than concentrates are taken from a report by Ferguson (1979). Such sample material is referred to as "silt" in this report.

Most concentrate samples were taken by J. W. Whitlow and W. R. Griffitts. Lesser numbers were taken by D. F. Siems, A. L. Meier, and K. A. Duttweiler. The mineral analyses were made by W. R. Griffitts, K. A. Duttweiler, J. W. Whitlow, and C. L. Bigelow, with special mineral determinations by Theodore Botinelly. All spectrographic analyses were made by D. F. Siems, in part from plates prepared by K. A. Duttweiler. Steve McDanal and Christine McDougal were responsible for entering and editing the spectrographic data in the RASS computer file. Many maps were subsequently plotted from this file by H. V. Alminas, L. O. Wilch, and J. D. Hoffman. Most mineral distribution maps were plotted by K. A. Duttweiler.

Barite has long been known to occur near Kings Creek; mining of barite began there in the 19th century. It has also been found in eastern and central Cabarrus County (Wilson and McKenzie, 1978). The barite deposits at Kings Creek are near the contact between Battleground schist to the northwest and the Bessemer granite to the southeast (Keith and Sterrett, 1931). Other barite deposits are near this contact and as far as 15 miles to the northeast and 5 miles to the west of Kings Creek. The barite at Kings Creek contains a little galena. The deposits in Cabarrus County are in veins in which the barite is associated with gold, scheelite, and an assortment of copper minerals. The veins have not been mined for barite, although they have been mined for the associated metalliferous minerals.

Industrially, the heavy-mineral barite is more in demand than barium, so heavy-mineral concentrates are most useful in exploration. The lower limit of spectrographic determination for Ba is 50 ppm. Our map shows both the distribution of barium in pan concentrates--which reflects the distribution of barite or of an unidentified barium mineral--and the distribution of the minus-100-mesh part of stream sediment, which probably mainly reflects the barium content of clays, as well as known occurrences of barite.

Three features are prominent on the barium map. The most conspicuous is a belt of barium-rich silts that crosses the map diagonally, between points near the northeastern and southwestern corners of the quadrangle. This belt contains, or is near, barium-rich concentrates only near its southwestern end; it seems unrelated to barite mineralization. The less conspicuous features are groups of barium-rich concentrate sites. One of these includes the Kings Creek barite district. The geochemical data derived from concentrates indicate that the barite mineralization extends many miles northeast of the northernmost reported mine along the Battleground schist contact--The Lawton mine, east of Crowder's Mountain. The data also show that barite is not restricted to that contact west of Kings Creek near and west of Cherokee Falls.

The other group of barium-rich concentrate samples sites is along the eastern edge of the Charlotte Belt, an area that includes the occurrences of barite in metalliferous veins. Here, as near Kings Creek, the geochemical data indicate that the barite mineralization occurs over a larger area than the mineral occurrences which are reported in the literature.

References

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