DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1510-C
PAMPHLET ACCOMPANIES MAP

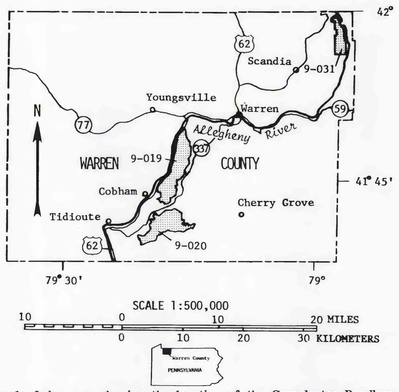

Figure 1.—Index map showing the location of the Cornplanter Roadless Area (9-031). Nearby areas of previous work include the Allegheny Front (9-019) and Hickory Creek (9-020) Roadless Areas (Schweinfurth and others, 1982), the Kinzua quadrangle (Lytle and Goth, 1970), and the Warren quadrangle Butts, 1910). Forest Service area designation numbers shown in parenthesis.

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands 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 Cornplanter Roadless Area in the Allegheny National Forest, Warren County, Pa. Cornplanter Roadless Area was classified as a further planning area (0-9031) during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

The Cornplanter Roadless Area of about 3,000 acres (1,220 ha) in the Allegheny National Forest, Warren County, Pa.,(fig. 1) contains flat-lying sedimentary rocks of Paleozoic age that have a high potential for gas and a moderate potential for oil. Other mineral resources having low economic potential include salt, various rocks suitable for road metal, conglomeratic sandstone suitable for high silica uses, and shale suitable for the production of structural clay products. No metallic mineral resources have been identified in the area.

The Federal Government owns all surface rights in the area but only about 23 percent of the mineral, oil, and gas rights.

SURFACE AND MINERAL OWNERSHIP

The Federal Government owns the surface rights to all of the study area, but owns oil, gas, and mineral rights to only about 750 acres of the study area (fig. 2). Oil, gas, and mineral rights are privately owned on about 1,660 acres of Federal subordinated land, on which extraction is limited by Federal regulations under Title 36, Chapter II, section 251.15. Oil, gas, and mineral rights to about 520 acres of the study area are privately owned and are not affected by these regulations. On one tract of about 85 acres, oil, gas, and mineral ownership is divided into 60 percent Federal and 40 percent private. As of June 1981, no oil and gas exploration permit applications had been filed on study area lands.

GEOLOGY

About 800 ft (240 m) of nearly flat-lying clastic marine sedimentary rocks of Late Devonian and Early Mississippian age are poorly exposed in the Cornplanter area (Lesure, 1983), and possibly as much as 9,000 ft (2,745 m) of older Paleozoic sedimentary rocks are present in the subsurface. The oldest exposed formations that form the steep slopes above the Allegheny reservoir pool level are part of the shale, siltstone, and sandstone beds of the Conneaut Group of Chadwick (1935) and overlying Conewango Formation of Late Devonian age. These are overlain by conglomerate and sandstone of the Knapp Formation of Mississippian age that forms much of the nearly flat upland surface in northeastern Warren County. Large masses of colluvium and old landslides mantle the steep slopes (Pomeroy, 1981). These deposits grade into thin sheets of alluvium along some of the larger stream valleys. A small deposit of glacial outwash is partly exposed in a gravel pit just above pool level on the toe of a large landslide mass near the north end of the study area.

Bedrock in the Cornplanter area is nearly flat lying. The Conneaut Group dips about 70 ft/mi (13m/km) to the south in the northern part of the area but levels off and forms two small northeast-trending shallow domes in the southern part of the area near Cornplanter Run. The sandstone beds near the base of the Conewango Group probably dip about 35 ft/mi (7m/km) to the south and the base of the Knapp dips about 15-20 ft/mi (3-4 m/km) in the same direction. No faults were observed during fieldwork, and none has been reported by previous workers.

