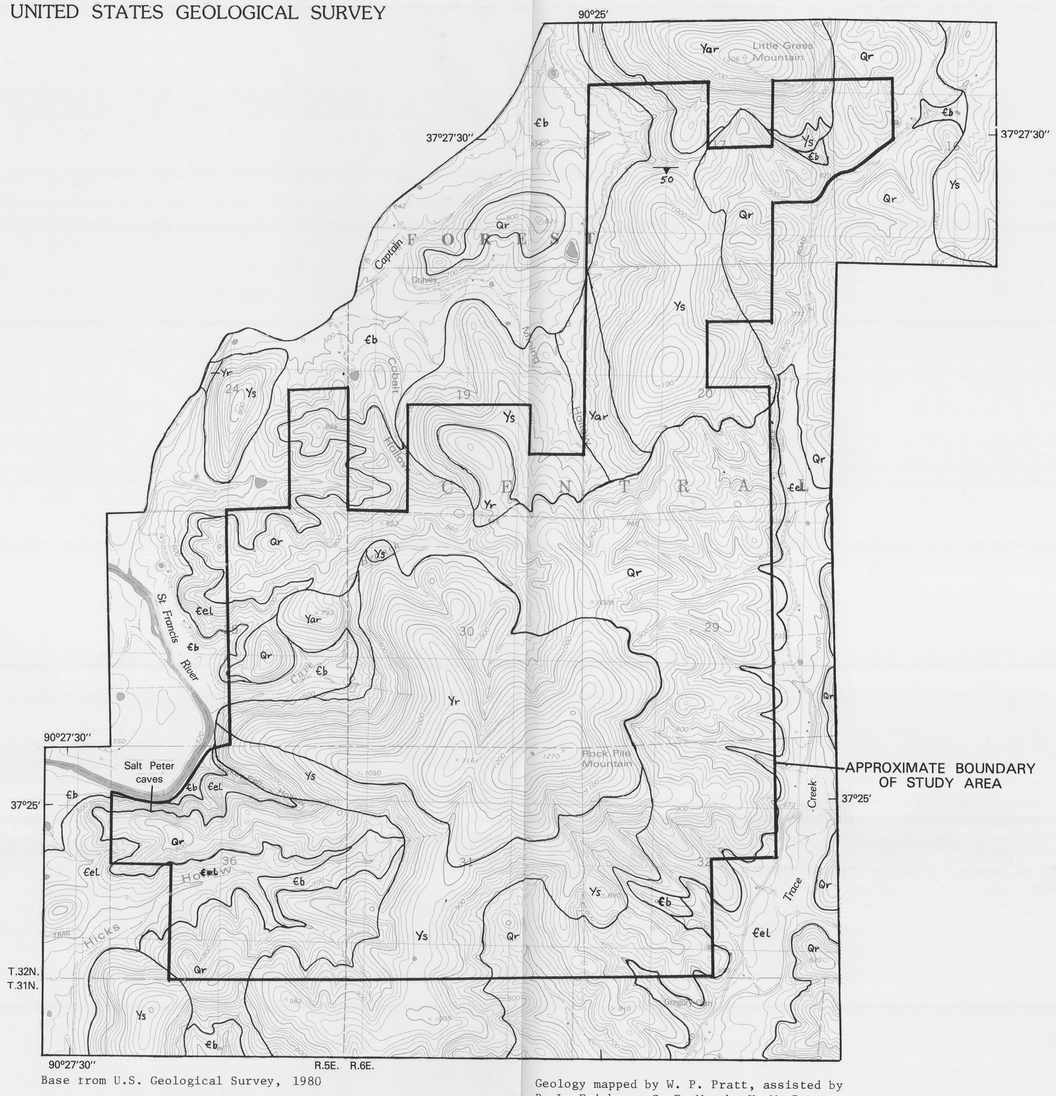
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY



Base from U.S. Geological Survey, 1980

Geology mapped by W. P. Pratt, assisted by R. L. Erickson, S. P. Marsh, V. M. Brown, and D. C. Smith, 1977-78. Paleozoic modified from Curtis and Dott, 1951

