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Possible Mineral Resources University Land Grant, Montana School of Mines Lands

Eugene S. Perry

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STATE OF MONTANA
BUREAU OF MINES AND GEOLOGY
A. E. Adami, Acting Director

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UNIVERSITY LAND GRANT
MONTANA SCHOOL OF MINES LANDS

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COUNTIES CONTAINING MONTANA SCHOOL OF MINES LANDS

INTRODUCTION

The following evaluation of the mineral resources of the University Land-Grant lands has been made from an office study of geologic maps and published reports, and from a rather thorough knowledge of the geology of the state by the writer after 23 years of experience in the state. Practically all the mineral resources of Montana, and the districts in which they occur, are described in reports issued by the United States Geological Survey, the Montana Bureau of Mines and Geology, and other agencies. It is improbable that any mineral resource of considerable importance has been overlooked on the lands in question.

It appears that most of the land-grant lands were chosen mainly for their agricultural or grazing possibilities. Nearly all of the lands in the mountain area lie in or near the large intermontane valleys, partially filled with alluvium and/or the deposits formed in extensive extinct fresh-water lakes which once occupied these valleys. Commonly these deposits are 1,000 feet or more in thickness. Where present, they obscure bedrock. No mineral resource of any considerable economic importance has yet been made known in the lake deposits, although locally deposits of sand and gravel, volcanic ash (pumicite), diatomite, and lignite coal are known to be present. Alluvial deposits in certain streams draining mineralized areas yield placer gold, but there is a definite relationship between the location of such streams and the mineralized areas from which the gold originates.

Coal occurs in certain definite formations. Hence, if these formations are not present, coal is not to be expected. In all cases, the geologic formation immediately underlying the various lands is known.

Prediction of occurrence of oil and gas is always accompanied by an element of uncertainty. Foremost in such predictions is the consideration of the presence of certain types of geologic structures, such as anticlines and domes; and most test wells are sunk on geologic structures considered favorable. However, deeply hidden traps of oil and gas, known as stratigraphic traps, make possible the occurrence of oil and gas in localities where favorable structural conditions do not show at the surface. Therefore, in central and eastern Montana, any lands directly underlain by Cretaceous or younger strata must be considered as possible oil and gas lands, because geologic formations known to yield oil or gas elsewhere should underlie such lands at depth.

This report consists of (1) a Record Book in which lands for the School are tabulated by township, range, section, and fraction of section, together with the township plat showing each tract. In most cases, the type of land is indicated. This information was compiled by President Bowman in years past. The Record book also shows the status of ownership as of 1949, compiled by Perry F. Roys. (2) A condensed tabulation of the various lands by counties, with brief descriptions of location, geology, and possible mineral resources. (3) A general description of possible mineral resources of lands by counties. These descriptions were prepared by the writer.

PART 1.--TABULATION OF MONTANA SCHOOL OF MINES LANDS

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources
BEAVERHEAD COUNTY				
5 S., 8 W.	29, 30, 32 33, 34, 35 Unsold 31 All sold 1947	137	In alluvium and lake deposits 9 mi. N. of Dillon in Beaverhead Valley.	In mineralized region but bedrock hidden. No coal, oil, or gas.
6 S., 8 W.	3 Unsold 4 Part sold 1946 6 All sold 1947	141	(Ditto above)	(Ditto above)
BLAINE COUNTY				
29 N.,21 E.	3, 4, 9, Unsold 10, 11, 12 Part sold 1912 - 1919	51	In glacial drift underlain by Upper Cretaceous strata (Judith River form.) on Peoples Creek 5 mi. E. of Bearpaw Mts. and 20 mi. SE. of Chinook.	No known metallic mineralization and none probable. In Cleveland coal field but coal is thin (1 to 3 ft.). (U. S. G. S. Bull. 541-A). Possible oil and gas territory but no known favorable structure.
CARTER COUNTY				
5 S., 56 E.	25 and 34, Unsold	133	In upper Cretaceous strata (Pierre form.) on ridge 25 mi. E. of Powder River 32 mi. S. of Ekalaka.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure. Abandoned test well in Paleozoic (6462 ft.) 8 mi. S.
CASCADE COUNTY				
20 N., 1 E.	3 and 11 Unsold 15 and 22 Part sold 1917	15	In basal Colorado form. on Sun River bench 12 to 14 mi. W. of Great Falls.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure and abandoned well to Devonian on Sec. 12.

