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MINERAL RESOURCE POTENTIAL OF THE RAMSEYS DRAFT ADDITION, AUGUSTA AND HIGHLAND COUNTIES, VIRGINIA

By

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Ramseys Draft Addition, which is a roadless area adjoining Ramseys Draft Wilderness Study Area in the George Washington National Forest, Augusta and Highland Counties, Virginia. The area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

Ramseys Draft Addition is a further planning area of 13,475 acres (5453 ha) adjoining Ramseys Draft Wilderness Study Area on the northwest, northeast, and southeast in the George Washington National Forest, Augusta and Highland Counties, Va. Ramseys Draft Addition (hereinafter also termed study area or Addition) is in the folded Appalachians and contains sedimentary rocks of Late Devonian and Early Mississippian age. These marine and nonmarine clastic sedimentary rocks have been folded into a broad syncline having smaller folds on the limbs. A few small alkalic igneous dikes of probable Jurassic age cut the Paleozoic sedimentary rocks, mostly in the northeastern part of the study area.

No metallic mineral resources of economic significance have been identified in or near the study area. Reconnaissance geochemical sampling has outlined an area of higher-than-background amounts of copper, lead, and zinc in sandstone of the Hampshire Formation and a smaller area that contains anomalous lead in residual soil on the Jennings Formation. These are probably related in origin to stratabound red-bed copper deposits similar to one found in Ramseys Draft Wilderness Study Area. Such mineralization, although typical for the rock types present, apparently in this area forms deposits that are too small to be economic.

No known coal beds occur in the part of the rocks of Mississippian age preserved in the study area. The possibilities of oil are low because of high thermal maturity of the rocks; structural conditions are possibly good for gas accumulation, but no drilling has been done in or near enough to the study area to evaluate the gas potential.

The only apparent mineral resources are moderate amounts of sand and gravel along the main streams, abundant sandstone suitable for construction material, and abundant shale suitable for brick, tile, and other low-grade ceramic materials. Deposits of all these are readily available and more accessible in surrounding areas.

INTRODUCTION

Ramseys Draft Addition is in the Valley and Ridge Province of west-central Virginia, about 18 mi (29 km) northwest of Staunton (fig. 1). Altitudes range from 4,196 ft (1,279 m) above sea level at the north end to 2,100 ft (640 m) along Shaw Fork on the west side, and 2,240 ft (683 m) on Braley Branch on the east side. Hillsides in the area are steep and heavily wooded with second- and third-growth hardwoods and scattered pines and hemlock. Parts of the headwaters of Brushy Fork at the north end of the study area have been cut over recently.

Access to the Addition is good. Forest Service roads are within a mile of the boundary. Old logging roads and trails extend up several creeks along the east side from State Road 715 and on the west side from State Road 616. U.S. Highway 250 is within half a mile of the southwest border. The Shenandoah Mountain trail passes through the study area following the higher ridges of the mountain along the border between Augusta and Highland Counties.

Previous Studies

W. B. Rogers, the first state geologist of Virginia, studied the geology in the general area of Ramseys Draft as early as 1835 (Rogers, 1836, p. 89-103) and assigned numbers to the different rock units (Rogers, 1838, p. 21-23). His units VIII, IX, and X are exposed in the study area. Rogers drew a cross section through the middle of the study area (Rogers, 1884, plate VII, section No. 8) that indicates clearly he understood its synclinal structure. N. H. Darton (1894) mapped the geology of the 30-minute Staunton quadrangle (fig. 1), which includes Ramseys Draft Addition. His mapping was excellent and is modified only slightly by our work. Darton (1892) applied the names Jennings Formation to Rogers' unit VIII and Hampshire Formation to unit IX, and correlated the Pocono Formation with unit X. These names are used in this report. Charles Butts (1933) compiled a geologic map of the Appalachian Valley in Virginia and divided the Jennings Formation of Darton into a lower unit called Brallier Shale and an upper unit called Chemung Formation. The Hampshire Formation he called Catskill Formation. Later, Butts (1940) used the name Hampshire in place of Catskill and gave more detailed descriptions for all the units. Kozak (1970) mapped the Elliott Knob, Deerfield, Craigsville, and Augusta Springs quadrangles to the south of Ramseys Draft (fig. 1).

Lesure and others (1977) made a mineral resource evaluation of Ramseys Draft Wilderness Study Area. Additional sampling led to the discovery of a small red-bed copper deposit in the area (Lesure and Motooka, 1980). Perry (1978) made a cross-sectional model across the south end of the area and discussed the sequence of deformation in the general area.

