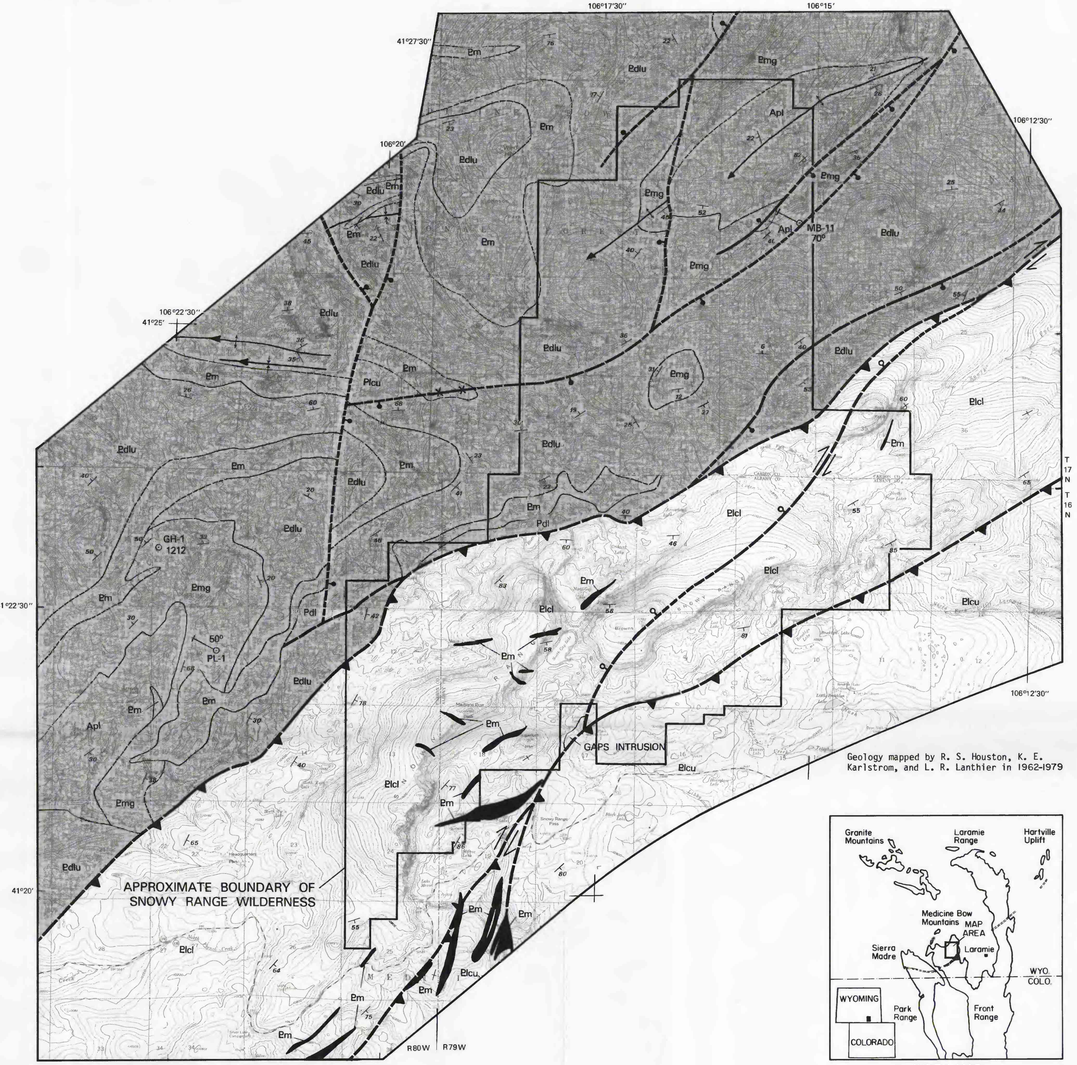
DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY



Base from U.S. Geological Survey, 1:24,000
Centennial, Medicine Bow Peak, Sand Lake,
Morgan, Phantom Lake, 1961

Geology mapped by R. S. Houston, K. E. Karlstrom, and L. R. Lanthier in 1962-1979