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
CASCADE COUNTY Cont'd				
20 N., 2 E.	17 Part sold 1910 18 and 20 Unsold	17	In basal Colorado form. on Sun River bench 10 mi. W. of Great Falls.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure and abandoned well to Devonian 1 mi. westward. Possible bentonite deposit.
21 N., 1 E.	8, 9, 15 Unsold	19	In lower Colorado shale form. along Muddy Creek 1 to 4 mi. NW. of Vaughn.	No metallic mineralization or commercial coal. Possible oil and gas territory near top of Sweetgrass arch but dry holes on secs. 3 and 10, and 9 more within 10 mi.
22 N., 1 E.	6 All sold 1933	25	In lower Colorado shale form. near Muddy Creek 10 mi. NW. of Vaughn.	No metallic mineralization or coal. Possible oil and gas territory on top of Sweetgrass arch but dry hole within ½ mi., 5 more within 5 mi.
CHOUTEAU COUNTY				
21 N., 8 E.	1, 2, 11 Unsold	21	In upper Colorado shale form. on high dry plains north of Highwood Mts.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure. In general this area has not attracted major oil companies.
21 N., 9 E.	10 Unsold 11 and 15 Part sold 1912-1915	23	(Ditto above)	(Ditto above)
22 N., 8 E.	3, 23, 24 Unsold 11, 14, 25 Part sold 1912 - 1935	27	(Ditto above)	(Ditto above)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
CHOUTEAU COUNTY Cont'd				
22 N., 9 E.	10 and 11 Unsold 30 All sold 1912	29	In upper Colorado shale form. on high dry plains north of Highwood Mts.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure. In general this area has not attracted major oil companies.
22 N.,10 E.	29, 31, 32 Part sold 1912 - 1945 30 Unsold	31	(Ditto above)	(Ditto above) (Close to but not in area containing Glauber salt).
23 N., 8 E.	9, 10, 12 14, 35 Unsold 11, 20, 27, 34 Part sold 1913-1947	37	In upper Colorado shale form. near Shonkin Creek 3 to 10 mi. S. of Fort Benton.	(Ditto above) (Dry hole 3 mi. E.).
23 N., 9 E.	6, 18, 19, Unsold	39	In upper Colorado shale form. near Shonkin Creek 3 to 10 mi. S. of Fort Benton.	No metallic mineralization or coal. Possible oil and gas territory but no known favorable structure. In general this area has not attracted major oil companies. (Dry hole on sec. 5).
24 N., 8 E.	27, 34, Unsold	41	In middle Colorado shale along Missouri River 2 mi. SW. of Fort Benton.	(Ditto above)
25 N.,14 E.	1, Part sold 1916	43	In high level terrace gravel overlying strata of Judith River form. on Eagle Creek 20 mi. SE. of Big Sandy.	No metallic mineralization or known commercial coal. Possible oil and gas territory but geologic structure obscured.

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
CHOUTEAU COUNTY Cont'd				
26 N.,14 E.	8, 13, 24, 26, Part sold 1916-1928 9, 10, 11, 12 and 25 Unsold	45	In high level terrace gravel overlying Judith River (?) strata 12 to 18 mi. SE. of Big Sandy. Igneous rock (laccolith) in section 12.	No metallic mineralization or known commercial coal. Possible oil and gas territory but geologic structure obscured.
26 N.,15 E.	7 Part sold 1918 8 and 19 All sold 1916-1918	47	Igneous rock (laccolith) in sec. 7. Lance formation around sides. Sec. 8 and 19 in terrace gravel, 17 mi. SE. of Big Sandy, SW. side of Bearpaw Mts.	No known metallic mineralization or coal. Possible oil and gas territory but geologic structure away from laccolith unknown.
27 N.,14 E.	21, 27, 28, 29, 30, 32, 33, 34, Unsold	49	In area of high level terrace gravel with outcrops of Lance form. and igneous rock 12 mi. SE. of Big Sandy on SW. side of Bearpaw Mts.	No known metallic mineralization. Big Sandy coal field 7 mi. N. but no coal reported on these lands (U. S. G. S. Bull. 541-H). Possible oil and gas territory, but no known favorable structure.
FLATHEAD COUNTY				
30 N.,21 W.	8, 9, 10 All sold 1908	95	In alluvium and lake deposits 3 to 4 mi. SE. of Whitefish in Flathead valley.	No known mineral resource.
30 N.,22 W.	4 and 32 Unsold 14, 25, 28 All sold 1901-1908	97	In alluvium and lake deposits, and in adjacent Belt strata 2 to 5 mi. SW. and S. of Whitefish.	No known mineral resource.
31 N.,20 W.	29 and 30, All sold 1907 - 1908	101	In alluvium and lake deposits 6 to 7 mi. E. of Whitefish.	(Ditto above)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
FLATHEAD COUNTY Cont'd				
31 N.,21 W.	20, 21, 26 All sold 1905 - 1908	103	In alluvium and lake deposits 2 to 4 mi. NE. of Whitefish.	No known mineral resource.
31 N.,22 W.	20 Part sold 1919 26 All sold 1901	105	In alluvium and lake deposits on lake shore 1 and 4 mi. NW. of Whitefish.	(Ditto above)
31 N.,23 W.	4, 10, 17, 26, All sold 1907	107	In alluvium and lake deposits 6 to 10 mi. W. and NW. of Whitefish.	(Ditto above)
32 N.,22 W.	6, 17, 29, Unsold	111	In alluvium and lake deposits 8 to 12 mi. NW. of Whitefish.	(Ditto above)
32 N.,23 W.	5, 18 30 and 34 Unsold 11, 22, 26 All sold 1908	113	In alluvium and lake deposits, and sec. 22, 26, 34 in adjacent area of Belt strata 9 to 15 mi. NW. of Whitefish.	No known mineral resource. (Some oxidized copper was shipped in 1930 from this general area. U. S. G. S. Min. Res. 1930-1931).
33 N.,23 W.	27 All sold 1908	115	In Belt strata at edge of Stillwater Valley 15 mi. NW. of Whitefish.	(Ditto above)
34 N.,20 W.	25 and 33, Unsold	117	In alluvium and lake deposits on N. Fork of Flathead 20 mi. N. of Columbia Falls.	No known mineral resource. Lignite coal in lake deposits 1 to 4 mi. NW. and W. Possibly coal under sec. 33. (E. and M. J., vol. 54, p. 57, 1892).