SCALE 1:24 000
1 MILE
1 KILOMETRE
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

MINERAL RESOURCE POTENTIAL MAP OF THE ROCK PILE MOUNTAIN WILDERNESS STUDY AREA, MADISON COUNTY, MISSOURI

By

Walden P. Pratt and Ralph L. Erickson, U.S. Geological Survey

and

Clarence Ellis, U.S. Bureau of Mines

1982

CORRELATION OF MAP UNITS

Qr	QUATERNARY
Unconformity	
€el, €b	CAMBRIAN
Unconformity	
Yar, Yr, Ys	PROTEROZOIC Y

LIST OF MAP UNITS

Qr — RESIDUUM (QUATERNARY)

UNCONFORMITY

€el — ELVINS GROUP (UPPER CAMBRIAN)--Thin-bedded dolomite

€b — BONNETERRE FORMATION (UPPER CAMBRIAN)--Massive dolomite

UNCONFORMITY

Yar — ALKALI RHYOLITE (PROTEROZOIC Y)--Potassium feldspar-bearing porphyry

Yr — RHYOLITE (PROTEROZOIC Y)--Potassium feldspar- and albite-bearing porphyry

Ys — QUARTZ LATITE (PROTEROZOIC Y)--Albite-bearing porphyry

CONTACT

STRIKE AND DIP OF LAYERING--In volcanic rocks

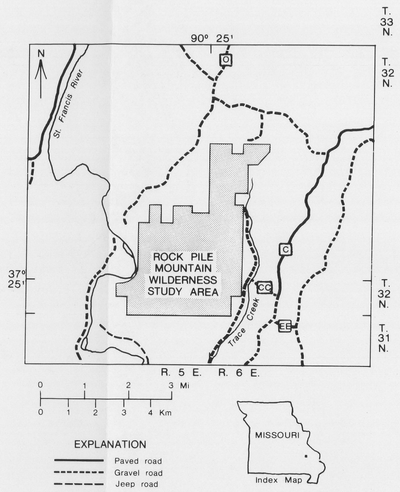
APPROXIMATE BOUNDARY OF STUDY AREA

Studies Related to Wilderness

The Wilderness Act (Public Law 88-577, Sept. 3, 1964), the Federal Land Policy and Management Act (Public Law 94-579, Oct. 21, 1976), and related Acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas to determine their mineral-resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral-resource-potential survey of the Rock Pile Mountain Wilderness Study Area, Madison County, Missouri.

MINERAL-RESOURCE POTENTIAL SUMMARY

Although the Rock Pile Mountain Wilderness Study Area is within the general boundary of the Southeast Missouri mining district, it has no record of mineral production and there is no mining or prospecting activity at present. Exploratory drill holes on private land along the west side of the area encountered no economic mineralization. Neither the Precambrian volcanic rocks nor the Cambrian sedimentary rocks in the study area contain any detectable evidence of economic mineralization. The area has no potential for coal resources, an unfavorable potential for oil and gas, and no known potential for geothermal energy. The volcanic rocks might be suitable for use as crushed stone, but similar rocks occur abundantly in more favorable locations elsewhere.



INDEX MAP

INTRODUCTION

The U.S. Bureau of Mines and U.S. Geological Survey made a mineral and geological survey of the Rock Pile Mountain Wilderness Study Area, southeast Missouri, in 1978-79. The study area covers 4,170 acres (1,690 hectares) of the Mark Twain National Forest in Madison County, about 100 mi (160 km) south of St. Louis and 15 mi (24 km) southwest of Fredericktown. The north and east boundaries of the area are readily accessible by Forest Service roads; the south and west sides are bounded by the St. Francis River and private land.

The study area is within the St. Francois Mountains, and is centered on a northerly trending forested ridge made up of several rounded knobs of igneous rock. Paleozoic sedimentary rocks that flank the igneous knobs have been eroded into valleys and low bluffs. Maximum elevation is 1,305 ft (398 m) on Little Grassy Mountain at the north boundary of the study area; relief is 780 ft (240 m). Captain Creek and the St. Francis River flank the west side of the area, and Trace Creek the east side.