GEOCHEMISTRY

The U.S. Geological Survey made a reconnaissance geochemical survey of the Cornplanter area to test for indistinct or unexposed mineral deposits that might be recognized by their geochemical halos. Twenty-two stream-sediment, 63 soil, and 23 rock samples were collected and analyzed for 31 elements (Lesure and Day, 1983). The analytical data do not outline any areas of potential metallic mineral resources.

MINERAL RESOURCE POTENTIAL

Oil and gas are the most important potential mineral resources in Cornplanter Roadless Area. Salt beds present at depth below the area are too thin and deeply buried to be economically important. Other potential mineral resources include shale, sandstone, conglomerate, and sand and gravel, all of use as construction materials (fig. 3).

Oil and Gas

The Cornplanter area lies within the main oil and gas producing region of western Pennsylvania and adjacent southwestern New York, where many thousands of wells have been drilled to the shallow Upper Devonian sandstones during the past 123 years. At least 57 shallow oil and gas test wells have been drilled either in or near the study area, many of them during the the mid-1940's (fig. 4). Five gas wells along Cornplanter Run produced initial gas flows of 50-200 thousand ft^3 (MCF)/day from Upper Devonian sandstones (Rhodes, 1977). A deep test well, Felmont Oil Corporation's #1 Collins, drilled to 4,000 ft (1,219 m) in the Hooks Brook area had a show of gas in the shallow Devonian sands but only saltwater in the Lower Devonian Oriskany Sandstone. The Appalachian Development Corporation's #1 Williams, which was drilled to a depth of 3,542 ft (1,080 m) along the Allegheny River just north of the old Cornplanter Indian Reservation, found a small show of oil and three shows of gas in the shallow Devonian sands, but only saltwater in the Oriskany Sandstone. At least two wells along Hooks Brook near the western boundary of the study area (fig. 4), produced oil (Lytle and Goth, 1970, pl. 1). All oil and gas wells in the study area have been abandoned for more than 15 years.

Unfortunately for appraisal purposes, most of these shallow oil and gas wells were drilled between 1860 and 1920 by cable-tool methods, and for many, if not most wells, drilling and production records are not available. However a reasonable picture of the subsurface stratigraphic framework of the Cornplanter Roadless Area may be synthesized by correlating the older lithologic sample descriptions from cable-tool drill cuttings with suites of newer wire-line electric logs from nearby wells.

Subsurface rocks—The Cornplanter Roadless Area is underlain by a sequence of Paleozoic sedimentary rocks about 9,000 ft (2,745 m) thick that lies unconformably upon an older basement complex of metamorphic and igneous rocks of Precambrian age (fig. 5). Oil and/or gas have been produced in nearby regions from the Upper and Lower Devonian sandstones, the Lower Silurian sandstones, the Middle Ordovician limestones and the Cambrian sandy dolomite. The formations older than Devonian have not been prospected in the study area.

Source rocks—The main source beds for oil and gas are fine-grained marine rocks that contain more than 1 percent organic carbon by weight. Most of the marine gray shale of the Upper and Middle Devonian and the Upper Ordovician shaly sequences containing one percent organic carbon are lean source beds, the black shale of the Middle and Upper Devonian containing several percent organic carbon are superior source beds, particularly for natural gas. Black shale in the basal part of the Lower Silurian-Upper Ordovician clastic sequence also appears to be a better than average source bed.

The presence of both oil and gas fields in a broad area adjacent to the Cornplanter Roadless Area indicates that the abundant source beds in the stratigraphic sequence attained sufficient thermal maturity to generate oil and gas and to release the fluid hydrocarbons to adjacent reservoir rocks. Regional study of the degree of thermal maturation (Harris and others, 1978) demonstrates that the younger Devonian rocks in the Cornplanter Area may contain oil and gas, whereas the older, more deeply buried Cambrian, Ordovician, and Silurian rocks will, most likely, contain only dry gas.

