

Minerals Research Laboratory October 1970 Progress Report
RML Project No. 5, Report No. 1
Lab. Nos. (See Summary Table) - Book 267, p. 1-191

by Robert M. Lewis

Introduction

A bright future is predicted for titanium metal for aircraft, spacecraft, and underwater vehicles. A plant for converting ilmenite into rutile is under construction in Texas. The chloride process for making pigment has caused price of rutile to rise to \$104 per short ton in 1963, and from \$104 to a present price of \$150 per short ton.

Drilling programs are being undertaken in the search for ilmenite, rutile and associated heavy minerals. This activity is taking place in Florida, Georgia, South Carolina, Tennessee and New Jersey, to name a few of which the writer is familiar.

Objective

This project was developed to encourage titanium exploration in the State and thereby to enhance the mineral industry through the mining of titanium minerals.

The object of this initial report is twofold:

- 1) To enlighten the mining industry and others as to the titanium project.
- 2) To present data on deposits investigated to date.

Procedure

No set procedure was used to beneficiate samples. Each sample was treated according to its inherent characteristics. The key processes

involved grinding, scrubbing, desliming, and/or gravity, heavy liquid, electrostatic, magnetic procedures.

A summary of data for samples is included with this report as Table 1.

Texas Gulf Sulphur Company's Phosphate
Plant, Aurora, North Carolina

Results

The amine tailings, from the processing of phosphate ore, contain approximately 4.0 percent heavy minerals. The heavy minerals are distributed as 64 percent ilmenite, 11 percent zircon, and 25 percent black opaques and miscellaneous. Thirteen thousand tons per year of heavy mineral products with a market value of \$384,000 are now going to waste. A report¹ on this project has been made available to the public.

Conclusions

The company is now recovering a quantity of heavy mineral concentrate from part of the amine tailings flow with a Humphreys spiral. The material will be used for additional tests and evaluation.

A. P. Causby Sand and Gravel Company,
Morganton, North Carolina

Results

Samples of feed (Lab. Nos. 3604 & 3605) and concrete sand product (Lab. No. 3606) were submitted by the company for heavy mineral evaluation. The feed sample contained approximately 1.50 percent heavy minerals. The concrete sand product contained 3.50 percent heavy minerals.

¹Lewis, R. M., Heavy Minerals from Texas Gulf Sulphur Company Amine Tailings, Minerals Research Laboratory TGS Report #1, August 1968 Progress Report.

The approximate distribution of minerals were: magnetite 9.2 percent, ilmenite 25.8 percent, zircon 23.9 percent, and miscellaneous 41.1 percent. Chemical analyses indicated the miscellaneous fraction contained about 50 percent ilmenite.

Conclusions

At the request of the company, a project is being conducted to determine the prospects for producing heavy minerals at this operation. A plant sampling program is planned to determine the heavy mineral content of the feed and locate points of heavy mineral concentration in the sand classifier.

T. P. Upchurch Property,
Jones Island, North Carolina

Results

Sixteen samples (Lab. No. 3671) from a drilling program on Jones Island were submitted for heavy mineral evaluation. One sample contained 4.40 percent heavy minerals, 3 contained approximately 2.00 percent heavy minerals and 12 contained between 1.00-2.00 percent heavy minerals. The average heavy mineral content for the sixteen samples was 1.61 percent. Sixty percent of the heavy minerals were recovered as an ilmenite product analysing 46.50 percent TiO_2 .

Conclusions

This deposit could be of interest if the 4 highest grade samples represented sufficient acreage and ore depth. Heavy minerals could be produced as co-products with shell. A project is being conducted involving the production of shell from the island.

Yadkin Valley Ilmenite Mine,
Richland, North Carolina

Background

This deposit is described by Lloyd Williams² as follows:

"The Yadkin Valley deposit is at Richland in Caldwell County along the east bank of the Yadkin River, about 2 miles east of U. S. Highway 321, and 3 miles southeast of Baily Camp. The total distance of road from Baily Camp to the mine is about 7 miles."

"The ore consists of lenses of ilmenite in sericitic talc between a footwall of gneiss and a hanging wall of schist, varying in thickness from 20 to 50 feet, with an average dip of about 60 degrees. The crude ore was reported to contain 41.4 percent TiO₂."

"The Yadkin Valley Mica and Ilmenite Company, formerly the Yadkin Valley Ilmenite Company, a subsidiary of Glidden Company, operated a mine and mill on the property between the years 1942 and 1952, removing about 75,000 cubic yards of ore from a pit about 1200 feet long, from which 215,400 tons of concentrate containing an average of 51 percent TiO₂ were recovered."

"The ore was drilled and blasted, and loaded into trucks with a one-fourth yard gasoline-powered shovel for haulage to the mill, where it was dumped into a bin above the crusher. After crushing, the ore was processed by classifiers, screens, and cones followed by flotation to produce the concentrate (Flotation was used during the initial operation and later abandoned in favor of differential grinding.)."