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
FLATHEAD COUNTY Cont'd				
34 N.,21 W.	10, 20, 22 27 and 31 Unsold	119	Mainly in Belt strata but some in alluvial valleys 20 mi. N. of Columbia Falls. Sec. 10 may be in lake deposits.	No known mineral resource in Belt strata. Possible coal under sec. 10.
26 N.,23 W.	14 All sold 1913 24 and 26 Unsold	79	In alluvium and adjacent Belt strata along Middle Fork of Ashley Creek 16 mi. SW. of Kalispell.	Five mi. NE. of Flathead Mine, but no known mineralization and commercial mineralization improbable. No coal, oil, or gas.
27 N.,19 W.	5 Unsold 22 and 28 All sold 1903-1908	83	In alluvium and lake deposits in Swan River valley 2 to 4 mi. E. of Big Fork.	No known mineral resource and none probable.
27 N.,23 W.	4 Part sold 1902 - 1903 30 Unsold	85	In alluvium and adjacent Belt strata on W. Fork of Ashley Creek 12 to 15 mi. SW. of Kalispell.	(Ditto above)
28 N.,25 W.	18, 28, 30 All sold 1907	87	In alluvium and adjacent Belt strata of Pleasant Valley 20 to 22 mi. W. of Kalispell.	(Ditto above)
28 N.,26 W.	4, 6, 30 All sold 1907	89	In alluvium and nearby Belt strata of Pleasant Valley 27 mi. W. of Kalispell.	(Ditto above)
28 N.,27 W.	24 Unsold 26 All sold 1901	91	In alluvium and adjacent Belt strata of Pleasant Valley 30 mi. W. of Kalispell.	(Ditto above)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
GALLATIN COUNTY				
1 N., 2 E.	2 and 12 Unsold	3	In alluvium and lake deposits 1 to 2 mi. S. of Logan.	No known mineral resource and none probable except possibly sand and gravel.
2 N., 2 E.	34 Unsold	5	In alluvium and lake deposits 2 mi. W. of Logan.	(Ditto above)
1 S., 2 E.	30 Unsold	123	In alluvium and lake deposits along Madison River 12 mi. SW. of Logan.	(Ditto above)
1 S., 3 E.	6 and 8 Unsold 18, 32, 34 All sold 1905 - 1912 20, 22, 28 Part sold 1905 - 1912	125	All in alluvium and lake deposits 6 to 12 mi. S. of Manhattan.	(Ditto above)
2 S., 2 E.	4 All sold 1912 8 and 14 Unsold 10 Part sold 1912	127	In lake deposits and adjacent gneiss 12 mi. S. of Logan.	No known commercial mineral resource. Small quartz veins in gneiss (?).
3 S., 6 E.	10 Unsold	129	In intensely deformed Paleozoic strata and gneiss 5 mi. SE. of Bozeman.	No known mineral resource.
3 S., 7 E.	6 Unsold	131	In intensely deformed upper Paleozoic and lower Mesozoic strata 6 mi. SE. of Bozeman.	No known mineral resource. Oil, gas, and coal most improbable. Possible limestone and brick clay.

