DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1638-A
PAMPHLET

MINERAL RESOURCE POTENTIAL OF THE SAVAGE RUN WILDERNESS, CARBON AND ALBANY COUNTIES, WYOMING

By

M. E. McCallum, U.S. Geological Survey
and
Steven E. Kluender, U.S. Bureau of Mines

STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, 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 discusses the results of a mineral survey of the Savage Run Wilderness in the Medicine Bow National Forest, Carbon and Albany Counties, Wyoming. The area was established as a wilderness by Public Law 95-237, February 24, 1978.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

Although numerous, small gold and copper mining operations were conducted for a number of years around the turn of the century and intermittently thereafter in areas immediately to the east, there is no evidence of any mineral production within the Savage Run Wilderness. Vein-type gold and silver mineralization associated with faults indicates a low resource potential for gold and silver (fig. 2), but all known occurrences suggest very limited tonnage. Palladium and platinum were recovered from copper ores at the New Rambler mine about 2 mi east of the wilderness, and both metals occur locally in trace amounts in the Savage Run area in rocks of the Mullen Creek mafic complex. Although there is a resource potential in this area for platinum, palladium, and (or) associated nickel (fig. 2), the absence of significant anomalies of these metals in stream-sediment concentrates indicates the resource potential is low. An area of sheared rocks in the northeastern corner of the wilderness has a low resource potential for copper (fig. 2).

LOCATION, SIZE, AND ACCESS

The Savage Run Wilderness encompasses 14,912 acres of the Medicine Bow National Forest in south-central Wyoming; about 14,000 acres in Carbon County, and 912 acres in Albany County (fig. 1). It is on the west flank of the Medicine Bow Mountains and overlooks the North Platte River and Saratoga Valley. It is approximately 40 mi west of Laramie, 60 mi southeast of Rawlins, 26 mi southeast of Saratoga, and 11 mi north of the Colorado-Wyoming border. The area is roughly bounded on the north, east, and south by unimproved U.S. Forest Service roads (fig. 1), which can be reached via Wyoming State Highways 130 and 230. The western boundary borders the A Bar A Ranch.

Four southwest-flowing streams drain the area; from north to south they are North Mullen Creek, South Mullen Creek, Savage Run Creek, and Cottonwood Creek (fig. 2). Elevations range from about 9,930 ft at the drainage divide near the northeast corner of the area to 7,740 ft near the mouth of Cottonwood Creek in the southwest.

GEOLOGY

Except for Quaternary alluvial and colluvial deposits and some possible late Tertiary high-level gravels, all rocks in the Savage Run Wilderness are Precambrian in age. The northwestern part of the area is traversed (from southwest to northeast) by cataclastic and intensely mylonitized rocks of the Mullen Creek-Nash Fork shear zone (Houston and McCallum, 1961; Houston and others, 1968; fig. 2), which is interpreted as a major Precambrian suture (Hills and Houston, 1979). Rocks northwest of the shear zone, and locally included within, are predominantly metasediments with variable amounts of metavolcanics and are the oldest rocks in the area. A quartzofeldspathic gneiss unit with abundant interlayered amphibolite, hornblende gneiss, and metagabbro, occurs within the shear zone and is