Present study

In May and October 1979, Lesure, assisted by James D. Bliss and A. E. Grosz, U.S. Geological Survey (USGS), extended the previous wilderness studies to include Ramseys Draft Addition. They collected 22 rock samples, 143 soil samples, and 57 stream-sediment samples for trace-element analyses. These samples, which supplement those collected in the earlier wilderness work, were analyzed in USGS

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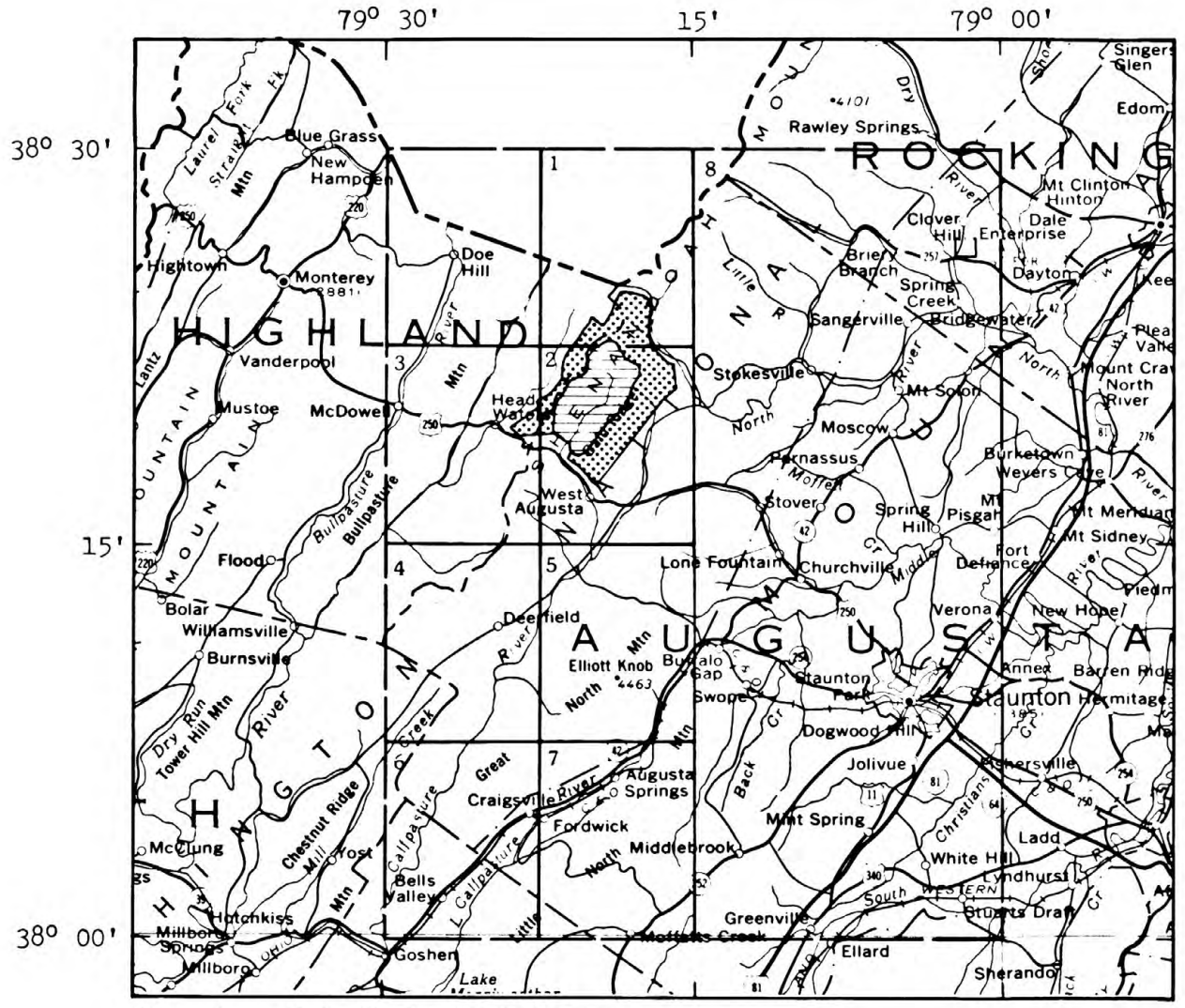


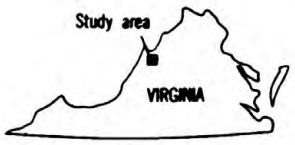
Base from U.S. Geological Survey
Virginia state base map, 1973

0 5 10 MILES
0 5 10 15 KILOMETERS

EXPLANATION

Ramseys Draft Addition

Ramseys Draft Wilderness Study Area (Lesure and others, 1977)



Quadrangle index
1. Palo Alto
2. West Augusta
3. McDowell

Published Geologic Maps
4. Deerfield (Kozak, 1970)
5. Elliott Knob (Kozak, 1970)
6. Craigsville (Kozak, 1970)
7. Augusta Springs (Kozak, 1970)
8. Staunton (Darton, 1894)

Figure 1.—Index map showing Ramseys Draft Wilderness Study Area and Addition.

laboratories, Denver, Colo.

