Description, composition, and tenor of unconsolidated sediments in monazite-bearing tributaries to the Broad River in the western Piedmont of South Carolina.

by

Theobald, P. K.

U. S. Geological Survey.

Reports. Open file series[redacted]

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Description, composition, and tenor of unconsolidated sediments in monazite-bearing tributaries to the Broad River in the western Piedmont of South Carolina and North Carolina

by

Paul K. Theobald, Jr.

1962

This report concerns work done on behalf of the Division of Raw Materials of the U.S. Atomic Energy Commission

Contents

Illustrations--long list

Tables

(Numbers follow in sequence from report of N. P. Cuppels, 1962.)

Description, composition, and tenor of unconsolidated sediments in monazite-bearing tributaries to the Broad River in the western Piedmont of South Carolina and North Carolina

by

Paul K. Theobald, Jr.

Introduction

The accompanying 10 tables were prepared during 1953-54 to assist in the appraisal of fluviatile monazite placers in the basin of the Broad River, South Carolina and North Carolina. Principal results have been summarized (Overstreet, Theobald, and Whitlow, 1959, p. 709-714). Details of the exploratory drilling of four monazite placers in this area were released in 1953 and 1954 (Griffith and Overstreet, 1953a, p. 3-30; 1953b, p. 3-17; 1953c, p. 3-27; Hansen and Cuppels, 1954, p. 3-27).

The samples described were panned by the writer, his co-workers, and assistants between July and November 1951 and April and November 1952. Co-workers were J. W. Whitlow, W. C. Overstreet, A. M. White, N. P. Cuppels, and D. W. Caldwell. Assistants were J. W. Keeler in 1951 and B. F. Spradlin, P. E. Myers, and J. W. Wissert, Jr., in 1952. The methods used to collect the samples and pan the concentrates have been described in detail (Theobald, 1957, p. 3-6).

The mineralogical analyses recorded in the tables were made in 1952-53 by M. N. Girhard, H. B. Groom, Jr., R. P. Marquiss, C. J. Spengler, Jerome Stone, and E. J. Young in the laboratories of the U. S. Geological Survey. Methods used to prepare the concentrates, identify the minerals, and transpose expressions of abundance from percentage by numerical frequency to percentage by weight of the concentrate have been summarized by Overstreet, Theobald, Whitlow, and Stone (1956, p. 692-694). Aspects of new methods of sample splitting evolved during the work were discussed by Richard Kellagher and F. J. Flanagan (1956, p. 213-221). A nomogram devised to obtain percent composition by weight from the grain counts of minerals was reviewed by R. M. Berman (1953, p. 120-123).

The field and laboratory work was sponsored by the Division of Raw Materials of the U.S. Atomic Energy Commission.

Location of the samples

Samples from the drainage basins of southern tributaries to the Broad River are described in 3 tables (tables 26-28) numbered in sequence after the tables presented by N. P. Cuppels.[1]

---

[1] Cuppels, N. P., 1962, Description, composition, and tenor of unconsolidated sediments in monazite-bearing tributaries to the Enoree, Tyger, and Pacolet Rivers in the western Piedmont of South Carolina: U.S. Geol. Survey Open-file Rept., 7 p., 2 figs., 10 tables.

Samples from the drainage basins of northern tributaries to the Broad River are described in tables 29-35.

The location of the area to which each table refers is shown on the index to areas used for placer appraisal between the Savannah and Catawba Rivers, South Carolina and North Carolina (fig. 1).

Locations of individual samples are given by the sample numbers on figure 2 which shows distribution of samples in the Savannah River-Catawba River District, South Carolina and North Carolina. At many localities several samples were taken.

Description of the tables

The tables give a systematic presentation of field and laboratory data about the samples.

Block, station number, and depth of sample below surface of flood plain

The block and station number identify the location of each sample. Blocks are identified by letter and stations by number which do not repeat in a given map area.

"Depth of sample below the surface of flood plain (feet)" is the measure of the vertical position of a sample below the top of the flood plain. For riffle samples it is the measure of the vertical height of the banks of the present channel of the stream.

