DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1523-B
PAMPHLET ACCOMPANIES MAP

NOTE: The following explanation is for the geologic base map shown in gray

CORRELATION OF MAP UNITS

Qal, Qtl, Qoa	Holocene, Pleistocene(?)	QUATERNARY
Unconformity		
Kd	Upper Cretaceous	CRETACEOUS
Kbc	Lower Cretaceous	CRETACEOUS
Unconformity		
Jmw	Upper and Middle Jurassic	JURASSIC
Jt	Middle Jurassic	JURASSIC
Je	Middle Jurassic	JURASSIC
Unconformity		
₹cp, ₹cl	Upper Triassic	TRIASSIC
Unconformity		
Pc	Lower Permian	PERMIAN

LIST OF MAP UNITS

Qal ALLUVIUM (QUATERNARY)

Qtl TALUS AND LANDSLIDES DEPOSITS (QUATERNARY)

Qoa OLDER ALLUVIUM (QUATERNARY)

Kd DAKOTA SANDSTONE (CRETACEOUS)--Sandstone, carbonaceous shale, and conglomerate

Kbc BURRO CANYON(?) FORMATION (CRETACEOUS)--Conglomerate, sandstone, and mudstone

Jmw MORRISON FORMATION AND WANAKAH FORMATION, UNDIFFERENTIATED (JURASSIC)--Sandstone, mudstone, claystone, limestone, and bentonite

Jt TODILTO LIMESTONE (JURASSIC)--Limestone, gypsum, and minor sandstone

Je ENTRADA SANDSTONE--(JURASSIC)

₹cp CHINLE FORMATION (TRIASSIC) Petrified Forest Member--Interbedded sandstone, conglomerate, siltstone, and mudstone; local limestone

₹cl Lower Member--Sandstone, shale, local conglomerate

Pc CUTLER FORMATION (PERMIAN)--Sandstone, siltstone, and mudstone

CONTACT--Dashed where approximately located

FAULT--Dashed where approximately located; dotted where concealed; bar and ball on downthrown side

STRIKE AND DIP OF BEDS

ANTICLINE--Showing trace of axial plane and plunge; dashed where approximately located

SYNCLINE--Showing trace of axial plane; dashed where approximately located

APPROXIMATE BOUNDARY OF CHAMA RIVER CANYON WILDERNESS

APPROXIMATE BOUNDARY OF CHAMA RIVER CANYON ROADLESS AREA

EXPLANATION

x⁶ PROSPECT--Showing number used in table 1

▲²⁰ DRY STREAM-SEDIMENT SAMPLE LOCALITY--Showing anomalous uranium value in parts per million

■⁶⁸ ROCK SAMPLE LOCALITY--Showing anomalous uranium value in parts per million

AREAS OF MODERATE TO HIGH MINERAL RESOURCE POTENTIAL

Areas that contain known resources or are highly likely to contain resources based on geologic and geochemical data

A COPPER--Stratiform deposits with associated uranium and silver. Criteria used to define area are: (1) Known deposits or occurrences near the study area that contain these elements; some deposits mined. (2) Similiar facies to those mineralized elsewhere. (3) Anomalous copper and uranium concentrations in samples from the Chinle Formation

B GYPSUM--Criteria used to define area are: (1) Observed outcrops of gypsum. (2) Nearby mining of gypsum. (3) Sufficient thickness to mine

AREAS OF LOW TO MODERATE MINERAL RESOURCE POTENTIAL

Areas that might contain resources, but are less likely to contain them, based on geologic and geochemical data

C URANIUM--In Todilto Limestone. Criteria used to define area are: (1) Known uranium prospects (loc. 4, 6). (2) Anomalous uranium concentration detected in rock sample. (3) Favorable facies, similar to area outside study area that was mineralized and mined (Hilpert, 1969, p. 46)