In December 1979, Mory, U.S. Bureau of Mines (USBM), made a reconnaissance of the mineral resources and collected four shale samples for further study. The samples were spectrographically analyzed by the USBM Reno Research Center, Reno, Nev., and were evaluated for ceramic and bloating properties by the USBM Tuscaloosa Research Center, Tuscaloosa, Ala. Mory obtained records of leasing and prospecting activities from the Bureau of Land Management in Alexandria, Va., and from the U.S. Forest Service in Harrisonburg, Va., and Atlanta, Ga. Representatives from industry, State, and other Federal agencies were contacted for pertinent information concerning the study area.

Surface- and mineral-rights ownership

The Federal Government owns all of the surface rights within the Ramseys Draft Addition. The majority of the surface was purchased as part of a large tract of land by the U.S. Government from Virginia Mining and Improvement Company on January 8, 1916, under authority of the Weeks Act of March 1, 1911. All or portions of 15 small acquired tracts make up the remainder of the study area.

The Federal Government owns about 70 percent of the mineral rights under the study area (fig. 2). Mineral rights were purchased on June 2, 1979 on a portion of the lands originally belonging to Virginia Mining and Improvement Company. Mineral rights for the entire northwest slope of Shenandoah Mountain and for a small tract of land in the northeast corner of the Addition are privately owned.

Acknowledgments

We wish to thank the Crab Run Gas Company, a subsidiary of Washington Gas Light Company, Washington, D.C., for information concerning lease status and oil and gas exploration in the general area. Donald C. LeVan and Eugene K. Rader of the Virginia Division of Mineral Resources and Douglas G. Patchen of the West Virginia Geological and Economic Survey provided information about the natural gas potential in the general area. Harry W. Webb, Jr., Virginia Division of Mineral Resources, provided background data on the geology of the area. The friendly cooperation of Leonard J. McNeal, District Ranger, U.S. Forest Service, George Washington National Forest, greatly speeded up the mapping and sampling. William E. Perry, Jr. and Wallace de Witt, Jr., USGS, supplied information on the oil and gas potential of the area.

GEOLOGY

Ramseys Draft Addition is part of a northeast-trending syncline in Upper Devonian and Lower Mississippian sedimentary rocks whose trough is centered along Ramseys Draft Wilderness Study Area (Lesure and others, 1977; Lesure, 1982a). Several thousand feet of interlayered olive-gray, fine-grained sandstone and dusky-yellow to olive-gray shale and siltstone of the Jennings Formation of Late Devonian age are exposed along Shenandoah Mountain on the western edge of the study area and along the foothills east of Bald Ridge on the eastern edge of the study area. Much of the intervening higher country is underlain by as much as 2,000 ft (600 m) of distinctive grayish-red and greenish-gray, fine- to medium-grained sandstone and shale of the younger Hampshire Formation, also of Late Devonian age. Five small areas along the trough of the syncline at the northeast end of the study area are underlain by the lower few hundred feet of pale orange to brown, medium- to coarse-grained sandstone of the Pocono Formation of Mississippian age. All these rock units are fairly well exposed in stream valleys and along ridges. Poorly exposed, however, are several alkalic igneous dikes, a few feet thick and as much as several hundred feet long, that cut the sedimentary rocks in the northern part of the study area. These dikes are part of a northwest-trending dike swarm of probable Jurassic age that extends from southeastern Augusta County northwestward through Staunton and the Ramseys Draft area, into Pendleton County, W. Va. (Johnson and others, 1971; Garner, 1956, Zartman and others, 1967).

The relatively broad syncline comprising the rocks of the Ramseys Draft area plunges gently to the northeast. This is part of a long fold, the McClung syncline of Butts (1940, p. 455), that extends for at least 50 mi (80 km) to the southwest and 100 mi (160 km) to the northeast as part of the Broadtop synclinorium (Jacobeen and Kanes, 1974; Perry, 1978). The Jennings Formation has been further folded into small anticlines and synclines on the limbs of the major fold. This simple structural picture is more complicated at depth where several nearly flat thrust faults have caused crustal shortening and repetition of beds (fig. 3).