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
JUDITH BASIN COUNTY				
17 N., 9 E.	4 and 5 Unsold 8, 9, 17 All sold 1910 - 1945	7	In strata of upper Kootenai form. and some terrace gravel 3 to 5 mi. W. of Geyser.	No metalliferous mineralization or coal. Possible brick clay in Kootenai. Possible oil and gas territory but no known favorable structure.
17 N.,10 E.	12 and 28 Unsold 9, 13, 21, 22 Part sold 1907-1912	9	In terrace gravel and underlying Colorado shale form. Sec. 28 in upper Kootenai form. 1 to 4 mi. SE. of Geyser.	(Ditto above)
18 N., 9 E.	12 Unsold	11	In Colorado shale 5 mi. N. of Geyser.	No known mineral resource and none probable.
18 N.,10 E.	4, 7, 13, 17, 18, 19, 20, 24, 30, 31 Unsold 12 All sold 1928	13	In Colorado shale in hills N. of Arrow Creek 3 to 6 mi. NE. of Geyser.	(Ditto above)
LAKE COUNTY				
25 N.,20 W.	8, 18 Part sold 1903-1909	73	8 in Belt argillite and quartzite, 18 in alluvium near west shore Flathead Lake 1 to 3 mi. N. of Rollins.	No known mineral resource and none probable.
26 N.,18 W.	6 All sold 1906 7 Part sold 1912	75	In alluvium and lake deposits of Swan River valley 7 mi. SE. of Big Fork.	(Ditto above)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
LAKE COUNTY Cont'd				
26 N.,19 W.	2 and 3 Part sold 20 Unsold	77	2 and 3 in alluvium 20 in Belt.	No known mineral resource and none probable.
LEWIS AND CLARK COUNTY				
14 N., 7 W.	4 Part sold 1911 6 Unsold 8 All sold 1911	63	In alluvium of upper Blackfoot River and adjacent Belt strata 9 mi. E. of Lincoln.	Lands lie 8 mi. E. of Lincoln mining district, 5 mi. NW. of Heddleston-Stemple mining district in a mineralized region. Possible mineral veins, but none known. Possible gold placer gravels. No coal, oil, or gas.
19 N., 6 W.	14, 15, 22, 23 Unsold 21 All sold 1903 - 1917	65	In upper Cretaceous strata (Two Medicine form.) 5 mi. E. of Mountain front 6 mi. SE. of Augusta.	No known metallic mineralization and none probable. No commercial coal. Possible oil and gas territory, but local character of structure not known.
19 N., 7 W.	5 and 8, Unsold	67	In Cretaceous strata in zone of Lewis thrust fault at mountain front 6 mi. SW. of Augusta.	(Ditto above)
20 N., 7 W.	15, 22, 23, 27, 33, 34, Unsold	69	In area of glacial drift and terrace gravel 4 mi. E. of Mountain front 2 to 4 mi. W. of Augusta.	(Ditto above)
LINCOLN COUNTY				
29 N.,26 W.	6 and 20 All sold 1907	93	In alluvium of Wolf Creek Valley (Pleasant Valley) 30 mi. NW. of Kalispell.	No known mineral resource and none probable. (Placers on Wolf Creek 10 miles West.)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
LINCOLN COUNTY Cont'd				
30 N.,27 W.	22, 26, 34 All sold 1907	99	In alluvium of Wolf Creek valley and adjacent Belt strata 32 mi. W. of Kalispell.	No known mineral resource and none probable. (Placers on Wolf Creek 10 miles West.)
31 N.,33 W.	8, 32, Unsold	109	Mainly in alluvium of large valley 2 mi. E. and 4 mi. SE. of Troy. Small tract in Belt strata in island-like area of Belt in alluvial valley.	No known mineral resource in alluvium excepting sand and gravel. Belt strata mineralized in this part of Montana, but no mineralization known on lands in question.
MADISON COUNTY				
4 S., 6 W.	12 All sold 1942 28, 29, 32 and 33 Unsold	135	All in alluvium and lake beds middle of Beaverhead valley 7 mi. S. of Twin Bridges.	No known mineral resource, and none to be expected--except sand and gravel.
6 S., 4 W.	6, 7, 17, 18, 19, 20, 29, 30, Unsold	139	All in alluvium and lake beds 1 to 3 mi. W. and S. of Alder.	No known mineral resource except sand and gravel. Alder Gulch gold placers and dredging ground lays 1 to 3 miles eastward and northeastward and gold placers in several creeks are 6 to 12 miles southward. Placer gold may lie in the gravel under part or all of this land. However, its general position on the west side of the valley suggests that the main gold-bearing channel of Alder Gulch may lie 1 mile or more eastward. There is a possibility of placer gold concentration from Ruby River north of the Ruby River gorge. Only testing will answer this question.