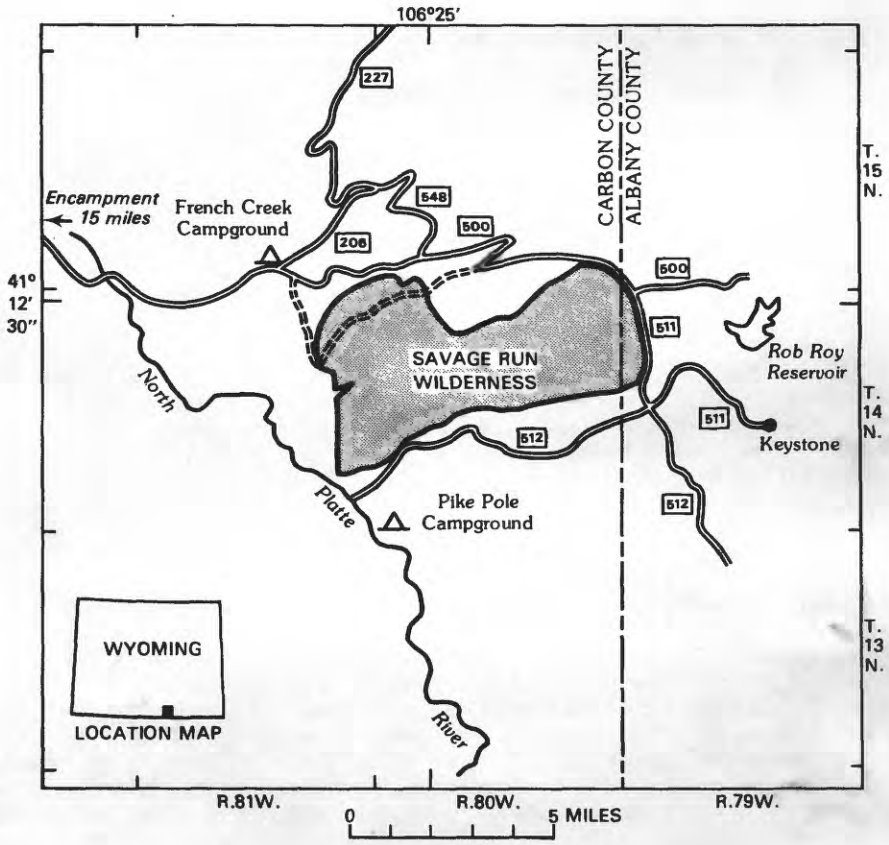
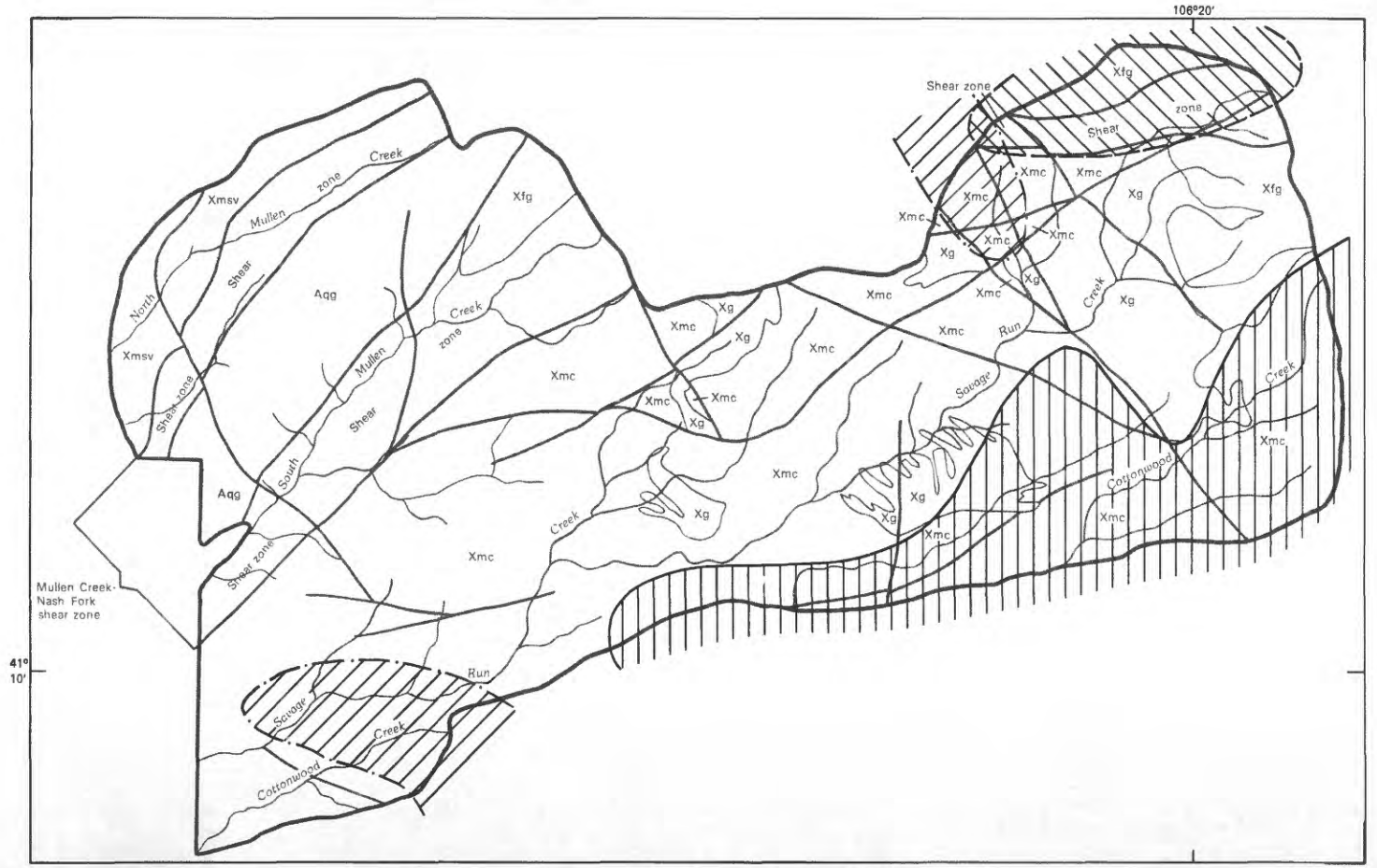


Figure 1.--Location map of the Savage Run Wilderness, Carbon and Albany Counties, Wyoming.



EXPLANATION

AREA OF LOW POTENTIAL FOR PLATINUM-PALLADIUM AND (OR) NICKEL RESOURCES

AREA OF LOW POTENTIAL FOR COPPER RESOURCES

AREAS OF LOW POTENTIAL FOR GOLD AND (OR) SILVER RESOURCES IN VEINS ASSOCIATED WITH FAULTS

Xg GRANITE (PROTEROZOIC X)

Xfg FELSIC GNEISS (PROTEROZOIC X)

Xmc LAYERED MAFIC COMPLEX (PROTEROZOIC X)

Xmsv METASEDIMENTARY-METAVOLCANIC SEQUENCE (PROTEROZOIC X)

Aqg QUARTZOFELDSPATHIC GNEISS, DIFFERENTIALLY SHEARED (ARCHEAN?)

CONTACT

FAULT

Figure 2.—Map showing generalized geology and areas of resource potential in the Savage Run Wilderness, Wyoming (geology modified from M. E. McCallum, unpub. mapping, 1980-81).

considered to be equivalent to Archean gneiss that is prevalent a short distance to the west (Houston and others, 1968). Lenticular blocks of Early Proterozoic (Proterozoic X) Heart Formation (quartzite with interlayered schist, hornblende gneiss, and amphibolite) and Medicine Peak Quartzite are included in the northwestern portion of the shear zone, and Heart Formation rocks occur in place northwest of the shear zone in contact with a thick assemblage of locally kyanite-bearing quartzites of the Proterozoic X Medicine Peak Quartzite (Houston and others, 1968).