D OIL AND GAS--Criteria used to define area are: (1) Target strata produces oil and gas in San Juan basin. (2) Possible favorable facies and presence of structural and stratigraphic traps at depth, especially along western part of study area. (3) Oil shows in target strata, outside of but not far from study area

AREAS OF LOW MINERAL RESOURCE POTENTIAL

Areas that probably contain resources, but resources would be too small due to locally unfavorable facies and preservation conditions and limited areal extent

E KAOLINITE--Criteria used to define area are: (1) Known mine just outside the study area (loc. 7). (2) Locally favorable facies

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 Chama River Canyon Wilderness and contiguous Roadless Area in the Santa Fe and Carson National Forests, Rio Arriba County, New Mexico. The Chama River Canyon Wilderness was established by Public Law 95-237, Feb. 24, 1978. The Chama River Canyon Roadless Area (03098) 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

The Chama River Canyon Wilderness and Roadless Area have a moderate to high potential for the presence of small deposits of copper with associated uranium and silver. These deposits, as yet undetected, would occur in the Permian Cutler Formation and in the lower part of the Triassic Chinle Formation, rock units that are, for the most part, present only in the subsurface. The presence of such deposits is inferred because similar deposits occur in rocks of equivalent age in adjacent areas. Gypsum, of probable mineable quality and quantity, occurs throughout the area. Oil and gas are possibly present in Pennsylvanian strata in the subsurface, although no drilling in this area has tested this hypothesis. Other commodities, including noncopper-related uranium, kaolinite, chromium, vanadium, manganese, and bitumen, although present locally in anomalous concentrations, do not appear to constitute potential mineral resources.

INTRODUCTION

The Chama River Canyon Wilderness, in Rio Arriba County, north-central New Mexico, was established by Congress in 1978 (index map). It covers 50,300 acres (20,365 hectares) within the Coyote and Cuba Ranger Districts of the Santa Fe National Forest and the Canjilon Ranger District of the Carson National Forest. In 1979 the U.S. Forest Service under the Forest Service Roadless Area Review and Evaluation (RARE II) program designated three additional areas contiguous to the wilderness for further planning to assess wilderness characteristics. These areas, totaling 4,800 acres (1,935 hectares) were collectively designated Roadless Area 03098.

The Chama River Canyon Wilderness and adjacent roadless area are approximately 70 mi (120 km) northwest of Santa Fe and nearly 130 mi (220 km) north of Albuquerque. The areas are accessible by several U.S. Forest Service roads that join major highways in the vicinity (index map).

The wilderness and adjacent roadless area occupy the steep canyons and adjacent slopes cut by the Rio Chama, Rio Gallina, and their tributaries. The elevation ranges from 6,300 ft (1,520 m) above sea level along the valley of the Rio Chama to 8,900 ft (2,715 m) at Mesa Alta, in the southern part of the wilderness.

GEOLOGY

Rock units exposed in the study area range in age from Permian to Quaternary. Strata of Pennsylvanian and Precambrian age are present only in the subsurface. Permian rocks consist of sandstone, siltstone, and mudstone of the Cutler Formation that were deposited in fluvial and coastal marine environments (Ridgley, in Green, 1982). Triassic red beds consisting of sandstone, siltstone, and mudstone of the Chinle Formation unconformably overlie Permian strata. The Triassic rocks were deposited in fluvial and lacustrine environments.

Jurassic rocks crop out at the surface over most of the study area and unconformably overlie Triassic strata. Jurassic rocks include the Todilto Limestone, Entrada Sandstone, Wanakah Formation, and Morrison Formation. These formations are characterized by limestone, gypsum, sandstone, and mudstone that were deposited in a variety of fluvial, lacustrine, eolian, and possibly marine environments (Ridgley, 1977).

Cretaceous rocks unconformably overlie the Jurassic rocks and, in the study area, include the Burro Canyon(?) Formation and the Dakota Sandstone. An unconformity separates these two formations. The Cretaceous rocks are sandstone, conglomerate, and shale that were deposited in fluvial and coastal marine environments.