"After the relatively soft ore had been mined from the upper part of the deposit, operations ceased due to increased costs of mining and concentration of the hard underlying ore."

Results

Ore (Lab. No. 3577) obtained by random sampling along 1200 feet of quarry was beneficiated in the Laboratory. The sample contained 80.0 percent plus 325 mesh deslimed material consisting of 97.7 percent heavy minerals. Seventy seven percent of the heavy minerals were recovered as an ilmenite product analysing 48.0 percent TiO₂.

²Williams, Lloyd., Titanium Deposits in North Carolina, Information Circular 19, North Carolina Division of Mineral Resources.

Conclusions

Sufficient ore reserves are available to warrant a mining operation in this deposit according to various sources of published data.

Good recovery and grade were obtained with the test sample and were similar to those reported at the plant.

Remarks

The writer feels that the mining operation may have been hindered, particularly when mining ceased in hard rock, by small size, low capacity one-fourth yard shovel. Concentration with a Humphreys spiral followed by magnetic separation, as used in several heavy mineral plants, might prove efficient in this ore.

Caldwell County,
Lab. No. 3580

Location

Sample No. 3580 is from the Happy Valley picnic area, 0.3 miles north of intersection of U. S. 321 and County road 1560, 100 feet from highway near tributary of Yadkin River. This area is approximately 10 miles downstream and south of the Yadkin mine.

Results

A hand-augered sample contained 12.8 percent heavy minerals, principally ilmenite.

Conclusions

Additional prospecting should be undertaken in this area as indicated by the grade and location relative to the Yadkin mine.

Clay County,
Shooting Creek Quadrangle

Background

The titanium minerals in this area are classified as rutile. A composite of titanium-bearing crystals obtained for this project analysed 81.3 percent TiO_2 . The crystals were crushed to minus 28 mesh and separated into two fractions with a magnetic separator. The magnetic fraction analysed 55.1 percent TiO_2 and was determined to be ilmenite. The non-magnetic fraction analysed 91.6 percent TiO_2 and was determined to be rutile. It was concluded that the large crystals found in the area were intergrowths of ilmenite and rutile.

Results and Conclusions

Two samples are of particular interest: Lab. No. 3659 contained 0.89 percent TiO_2 and Lab. No. 3663 contained 0.79 percent TiO_2 . Surface concentration of heavy mineral was in evidence along a logging road approaching a hill in the general area of sample, (Lab. No. 3663). New road cuts have been opened since prospecting described in literature, and therefore should be investigated.

Additional Clay County samples were evaluated as follows.

Lab. No. 3655

Location - Sample No. 3655 was obtained 0.3 miles north of Union Chapel Church on south fork of Licklog Creek, 12 feet east of road.

Results - A hand-augered sample contained 70.3 percent plus 325 mesh deslimed material. This material consisted of 2.06 percent heavy minerals and analysed 0.46 percent TiO_2 .

Lab. No. 3656

Location - Sample No. 3656 was obtained 0.37 miles S 85° W of Union Chapel Church, 800 feet east of creek.

Results - A composited grab sample from 100 feet of new road cut contained 80.9 percent plus 325 mesh deslimed material. This material contained 3.96 percent heavy minerals and analysed 0.49 percent TiO₂.

Lab. No. 3657

Location - Sample No. 3657 was obtained 0.23 miles S 40° E of junction of main road and Stillhouse Branch Road south.

Results - A hand-augered sample 30 feet west of road near creek bed, contained 67.0 percent plus 325 mesh deslimed material. This material contained 2.84 percent heavy minerals and analysed 0.68 percent TiO₂.

Lab. No. 3658

Location - Sample No. 3658 was obtained 0.12 miles S 45° E of junction of main road and Stillhouse Branch Road, northeast side of road where creek crosses road.

Results - Composited grab sample of hard rock from mica schist exposure contained 82.8 percent plus 325 mesh deslimed material. This material contained 6.24 percent heavy minerals and analysed 0.50 percent TiO₂.

Lab. No. 3659

Location - Sample No. 3659 was obtained at Forest Boundary Road and Needmore Branch, 0.78 miles south along road from junction of main road.

Results - A three foot channel sample from new road cut contained 76.2 percent plus 325 mesh deslimed material. This material contained 6.66 percent heavy minerals and analysed 0.89 percent TiO₂.

Lab. No. 3660

Location - Sample No. 3660 was obtained at Forest Boundary Road and Needmore Branch, 0.70 miles south along road from junction of main road. Road cut approximately 500 feet north of Sample No. 3659.

Results - Four foot channel sample contained 80.7 percent plus 325 mesh deslimed material. This material contained 1.50 percent heavy minerals and analysed 0.51 percent TiO_2 .

Lab. No. 3661

Location - Sample No. 3661 was obtained at Forest Boundary Road and Needmore Branch, 0.58 miles south along road from junction of main road. Road cut approximately 500 feet north of Sample No. 3660.