Rocks south of the main trace of the Mullen Creek-Nash Fork shear zone are all of Proterozoic age. Granitic gneiss and felsic mylonite gneiss are abundant to the north and northeast adjacent to the main shear zone and to a subsidiary shear zone that extends from the main shear zone in an east-northeast direction. Gabbroic rocks of the informal Mullen Creek mafic complex (Houston and others, 1968) dominate the terrane south and southeast of the shear zone. This mafic complex covers approximately 60 mi^2, has been folded in the form of a slightly overturned anticline that plunges steeply to the northwest, has been locally refolded, and is truncated to the northwest by the shear zone (Donnelly and McCallum, 1977). Rocks of the complex range from massive to well-layered and most exhibit the effects of amphibolite-grade metamorphism and locally intense hybridization associated with felsic intrusives. The northern portion of the mafic complex underlies much of the Savage Run Wilderness, and it consists of crudely layered to well-layered, variably metamorphosed gabbro, leucogabbro, anorthositic gabbro, and pyroxenite. Microgabbroic and diabasic phases are important locally, and hybridized phases are prevalent where younger felsic intrusives are abundant (for example, central portion of area). A few magnetite and locally sulfide-enriched zones have been recognized but no significant base- or precious-metal concentrations were obtained from any of the samples that were analyzed.

Northwest- and northeast-trending faults predominate and both groups show evidence of reactivation. The northwest-trending faults generally exhibit more evidence of later movement and have more associated mineralization, although some of the northeast-trending group appear to displace northwest-trending faults and may be mineralized locally. Mineralization is especially prevalent where faults cut across shear zones. A zone nearly 0.5 mi wide of differentially sheared gabbroic rocks of the Mullen Creek mafic complex extends in a southeasterly direction through parts of sections 8 and 9 and dissipates in the northern part of sec. 16, T. 14 N., R. 80 W. (M. E. McCallum, unpub. mapping, 1980-81). This zone is truncated on the northwest by the Mullen Creek-Nash Fork shear zone.

GEOCHEMISTRY

Rock and stream sediment geochemistry surveys in the Savage Run Wilderness for the most part reflect only the chemistry of the predominant rock types in any particular area. Samples from mafic-rock terranes, such as where gabbroic units of the Mullen Creek mafic complex are exposed, are understandably enriched in chromium, nickel, and cobalt (Cr and Ni commonly in excess of 1,500 ppm and Co in excess of 100 ppm in rock chip samples; in excess of 300 ppm chromium, 100 ppm nickel, and 30 ppm Co in stream-sediment concentrates; tables 1 and 2). Where granitic and quartzofeldspathic rocks predominate, chromium, nickel, and cobalt rarely exceed 10 ppm, but elements such as boron, barium, beryllium, lanthanum, uranium, and zirconium, consistently are more abundant than they are in mafic rocks. Uranium values of 5-10 ppm (table 2) were obtained from some stream sediments from North Mullen Creek, which cuts through the metasedimentary Heart Formation, Medicine Peak Quartzite, and mylonitic rocks of the Mullen Creek-Nash Fork shear zone.

Slightly anomalous lead values (>50 ppm) are common in stream-sediment samples from the headwater regions of Savage Run Creek. These values reflect the presence of the argentiferous galena-bearing veins that were observed near the wilderness boundary in that area. Gold values as much as 0.5 ppm were obtained from stream-sediment concentrates from the lower reaches of Mullen Creek, Savage Run Creek, and Cottonwood Creek, and from Boat Creek immediately below the gold vein workings in sec. 30, T. 14 N., R. 80 W. All of these samples probably reflect the presence of small, gold-bearing quartz veins similar to those observed in the workings at sample localities K18, 22-1C, and 22-2D. Slightly anomalous values of platinum and palladium were obtained from both rock chip samples and stream-sediment concentrates from the southeast portion of the wilderness along the upper tributaries of Cottonwood Creek (as much as 0.03 ppm and 0.005 ppm Pt and 0.016 and 0.006 ppm Pd for rock samples and stream sediments, respectively). Although these values are in the range of normal background for mafic rocks, they clearly exceed values obtained from most mafic rocks in other parts of the wilderness. In this regard, they may reflect greater platinum group element enrichment in this area, and additional geochemical evaluation work may be justified. Moderately anomalous nickel values (as much as 3,000 ppm, table 1) also are confined chiefly to the southeast portion of the wilderness. The high nickel values occur almost exclusively in metapyroxenitic rocks, and are commonly accompanied by slightly elevated levels of platinum and palladium.

GEOPHYSICS

Much of the western part of the Savage Run Wilderness is characterized by a prominent aeromagnetic high that has a northeasterly trend which is roughly parallel to that of the Mullen Creek-Nash Fork shear zone. The high coincides with mafic rocks of the Mullen Creek mafic complex and with variably sheared metagabbros included in the southeastern portion of the shear zone. The main portion of the shear zone exhibits a rapid decrease in magnetic potential as do areas underlain by quartzites of the Heart Formation and by the Medicine Peak Quartzite. The magnetic pattern in the central and eastern parts of the wilderness is irregular and values are lower except for the southeastern areas. These patterns reflect the increased concentration of granitic material that has intruded mafic-complex rocks, and the strongly quartzofeldspathic nature of the gneiss and mylonites that prevail in the northeast. Aeromagnetic data are available from the

Table 1.--Rock chip samples having anomalous precious- and (or) base-metal values

[Values comprising the highest 2.5 percent of a given population are considered anomalous. All values in ppm except where indicated otherwise. Au, Ag, Pd, and Pt by fire-assay emmission spectrography (analysts: B. M. Adrian, R. R. Carlson, E. F. Cooley, and T. A. Doerge); Ag, As, Co, Cr, Cu, Mo, Ni, Pb, Zn, Bi, Cd, La, Sn, and Zr by semiquantitative d.c. arc spectroscopy (analysts: R. Babcock, B. M., Adrian, B. Arbogast, L. B. Breeden, E. F. Cooley, K. J. Currey, G. W. Day, J. Domenico, W. D. Goss, D. J. Grimes, J. Haffty, R. Hopkins, L. B. Riley, and D. Siems); U by fluorimetric method (analyst: B. Arbogast); underlined values for Au and Ag by atomic absorption (analysts: R. B. Carten, C. A. Curtis, J. G. Frisken, J. Kelley, J. Mitchell, R. M. O'Leary, J. A. Roybol, J. Sharkey, and J. G. Viets); K prefix samples analyzed by U.S. Bureau of Mines; As, Cu, and Mo by spectrographic analysis; values in parentheses under elements indicate lower limits of determinations; N, not detected at limit of detection, or below value shown; (G), greater than value shown; D, detected but below limit of determination; leaders (---), indicate not detected; nd, not determined]