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
MEAGHER COUNTY				
8 N., 6 E.	24 Unsold	55	Alluvium and lake deposits and adjacent Belt strata 8 mi. S. of White Sulphur Springs.	No known mineral resource, none probable.
POWELL COUNTY				
8 N., 10 W.	32 All sold 1911	61	Glacial drift (part K) and lake deposits 10 mi. W. Deer Lodge.	No known mineral resource and none probable except sand and gravel.
RAVALLI COUNTY				
1 N., 19 W.	14, 17, 20, 21, 28, 29, 32, 33, 34 Unsold 11 Part sold 1907	59	Part in alluvium Part in Belt Part in Idaho Bath. Near Sula 30 mi. S. of Hamilton.	No known mineral resource. No commercial mineral development in this region to date.
TETON COUNTY				
23 N., 1 E.	22, 26, 27 Part sold 1917—1943	33	In middle Colorado shale 6 mi. E. of Power.	No known metallic mineralization, and none to be expected. No coal. Possible oil and gas territory along crest of Sweetgrass arch 35 miles SE. of Pondera oil field. Several dry holes in this general area.
23 N., 2 E.	26, 27, 31, 34, 35 Unsold	35	(Ditto above)	(Ditto above)
22 N., 1 W.	1, 15, 22, 23, 26 Part sold 1919-1936	71	Colorado shale 5 mi. S. Power.	(Ditto above)

Township and Range	Section or part Sec.	Rec. Book Page	Location and Geology	Possible Mineral Resources.
TOOLE COUNTY 32 N., 3 E.	30 Unsold	53	In upper Colorado shale 3 mi. NW. of Galata.	No metallic mineralization, no coal. Possible oil and gas territory but no outstanding known anticlinal structure.

PART 2

DESCRIPTION OF POSSIBLE MINERAL RESOURCES OF MONTANA SCHOOL OF MINES LANDS

General Statement

The land-grant lands listed for Montana School of Mines lie in 17 counties, or in 68 townships, widely scattered in western and west-central Montana. They appear to have been chosen largely for their agricultural and grazing possibilities. Nearly all lands in the mountainous areas lie in the large intermontane valleys partially filled with alluvium and lake deposits, and those lands in west-central Montana are in high plains regions.

Three localities may have mineral possibilities: (1) in Lewis and Clark County, (2) in Madison County, and (3) in northern Flathead County.

Land in T. 14 N., R. 7 W. in Lewis and Clark County lies in Belt strata in a mineralized region, and other land in this township lies along upper Blackfoot River which in places has been placered for gold. It may be advisable to make a field examination of these lands. Land in Madison County 1 to 3 miles southwest of Alder may be underlain by gold-bearing gravel. Land in northern Flathead County is near deposits of lignite coal.

All lands in central Montana immediately underlain by Cretaceous strata should be considered possible oil and gas lands, and most of Montana School of Mines lands in this region fall into this classification. However, none of the lands in question are known to be on or near favorable structure (except possibly those in Cascade County). Many unsuccessful test wells for oil and gas have been drilled in the plains areas near most of the lands in question, and certainly all of these lands have been examined critically by geologists of the major oil companies. None of the lands appear particularly inviting for oil and gas prospecting as seen on the various published geologic maps.

Beaverhead County

All lands listed for Montana School of Mines in Beaverhead County lie in the open valley of Beaverhead River on low bench-land. The area is underlain first by alluvium and lake deposits, and then (from inference) by intensely folded and faulted Mesozoic and upper Paleozoic strata.

The Argenta mining district lies 8 to 15 miles westward, and the Apex district, in which a little mining has been practiced, lies 3 to 6 miles northwest. The McCarthy mountain district is about 12 miles northward. No mineral resource is known or expected in the lake deposits. It is rank speculation to guess about possible mineralization beneath a body of lake deposits. However, the type of rocks believed to underlie these deposits in this area have not been found to be particularly favorable for metallic mineralization. No coal, oil, or gas is to be expected, and no other mineral deposits are known.

Blaine County

The lands listed in Blaine County lie 2 to 5 miles east of the Bearpaw Mountains in a plains area underlain by glacial drift beneath which strata in the middle part of Judith River formation should be present. No known commercial metallic deposits are known, and none is to be expected.

These lands lie in the Cleveland coal field 20 miles southeast of Chinook. Nearest outcrops of coal are 3 to 4 miles north and about 5 miles west. The coal seam may underlie these lands at depths of 100 to 200 feet. The coal seam is thin ($1\frac{1}{2}$ to 3 feet at the nearest outcrops) and has partings, hence it is not to be considered commercial at present. This is possible oil and gas territory, and the Bowes oil and gas field lies about 20 miles northwestward. No favorable geologic structure is known to be present on the land in question, although bedrock is obscured by glacial drift and alluvium in most places. Laccolithic intrusions of the Bearpaw mountains lie 3 miles to the west.

Carter County

Lands listed for Montana School of Mines in Carter County lie in a high dry plains area underlain by Upper Cretaceous strata (Pierre shale formation). No metallic mineralization or commercial coal are known or to be expected, and there are no other known non-metallic mineral resources.