GEOLOGY

The Rock Pile Mountain Wilderness Study Area, situated on the southeast flank of the Ozark uplift, is centered on a northerly trending ridge of Precambrian alkali-rhyolite, rhyolite, and quartz latite, parts of a widespread volcanic complex that underlies most of the St. Francois Mountains. Cambrian dolomites and minor sandstones lap up onto the Precambrian rocks on all sides, but are well exposed only in a few places on the west side of the study area. Through the rest of the area the surface is underlain by chert- and drusy quartz-bearing residuum of unknown thickness, derived by dissolution of carbonate sedimentary rocks.

Geologic structures of the area are limited to the erosional and depositional features of the rocks. The Paleozoic rocks either are flat lying or dip gently away from nearby Precambrian knobs, reflecting initial depositional dips probably accentuated by diagenetic compaction. No faults have been identified or inferred in either the Precambrian or the Paleozoic rocks. The geology of the area is discussed in detail in a companion report (Pratt and Erickson, 1982).

GEOCHEMISTRY

A geochemical study of the area was made to augment surface observations (Pratt and Erickson, 1982). This study consisted of semiquantitative spectrographic and chemical analyses of unconcentrated stream sediments, pan-concentrated stream sediments, and outcropping volcanic rocks. Results show the presence of no metal values of unusual concentrations.

Stream-sediment samples were collected at 25 sites representing all streams draining the area. No anomalously high metal contents were obtained, and all reported metal contents are in the same range (chiefly 10-100 ppm).

The pan-concentrated stream-sediment samples were collected at the same 25 sites as the unconcentrated samples. The concentrates are composed chiefly of metal-rich, yellow- to orange-brown limonitic iron oxide and metal-poor, maroon to black hematitic iron oxide. The limonite is derived from oxidation of disseminated pyrite and marcasite in the Paleozoic carbonate rocks, and the hematite is mostly primary and derived from the Precambrian volcanic rocks. The analytical results for panned concentrates show the same lack of clearly anomalous metal contents and the same restricted range of concentration as the stream-sediment analyses.

Spectrographic and chemical analyses of 17 rock samples from outcrops of Precambrian volcanic rocks show only two localities that contain anomalously high amounts of metal: these were samples of quartz latite that contain small, sparsely disseminated pyrite crystals, and the analyses show a few hundred parts per million of lead and zinc.

GEOPHYSICS

A Bouguer gravity map of the region (Pratt and Erickson, 1982) shows that the study area is located in a gravity saddle between a north-northwest-trending gravity gradient and a broad gravity high about 5 mi (8 km) in diameter; both features are several miles outside the study area. The sources of these features must be at deep levels in the basement and cannot be identified on the basis of available geologic data. Detailed gravity trends are not resolved within the study area because no gravity stations exist within a mile or so of its borders.

A regional aeromagnetic map (Pratt and Erickson, 1982) shows that aeromagnetic signature patterns within the study area are typical of those of the region in general, with the possible exception of a prominent positive anomaly in the southern third of the study area. This anomaly coincides with the rhyolites underlying the summit of Rock Pile Mountain, and the apparent intensity of the magnetic anomaly is, at least in part, a topographic effect. Another positive anomaly coincides with a ridge of quartz latites in the northeast part of the study area, and a magnetic low trending east-west across the study area is approximately coincident with a zone of residuum within a structural saddle. In summary, the magnetic features show good correlation with the known geology and topography, and no economic implications are evident.

MISCELLANEOUS FIELD STUDIES
MAP MF-1339-B

MINING DISTRICTS AND MINERALIZATION

There is no mining activity in the study area at present, and no mineral production has been recorded from the study area or its immediate vicinity.

Small prospect pits are common in the study area and are concentrated on the west side of a drainage in SW1/4 sec. 19, T. 32 N., R. 6 E., locally known as Cobalt Hollow. Outcrops are limited to a few ledges of dolomite near the saddle on the ridge west of the drainage. Pits are nearly filled by slope wash. The dumps of five pits across the slope were sampled, as was one near the top of the slope. Material excavated from the dumps was the same as that found in the residual soil: chert, quartz druse, and soil. Analytical results indicate that mineralization was not present; the pits may not have been related to mineral activity.