Sample no.	Pt	Pd	Au (0.001)	Ag (0.5)	As (200)	Co (5)	Cr (10)	Cu (5)	Mo (5)	Ni (5)	Pb (10)	Zn (200)	Other	Sample description
M553-1	N(0.005)	0.010	0.30	1600	500	N	N	1500	15	N	(G)2.0%	500		Selected vein material.
M553-2	N(.005)	.015	4.5	40	1500	N	N	(G)2.0%	10	N	(G)2.0%	1500		Do.
M1009E	nd	nd	N	N	2000	100	200	200	N	100	10	N		Leucogabbro.
M1024A	.010	.010	.015	N	N	100	700	150	N	200	D	N		Gabbro.
M1056A	N(.010)	N(.002)	N	N	N	100	3000	70	N	1500	D	D		Metapyroxenite.
M1071A	nd	nd	N	N	N	100	70	70	N	70	100	200		Sheared and altered metagabbro.
M1073B	N(.010)	.010	N	N	N	100	5000	100	N	1500	D	D		Sheared metapyroxenite.
M1074	nd	nd	N	N	N	10	N	70	N	D	30	N	U:11	Biotite granite.
M1076B	nd	nd	N	N	N	70	1000	200	N	300	10	N		Basalt.
M1086B	nd	nd	N	N	N	10	N	20	N	D	50	N	Zr:>1000	Biotite granite.
M1093A	N(.005)	.010	.001	N	N	70	500	200	N	500	10	N		Gabbro.
M1095	.005	.001	.002	N	N	200	1000	50	N	2000	N	D		Metapyroxenite.
M1116A	nd	nd	N	10	N	70	150	200	N	100	10	N		Gabbro.
M1125	N(.010)	.002	N	N	N	100	5000	50	N	3000	10	D		Metapyroxenite.
M1133A	N(.010)	N(.002)	N	N	N	100	5000	100	N	3000	10	D		Do.
M1151	N(.005)	N(.002)	N	N	N	50	1500	50	N	1500	N	200		Do.
M1177	N(.005)	N(.001)	N	N	N	50	1500	10	N	1500	D	200		Do.
M1190	nd	nd	N	N	N	N	N	7	N	5	D	N	Sn:200	Biotite granite.
M1197A	N(.010)	.007	N(.002)	N	N	50	70	(G)2.0%	N	150	D	N		Fault breccia.
M1197B	N(.005)	.005	.005	3	N	5	50	1.5%	N	20	N	N		Do.
M1197C	N(.005)	.002	.003	N	N	5	30	1.5%	N	15	N	N		Do.
M1201	N(.005)	.010	.015	N	N	50	70	150	N	50	10	300		Sheared metagabbro.
M1204-1	N(.005)	.002	.003	10	N	300	70	200	50	50	50	N		Fault zone gossan.
M1204-2	N(.005)	.001	N	7	N	1000	70	500	300	200	70	N	Bi:15	Do.
M1215-1	nd	nd	N	N	1000	70	10	150	20	150	20	300	La:1000	Selected vein material.
M1221-A	N(.005)	N(.001)	N	N	N	150	100	50	N	30	10	N		Ironstone in metaconglomerate.
M1221-B	N(.010)	N(.002)	.005	N	N	150	70	20	N	30	10	N		Do.
M1233	N(.015)	N(.003)	.005	N	N	N	N	D	N	5	15	N	La:500	Chlorite schist.
M1238	N(.005)	N(.001)	N	N	N	15	1500	70	N	1500	N	N		Quartzofeldspathic gneiss.
M1241-4	N(.005)	N(.001)	.003	7	N	30	N	5000	N	5	N	N		Vein material.
M1271-C	nd	nd	N	5	500	N	N	5000	N	5	10	N		Do.
M1281-1	nd	nd	N	150	2000	N	10	500	50	5	1.0%	1.0%	Cd:150	Do.
M1281-5	nd	nd	N	700	300	N	D	7000	50	5	2.0%	5000	Bi:70	Do.
M1281-7	nd	nd	N	700	(G)1.0%	D	D	700	10	5	(G)2.0%	1500	Cd:>500; Sb:>1%	Do.
M1281-8	nd	nd	N	700	N	N	10	3000	70	5	(G)2.0%	5000		Do.
M1282	N(.005)	.002	.003	.5	N	100	3000	150	N	1000	100	D		Metapyroxenite.
M1283	N(.005)	N(.001)	.002	.7	N	50	300	200	N	150	150	N		Microgabbro.
M1284	nd	nd	N	N	N	5	300	200	N	150	100	N		Biotite granite.
M1288	nd	nd	N	N	N	D	N	7	N	D	100	N		Do.
M1301B	nd	nd	N	1.5	N	200	N	7000	7	100	30	N		Fault breccia.
M1310C	nd	nd	N	2	N	150	N	1.5	N	70	20	N		Do.
OR-393	N(.005)	.007	N	----	N	150	1000	20	N	700	D	N		Metapyroxenite.
OR-436	N(.005)	.005	N	----	N	150	1000	30	N	1000	D	N		Do.
OR-1272B1	N(.010)	.004	N	----	500	10	D	(G)2.0%	N	7	50	N		Mylonite.
OR-1273	N(.010	N(.004)	N	.5	N	15	D	(G)2.0%	50	10	30	N		Do.
22-1C	N(.010)	.003	280	2.5	5000	100	N	300	15	100	50	500		Vein material.
22-2D	N(.010)	N(.004)	800	24	3000	30	10	500	20	50	N	D		Do.
22-137	.030	.016	.01	.5	N	20	150	1500	D	70	N	N		Metagabbro.
22-160	N(.002)	.009	.025	1.0	N	100	150	1500	10	200	N	N		Metaleucogabbro.
22-245	N(.002)	N(.001)	.003	----	N	100	50	70	N	1500	N	N		Metapyroxenite.
K5	N	nd	N	13.7	N	nd	nd	5000	1000	nd	nd	nd		Vein material.
K18	N	nd	84.4	41.2	N	nd	nd	N	N	nd	nd	nd		Do.