GEOCHEMICAL SURVEY

Reconnaissance geochemical sampling for the Ramseys Draft Addition includes 33 stream-sediment, 2 soil, and 22 rock samples collected during the earlier study of Ramseys Draft Wilderness Study Area (Lesure and others, 1977), and 57 stream-sediment, 143 soil, and 22 rock samples collected for this study (Lesure, 1982b). These samples were analyzed for 31 elements by semiquantitative spectrographic analysis methods and for zinc by atomic absorption (Motooka and others, 1981). The resulting data outline one area on McMannaway Run in the Hampshire Formation containing higher-than-background amounts of lead, copper, and zinc in rock samples, and another area on the west slope of Shenandoah Mountain, near the northern end of the Addition, that contains anomalous lead in residual soil on the Jennings Formation (fig. 4). The mineralized rock of the first area contains 150 to 1,500 parts per million (ppm) lead, 70 to 150 ppm Cu, and 40 to 450 ppm Zn in a zone about 50 ft (15m) long and 6 ft (2m) wide. At the other locality two soil samples from one sample site contain 300 to 500 ppm lead but samples within 50 ft (15m) in either direction along the ridge contain background concentrations of 10 to 30 ppm lead. Both sites probably contain only subeconomic amounts of the metals, but the discoveries are of scientific interest. The deposits are probably similar to the low-grade copper deposit found in Ramseys Draft Wilderness Study Area (Lesure and Motooka, 1980). We estimated that deposit to contain less than 10 tons of copper, not an economic amount.

MINES AND PROSPECTS

There has been no known commercial mineral production from within or near the Ramseys Draft Wilderness Study Area or the Addition. A small pit inside the wilderness study area (fig. 4) furnished sand, gravel, and shale as road metal for U.S. Forest Service Road 68, and a now-active quarry about 0.7 mi (1.1 km) northeast of the Addition boundary along U.S. Forest Service Road 95 (fig. 4) supplied shale and sandstone for local road metal. No other pits, mines, or prospects are known within or in the vicinity of the Ramseys Draft Addition.

OIL AND GAS LEASES

About 1 percent of the Ramseys Draft Addition was under Federal oil and gas leases as of December 1981 (fig. 2). These active leases cover land along the northwest and northeast boundaries of the Addition. A private lease was held by Washington Gas Light Company on the entire wilderness study area between November 1970 and October 1972. Crab Run Gas Company, a subsidiary of Washington Gas Light Company, had either private or Federal oil and gas leases on all the area east of Bald Ridge. The private lease was acquired prior to the Federal Government's purchase of the mineral rights and expired in November 1980. The Federal leases that expired in October 1980 were for land in the southeast corner of the Addition (fig. 2).

An application has been submitted for a Federal oil and gas lease covering the southern part of the Ramseys

