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MINERAL RESOURCE POTENTIAL OF THE TROUBLESOME ROADLESS AREA, MCCREARY COUNTY, KENTUCKY

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STUDIES RELATED TO WILDERNESS

Roadless Areas

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 directs that results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Troublesome Roadless Area, Daniel Boone National Forest, McCreary County, Ky. The area was classified as a further planning area by the U.S. Forest Service during the Second Roadless Area Review and Evaluation (RARE II), January 1979.

SUMMARY

A geologic and geochemical investigation and a survey of existing mines and prospects have been conducted to determine the mineral resource potential of the Troublesome Roadless Area, McCreary County, Ky. The study area comprises six tracts totaling about 2,943 acres in the Daniel Boone National Forest. It is in the Cumberland Plateau section of the Appalachian Plateaus Province. All surface and mineral rights are federally owned.

Limestone and shale units of Mississippian age and overlying sandstone, shale, and coal beds of Pennsylvanian age comprise the bedrock exposed in the Troublesome Roadless Area.

Coal, sandstone, and shale are the principal mineral resources in the study area. Coal has been mined near the roadless area from at least two coal beds. Available data indicate that coal reserves do not underlie the area. Coal resources totalling 747,000 short tons in the Stearns No. 1 1/2 (?) coal bed and 166,000 short tons in the Barren Fork(?) coal bed are contained in the Troublesome Roadless Area.

Possible uses for sandstone units include silica sand, construction sand, and dimension stone. Shale may be suitable for structural clay products. Commercial quantities of oil and gas may be present at shallow depth in rocks of Mississippian age. A stream-sediment geochemical survey failed to recognize anomolies that would suggest mineralization, and the metallic mineral potential of the study area appears limited.

INTRODUCTION

The Troublesome Roadless Area is composed of six individual tracts of land that contain a total of 2,943 acres.

The largest tract is about 13 mi southwest of Stearns, Ky., and is accessible via State Route 92 to Hill Top, Ky., and then southwestward along county roads (fig. 1). Unimproved Forest Service roads, abandoned logging roads, and primitive trails provide access by foot or horseback into the interior of each tract.

Physiographically, the Troublesome Roadless Area is in the Cumberland Plateau section of the Appalachian Plateaus Province and is near the western edge of the Appalachian coal region. The topography, typical of the Cumberland Plateau, is characterized by irregular, narrow-crested ridges, deep narrow canyons, and dendritic drainage. Altitudes range from about 1,600 ft on Laurel Ridge in the largest tract to approximately 800 ft along the South Fork of the Cumberland River. Troublesome Creek, a small tributary of the South Fork of the Cumberland River, is the source of the study area's name.

Previous Investigations

Early reports concerning geology and mineral resources of McCreary County include regional coal investigations by Crandall and Hodge (1887), Crandall (1889), and Miller (1910). The geology of McCreary County and the locations of oil and gas exploratory wells near the study area were mapped by Murphy and Miller (1928). The oil and gas resources of Wayne County and southwestern McCreary County were discussed in an early, comprehensive report by Munn (1914). Regional Pennsylvanian geology of part of the Southern Appalachian coal field was discussed by Wanless (1946). Other geologic mapping adjacent to the area includes the work of Swingle and others (1966) and Bergenback and Wilson (1961). The coal reserves of eastern Kentucky are discussed by Huddle and others (1963). Rice and Smith (1979) have correlated coal beds in all districts of the eastern Kentucky coal field. Geologic quadrangle maps covering parts of the Troublesome Roadless Area and vicinity have been prepared by Pomerene (1964) and Smith (1978).

Present Investigation

U.S. Geological Survey (USGS) field investigations were conducted by W. R. Sigleo and A. H. Randall, III, in the fall of 1980. Stratigraphic sections and coal beds were measured; altitudes of individual stratigraphic units, mines, and prospects were determined using an altimeter; and mappable units were determined in and adjacent to the roadless area.

A geochemical investigation was conducted in 1980 by A. E. Grosz, and he collected 18 bulk stream-sediment samples. These were analyzed semiquantitatively for 31 elements, including metals having the greatest economic importance, by USGS laboratories, Denver, Colo. (Grosz and Siems, in press). Records of test holes for oil and gas exploration in nearby areas and related publications were examined by R. C. Kepferle of the USGS for an evaluation of the oil and gas potential in the roadless area.