Table 2.--Stream-sediment samples (panned concentrate) having anomalous precious- and (or) base-metal values

[Values comprising the highest 2.5 percent of a given population are considered anomalous. All values in ppm. Au, Pd, and Pt by fire-assay emission spectrography (analysts: B. M. Adrian, R. R. Carlson, E. F. Cooley, and T. A. Doerge); Ag, As, Co, Cr, Cu, Mo, Ni, Pb, Zn, La, and V by semiquantitative d.c. arc spectroscopy (analysts: R. Babcock, B. M. Adrian, B. Arbogast, L. B. Breeden, E. F. Cooley, K. J. Currey, G. W. Day, J. Domenico, W. D. Goss, D. J. Grimes, J. Haffty, R. Hopkins, L. B. Riley, and D. Siems). U by fluorimetric method (analysts: B. Arbogast and W. W. Vaughn); W by colorimetric method (analyst: B. Arbogast). K prefix samples analyzed by U.S. Bureau of Mines: Au, Ag, and Pt by fire-assay emission spectrography. As, Cu, and Mo by spectrographic analysis. Values in parentheses under elements indicate lower limits of determinations; N, not detected at limit of detection, or below value shown; D, detected but below limit of determination nd, not determined]

Sample no.	Pt (0.005)	Pd (0.001)	Au (0.001)	Ag (0.5)	As (200)	Co (5)	Cr (10)	Cu (5)	Mo (5)	Ni (5)	Pb (10)	Zn (200)	Other
SR1	N(0.005)	N(0.001)	0.070	nd	nd	nd	nd	nd	nd	nd	nd	nd	
SR34	nd	nd	N	N	20	50	70	70	N	50	30	N	
SR36	nd	nd	N	N	N	70	500	70	N	150	30	N	
SR42	N(.005)	.010	.005	N	N	70	20	100	N	70	20	N	
SR57	N	N	N	N	N	50	150	700	N	30	20	D	
SR58	N	N	N	N	N	50	150	700	N	100	20	D	
SR85	nd	nd	N	N	N	100	100	100	N	100	30	N	V:1000
SR91	nd	nd	N	N	N	10	70	15	N	15	70	D	
SR92	nd	nd	N	N	N	10	70	15	N	20	70	300	W:40
SR93	nd	nd	N	N	N	20	100	20	N	100	50	300	W:50
SR102	nd	nd	N	N	10	10	30	10	N	70	30	D	
SR111	nd	nd	N	N	N	15	70	30	N	50	20	D	U:10.2
SR128	nd	nd	N	N	N	30	300	70	N	100	10	200	
SR141	.050	.015	.030	N	N	20	70	30	N	50	10	D	
SR156	N(.010)	N(.002)	N(.002)	N	N	30	300	50	N	70	10	D	
SR158	N(.005)	N(.001)	.50	N	N	30	100	50	N	70	10	D	
SR166	N(.010)	.005	.010	N	N	30	70	30	N	70	10	D	
SR177	N(.010)	N(.002)	N(.002)	N	N	30	100	70	N	30	10	300	
SR179	nd	nd	N	N	10	20	100	70	N	50	10	200	
SR180	N(.015)	.005	.010	N	N	20	70	30	N	30	50	D	La:200
SR184	N(.010)	.002	N(.002)	3.0	N	20	70	50	N	50	70	N	
SR186	N(.010)	N(.002)	N(.002)	N	N	15	70	30	N	50	50	N	
SR203	nd	nd	N	N	N	30	100	50	N	100	10	300	
SR214	nd	nd	N	N	N	30	100	70	N	30	10	300	
MC5	N	N	N	N	N	50	200	50	N	50	50	D	
MC10	N	.006	N	N	N	100	500	100	N	70	20	D	
MC14	N	.003	N	N	N	50	150	100	N	50	50	D	
MC17	.005	.003	N	N	N	70	300	70	N	70	D	D	
MC18	N	.003	N	N	N	70	300	70	N	70	D	D	
MC22	N	.004	N	N	N	50	300	70	N	70	D	D	
MC35	N	.003	N	N	N	70	300	70	N	100	D	N	
MC38	N	.005	N	N	N	70	300	70	N	70	D	N	
MC52	N	N	N	N	N	50	300	70	N	50	70	N	W:100
MC58	N	N	N	N	N	50	300	100	N	70	30	N	
MC81	N	N	N	N	N	100	300	200	N	100	100	N	
MC90	N	.003	N	N	N	70	1500	50	N	200	30	N	
MC98	N	N	N	N	N	50	300	30	N	100	20	N	
MC130	N	N	.05	N	N	50	200	70	N	50	D	N	
MC139	N	N	.05	N	N	50	300	200	N	70	D	N	
MC141	N	N	N	N	N	50	500	100	N	70	D	N	V:500
MC142	N	N	N	N	N	50	300	100	N	70	D	N	
MC148	N	N	N	N	N	70	500	70	N	100	30	N	
MC150	N	N	N	N	N	50	500	70	N	100	30	N	La:150
MC153	N	N	.03	N	N	50	300	70	N	70	20	N	
MC157	N	N	N	N	N	70	200	150	N	50	20	N	
K1	N	nd	N	0.14	N	nd	nd	N	N	nd	nd	nd	
K2	N	nd	N	.24	N	nd	nd	N	N	nd	nd	nd	
K20	N	nd	N	.24	N	nd	nd	N	N	nd	nd	nd	

Aeromagnetic Map of the Medicine Bow Mountains, Wyoming (U.S. Geological Survey, 1976) at a scale of 1:62,500. Unfortunately data obtained at this scale were not sufficiently sensitive to resolve local variations, especially the presence of more magnetite-rich layers in the gabbroic rocks of the Mullen Creek mafic complex.