Two caves, known as Salt Peter Caves, are in the bluffs above the St. Francis River in sec. 36, T. 32 N., R. 5 E. Bat guano was allegedly mined from one or both for use as saltpeter, a component of black powder. Neither cave is extensive and very little guano is present. No decoration by travertine or other mineralization is present.

ASSESSMENT OF MINERAL-RESOURCE POTENTIAL

The rocks of the Rock Pile Mountain Wilderness Study Area contain no evidence of mineralization of possible economic significance. Neither surface observations nor geochemical analysis of selected rocks, stream sediments, or pan concentrates show any significant anomalous metal content. Available geophysical data show no anomalies of economic significance. Approximately 40 percent of the area is known or presumed to be underlain at depths of a few hundred feet (several tens of meters) or less by the Cambrian Bonneterre Formation, which is the principal host rock for lead sulfide ore deposits elsewhere around the St. Francois Mountains. The surface geochemical sampling study does not adequately test this formation in the subsurface. However, drill-hole information from adjacent areas suggests that the Bonneterre Formation in this area is not favorable for mineral discovery (Erickson and others, 1978; 1979). No prospecting permit applications have been filed for acreage within the study area at any time. The known ore trends in the region closely parallel limestone-dolomite interfaces in the Bonneterre Formation, and no such interfaces are known to exist within about 12 mi (20 km) of this area. However, the possible occurrence of lead mineralization of the Annapolis mine type--in coarse-textured dolomite close to the contact with Precambrian rocks--cannot be entirely ruled out. Similar occurrences were mined in parts of the Fredericktown and Doe Run areas.

The study area has little potential for economic resources of industrial or energy minerals. Precambrian rocks like those that occur in the study area have been quarried elsewhere in the region for use as crushed stone ("felsite"), but abundant supplies of similar rocks are available in more favorable locations outside the study area. The Bonneterre Formation is a major source of refractory dolomite in Missouri, but is widely exposed and can be quarried at more desirable locations outside the study area (Kisvarsanyi, 1967). The Ozark uplift is considered unfavorable for oil and gas exploration (Wharton and others, 1969, p. 82). Missouri coal deposits are in rocks of Pennsylvanian age, none of which are near the study area. No evidence exists that geothermal energy could be developed in the study area.

A comprehensive appraisal of the metallic mineral-resource potential of the Rolla 1^{o} x 2^{o} quadrangle, which includes the Rock Pile Mountain Wilderness Study Area, has been published recently (Pratt, 1981).

REFERENCES

Erickson, R. L., Mosier, E. L., and Viets, J. G., 1978, Generalized geologic and summary geochemical maps of the Rolla 1^{o}x 2^{o} quadrangle, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-1004A, scale 1:250,000.

Erickson, R. L., Mosier, E. L., Viets, J. G., and King, S. C., 1979, Generalized geologic and geochemical maps of the Cambrian Bonneterre Formation, Rolla 1^{o}x 2^{o} quadrangle, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-1004B, scale 1:250,000.

Kisvarsanyi, E. B., 1967, Refractory dolomite, in Mineral and water resources of Missouri: Missouri Division of Geological Survey and Water Resources [Report], 2d ser., v. 43, p. 192-196.

Pratt, W. P., ed., 1981, Metallic mineral-resource potential of the Rolla 1^{o}x 2^{o} quadrangle, Missouri, as appraised in September 1980: U.S. Geological Survey Open-File Report 81-518, 77 p.

Pratt, W. P., and Erickson, R. L., 1982, Geologic, geochemical, and geophysical maps of the Rock Pile Mountain Wilderness Study Area, Madison County, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-1339-A.

Wharton, H. M., Martin, J. A., Rueff, A. W., Robertson, C. E., Wells, J. S., and Kisvarsanyi, E. B., 1969, Missouri minerals--resources, production, and forecasts: Missouri Geological Survey and Water Resources Special Publication No. 1, xi + 303 p.

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