This is possible oil and gas territory, but no known favorable geologic structure is present. The Baker-Glendive gas horizon in the Baker gas field 50 miles northward is eroded and not present. The Amerada-Washburn deep test is 6 miles south, (Sec. 31, T. 5 S., R. 57 E.) but at a depth of 6462 feet in upper Paleozoic strata commercial amounts of oil or gas had not been reported. This area has been prospected by geophysical methods.

Cascade County

The Montana School of Mines lands listed in Cascade County lie (1) on the high dry Sun River bench 10 to 14 miles west of Great Falls and are underlain by basal sandstone of the Colorado formation, and (2) along Muddy Creek valley near Vaughn at the Mowry (?) shale horizon of the Colorado formation (upper Cretaceous).

No metallic mineralization or commercial coal is likely, although a thin impure coal is said to be present on the west side of Muddy Creek. A bentonite deposit may possibly occur along Muddy Creek (?). This is possible oil and gas territory. No geologic structure favorable for oil or gas occurrence is known to be present on those lands on the Sun River bench. A test well within one mile was drilled into Devonian strata and abandoned. Those lands along Muddy Creek lie on top of the Sweetgrass arch, however 17 unsuccessful test wells have been drilled within 15 miles of these lands, some of which were nearby.

Chouteau County

Montana School of Mines lands listed in 12 different townships in Chouteau County lie in the outcrop area of upper Cretaceous strata on the north side of the Highwood Mountains, and also on the south and west sides of the Bearpaw Mountains.

All of the lands are without known metallic mineralization and geologic conditions are unfavorable for its occurrence.

Lands in T. 22 N., R. 10 E. are near area of sodium sulphate deposits, but according to Sahinen (special report) they do not have any of these deposits on them.

Lands in T. 27 N., R. 14 E. lie 6 miles south of the Big Sandy coal field, but no coal deposits are reported on them, and it is indeed doubtful if commercial coal seams are present. The Big Sandy coal seam is mainly thin and with partings. In one mine the thickness of coal is reported as totaling 6 feet including partings, but apparently such a large thickness is local. (See U. S. G. S. Bull. 541-h). Coal has not been mined in this field for many years.

Oil and gas are possible beneath any plains region across which Cretaceous strata are exposed. However, maps issued by the U. S. G. S. (Bull. 806-E, etc.) show no favorable structures on any of these lands, which makes them unattractive for oil and gas prospecting from a structural view point alone. During the many years of oil and gas development in Montana none of these lands have been important in leasing activities.

In general none of the lands listed are considered attractive for metallic minerals, coal, or oil and gas, and no other mineral resource is known in this area.

Flathead County - North Half

The many lands listed for Montana School of Mines in Flathead County lie in the broad valleys partly filled with lake deposits and alluvium, or in the lower hill-lands closely adjacent, which are in outcrop areas of quartzite and argillite of the Belt series. Most of the lands are underlain by lake deposits. No metallic mineralization is known on or near these lands, but exact information from inspection is not at hand. Metallic mineralization occurs in many places in strata of the Belt series in Lincoln and Sanders counties 20 to 30 miles west and southwest of Flathead County, but so far as known by the writer no important commercial mineralization has been found in Belt strata in Flathead County. The mineralization of the Hog Heaven district (south half of county) appears to be confined to areas of relatively late lavas, the ore occurring in the lava. Montana Bureau of Mines and Geology Memoirs 20 and 31 show two mining districts 10 miles west of Whitefish, but make no mention of mines. U. S. Geological Survey Mineral Resources for 1930 and 1931 mention some oxidized copper ore shipped, but later reports do not mention this area. In view of inactivity since 1931 in a region so easily accessible and so well populated, it is probable that the mineralization in these localities is either non-commercial as of the present time, or else of minor importance.

Locally in the river valley of the North Fork of Flathead River, the lake deposits (?) are reported to contain a low grade (lignite) coal, but so far as known these coals have not been worked for many years. Six or eight beds dipping about 45° and 2 to 13 feet thick are reported. (See E. & M. J. vol. 54, 1892, p. 57). No coal is known to underlie any of the lands in question, but definite information is not available. Montana Bureau of Mines & Geology Memoir 20 (1940) reports that the North Fork Coal Co. of Columbia Falls produced 30 tons per day, but Memoir 31 (1950) gives no mention of this mine. Sec. 33, T. 34 N., R. 20 W. (Montana School of Mines lands) possibly may be underlain by this coal.

Seepages of oil are reported to occur near Kintla in Flathead River valley, the oil said to be coming from fissures in Belt quartzite and argillite (pre-Cambrian age). (See Montana Bureau of Mines & Geology Memoir 3, p. 96). This is a most unusual occurrence, and not fully understood. The seepages may be associated with large scale thrust faulting (the Lewis overthrust is present in this region). The major oil companies have not taken the seepages seriously, which casts doubt on their commercial significance; however test wells have been drilled. No seeps are known on or near any of the lands in question.