Results - Composited grab sample from 100 feet of new road cut contained 80.4 percent plus 325 mesh material. This material contained 1.34 percent heavy minerals and analysed 0.57 percent TiO_2 .

Lab. No. 3662

Location - Sample No. 3662 was obtained at Forest Boundary Road and Needmore Branch at bridge.

Results - A hand-augered sample 12 feet east of road near branch contained 49.4 percent plus 325 mesh material. This material contained 1.86 percent heavy minerals and analysed 0.44 percent TiO_2 .

Lab. No. 3663

Location - Sample No. 3663 was obtained at Hothouse Branch Road, 1.06 miles south from junction of main road. East side of road loop which returns on Laurel Branch Road.

Results - A channel sample from road cut contained 55.2 percent plus 325 mesh material. This material contained 6.40 percent heavy minerals and analysed 0.79 percent TiO_2 .

Yancey County

Background

Most of these samples were obtained during a reconnaissance of areas reported in the Department of Conservation and Development Information Circular 19³. Some of these samples were described as containing a certain percent TiO₂ or ilmenite in the concentrate, with no indication of percent heavy mineral concentrate in the ore.

Lab. No. 3595

Location - Sample No. 3595 was obtained 0.2 mile on Possum Trot Road S. W. of Pleasant Valley Missionary Baptist Church.

Results - Channel sample at road cut contained 0.11 percent TiO₂. This area was radioactive as detected with a Gamma Scintillation meter.

Lab. No. 3596

Location - Sample No. 3596 was obtained from the right hand fork of head waters of Possum Trot Creek. Random sample of float rock over 1000 foot distance on hill side south of creek.

Results - Sample contained 0.13 percent TiO₂.

Lab. No. 3598

Location - Sample No. 3598 was obtained from the south side of Bald Creek at mouth of creek and junction of Cane Creek.

Results - A hand-augered sample contained 1.12 percent ilmenite product.

Lab. No. 3600

Location - Sample No. 3600 was obtained from the west side of Cane River 500 feet up stream from Route 19 near State Prison Camp.

³Williams, Lloyd., Titanium Deposits in North Carolina, Information Circular 19, North Carolina Division of Mineral Resources.

Results - The hand-augered material contained 21.6 percent heavy minerals, most of which were garnet and miscellaneous iron minerals. The sample contained 0.46 percent ilmenite.

Lab. No. 3601

Location - Sample No. 3601 was obtained from the Mine Fork Road six miles north of Burnsville. Vertical bed of ore 6-10 feet wide on south side of Mine Fork Creek, one half mile above its mouth.

Results - Sample contained 1.19 percent ilmenite product.

Richmond County,
Submitted by Joe Bostic

Lab. No. 3674

Location - Sample No. 3674 was obtained at U. S. 1 and Drowning Creek.

Results - Sample of draglined material from creek contained 0.40 percent heavy mineral.

Forsyth County,
Submitted by Joe Bostic and James Team

Lab. No. 3675

Location - Sample No. 3675 was obtained at Yadkin River at Interstate 40 bridge about 12 miles west of Winston Salem.

Results - Sample of material dredged from river contained 2.20 percent heavy minerals.

Madison County

Lab. No. 3583

Location - Sample No. 3583 was obtained on State Route 213 east of Doggett Gap.

Results - Sample contained 0.70 percent heavy minerals.

Lab. No. 3584

Location - Sample No. 3584 was obtained on N.C. 209 approximately two miles south of Hot Springs at Stoney Spur Cliff.

Results - Grab sample contained 0.80 percent heavy minerals.

Table 1

Summary Table

<u>Lab. No.</u>	<u>Location</u>	<u>%* Heavy Mnrl.</u>	<u>% TiO₂ in Deslimed Sample</u>	<u>% Ilmenite in Heavy Mnrl.</u>
	T.G.S. Plant, Aurora	4.00	-	64.0
3604-3605	A. P. Causby Sand Co., Morganton	1.50	-	23.9+
3671	T.P. Upchurch Co., Jones Island	1.61	-	60.0
3577	Yadkin Mine Quarry	97.70	-	77.0
3580	Caldwell County	12.80	50.10	90.0+
3655	Clay County	2.06	0.46	-
3656	Clay County	3.96	0.49	-
3657	Clay County	2.84	0.68	-
3658	Clay County	6.24	0.50	-
3659	Clay County	6.66	0.89	-
3660	Clay County	1.50	0.51	-
3661	Clay County	1.34	0.57	-
3662	Clay County	1.86	0.44	-
3663	Clay County	6.40	0.79	-
3595	Yancey County	-	0.11	-
3596	Yancey County	-	0.13	-
3598	Yancey County	-	1.12	-
3600	Yancey County	-	0.46	-
3601	Yancey County	-	1.19	-
3674	Richmond County	0.40	-	-
3675	Forsyth County	2.20	-	-
3583	Madison County	0.70	-	-
3584	Madison County	0.80	-	-

*The percent heavy minerals represent the heavy minerals in the plus 325 mesh deslimed material.