The U.S. Bureau of Mines (USBM) field reconnaissance was conducted in the fall of 1979. Nine rock samples and one coal sample were collected during the investigation. All samples were analylzed spectrographically for 40 elements by the USBM, Reno Research Center, Reno, Nev. Atomic-absorption, radiometric, and chemical analyses were also performed on selected samples. Clay and shale samples were evaluated for ceramic and bloating properties by the USBM Tuscaloosa Research Center, Tuscaloosa, Ala. One coal

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sample was analyzed by the U.S. Department of Energy, Division of Solid Fuel Mining and Preparation, Pittsburgh, Pa.

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Land and Mineral Ownership

The Federal Government owns all surface and mineral rights in the Troublesome Roadless Area. Mineral rights on about 1,647 acres previously held by Stearns Coal and Lumber Company were purchased by the Federal Government in July 1979 for establishment of the Big South Fork of Cumberland National River and Recreation Area.

Geology

About 800 ft of sedimentary rocks of Late Mississippian to Middle Pennsylvanian age crop out in and adjacent to the study area, and as much as 8,000 ft of older Paleozoic rocks may be present in the subsurface (Sigleo and Randall, 1981). The basal part of the exposed section, assigned to the Newman Limestone of Late Mississippian age, crops out along the South Fork of the Cumberland River and its major tributaries east of the area. Overlying rocks of the Lee and Breathitt Formations of Early and Middle Pennsylvanian age are mostly continental and coal bearing, but the sequence may also contain marine deposits. The rocks of these formations crop out in the study area and underlie the highlands. Unmapped deposits of colluvium mantle many valley slopes, and deposits of alluvium consisting of sand, coarse gravel, and large boulders are present along the valley floors.

The basal 50+ ft of the exposed section, assigned to the upper member of the Newman Limestone, consists predominantly of greenish-gray or grayish-red shale and thin beds of yellowish-brown-weathering sandstone and limestone. The sandstone units are fine grained, slightly calcareous, and locally crossbedded, and several of the thin limestone beds contain finely divided, bioclastic debris. Deposition of this sequence probably took place in tidal-flat and (or) delta-front environments.

The Newman Limestone is disconformably overlain by an undivided sequence of sedimentary rocks that is assigned to the Lee and Breathitt Formations. Beds of quartz-pebble conglomerate locally fill irregularities in the unconformity.

The Lee and Breathitt Formations have a combined thickness of about 750 ft and include beds of conglomeratic, cliff-forming sandstone interbedded with nonresistant sandstone, siltstone, shale, coal, and underclay. Topographically, the most prominent unit in this sequence is the Rockcastle Sandstone Member of the Lee Formation, a massive sandstone and conglomerate that forms cliffs as high as 125 ft. This unit, together with the overlying middle sandstone member of the Lee Formation, underlies the broad uplands of the Troublesome area. The Corbin(?) Sandstone Member of the Lee Formation is relatively thin and crops out as isolated remnants that cap the higher ridge tops. Deposition of sediments assigned to these formations took place in a coastal or near-coastal environment dominated by barrier-bar, lagoonal, and deltaic processes.

Quaternary deposits consist primarily of sandstone and conglomeratic sandstone debris, locally as house-sized, rectangular blocks, that occur as colluvium in slope deposits and as alluvium on the valley floors.

The Troublesome Roadless Area is on the western limb of a small north-trending anticline near the western margin of the Cumberland escarpment. Structure contour lines drawn on the base of the Rockcastle Sandstone Member indicate a low west-southwestward dip, generally less than 1°. No evidence of faulting was observed in the area.

MINERAL RESOURCES

Coal, sandstone, and shale are the principal resources in the study area. Coal has been mined near the roadless area from the Stearns No. 1 1/2 (?) and the Barren Fork(?) coal beds. Quartzose sandstone, exposed throughout most of the area, may be suitable for glass, filter, furnace, and abrasive sand. Other possible uses for sandstone include construction sand and dimension stone. In addition, shale may be suitable for structural clay products. Commercial quantities of oil and gas may be present at shallow depth in rocks of Mississippian age. No potential was found for metallic mineral deposits.

Coal

Coal in the Troublesome area is apparently of high-volatile A bituminous rank. It occurs in at least 13 identified beds of which two, the Stearns No. 1 1/2 (?) and the Barren Fork(?), contain coal resources. The coal resources in the Troublesome area have not been commercially developed except for local use. Coal has been produced from several mines north of the area near Fidelity, Ky., and to the southeast on Watson Branch, a tributary of the South Fork of the Cumberland River. All adits are now abandoned and most are caved.

Most of the coal is banded with dull and bright attritus and less amounts of vitrain and fusain. Partings of impure coal, shale, and underclay are common, and finely disseminated pyrite is characteristic of the principal beds. The stratigraphic position and range in thickness of each coal bed and the thickness and lithologic characteristics of the intervening strata are presented in Sigleo and Randall (1981).