Quaternary units consist of alluvium, talus, and landslide deposits.

The Chama River Canyon Wilderness and adjacent Roadless Area are in the southern part of the Chama basin, in the southeast part of the Colorado Plateaus physiographic province. The wilderness and contiguous roadless area are in a structural transition zone. Rocks in the western part of the study area are folded and faulted, and form the southern part of the Archuleta anticlinorium, a series of faulted anticlines and synclines that separate the Chama basin from the San Juan basin to the west. Structural features that characterize the eastern part of the study area consist of gently north- and northwest-dipping strata, broad open folds or warps, and a few steep normal faults (Smith and others, 1961).

GEOCHEMISTRY

Reconnaissance geochemical studies of the Chama River Canyon Wilderness and adjacent Roadless Area were conducted to check for indistinct or unexposed mineral deposits. Sampling of the different rock units within each formation at several localities throughout the study area was conducted to assess background and anomalous concentrations of various elements. Dry stream sediments and panned concentrate samples were collected from nearly all first- and second-order drainages in the study area. Geochemical data from these different samples indicate anomalous concentrations of several elements; however, none of these anomalies is considered significant.

Uranium in anomalous concentrations was found in three dry stream-sediment and two rock samples (see map). The uranium anomaly in the sample from the site along Rio Chama is associated with known uranium prospects in the Triassic Chinle Formation (Light, 1983, loc. 5). An anomalous concentration of uranium (26 ppm) was detected in one limestone sample from the Todilto Limestone, at Mesa Alta (see map). This area is adjacent to one of the parts of the roadless area that is known to contain a uranium prospect in the Todilto (Hilpert, 1969; Light, 1983, loc. 6). Anomalous uranium (46 ppm) was also detected in a siltstone sample from the Chinle; this sample also contains anomalous vanadium (2,000 ppm)(Ridgley, 1983a).

Chromium was detected in anomalous concentrations in sandstone from the Wanakah Formation at two sample localities, one near Navajo Peak and the other at Mesa Alta (Ridgley, 1983a). Amounts detected were 150 and 70 ppm, respectively. The sample site at Navajo Peak is at a prospect that was mined for uranium (table 1, prospect 2). Light (1983) and Hilpert (1969) have reported minor uranium anomalies from this area. Chromium anomalies were also detected in two stream-sediment samples, one from Presa Spring near the southwestern boundary of the wilderness, and the other from along the south side of the Rio Chama. Further planning to assess wilderness characteristics. These areas, totaling 4,800 acres (1,935 hectares) were collectively designated Roadless Area 03098.

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Table 1.--Mineral occurrences in and near the Chama River Canyon Wilderness, Rio Arriba County, New Mexico

[Leaders (--), not sampled, see references; sample numbers correspond to those in Light (1983)]

Prospect No.	Name	Location	Resource	References	Sample Nos.	Formation
1	Cebolla 2-	NE1/4 sec. 27, T. 26 N., R. 2 E. (unsurveyed).	Uranium	Hilpert, 1969	1-16	Morrison.
2	Heart 3---	SW1/4 sec. 26, T. 26 N., R. 2 E. (unsurveyed).	----do----	-----do-----	17	Wanakah(?).
3	El C-B and Maxine.	SE1/4 sec. 7, T. 25 N., R. 2 E.	----do----	-----do-----	20	Morrison.
4	Alex------	N1/2 sec. 31, T. 25 N., R. 3 E.	----do----	-----do-----	--	Todilto.
5	Pivot Rock	SW1/4 sec. 4, T. 24 N., R. 3 E. (unsurveyed).	----do----	-----do-----	27-36	Chinle.
6	Mesa Alta-	SW1/4 sec. 18 and NW1/4 sec. 19, T. 23 N., R. 3 E.	----do----	-----do-----	46-48	Todilto.
7	Ensign----	S1/2 sec. 2 and N1/2 sec. 11, T. 23 N., R. 2 E.	Kaolinite	Bingler, 1968; Reeves, 1963; Kerr and others, 1949; Leopold, 1943.	--	Burro Canyon(?).