A gravity survey was conducted in 1981 over the Savage Run Wilderness by D. M. Kulik of the U.S. Geological Survey (unpub. data). In general, the gravity pattern is similar to the aeromagnetic pattern; highs correlate with areas underlain predominantly by mafic rocks, whereas values are lower where felsic rocks prevail. The northeast and east trends of the Mullen Creek-Nash Fork shear zone and its southern branch, respectively, are reflected in the gravity patterns. However, the 1-3 mi spacing of survey sites did not provide sufficient sensitivity to reflect local variations that might be related to mineralization.

MINING DISTRICTS AND MINERALIZATION

Mining activity

No mines are presently being worked within or adjacent to the Savage Run Wilderness. However, numerous pits, drill holes, and claim stakes are evidence of recent exploratory and prospecting work in and near the area. The most recent mining activity apparently has been at a small adit and shaft in sec. 30, T. 14 N., R. 80 W., along the southwestern boundary of the wilderness, where gold values are present in small veins.

Mining districts and mining history

Several historic mining districts and numerous mining claims are in and near the Savage Run Wilderness. The best known of the historic districts is the New Rambler which covers 20 mi^2 in parts of four townships (T. 14 N., T. 15 N., R. 79 W., and R. 80 W.; Kluender, 1982). The northern half of the old Holmes-Keystone district overlaps the eastern portion of the New Rambler district (east of Savage Run Wilderness). The Douglas placer district includes Quaternary alluvial deposits along Douglas Creek, Dave Creek, Bear Creek, Elk Creek, and related tributaries. This district overlaps both the New Rambler and the Holmes-Keystone districts (Kluender, 1982).

The first authenticated mining activity near the Savage Run Wilderness began in 1868 when placer gold was discovered in Moores Gulch (secs. 10 and 11, T. 14 N., R. 79 W.) about 3 mi east of the wilderness. During the spring of 1869, about $8,000 worth of gold was taken from the gulch using sluice box, rocker, long tom, and gold pan methods (Beeler, 1906). Placer mining continued at an active level for a number of years thereafter, and included some large-scale operations. Recovered gold was primarily flour or fine gold (0.900-0.950 fine) that was easily amalgamated, and nuggets as much as 1/8-in. long (Beeler, 1906). Platinum and palladium were reported in placer gravels associated with black sands, but no recovery of these metals is known.

In 1870 a lode gold claim, the Douglas mine (sec. 22, T. 14 N., R. 79 W.), was located along Douglas Creek north of Keystone (Beeler, 1906), near the present site of the Rob Roy Reservoir dam. During the next 30 years, prospecting and mining activity flourished in the area. One of the premier mining operations in the early 1890's was the Keystone gold-copper mine located on the Keystone-Florence trend about 2 mi south of the Douglas mine (Currey, 1965). This trend is defined by a northwest-trending fault, 2-6 ft in width, that contained gold and sulfide-bearing quartz; reported grades averaged 1.2 oz of gold per ton (Currey, 1965).

The New Rambler mine (SW1/4 sec. 33, T. 15 N., R. 79 W.; called Rambler mine on U.S. Geological Survey topographic maps) is less than 2 mi east of the wilderness and is the most important lode deposit developed in the New Rambler district. It was originally located as a gold deposit in 1899, but in 1900, copper was found at a depth of 65 ft in the main shaft, and shipment of high-grade copper ore began that same year. Platinum group metals were discovered in the ore in 1901 and subsequent production figures include these metals (Knight, 1902). By 1906, more than $120,000 worth of copper and platinum ore had been mined from the New Rambler and immediately adjacent properties (Anonymous, 1911). The richer ores of the district were rapidly exhausted and a concentrating mill was erected at the New Rambler mine in 1910 in an effort to economically process the remaining low-grade ores. Ore production continued intermittently until 1918 when the New Rambler mill and mine buildings were destroyed by fire. Records after 1918 are scarce, but periodic attempts at reopening the mine apparently generated no ore production. At the time of the fire, estimated possible and probable reserves were established by the mine manager at 7,000 tons of ore containing 7-8 percent copper, 0.25 oz/ton of platinum, and some gold and silver (U.S. Bureau of mines, 1942). However, recent estimates by the U.S. Bureau of Mines indicate that the ore has been totally depleted (Mike Sawyer, oral commun., 1981).

The New Rambler orebody was localized near the intersection of a poorly defined northeast-trending mylonite zone with the east-trending branch of the Mullen Creek-Nash Fork shear zone (McCallum and Orback, 1968) that is present in the northeast corner of the Savage Run Wilderness. The deposit has been interpreted by McCallum and others (1976) as at least in part a product of hydrothermal leaching of platinum group elements and other metals from sheared gabbroic rocks and redeposition of these metals as palladium- and platinum-rich copper sulfide ores at the intersection of the shear zones. Many sulfide ore samples taken from the mine dumps were enriched in platinum (several tens of parts per million) and palladium (several hundreds of parts per million) and 10 platinum group minerals have been recognized (McCallum and others, 1976; Loucks and McCallum, 1980). Significant values of platinum and palladium were reported by Theobald and Thompson (1968) from mine dump material, stream sediments, and soils in the immediate vicinity of the mine workings, but levels drop off rapidly in all directions.

The Blanche mine (SE1/4 sec. 32, T. 15 N., R. 79 W.) is immediately west of the New Rambler workings, and the main shaft was sunk in sheared gneiss and gabbroic rocks to a depth of 160 ft. A zone of quartz veins containing copper carbonates, chalcocite, and chalcopyrite was penetrated at 120 ft (Beeler, 1906), but no assay or production figures are available.