Coal resources were estimated for the Stearns No. 1 1/2 (?) bed in the Lee Formation and for the Barren Fork(?) coal bed in the Breathitt Formation. The Stearns No. 1 1/2 (?) coal bed is 20-130 ft above the Mississippian-Pennsylvnian unconformity and crops out only on Watson Branch southeast of the easternmost part of the roadless area. Measurements made at prospects, outcrops, and from available drill core records indicate that the coal ranges from 15 to 50 in. thick.

The Barren Fork(?) coal bed is about 385 ft above the Stearns No. 1 1/2 (?) coal in a thin shale unit that overlies the Rockcastle Sandstone Member of the Lee Formation. The coal bed is discontinuous, ranging from 0 to 22 in. in thickness, and is believed to underlie most of the easternmost part of the study area. Exposures of the Barren Form(?) coal bed were not found in the large western tract of the Troublesome Roadless Area.

The coal resources of the Troublesome Roadless Area were estimated according to standard procedures and categories, as follows:

1. Measured resources underlie areas where the thickness and areal extent of the coal beds are well defined by measurements 0.5 mi or less apart. They generally extend in a belt 0.25 mi wide adjacent to an outcrop or point or measurement.
2. Indicated resources underlie areas where observation points are 0.5-1.5 mi apart. They generally extend in a belt as much as 0.75 mi beyond the limit assumed for measured coal.
3. Inferred resources underlie areas where observation points are 1.5-3.0 mi apart, and the continuity of the coal is supported by geologic evidence. Inferred coal extends as a 2.25-mi-wide belt 0.75-3.0 mi from a measured point.

In addition to these reliability categories, bed maps with thickness intervals of 14-28 in., 28-42 in., and 42 in.

were used to estimate the total coal resources. Tonnages for coal in beds less than 14 in. thick were not determined.

Approximately 913,000 short tons of coal are estimated for the two resource-bearing coal beds in the Troublesome study area (table 1). Of the estimated original and remaining resources, 53 percent is 14-28 in. thick and 47 percent is 28-42 in. thick. There are no known coal resources thicker than 42 in. The Stearns No. 1½(?) is the thickest and most persistent bed, and it contains as estimated 747,000 short tons of coal or 82 percent of the total calculated for the study area. The coal resources for the two beds appear to be mostly in the southeastern part of the study area; no known coal reserves exist in the study area.

Approximate analysis of the Stearns No. 1½(?) coal on Watson Branch was determined by the USBM. This analysis indicates the following values (in percent, as received basis): moisture, 8.0; volatile matter, 35.5; fixed carbon, 50.1; ash, 6.4; sulfur, 0.64; and heating value, 12,440 Btu/lb. The analysis indicates that the coal is of high-volatile A bituminous rank and has low sulfur and ash contents. No analyses are available for the Barren Fork(?) coal in the Troublesome area. Accurate rank determinations were not made because of the lack of unweathered coal samples.

Sandstone and Shale

Sandstone in the Troublesome Roadless Area occurs as cliff-forming orthoquartzites in the Lee Formation and as poorly exposed subgraywacke and quartzose sandstones in the Breathitt Formation. The Rockcastle Sandstone Member of the Lee Formation contains 95 percent or more SiO_2. Chemical analyses of selected samples of Lee Formation sandstone, from the study area or nearby, are shown in table 2 on the accompanying map. Potential uses of sandstone from the study area include filter, furnace, and abrasive sand (samples KT-3, -4, -6, and -8). Three samples (KT-4, -6, and -8) of friable, deeply weathered sandstone have marginal potential for use as low-grade glass sand.

Shale, ranging in color from light to dark gray, occurs in both the Lee and Breathitt Formations in the study area. Good exposures of shale are found in deep stream valleys that have been cut below the base of the Rockcastle Sandstone Member of the Lee Formation. Three shale samples were collected during the field investigation and tested to determine ceramic and bloating properties. Preliminary tests indicate that shale exposed in the roadless area may be suitable for structural clay products (table 3 on the accompanying map). None of the samples bloated during quick-fire tests, thus eliminating the shale from consideration as possible raw material for lightweight aggregate production.

Oil and Gas

Nearby producing and abandoned oil and gas wells suggest the possibility that limited oil and gas resources may be present in the Troublesome Roadless Area. In most wells, production is from a porosity zone known to drillers as the "Beaver" sand, a limestone accumulation in the lower part of the Fort Payne Formation of Early Mississippian age (Kepferle, written commun. 1981). No exploratory drilling has been conducted in the study area; however, about 410 acres were included in an oil and gas lease (ES-7925) issued by the U.S. Bureau of Land Management in 1971. Additional exploration, particularly deep drilling, is necessary before the oil and gas potential can be fully evaluated.