Local areas in the alluvium contain deposits of sand and gravel, and some inferior clay for brick making may be present.

Flathead County - South Half

Montana School of Mines lands listed east of Flathead Lake (T. 27 N., R. 19 W.) all lie in alluvium or lake deposits in which economic mineral resources are neither known nor expected.

Land listed along Ashley Creek 12 to 15 miles southwest of Kalispell lie partly in alluvial valleys and partly in Belt strata adjacent to the valleys. No mineral resource is known or expected in the alluvial material. Lands in T. 26 N., R. 23 W. are about 5 miles northeast of the Hog Heaven mining district in which is the formerly productive Flathead lead-silver mine. However, ore of this and nearby mines are in and associated with late lava beds, and commercial mineralization is not known in strata of the Belt series in this vicinity. Lands in the township just mentioned (partly in alluvium and partly in Belt strata) lie adjacent to a graveled road, hence should be easily accessible. If mineralization were present at the surface it seems probable that it would have been discovered. It is indeed doubtful if any is present.

Lands in Pleasant Valley tributary to Fisher River 30 miles west of Kalispell, also lie partly in alluvial material and partly in Belt strata. Metallic mineralization occurs in Belt strata about 20 to 30 miles westward and southwestward in Lincoln and Sander counties, but other than mines in the Hog Heaven district, no mine is reported in southern Flathead county. (See Montana Bureau of Mines and Geology Memoir 31, Plates 7 and 22). Apparently the mineralized area of Sanders and Lincoln counties stops before reaching Flathead County.

Gallatin County

The several tracts of land listed for Montana School of Mines in Gallatin County lie in areas of lake deposits, in areas of gneiss, or in intensely folded Paleozoic and Mesozoic strata. Nearest mining districts are Radersburg and Norris 20 to 30 miles distant. No known metallic mineralization occurs near these lands, and it is indeed doubtful if any is present.

A large acreage (partly sold) in Tps. 1 N. and 1 and 2 S., Rs. 2 and 3 E. lies in the bench lands underlain by lake deposits near Logan and 5 to 12 miles south of Manhattan. No mineralization is known.

Another group of sections or partial sections in T. 2 S., R. 2 E. lie in low hills of gneiss at the edge of the area of lake deposits about 14 miles south of Logan. No commercial mineralization is known in the gneiss. Corundum occurs locally in the gneiss of this region, but these deposits and this area has been studied in much detail by the U. S. Geological Survey (Special report by Clabaugh, Montana School of Mines Library) and maps of the area do not show that corundum occurs on the lands in question. Also it is reported that small quartz veins are present. Since this area is easily accessible and well populated, it would seem probable that if important mineralization were present and gave evidence at the surface, it would have been made known.

Two sections in T. 3 S. Rs. 6 and 7 E. (not sold) lie in the mountainous area on and near Bear Creek 6 miles southeast of Bozeman. They are underlain by intensely deformed Paleozoic and Mesozoic strata. No metallic mineralization is known in this general area. The Trail Creek coal field lies about 3 miles eastward, but as interpreted from a geologic map, the coal-bearing formation (Eagle) is not present under these sections. Brick clay may be present in the Kootenai formation on that section on Bear Creek (sec. 6), but good exposures of Kootenai strata lie along the railroad 2 miles northward. This region is not favorable for oil or gas occurrence.

Judith Basin County

Several sections of land listed for Montana School of Mines in Judith Basin County lie near Geyser in the outcrop areas of the lower part of the Colorado shale and upper part of the Kootenai formation in a plains area northeast of the Belt mountains. Nearest mining district is at Hughesville 14 miles southwest of Geyser in the heart of the Belt mountains. No known metallic mineralization is known to be present on the lands listed, and none is to be expected.

Coal possibilities are negligible. Brick clay may be present in Kootenai strata, and gravel in alluvial terrace deposits. Lands on which Cretaceous strata crop out are underlain by formations which elsewhere in Montana yield oil and gas, hence such lands should be considered possible oil and gas lands. However, no geologic structure such as is considered favorable for oil or gas accumulation is known to be present beneath the lands in question. Although this does not condemn the lands, together with other considerations not mentioned does cast doubt on their desirability for oil or gas prospecting.

Lake County

Montana School of Mines lands listed in Lake County are (1) in rocky hills near the west shore of Flathead lake north of Rollins underlain in part by alluvium and in part by argillite and quartzite of the Belt series, and (2) in flat, bottom-lands of Swan River valley underlain first by alluvium and probably lake deposits and then at considerable depth by Belt strata.