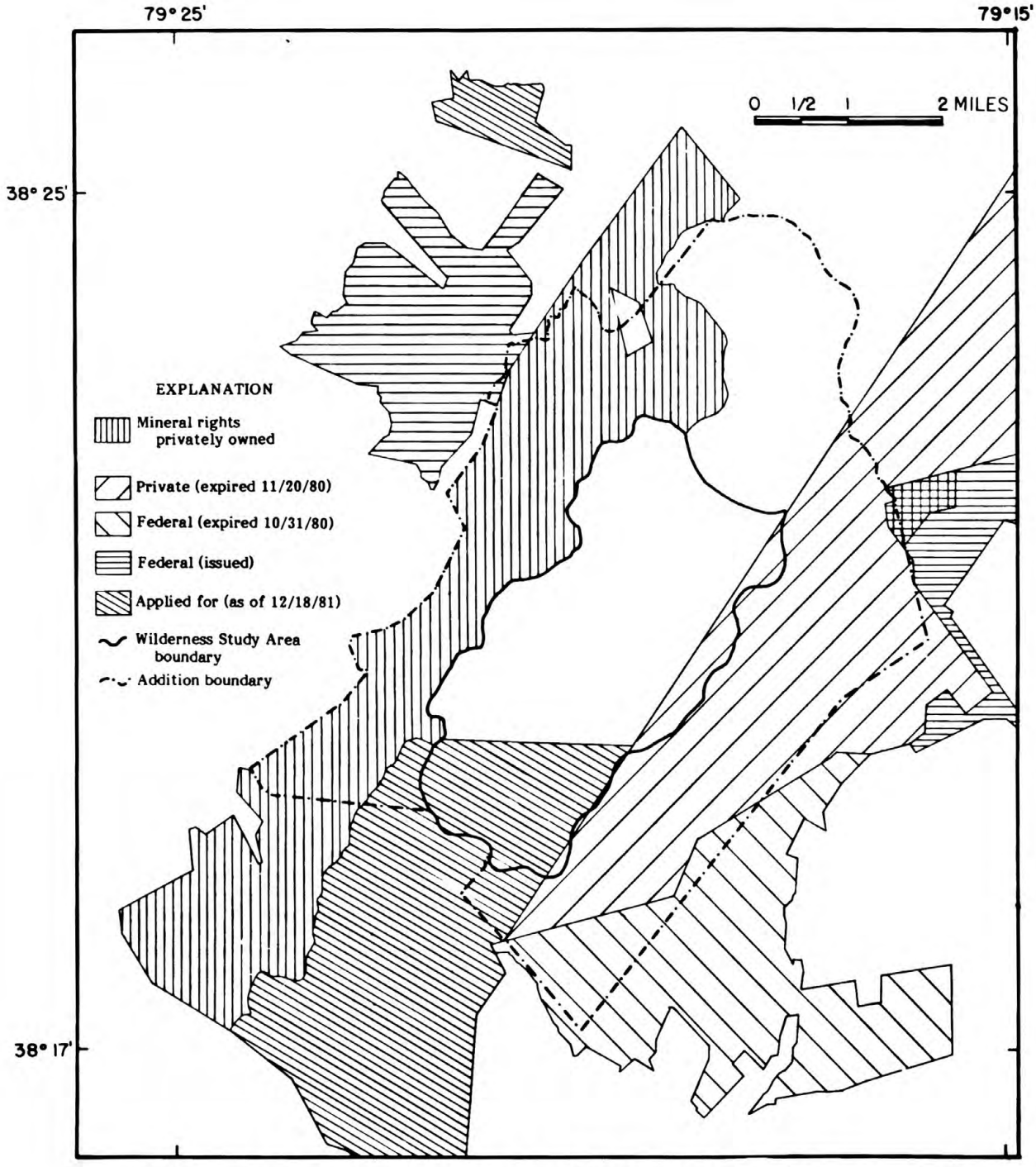


Figure 2.--Map showing mineral-rights ownership and oil and gas lease status, Ramseys Draft Wilderness Study Area and Addition, as of December 1981.