Reservoir rocks—The uppermost 1,500-2,000 ft (457-610 m) of the Upper Devonian sequence contains 8-12 zones of lenticular, fine-grained sandstone, from a few to more than 80 ft (24 m) thick, intercalated in a thick sequence of marine siltstone and shale. Because the lenticular shallow Devonian reservoir sands of the Cornplanter Roadless Area commonly grade laterally in relatively short distances into impermeable shale, they cannot be correlated with certainty throughout the roadless area. Porosity and permeability of these reservoir sands vary abruptly. The sand lenses are stratigraphic traps, which are considerably more difficult to locate than structural traps. Drilling is the only method for positive confirmation of the presence or absence of the shallow Upper Devonian sands at a specific site in the Cornplanter Roadless Area. Higher prices recently paid for gas and oil have made many low-yield wells commercially profitable to develop and produce. These factors have led to additional drilling in old developed areas as well as exploratory drilling in relatively untested areas. The Upper Devonian shallow-sand sequence in and adjacent to the Cornplanter Roadless Area has sufficient low-permeability reservoir sands to encourage drilling near old wells that had found gas or oil but not in commercial volumes.

The Lower Devonian Oriskany Sandstone is an excellent reservoir rock in much of western Pennsylvania and adjacent southern New York. Scattered deep wells, wells more than 2,500 ft (762 m) deep, in the vicinity of the Cornplanter area show that the Oriskany is generally less than 10 ft (3 m) thick and commonly contains saltwater and a little natural gas.

Although data are very scant, the Bass Islands Dolomite in the upper part of the Silurian carbonate rock sequence is sufficiently porous and permeable locally in parts of northwestern Pennsylvania and adjacent southern New York to contain gas, oil, and saltwater. Because the Bass Islands Dolomite is probably present under the Cornplanter area, it must be considered a potentially productive reservoir rock until evaluated by drilling.

The basal Silurian sandstones of the "Medina Group" have been gas productive in western New York and adjacent northwestern Pennsylvania. Locally a small amount of oil has accompanied the gas from "Medina" wells in Erie County, Pa., but the volume of oil appears to decrease to the east. Only dry natural gas has been found in the "Medina" of western Warren County, Pa. The production from the "Medina sands" in the general vicinity of the Cornplanter area suggests they may have a moderate potential for gas under the roadless area.

Very few deep wells have been drilled into the Cambrian and Ordovician carbonate rock sequence in the general vicinity of the Cornplanter area; consequently the presence of good reservoir rocks in the sequence is largely conjectural. However, gas has been found in beds of sandstone in the upper part of the Cambrian sequence near Bradford, McKean County, Pa. near Dunkirk, Chautauqua County, N. Y. and in western Erie County, Pa. These findings bracket the study area and suggest that porous reservoir rocks containing gas and saltwater may be present in the Cambrian rocks under the study area.

Oil and gas summary—The Cornplanter Roadless Area has a high potential for natural gas and a moderate potential for oil. Thick sequences of source rocks are present in the stratigraphic sequence under the roadless area. The level of thermal maturity is sufficiently high to have generated both oil and gas which have migrated into adjacent reservoir rocks. The presence of both oil and gas pools in the area demonstrates that the maturation process has not destroyed existing fluid hydrocarbons. Stratigraphic traps containing porous and permeable reservoir rocks are abundant in the shallow Upper Devonian sequence and scattered subsurface data suggest the presence of source rocks, reservoir rocks, traps, and seals deeper in the Silurian, Ordovician, and Cambrian rocks under the area. Because of the lenticularity of reservoir rocks and the absence of much subsurface data, exploratory drilling is the only satisfactory method to determine the presence, geometry, and hydrocarbon content of potential reservoir rocks under the study area.

Salt

A sequence of Middle and Upper Silurian dolomite, anhydrite, halite, and shale about 1,300 ft (396 m) thick underlies the Devonian rocks of the study area (Rickard, 1969). The halite (rock salt) occurs in beds as thick as 35 ft (11 m) in the upper medial part of the carbonate-rock sequence. The beds of salt are part of a regionally extensive sequence of evaporitic rocks that underlies large parts of western New York, Pennsylvania, Ohio, West Virginia, and Michigan. Salt has been recovered by solution and mechanical mining for industrial and domestic use in New York, West Virginia, Ohio, and Michigan. Beds of salt under the Cornplanter area are too deeply buried and too thin to be recovered at present in competition with salt beds in the Silurian sequence at more favorably located sites to the north in central New York or to the west along the south shore of Lake Erie, in the vicinity of Cleveland, Ohio.