The Duchess mine (SW1/4 sec. 32, T. 15 N., R. 79 W.), also west of the New Rambler workings, is only about 1 mi east of the wilderness. A steam plant was erected in the early 1900's and several exploratory shafts were sunk in sheared and intensely fractured rocks of the east-trending branch of the Mullen Creek-Nash Fork shear zone. Evidence of minor copper mineralization is present at these workings, but apparently no ore production was realized.

Mineralized areas

No evidence of significant mineralization was observed from samples collected from prospect pits and minor workings within the Savage Run Wilderness. Other than small amounts of copper, the only anomalous values of base and precious metals obtained from workings within the wilderness were from a small prospect in the North Mullen Creek valley in the NE1/4 sec. 1, T. 14 N., R. 81 W. (sample M1204-1 and M1204-2). Samples from this site have one of the highest molybdenum values (300 ppm) and the highest cobalt value (1,000 ppm) recorded in this study, and also contain 10 ppm silver and 15 ppm bismuth (table 1). The prospect pit is in a gossan zone at the sheared contact between quartzite and metagabbro.

Several workings immediately adjacent to the wilderness contain anomalous metal values, and further exploration in these areas may be justified. For example, high gold values (as much as 800 ppm or 23 oz/ton) were obtained from small, high-grade specimen samples containing visible native gold, collected from a drift and several shafts and prospect pits on a patented claim (NW1/4 sec. 30, T. 14 N., R. 80 W.) just outside the southwest boundary of the wilderness. Most samples from these sites contain less than 80 ppm gold (less than 2.3 oz/ton), and the "high-grade" samples having visible free gold must be considered extremely anomalous. Maximum anomalous values for other metals at these sites include 24 ppm silver, 5,000 ppm arsenic, and 500 ppm zinc (table 1, samples K18, 22-1C, and 22-2D). The workings are along two different northwest-trending vein systems, in which quartz veins averaging approximately 0.5-8 in. wide, contain traces of free gold intermixed with pyrite, arsenopyrite, chalcopyrite, and limonite (Donnelly, 1979). The small size and limited extent of most of the veins suggests that a resource tonnage is not present.

Samples containing high silver values (as much as 1,600 ppm or 46 oz/ton from high-grade samples of argentiferous galena) were collected from several prospect pits within 0.25 mi northeast of the wilderness in the SE1/4 sec. 34, T. 15 N., R. 80 W. Other anomalous values include: more than 1 percent arsenic, 2 percent lead, 1 percent zinc, and 1 percent antimony, and as much as 7,000 ppm copper, 70 ppm molybdenum, 500 ppm cadmium, 70 ppm bismuth, 5,000 ppm vanadium, and 0.015 ppm palladium (table 1, samples M553-1 and 2, and M1281-1, 5, 7, and 8). Mineralization is concentrated in a 2- to 10-in.-wide quartz vein occupying a northwest-trending fault zone that parallels the margin of a diabase dike that intrudes granite. Abundant argentiferous galena occurs with siderite, specular hematite, and goethite, with subordinate amounts of fine-grained bournonite, friebergite, sphalerite, chalcopyrite, and pyrite (Loucks, 1976).

Three other minor silver vein prospects occur just west and northwest of the wilderness in the NW1/4 sec. 26, T. 14 N., R. 81 W. (sample site M1310-C), the NE1/4 sec. 14, T. 14 N., R. 81 W. (sample site M1241-4) and the SE1/4 sec. 35, T. 15 N., R. 81 W. (sample site K5). These prospects contain limited silver (maximum 15 ppm) and as much as 1.5 percent copper and 200 ppm cobalt; one sample (K5) contained 1,000 ppm molybdenum (table 1). All of these prospects are along small fault zones, and do not constitute a resource.

A group of shallow shafts, pits, and trenches are along the northeast boundary of the wilderness in the SW1/4 sec. 35, T. 15 N., R. 80 W. (sample sites OR1272B1 and OR1273). Most samples assayed show anomalous copper values (commonly greater than 2 percent copper), but levels of other base and precious metals are low (table 1). Most of the mineralization is as secondary carbonates of copper along joints and fracture planes, and no evidence of any significant concentrations of primary copper minerals was observed. The workings are mainly along northwest-trending fault zones cutting the southern branch of the Mullen Creek-Nash Fork shear zone or in shatter zones associated with these faults.

Production

There is no record of production for any of the workings within the wilderness, and no data are available for the small workings immediately adjacent to the wilderness.

The New Rambler mine, which is approximately 2 mi east of the wilderness, shipped 6,080 tons of ore during the period from 1900 to 1918, from which 1,750,000 pounds copper, 170 oz gold, 7,350 oz silver, 170 oz platinum and 451 oz palladium were recovered (U.S. Bureau of Mines, 1942). An estimate of gold production from the Keystone Mine, 3.5 mi to the southeast, is approximately 5,000 ounces (Currey, 1965). Reliable total production figures for placer gold from the Douglas placer district are not available, although reported estimates infer recovery of at least 4,000 oz (Currey, 1965).

Resource estimates

No production has been realized from the workings examined within the Savage Run Wilderness nor have any resources been identified at these workings or elsewhere in the wilderness area.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Gold and silver

Gold and (or) silver occur in small veins associated with faults in several parts of the Savage Run Wilderness, but significant anomalies were obtained only from samples collected immediately

adjacent to the southwest and northeast boundaries of the wilderness (fig. 2). A few small, high-grade samples with visible native gold, collected from veins just outside the southwest boundary, yielded gold values of as much as 800 ppm (23 oz/ton), and high-grade samples of argentiferous galena from veins a short distance from the northeast boundary contain as much as 1,600 ppm (46 oz/ton) silver (table 1). The veins trend into the wilderness, where their presence may be reflected by slightly elevated levels of gold (as much as 0.5 ppm in the southwest) and lead (in excess of 50 ppm in the northeast) in stream-sediment concentrates (table 2). Silver values for the most part, are negligible in the stream sediments, but high lead values (>1 percent) in rock chip samples are associated exclusively with argentiferous galena-bearing veins; thus, lead in stream sediments is probably a reliable pathfinder for silver in the area.