INDEX MAP

SCALE 1:50 000

1 ½ 0 1 2 3 MILES

1 5 0 1 2 3 KILOMETERS

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

MINERAL RESOURCE POTENTIAL MAP OF THE SNOWY RANGE WILDERNESS, ALBANY AND CARBON COUNTIES, WYOMING

By

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1983

EXPLANATION OF MINERAL RESOURCE POTENTIAL

AREA OF LOW TO MODERATE POTENTIAL FOR URANIUM, THORIUM, AND GOLD RESOURCES

DRILL HOLE

EMB-4 60° — Inclined--Shows name, bearing, plunge, and total length of hole

MB-5 1429 — Vertical--Shows name and total length of hole

CORRELATION OF MAP UNITS

Pm		
Plcu	Libby Creek Group	PROTEROZOIC
Plcl		
Pdlu	Deep Lake Group	
Emg		
Apl	Phantom Lake Metamorphic Suite	ARCHEAN

DESCRIPTION OF MAP UNITS

Pm — MAFIC INTRUSIVES (PROTEROZOIC)--Metagabbro, metabasalt, metadiabase, and metapyroxenite

LIBBY CREEK GROUP (PROTEROZOIC)

Plcu — UPPER PART--Black phyllite and slate, local iron-formation, green chlorite schist, and chlorite amphibole schist, metadolomite, and black slate

Plcl — LOWER PART--Quartz arenite, laminated schist, and local iron-formation, clastic dikes, arkosic quartzite, chlorite-biotite phyllite, diamictite, and chlorite-biotite-quartz schist

DEEP LAKE GROUP (PROTEROZOIC)
(Includes upper part Deep Lake Group and Magnolia Formation)

Pdlu — UPPER PART, DEEP LAKE GROUP--Diamictite, marble, biotite-quartz schist, quartzite, quartz arenite, chlorite-biotite-quartz schist, and phyllite

Emg — MAGNOLIA FORMATION--Radioactive quartz-pebble conglomerate, arkosic paraconglomerate, coarse-grained quartzite

Apl — PHANTOM LAKE METAMORPHIC SUITE (ARCHEAN)--Muscovite quartzite, metabasalt, metatuft, metagraywacke, paraconglomerate, and quartzite

——— CONTACT--Long dashed where approximately located; short dashed where inferred

MAJOR REVERSE FAULT--Dashed where inferred; arrows show relative horizontal movement; sawteeth on upper plate

FAULT--Long dashed where approximately located; short dashed where inferred; bar and ball on downthrown side; arrows show relative horizontal movement; open symbols show Laramide or post-Laramide movement

INTRUDED FAULT--Intruded by mafic sill or dike

ANTICLINE--Showing axial trace and direction of plunge

SYNCLINE--Showing axial trace and direction of plunge

STRIKE AND DIP OF BEDDING
Inclined
Vertical
Overturned

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 Snowy Range Wilderness in the Medicine Bow National Forest, Albany and Carbon Counties, Wyoming. The area was established as a wilderness by Public Law 95-237 in February 1978.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

The U.S. Bureau of Mines and U.S. Geological Survey made a mineral and geological survey of the Snowy Range Wilderness, southern Wyoming. The area is part of a dissected Laramide uplift ranging in elevation from 8,000 to 12,000 ft and is underlain by metasedimentary and metavolcanic rocks of Late Archean and Early Proterozoic age. The Early Proterozoic Deep Lake Group consists chiefly of quartzite of fluvial origin and has a radioactive conglomerate at its base. This conglomerate was the unit considered to possibly contain resources because its stratigraphic setting and geologic characteristics are like those of the productive uranium-bearing conglomerate of the Blind River area of Canada.

Neither surface nor subsurface investigations in the Snowy Range Wilderness and contiguous areas has revealed uranium, thorium, or gold resources. However, some exceptionally high radon anomalies suggest uranium may be present at depth. The conglomerate at the base of the Deep Lake Group would have to be tested by closely spaced drilling before it can be ruled out as a source of these metals. On the basis of information available by spring 1981, the northern part of the Snowy Range Wilderness has a low to moderate potential for uranium, thorium, or gold resources.