Sample numbers

Sample numbers follow the system: (1) the calendar year in which the sample was collected is shown by the left-hand digits, (2) the collector is indicated by the pair of letters, (3) the samples progress in numerical sequence throughout the year, and (4) the right-hand digits show the position of a sample in the sequence collected in a given year by an individual. Thus, sample number 52-PK-346 was collected in 1952 by P. K. Theobald, Jr., and it is the 346th sample taken by him that year. Collectors indicated by other letters are:

JW = J. W. Whitlow

OT = W. C. Overstreet

WE = A. M. White

DC = D. W. Caldwell

KR = J. W. Keeler

PM = P. E. Myers

Material sampled

The column headed "Material sampled" contains entries which give a summary of the position and grade size of the sediment sampled.

Position is designated as "riffle," "bank," or "terrace" accordingly as the sample was taken from the bed of the present channel of the stream, from a bank of the present channel, or from terrace deposits of an older fluvial deposition than the "bank" and "riffle" sediments.

Grade size of the unconsolidated sedimentary material sampled was classed as gravel, sand, silt, or clay according to field criteria. Clay and silt were identified by the feel and cohesiveness of the sedimentary material. Alluvium was described as clay if it was unctuous or its matrix was both unctuous and the dominant component, and if it was sufficiently tenaceous to roll into rods between one's hands. Fine-grained sediments that were incapable of being rolled into rods were called silt. Various uncohesive, gritty, fine- to coarse-grained sediments were called sand or gravel depending upon the part of the material from the original volume (0.34 cu. ft.) that passed through the sieve and was caught in a pan after washing and screening the sample through a 1/8-inch sieve. In two-component mixtures of sand and gravel the sediment was called sand if 0.18 cubic foot or more material passed through the sieve, and it was called gravel if less passed through. Three- or four-component mixtures were classed as gravel or sand accordingly as the dominant constituent was retained on the sieve or caught in a pan below the sieve.

Screening characteristics

The "Screening characteristics" of a sample are field descriptions of the sediment. Sizes of particles are divided into plus 1/4 inch, minus 1/4 inch to plus 1/8 inch, and minus 1/8 inch according to the size of aperature of sieve on which the particle was retained, or through which it passed, when the sample was screened to prepare it for panning.

The "Volume ratio" given in the table under "Screening characteristics" is an expression to show the part of the original sample in each size class. It is based on an original volume of 0.34 cubic foot, and is the measured volume in hundredths of a cubic foot of the component expressed as a whole number.

Material listed as "Minus 1/8 inch" is divided into "Sand" and "Silt and clay." For sand the volume ratio was measured, but the silt and clay is sediment that suspends in water and cannot be measured by the system used in the field. Hence, an estimate of the silt and clay is given under "Abundance" in the same unit used for volume. The few originally larger or smaller samples than the standard have been recalculated to equal the standard volume.

Estimates of the percentages of the different detrital components coarser than 1/8 inch were made to determine variations in the gross character and degree of weathering of the bedrock in the drainage basin. A dominance of quartz and potassium feldspar over rock fragments indicates lack of exposures of unweathered rock in the drainage basin. The "Maximum intermediate dimension (inches)" gives the length of the intermediate dimension of the largest fragment in the sample of alluvium.

Abbreviations for "Composition" and for other parts of the table are:

Word	Abbreviation
Amphibole	amph
Biotite gneiss	bio gn
Biotite-hornblende gneiss	bio-hgn
Biotite schist	bio sch
Calc-silicate rock	calc-silicate
Chlorite schist	chl sch
Diabase	diab
Epidote	ep
Feldspar	fels
Gabbro	gb
Garnet	gar
Granite	gr
Hornblende	hnb
Hornblende gneiss	hgn
Ilmenite	ilm
Kyanite	ky
Limestone	ls
Magnetite	magn
Muscovite	musc
Organic fragments	organic frags
Pegmatite	peg
Quartz	qtz
Sillimanite schist	sil sch
Spinel	spi
Tourmaline	tour
Trace	tr
Xenotime	xen

Minerals in concentrate

The columns under "Minerals in concentrate" show the weight of the concentrate in grams, the "Sieve fraction," seven minerals of possible economic interest, seven accessory minerals, and a column for other minerals. Weight of the concentrate shows the amount of minerals panned from a sample of standard size (0.34 cu. ft.). Under "Sieve fraction" the size distribution of the minerals in the concentrate is shown by weight percentage retained on the 45, 100, and 170 mesh sieves. Where the percentage of the concentrate caught on the 32 mesh sieve or passing through the 170 mesh sieve is greater than 1 percent it is also recorded.