Construction Materials

Preliminary evaluations of the shales in the study area indicate they have a potential use in structural clay products such as building or floor brick (Welsh and Grau, 1982, p. 22). Sandstone and conglomerate in the area can be used for common building stone and crushed rock. Analyses of three high-silica sandstones indicated levels of iron oxide averaging 1.71 percent, prohibitive for use in glass manufacture without beneficiation (Welsh and Grau, 1982, p.15); other samples of the same unit contain 0.1-2 percent iron (Lesure and Day, 1983). Sand and gravel deposits are of limited extent, and utilization would be hampered by poor transportation access, as is the case with the other construction materials.

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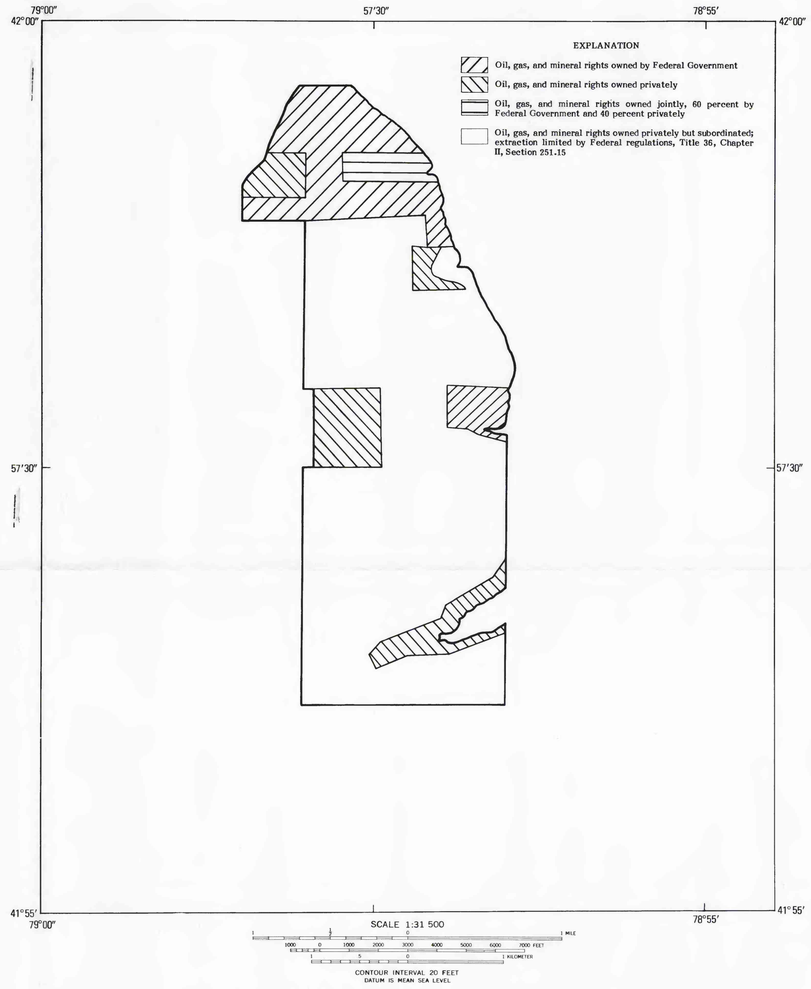
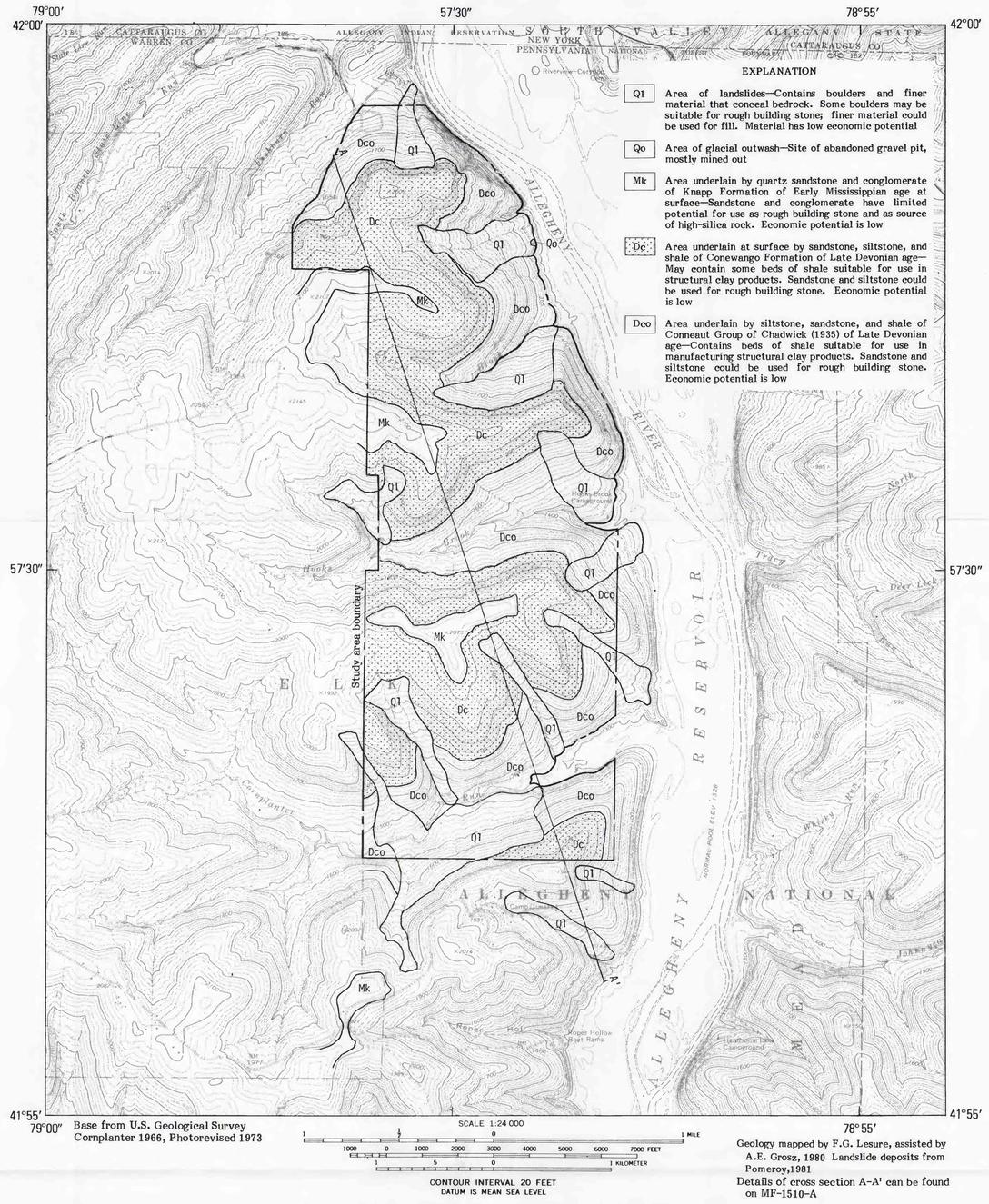


Figure 2.—Map showing oil, gas, and mineral ownership in the Cornplanter Roadless Area.