INTRODUCTION

The Snowy Range Wilderness covers 53 mi^2 of the Medicine Bow National forest, Albany and Carbon Counties, Wyo. The study area, along with parts of the Medicine Bow Mountains to the west and north, were recognized as possible areas for uranium and gold-bearing conglomerate of the Blind River type (Miller and others, 1977; Houston and others, 1977). For this reason, it was determined that additional geological and geochemical studies, both within and outside the wilderness, were needed in order to evaluate the mineral resource potential. Additional work was sponsored by the National Uranium Resource Evaluation Program of the U.S. Geological Survey (Houston and others, 1978) and by the U.S. Department of Energy (Houston and Karlstrom, 1979; Karlstrom and others, 1981a, b; and Borgman and others, 1981). The U.S. Department of Energy study included a diamond-drilling program, of which one hole was drilled within the wilderness. The results of all these investigations, where they apply to the wilderness, are discussed in the accompanying pamphlet.

URANIUM, THORIUM, AND GOLD

Early Proterozoic quartz-pebble conglomerate

The northern one-half of the Snowy Range Wilderness is underlain by uranium, thorium, and gold-bearing quartz-pebble conglomerate which is at and near the base of the Magnolia Formation, the basal formation of the Deep Lake Group. On the northeast limb of Arrastre anticline about 1 1/2 mi west of the study area border, lenticular beds of radioactive quartz-pebble conglomerate are within a thick sequence of arkosic paraconglomerate. These paraconglomerates can be traced for about 3,300 ft on the east limb of the Arrastre anticline. The maximum uranium value in surface samples is 32 ppm. The radon content of ground water from springs, seeps, and bogs was found to be significantly higher than could be accounted for by the uranium content of the surface rocks (Miller and others, 1977).

Hole PL-1 drilled by private sector companies was spudded east of outcrops of radioactive conglomerate on the northeast limb of the Arrastre anticline and was located E1/2 sec. 10, T. 16 N., R. 80 W. Drill hole PL-1 was spudded in beds of the upper Magnolia Formation that dipped southeast and was drilled at an angle of 50° to intersect these beds perpendicular to bedding. Drill hole PL-1 encountered 599 ft of quartzite of the upper Magnolia Formation and encountered arkosic polymictic paraconglomerate of the basal Magnolia Formation from 599 to 1,232 ft where basalt of Colberg Metavolcanics of the Archean Phantom Lake Metamorphic Suite was encountered. Conglomerates were only mildly radioactive and maximum uranium values were 11 ppm and maximum thorium values were 30 ppm at 1,134 ft (Karlstrom and others, 1981a). Surface and subsurface studies failed to verify the radon results in the conglomerate of the Magnolia Formation in the Arrastre Lake area.

Near the head of the North Fork of Rock Creek, which is within the wilderness, radioactive quartz-pebble conglomerate of the basal Magnolia Formation lies unconformably on basalt of the Archean Phantom Lake Metamorphic Suite. Surface samples contained as much as 3.2 ppm uranium and 13 ppm thorium and had about 3 times background radioactivity. Radon samples of water from springs, seeps, and bogs showed that this area has exceptionally high radon values to 20,605 picocuries per liter in SE1/4N1/2 sec. 22, T. 17 N., R. 79 W. (Houston and Miller, 1984).

Several other formations of the Deep Lake Group and of the lower Libby Creek Group in the wilderness and adjacent areas contain quartz-pebble conglomerate. The most important of these in terms of extent and thickness are in the Cascade Quartzite of the Deep Lake Group and Medicine Peak Quartzite of the lower Libby Creek Group. The Cascade Quartzite contains persistent conglomerate layers commonly 2.5-4 in. thick but up to 60 ft thick in an area northeast of North Twin Lake. However, no surface outcrops of conglomerate in the Cascade Quartzite were radioactive. Of 14 surface samples of conglomerate from the Cascade Quartzite in the wilderness and adjacent areas only three had detectable uranium and thorium; the highest uranium value was less than 1 ppm and the highest thorium value was less than 5 ppm.

The Medicine Peak Quartzite of the Libby Creek Group contains well-developed and persistent layers of quartz-pebble conglomerate near the middle of the formation. One of these quartz-pebble conglomerate layers was traced from a roadcut north of Silver Lake to outcrops east of Lewis Lake, a distance of over 5 mi. Radiometric surveys of outcrops of quartz-pebble conglomerate from the Medicine Peak Quartzite were negative for the most part. Forty-nine samples of the quartz-pebble conglomerate of the Medicine Peak Quartzite from within the study area were analyzed for uranium and thorium. Forty-eight of these samples contained uranium, but the average uranium content was less than 1.7 ppm.