Despite the high gold and silver values from isolated veins adjacent to the wilderness, the high-grade nature of the analyzed samples along with the small size and limited extent of most of the veins suggests a low resource potential for gold and silver in the northeast and southwest parts of the wilderness.

Palladium, platinum, and nickel

The southeastern area of the wilderness is underlain by a portion of the Mullen Creek mafic complex and is characterized by slightly anomalous values of palladium, platinum, and nickel in rock chip samples and stream-sediment concentrates (as much as 0.03 ppm and 0.005 ppm Pt, 0.016 and 0.006 ppm Pd, and 3,000 and 200 ppm Ni for rock chip samples and stream sediments, respectively; tables 1 and 2). These values are comparable to background values for mafic rocks, but they clearly exceed those of other mafic rocks in the wilderness and indicate that this area has a low potential for Pd, Pt, and (or) Ni resources. More detailed delineation and mapping of specific mafic layers, accompanied by more extensive geochemical sampling might reveal higher local concentrations of these metals.

Copper

In the northeast part of the wilderness, intensely fractured rocks in the east-northeast-trending subsidiary shear zone of the Mullen Creek-Nash Fork shear zone contain appreciable copper (in excess of 2 percent; fig. 2; table 1). Mineralization was most intense in shatter zones where northwest-trending faults cut the shear zone, and ore minerals are predominantly secondary. Concentrations of other base and precious metals are minimal, and the potential for the occurrence of copper resources is low in the northeast part of the wilderness.

Other commodities

There is no evidence of a potential for other mineral commodities in the Savage Run Wilderness. Although anomalous levels of several metals were recorded from isolated samples of both rocks and stream sediments (for example, isolated rock chip samples had >1 percent As, 1,000 ppm Co, 1,000 ppm Mo, >2 percent Pb, 5,000 ppm Zn, >500 ppm Cd, >1 percent Sb, 70 ppm Bi, 200 ppm Sn, 1,000 ppm La, and 11 ppm U; and isolated stream sediment samples had as much as 100 ppm Co, 100 ppm Pb, 300 ppm Zn, 100 ppm W, 1,000 ppm V, and 10 ppm U; tables 1 and 2), no evidence was obtained that supports the existence of resources.

REFERENCES

Anonymous, 1911, Concentration of platiniferous copper ore at the Rambler mine, Wyoming: Metal and Chemical Engineering Journal, v. 9, no. 2, p. 75-78.

Beeler, H. C., 1906, Mineral and allied resources of Albany County, Wyoming and vicinity: Laramie, Wyoming, Laramie Republican Co., Printers, 79 p.

Currey, D. R., 1965, The Keystone gold-copper prospect area, Albany County, Wyoming: Geological Survey of Wyoming Preliminary Report 3, 12 p.

Donnelly, M. E., 1979, Petrology and structure of a portion of the Precambrian Mullen Creek metaigneous mafic complex, Medicine Bow Mountains, Wyoming: Fort Collins, Colorado State University M.S. thesis, 162 p.

Donnelly, M. E., and McCallum, M. E., 1977, Petrology and structure of the southern portion of the Mullen Creek mafic complex, Medicine Bow Mountains, Wyoming: Geological Society of America Abstracts with Programs, v. 9, no. 6, p. 720-721.

Hills, F. A., and Houston, R. S., 1979, Early Proterozoic tectonics of the central Rocky Mountains, North America: University of Wyoming, Contributions to Geology, v. 17, no. 2, p. 89-109.

Houston, R. S., and McCallum, M. E., 1961, Mullen Creek-Nash Fork shear zone, Medicine Bow Mountains, southeastern Wyoming [abs.]: Geological Society of America Special Paper 68, p. 91.

Houston, R. S., and others, 1968, A regional study of rocks of Precambrian age in that part of the Medicine Bow Mountains lying in southeastern Wyoming, with a chapter on the relationship between Precambrian and Laramide structure: Wyoming Geological Survey Memoir 1, 167 p.

Kluender, S. E., 1982, Mineral resources investigation of the Savage Run Wilderness, Albany and Carbon Counties, Wyoming: U.S. Bureau of Mines Open-File Report 75-83.

Knight, W. C., 1902, Notes on the occurrence of rare metals in the Rambler Mine: Engineering and Mining Journal, v. 73, p. 696.

Loucks, R. R., 1976, Platinum-gold-copper mineralization, central Medicine Bow Mountains, Wyoming: Fort Collins, Colorado State University M.S. thesis, 298 p.

Loucks, R. R., and McCallum, M. E., 1980, Platinum-group minerals in the New Rambler copper-nickel deposit, Wyoming--A preliminary report: International Mineralogical Association, 11th Meeting, Novosibirsk, U.S.S.R., Proceedings, p. 200-218.

McCallum, M. E., Loucks, R. R., Carlson, R. R., Cooley, E. F., and Doerge, T. A., 1976 Platinum metals associated with hydrothermal copper ores of the New Rambler mine, Medicine Bow

Mountains, Wyoming: Economic Geology, v. 71, p. 1429-1450.
McCallum, M. E., and Orback, C. J., 1968, The New Rambler copper-gold-platinum district, Albany and Carbon Counties, Wyoming: Geological Survey of Wyoming Preliminary Report 8, 12 p.
Theobald, P. K., Jr., and Thompson, C. E., 1968, Platinum and associated elements at the New Rambler Mine and vicinity, Albany and Carbon Counties, Wyoming: U.S. Geological Survey Circular 607, 14 p.
U.S. Bureau of Mines, 1942, Rambler Mine, Albany County, Wyoming: War Minerals Report 17, 7 p.
U.S. Geological Survey, 1976, Aeromagnetic map of Keystone and vicinity, Wyoming: U.S. Geological Survey Open-File Report 76-687, scale 1:62,500.