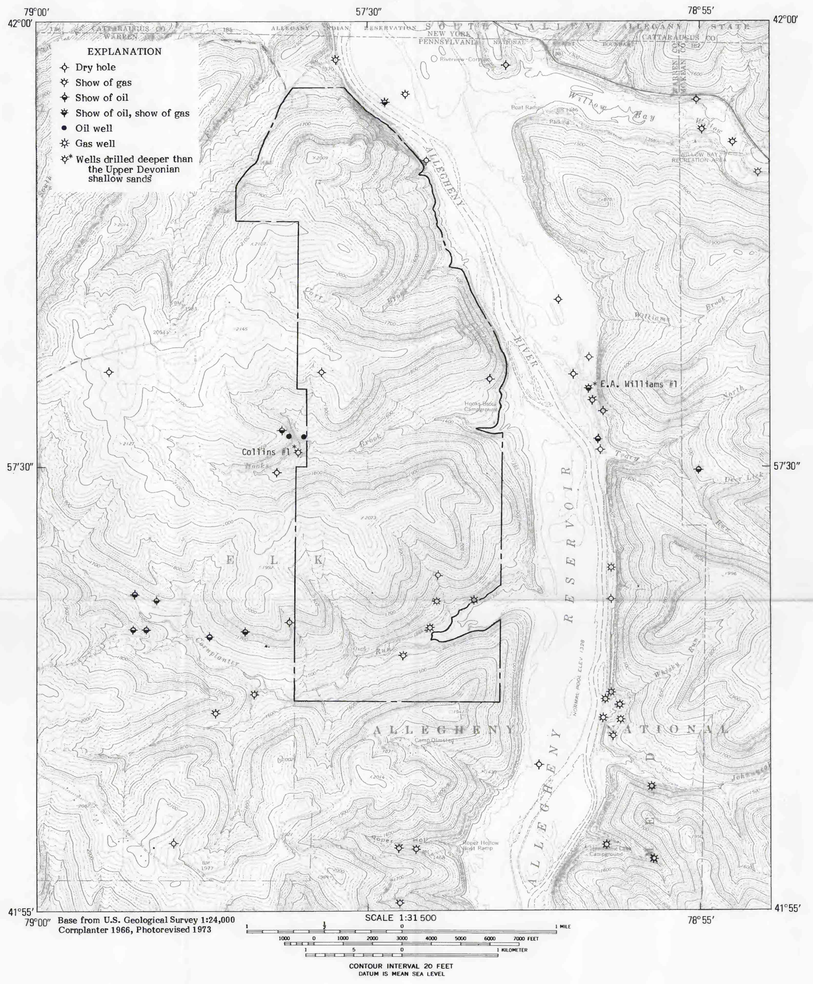


79°00' Base from U.S. Geological Survey Cornplanter 1966, Photorevised 1973

Geology mapped by F.G. Lesure, assisted by A.E. Grosz, 1980 Landslide deposits from Pomeroy,1981

Details of cross section A-A' can be found on MF-1510-A

Figure 3.—Map showing nonfuel mineral resource potential of Cornplanter Roadless Area.



79°00' Base from U.S. Geological Survey 1:24,000 Cornplanter 1966, Photorevised 1973

Figure 4.—Oil and gas wells drilled in and near the Cornplanter Roadless Area (after Lytle and Goth, 1970).

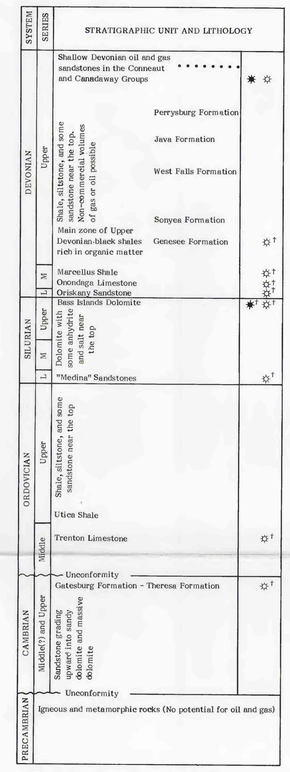


Figure 5.—Generalized lithologic section showing subsurface stratigraphic units mentioned in text.

MINERAL RESOURCE POTENTIAL MAP OF CORNPLANTER ROADLESS AREA, WARREN COUNTY, PENNSYLVANIA

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1983

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