Twenty surface samples of quartz-pebble conglomerate from the basal Magnolia Formation were analyzed for gold. Gold was detected in 10 of these samples, but the maximum gold content was only 0.08 ppm.

Forty-nine surface samples from the quartz-pebble conglomerate of the Medicine Peak Quartzite were analyzed for gold. Gold was not detected in any of these samples.

Fourteen samples of the Cascade Quartzite were analyzed for gold; one contained 0.02 ppm and the other 0.08 ppm. Gold was not detected in 12 of the samples.

Veins of Precambrian age

Discontinuous quartz veins ranging in width from a few inches to 2 ft and traceable along strike for tens of feet maximum are common in the wilderness. These quartz veins are most common near contacts between mafic intrusive rocks and the various metasedimentary rocks. They are also present in the Gaps Intrusion.

Most quartz veins are oxidized and have poorly developed limonitic gossans. Pyrrhotite, chalcopyrite, and pyrite can be recognized in some veins exposed in prospect pits.

Fifteen samples of vein quartz which had sulfide mineralization were analyzed, and several samples from the shear zones with visible sulfide mineralization were also analyzed. Most of the quartz veins and shear zones were not radioactive, but veins and shear zones in and adjacent to the Gaps Intrusion were radioactive and one mineralized quartz vein cutting the Gaps Intrusion exposed in a prospect pit on the southwest shore of Lewis Lake contained 1,000 ppm uranium and 1,655 ppm thorium. Another shear zone in the Gaps Intrusion contained 19.6 ppm uranium and 52.5 ppm thorium.

Other quartz veins were either in or near contacts with mafic intrusions and these veins all contained uranium, averaging 4.03 ppm, and having a maximum of 31.20 ppm.

It may be significant, however, that the highest uranium and thorium values in any igneous rocks and associated veins are in the same general area. These rocks are the Gaps Intrusion of the Gaps area and the gabbroic intrusion located about 0.75 mi southwest of the Gaps Intrusion near Lookout Lake. The Gaps Intrusion is emplaced in a major fault system that may be mineralized at depth, and both intrusions are near a faulted major unconformity between the lower and upper parts of the Libby Creek Group.

Gold was detected in 5 of 14 veins that were analyzed, but the average gold content was 0.13 ppm and the highest value detected was 0.70 ppm.

Fractures showing hematitic alteration

Hematitic alteration often accompanies uranium mineralization and is regarded as a guide in exploration for vein-type uranium deposits (Rich and others, 1977). In the Lewis Lake area, however, fractures showing hematitic alteration are radioactive (5-10 times local background). Three samples from both dip faults and strike faults average 69.3 ppm uranium and 122.7 ppm thorium. Only one of the above samples contained gold, and that value was 0.05 ppm.

The uranium and thorium values in veins, fractures, and igneous rocks in the vicinity of Lewis Lake are indicative of a potential for uranium and thorium resources. Particular attention should be directed to major faults with hematitic alteration.

Proterozoic unconformities

The contact between the Sugarloaf Quartzite and Nash Fork Formation of the Libby Creek Group is interpreted to be a faulted unconformity (Karlstrom and others, 1981a, b). Major uranium deposits are known to occur in fractures below Proterozoic (Kalliokoski and others, 1978). Some of the most radioactive and uranium-rich veins of the study area and adjacent areas are near this unconformity.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Despite positive results from radon surveys and the presence of radioactive quartz-pebble conglomerate in outcrops, no conglomerate or any other rock type of the Magnolia Formation sampled in the surface or subsurface in the Snowy Range Wilderness contained uranium or thorium values indicating resource potential. The basal conglomerate of the Magnolia Formation in the wilderness is similar in many respects to the uranium-ore-bearing quartz-pebble conglomerate of the Matinenda Formation found near Elliot Lake in Canada (Houston and others, 1977; Karlstrom and others 1981b). Furthermore, interesting amounts of uranium were found in the basal conglomerate of the Magnolia Formation at the Onemile Creek locality about 8 mi northeast of the wilderness. Metamorphic rocks of the Onemile Creek area are upper amphibolite grade metamorphism; where metamorphic grade is this high, uranium could be mobilized and removed from the conglomerate, thus reducing the uranium values. The metamorphic grade of the Magnolia Formation conglomerate in the study area is greenschist and the conglomerate is less deformed than at Onemile Creek. The low grade, lack of severe deformation, and resemblance to the Canadian ore-bearing conglomerate all suggested that the conglomerate of the Magnolia Formation of the study area should contain ore-grade uranium, but this has not been demonstrated by work to date.