Metallic Minerals

Metallic mineral deposits have not been reported in the area, and none were observed during the field investigations. The rock units exposed in the study area do not normally host metallic deposits in this region, and the potential for such deposits appears low. No major geochemical anomalies indicative of mineralization were located by the geochemical survey (Grosz and Siems, in press).

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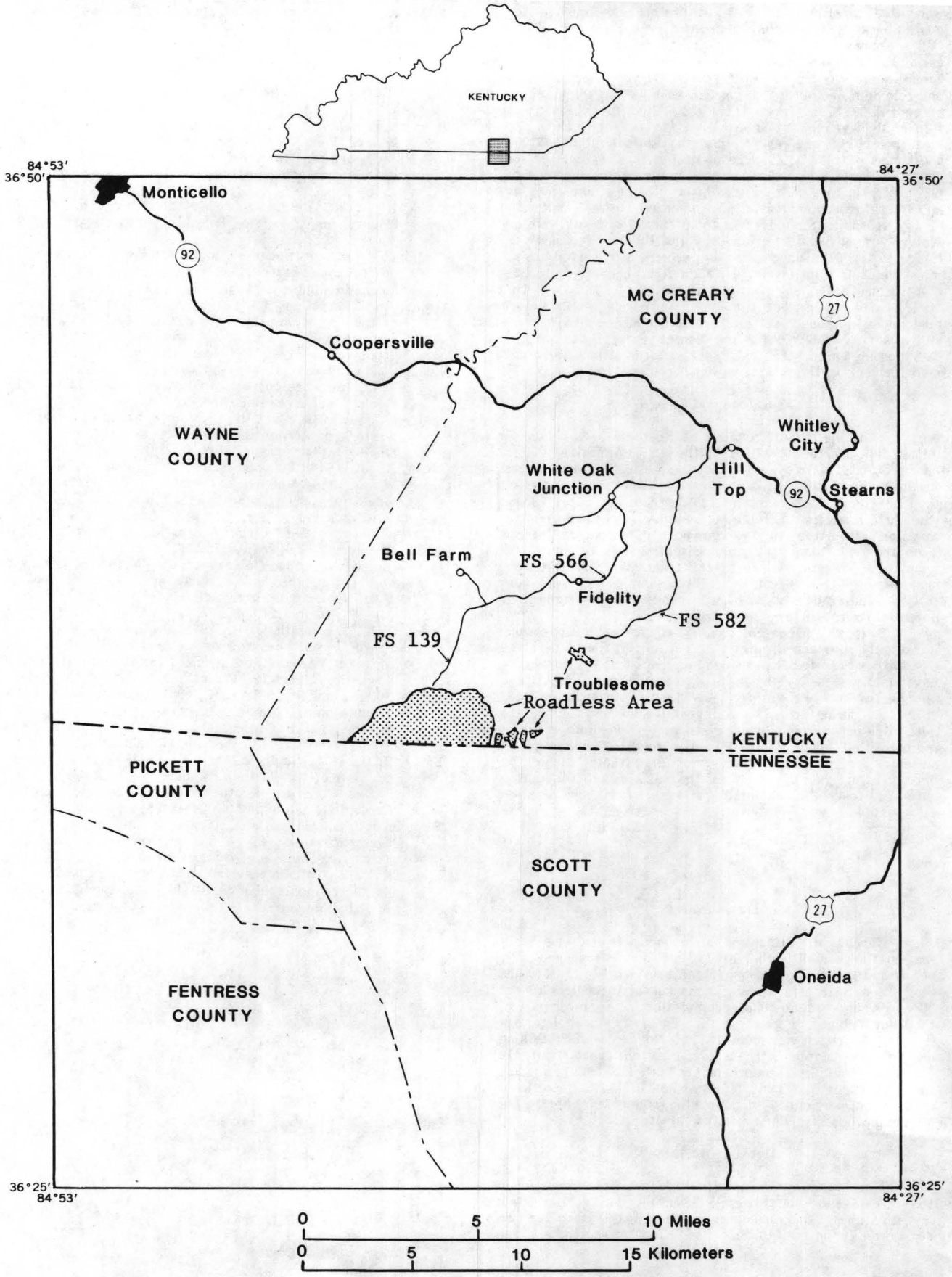

Figure 1.—Index map showing location of Troublesome Roadless Area. (F S stands for U.S. Forest Service Route).