The seven minerals of possible economic importance are monazite, ilmenite, rutile, zircon, garnet, kyanite, and sillimanite. Abundance of each of these minerals in the panned concentrate is shown as a weight percentage of the concentrate. Dashes are used in the columns headed "Percent of concentrate" to show that the mineral was looked for but not found. Trace means that the mineral is present but makes up less than 1 percent of the weight of the concentrate. The tenors of these possibly economic minerals are given as pounds per cubic yard of sediment in place. Tenors estimated to be less than 0.1 pound per cubic yard are recorded to show the sparseness of the mineral, but the estimates of less than 0.1 pound are not reliable. Tenors have been adjusted for swell to reduce the measured volume of the sample to approximate volume in place. For reduction of swell the factors published by Peele and Church (1941, v. 1, p. 3-03) were used:

Class of alluvium	Swell (in percent)
Riffle sand and gravel	14
Bank silt, sand, and loose gravel	20
Clay and compact bank gravel	35

No adjustment for recovery in panning was applied to the estimated tenors of the samples, because the recovery is different for different minerals in the different classes of sedimentary materials. Recoveries of monazite, the mineral with which the work is concerned, were about 84 percent in the different materials, and the recoveries of the other minerals ranged from about 40 to 90 percent with the lowest recoveries being for minerals in samples of silt and clay (Theobald, 1957, p. 11).

The abundance of the accessory minerals of no economic value are shown as weight percentage of the concentrate. Estimates of tenors have not been prepared. Staurolite is here classed as an accessory instead of an economic mineral because of its general sparseness in the high-grade metamorphic rocks on which the fluvial placers are developed.

"Others" lists minor accessory minerals of infrequent occurrence. The name of the minor mineral is written above percentages showing its abundance in the concentrate. Abbreviation of the names of the minerals were given above.

References cited

Berman, R. M., 1953, A nomogram for obtaining percent composition by weight from mineral-grain counts: Jour. Sed. Petrology, v. 23, p. 120-123.

Griffith, R. F., and Overstreet, W. C., 1953a, Knob Creek monazite placer, Cleveland County, North Carolina: U.S. Atomic Energy Comm. RME 3112, p. 3-30.

_____1953b, Buffalo Creek monazite placer, Cleveland and Lincoln Counties, North Carolina: U.S. Atomic Energy Comm. RME 3113, p. 3-17.

_____1953c, Sandy Run Creek monazite placer, Rutherford County, North Carolina: U.S. Atomic Energy Comm. RME 3114, p. 3-27.

Hansen, L. A., and Cuppels, N. P., 1954, Monazite placer on the First Broad River and its tributaries, Cleveland County, North Carolina: U.S. Atomic Energy Comm., RME 3116, p. 3-27.

Kellagher, Richard, and Flanagan, F. J., 1956, The multiple cone splitter: Jour. Sed. Petrology, v. 26, no. 3, p. 213-221.

Overstreet, W. C., Theobald, P. K., Jr., Whitlow, J. W., 1959, Thorium and uranium resources in monazite placers of the western Piedmont, North and South Carolina: Mining Eng., v. 11, no. 7, p. 709-714.

Overstreet, W. C., Theobald, P. K., Jr., Whitlow, J. W., and Stone, Jerome, 1956, Heavy-mineral prospecting, in Internat. Conf. Peaceful Uses Atomic Energy, Geneva 1955, Proc., v. 6, p. 692-694.

Peele, Robert, and Church, J. A., 1941, Mining engineers' handbook, 3rd ed.: New York, John Wiley and Sons, Inc., p. 1-01 to 14-66, plus 63.

Theobald, P. K., Jr., 1957, The gold pan as a quantitative geologic tool: U.S. Geol. Survey Bull. 1071-A, p. 1-54.