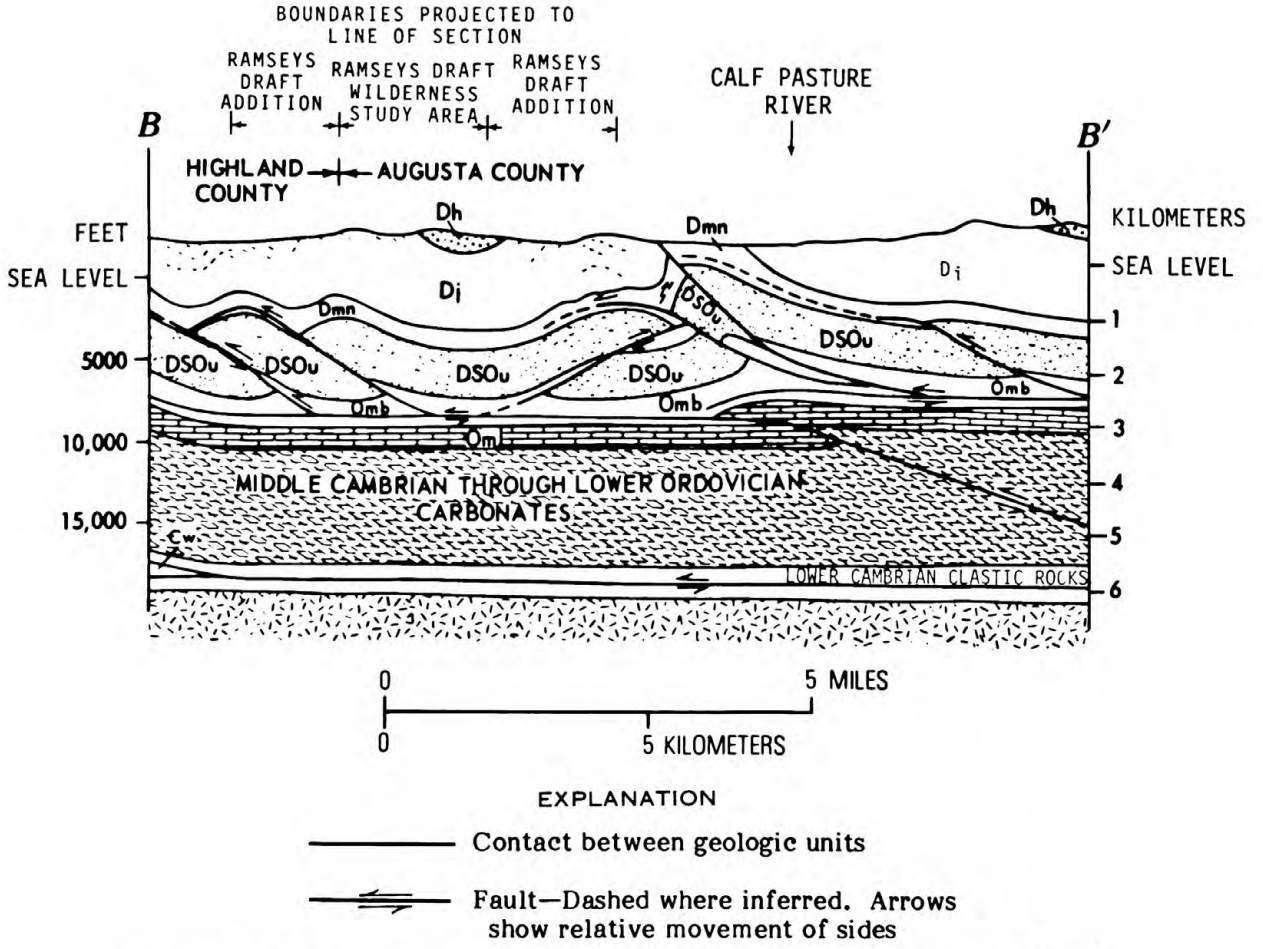


Figure 3.—Cross-sectional model of B-B', drawn just south of Ramseys Draft Wilderness Study Area and Addition (modified from Perry, 1978, fig. 2). Boundaries of Wilderness Study Area and western boundary of the Addition are projected to line of section. Location of section is shown in figure 4. Letter symbols used: Dh - Hampshire Formation (Devonian); Dj - Jennings Formation (Devonian); Dmn - Millboro and Needmore Shales (Devonian); DSOu - Lower Devonian through Upper Ordovician rocks, undivided; Omb - Martinsburg (in part Reedsville) Shale (Ordovician); Oml - Middle Ordovician limestones; Cw - Waynesboro Formation (Cambrian).

Draft Wilderness Study Area and Addition; a second application is for an area that lies about 1.5 mi (2.4 km) northwest of the Addition (fig. 2). No action had been taken on these applications as of December 1981. According to the Bureau of Land Management, the lands previously covered by leases east of Bald Ridge will be offered for lease in the future.

MINERAL RESOURCE POTENTIAL

The relatively simple lithology of the siliceous clastic sediments and the uncomplicated structure with no major faulting in the Ramseys Draft Addition limit the potential mineral resources to nonmetallic resources, construction materials, and fuels. Metallic resources are limited to small low-grade uneconomic red-bed base-metal deposits (fig. 4). No evidence was found for the presence of other metals, including uranium (Lesure, 1982b).

Nonmetallic resources and construction materials

High-silica sand

Several Paleozoic sandstone formations in western Virginia have been considered as possible sources of high-silica sand (Lowry, 1954, p. 9), but among these only the Pocono Formation crops out within the study area. Analyses of chip samples taken across two exposures of sandstone of the Pocono show that the sandstone contains higher percentages of aluminum (Al), iron (Fe), magnesium (Mg), and titanium (Ti) than considered suitable for high-silica sand (Lesure and others, 1977, p. C33). The rock could be used, however, as low-quality glass sand.

Shale

Within the study area, the Jennings Formation and to a lesser extent the Hampshire Formation contain beds of shale that are best exposed along U.S. Highway 250 on the flanks of Shenandoah Mountain. Twenty composite chip samples were collected continuously across shale outcrops for the mineral evaluation of the Ramseys Draft Wilderness Study Area (Lesure and others, 1977, p. C33). Four additional samples, from shale beds not evaluated during the previous investigation, were collected for the present study (fig. 4). All samples were submitted for preliminary ceramic tests, raw property determinations, and preliminary bloating tests.

The tests indicate that these shales are suitable for the manufacture of structural clay products including floor and wall brick, sewer pipe, and quarry tile. Only one sample (no. 328) expanded during the fast-fire bloating test, which indicates that some of the shale may be suitable for lightweight aggregate when fired between 1,200° and 1,250°C.