We believe that the Magnolia Formation of the Snowy Range Wilderness has not been adequately tested for uranium or thorium, and, in the absence of closely spaced drilling, we cannot rule out the presence of significant uranium and thorium deposits. The exceptionally high radon values in this area remain unexplained, and suggest that uranium may be present in greater amounts at depth. On the basis of information available by spring 1981, the northern part of the Snowy Range Wilderness has a low to moderate potential for uranium, thorium, and gold resources in the Magnolia Formation.

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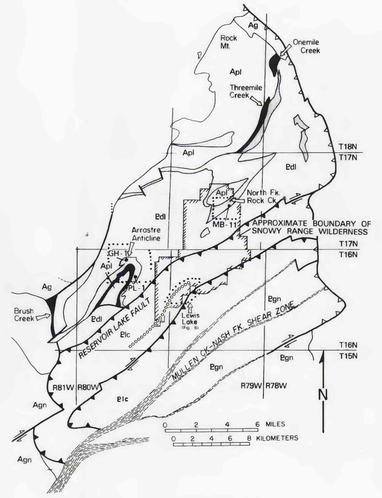
MISCELLANEOUS FIELD STUDIES
MAP MF-1596-A
PAMPHLET ACCOMPANIES MAP



EXPLANATION

Egn — GNEISS (PROTEROZOIC)
Plc — LIBBY CREEK GROUP (PROTEROZOIC)
Pdl — DEEP LAKE GROUP (PROTEROZOIC)
Ag — GRANITIC ORTHOGNEISS (ARCHEAN)
Apl — PHANTOM LAKE METAMORPHIC SUITE (ARCHEAN)
Agn — BASEMENT GNEISS (ARCHEAN)

RADIOACTIVE CONGLOMERATES

Conglomerate bed in Medicine Peak Quartzite (Libby Creek Group)
Quartzite member, Magnolia Formation (Deep Lake Group)
Conglomerate member, Magnolia Formation (Deep Lake Group)
GH-1 — DRILL HOLE LOCATION AND NUMBER
LARAMIDE FAULTS—Sawteeth on upper plate; arrows show direction of horizontal movement
PRECAMBRIAN FAULTS—Sawteeth on upper plate
SHEAR ZONE

Figure 1.--Generalized geologic map of the Medicine Bow Mountains showing the location of drill holes and radioactive conglomerate.

Table 1.--Stratigraphic succession of the Medicine Bow Mountains, Wyo.

Age	Group	Formation	Thickness (ft)
Early Proterozoic (2,000-1,700 m.y.).	Upper unit of Libby Creek Group.	French Slate----------	2,000
		Towner Greenstone----------	1,100
Early Proterozoic (2,200-2,000 m.y.).	Lower unit of Libby Creek Group.	Nash Fork Formation----------	6,500
		Sugarloaf Quartzite----------	1,800
		Lookout Schist----------	1,000
		Medicine Peak Quartzite----------	5,600
		Heart Formation----------	2,100
		Headquarters Formation----------	2,060
		Rock Knoll Formation----------	1,250
Early Proterozoic (2,200-2,400 m.y.).	Deep Lake Group-------	Vagner Formation----------	1,500
		Cascade Quartzite----------	2,000
		Campbell Lake Formation----------	223
		Lindsey Quartzite----------	1,450
		Magnolia Formation----------	2,600
Archean (2,500 m.y.).	Phantom Lake Metamorphic Suite.	Conical Peak Quartzite----------	2,080
		Colberg Metavolcanics----------	5,700
		Bow Quartzite----------	1,250
		Rock Mountain Conglomerate----------	650
		Stud Creek Metavolcaniclastics----	1,300

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