REFERENCES

Bingler, E. C., 1968, Geology and mineral resources of Rio Arriba County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 91, 158 p.

Green, M. W., 1982, National uranium resource evaluation, Aztec quadrangle, New Mexico: U.S. Department of Energy Open-File Report PGJ/F-012(82), 79 p.

Hilpert, L. S., 1969, Uranium resources of northwestern New Mexico: U.S. Geological Survey Professional Paper 603, 166 p.

Kerr, P. F., Kulp, J. L., and Hamilton, P. K., 1949, Differential thermal analyses of reference clay mineral specimens: New York, Columbia University, American Petroleum Institute Project 49, 50 p.

Leopold, L. B., 1943, Climatic character of the interval between the Jurassic and Cretaceous in New Mexico and Arizona: Journal of Geology, v. 51, no. 1, p. 56-62.

Light, T. D., 1983, Mine and prospect map of the Chama River Canyon Wilderness and contiguous Roadless Area, Rio Arriba County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1523-A, scale 1:48,000.

Reeves, C. C., Jr., 1963, Geology of A. P. I. Project 49 kaolin clay reference locality, Mesa Alta, New Mexico: Economic Geology, v. 58, no. 2, p. 237-249.

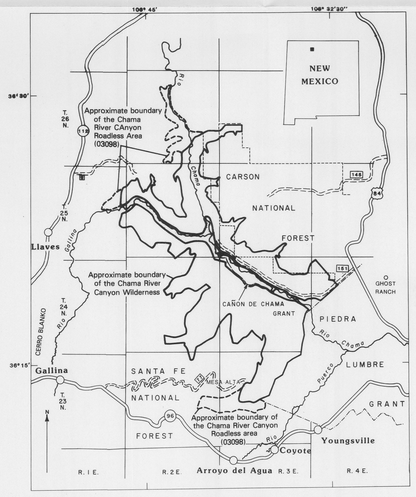
Ridgley, J. L., 1977, Stratigraphy and depositional environments of Jurassic-Cretaceous sedimentary rocks in the southwest part of the Chama Basin, New Mexico, in San Juan Basin III, northwestern New Mexico: New Mexico Geological Society, 28th Field Conference, Guidebook, p. 153-158.

_____1983a, Geochemical map of the Chama River Canyon Wilderness and contiguous Roadless Area, Rio Arriba County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1523-D, scale 1:48,000, in press.

_____1983b, Geologic map of the Chama River Canyon Wilderness and contiguous Roadless Area, Rio Arriba County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1523-C, scale 1:48,000.

Smith, C. T., Budding, A. J., and Pitrat, C. W., 1961, Geology of the southeastern part of the Chama Basin: New Mexico Bureau of Mines and Mineral Resources Bulletin 75, 57 p.

Base from U.S. Geological Survey
Arroyo del Agua, Echo Amphitheater, Laguna Peak, Navajo Peak, Youngsville, 1:24,000, 1953; Llaves and Tierra Amarilla, 1:62,500, 1955



INDEX MAP SHOWING THE LOCATION OF THE CHAMA RIVER CANYON WILDERNESS AND ROADLESS AREA (03098), NORTHERN NEW MEXICO

SCALE 1:48 000

CONTOUR INTERVAL 20 AND 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology from Ridgley (1983b)

MINERAL RESOURCE POTENTIAL MAP OF THE CHAMA RIVER CANYON WILDERNESS AND CONTIGUOUS ROADLESS AREA, RIO ARRIBA COUNTY, NEW MEXICO

By

Jennie L. Ridgley, U.S. Geological Survey and Thomas D. Light, U.S. Bureau of Mines

1983

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