Until the early 1960s, brick plants were operated in both Buffalo Gap, 10 mi (16 km) to the southeast, and Staunton, 18 mi (29 km) to the southeast. The nearest plants operating now are in Glasgow, Rockbridge County, and Somerset, Orange County, Va., both over 50 mi (80 km) from the study area (Le Van, 1974, p. 6-7). Although useable, the shale within the study area is considered to be too far from marketing areas to compete economically with more readily available material.

Stone, sand, and gravel

Sandstone suitable for crushed stone, riprap, or possibly dimension stone is the principal mineral resource in the study area. Commercial potential is low because of distance to market and the ready availability of similar material nearer to markets.

Small deposits of sand and gravel occur in the valley floor of North River, but production was limited to use as road metal or ballast in local construction. Because more accessible construction materials are available in the larger river valleys of the region, sand and gravel within the study area is deemed of little economic value.

Fuels

Coal

Semianthracite coal has been mined near North River Gap, approximately 8 mi (13 km) east of the study area (Darton, 1894). This coal was examined as early as 1835 by W. B. Rogers (1836, p. 99), and the area has been known as the North River coal field for many years (Watson, 1907, p. 348). The coal occurs as thin beds in the upper section of the Pocono Formation on Narrow Back Mountain, from Stokesville in Augusta County northeastward to Rawley Springs in Rockingham County (Howell, 1925, p. 283). Only the lower part of the Pocono is preserved in the study area and no coal was found during the course of our field investigations.

Oil and gas

Only small quantities of oil and natural gas have been produced from the folded rocks of the Valley and Ridge physiographic province in the eastern United States (Meyer and Edgerton, 1968, p. 153).

Two minor gas fields have been partly defined in the general area of Ramseys Draft: the Thornwood field, 22 mi (35 km) northwest in Pocahontas County, W. Va. (Patchen, 1968, p. 19-20), and the Bergton field, 34 mi (55 km) northeast in Rockingham County, Va. (Young and Harnsberger, 1955, p. 317). In both gas fields, the Oriskany Sandstone of Early Devonian age is the major gas-bearing horizon, and minor shows were reported in the overlying formations. Patchen (1968, p. 19-20) indicated that the Thornwood field is along the trace of the Horton anticlinal axis; the Bergton field occurs along the axis of the Bergton-Crab Run anticline (Young and Harnsberger, 1955, p. 320-326). Both gas fields are shut-in and neither has had commercial production.

No test wells have been drilled in Ramseys Draft Wilderness Study Area or in the Addition. The nearest known exploratory gas well was drilled in Rockingham County about 10 mi (16 km) northeast of Ramseys Draft (lat. 38°29'16" N., long. 79°10'34" W.) in 1974 by Crab Run Gas Company. The well was spudded just west of the Bergton-Crab Run anticlinal axis and was drilled to a total depth of 6,972 ft. "Salt water was encountered in the Oriskany Sandstone target formation and due to the absence of gas, the well was plugged and abandoned as a dry hole" (Virginia Department of Labor and Industry, 1974, p. 102). A second test hole was planned to be drilled just north of the first (lat. 38°30'24" N., long. 79°09'17" W.); however, no information is available concerning this plan.

The Pocono, Hampshire, and Jennings Formations have petroliferous equivalents deeply buried under the Appalachian Plateau to the west in West Virginia, but in the study area the thermal maturity of these rocks (the combined effects of heat and pressure to which the strata have been subjected since their deposition) exceeds the temperature at which oil is decomposed and expelled from source or reservoir rocks (Wallace de Witt, USGS, written commun., 1975). The more deeply buried Cambrian to Middle Devonian sedimentary rocks, at least to the depth of the Broadtop decollement (Jacobeen and Kanes, 1974), a major detachment thrust-fault zone, are within the thermal range capable of containing natural gas.

Relatively little is known about the rocks below the major detachment zone, about 9,000 ft (2,700 m) below Ramseys Draft Addition (fig. 3). Scant drilling on anticlines to the west in the Valley and Ridge Province has demonstrated the presence of complexly folded and faulted rocks at depth (Perry, 1964). Near-surface anticlines and synclines have been displaced westward several miles along the major detachment thrust fault, and these surface structures cannot be projected accurately across the fault without abundant geophysical data. The few wells that have

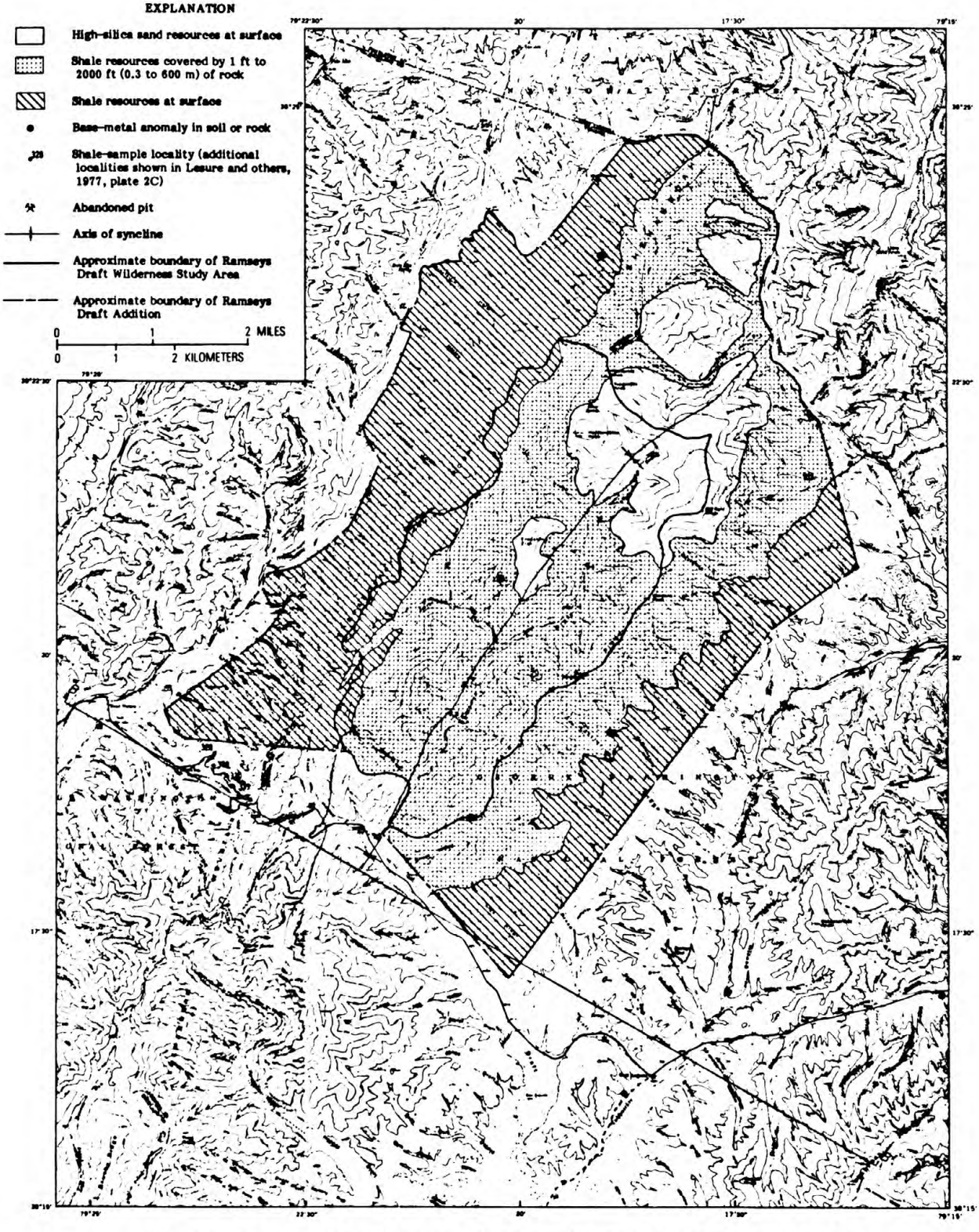


Figure 4.—Map of Ramseys Draft Wilderness Study Area and Addition showing areas containing shale and high-silica sand resources, and locations of base-metal anomalies. Base-metal anomaly in the Wilderness Study Area is described by Lesure and Motooka (1980).

been drilled through the major detachment fault have not found oil or gas below the detachment zone.

Crab Run Gas Company has conducted seismic investigations along U.S. Route 250 from just south of Ramseys Draft Wilderness Study Area to a point east of West Augusta, Va. On the basis of these data, the company is of the opinion that the Wilderness Study Area, because of its synclinal structure, has no potential for the accumulation of oil or gas. If oil or gas accumulation exists this far south along the Bergton-Crab Run anticline, it would be to the east of Bald Ridge (F. H. Jacobeen, Jr., Crab Run Gas Company, written commun., February 1975). No geophysical data are available for the area covered by oil and gas leases to the east and west of Ramseys Draft Wilderness Study Area.

The potential for oil and gas in the Ramseys Draft Addition cannot be fully evaluated at present. The possible presence of structural traps, minor anticlines, or high-angle faults on the limbs of the syncline (fig. 3) has been suggested by Perry (1978), but can be adequately determined only by a carefully designed geophysical and drilling exploratory program.

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