Nearest mining district is Hog Heaven 20 to 30 miles westward. No known metallic mineralization is known on or near these lands, and it is probable that none is present. (See Flathead Co.). Coal, oil and gas possibilities are negative.

Lewis & Clark County

Section 6, T. 14 N., R. 7 W. listed for Montana School of Mines in Lewis and Clark County (unsold) lies in Belt strata about 8 miles east of the Lincoln mining district, and about 5 miles northwest of the Stemple-Heddleston mining district. The Mike Horse Mine is 10 miles to the eastward. This general region is mineralized with veins yielding gold, silver, lead, zinc, and some copper. Some placer gold has been found along Blackfoot River above and below the land in question. Lands in sections 4 and 8 in this township, listed for Montana School of Mines, lie along Blackfoot River. As far as known, no mines or veins are present on sections 6, 4, or 8, however it might be advisable for this area to be examined by field inspection.

The remainder of the Montana School of Mines lands in this county (partly sold) lie east of the mountain front in and close to the zone of intense Lewis overthrust faulting 3 to 8 miles west and south of Augusta. Strata underlying the several tracts are of Upper Cretaceous age, although high-level gravel blankets much of the surface. The zone about 10 to 15 miles wide east of the mountain front (known as the "disturbed" zone) has been crumpled and faulted, and in places strata are overturned. Geologic conditions at the Turner Valley (Canada) oil field are somewhat similar, hence this region should be considered possible oil and gas territory. However, little or no leasing has been carried on in this area. Perhaps this area should be considered as possible, but not particularly attractive, oil and gas territory. No metallic mineralization is known, and none is expected. Commercial deposits of coal are improbable, and no other mineral source is known in this part of Montana.

Lincoln County

Of 480 acres of unsold land listed for Montana School of Mines in Lincoln County in T. 31 N., R. 33 W. all but 40 acres are in alluvium and lake deposits of the Troy valley; 40 acres are in an island-like area of Belt strata within the lake-bed valley.

Other than sand and gravel, and possible low-grade brick clay, no mineral reresource is known or to be expected in the alluvium and lake beds.

Scant mineralization (but no important mines) occurs in the area 3 to 6 miles west and about 15 miles northeast. The Snowshoe mine lies about 20 miles southeastward in Belt strata. No mineralization is known on the 40 acres listed in the area of Belt strata. This 40 is near a gravel road about 3½ miles south of Troy, and hence is easily accessible. It is not likely that this 40 is mineralized with commercial deposits readily visible, or else they would have been made known.

Madison County

All the lands listed in Madison County lie in the alluvium and lakebeds of Jefferson Valley along Beaverhead and Ruby Rivers. Other than as mentioned below no mineral resource (excluding sand and gravel) is known in the alluvium or lake deposits which may be several hundred feet thick.

Lands in T. 6 S., R. 4 W. lie about 1 to 3 miles west and southwest of the Alder Gulch gold placers, and the ground in the main valley which was dredged for gold. Also gold has been placered in several creeks tributary to Ruby River from 6 to 12 miles southward.

Placer gold may be contained in the gravel under part or all of these lands (T. 6 S., R. 4 W.). However, their position on the west side of the valley suggests that the main gold-bearing channel of Alder Gulch may lie 1 mile or more eastward. There is a possibility of placer gold concentration in the main valley north of the Ruby River gorge, the gold coming from the tributary streams southward. Only testing will answer this question. It may be advisable for these lands to be examined for their placer gold possibilities.

Meagher County

The land listed for Montana School of Mines in Meagher County lies about 8 miles south of White Sulphur Springs in the area of lake deposits and alluvium, which in turn should be underlain by strata of the Belt series.

No mineral resource is to be expected in the alluvium and lake beds. Extensive areas of Belt strata 2 miles and more to the southwest are not known to be mineralized. Hence it is unlikely that this land has a mineral value.

Powell County

The land listed for Montana School of Mines in Powell County lies on the west side of Deer Lodge valley about 10 miles west of Deer Lodge, and is underlain by glacial drift and lake deposits.

No known mineral resource is known to be present, and it is not likely that any will be found other than sand and gravel.

Ravalli County

A large tract of land listed for Montana School of Mines in Ravalli County lies in a mountainous country near Sula about 30 miles south of Hamilton and 6 miles from Idaho. It is partly in valley alluvium, partly in Belt strata, and partly in igneous rock, probably the eastern edge of the Idaho batholith.

No commercial metallic mineralization is known in this part of Montana, although geologic condition are such that mineralization could occur. In view of the intense prospecting to which southwest Montana has been subjected, it would seem that if important mineralization were present and visible, it would have come to attention. Conditions are favorable for placer gold, but none is reported in this locality in Montana Bureau of Mines and Geology Memoir 26, which suggests that gold-bearing lodes are not present.

Of course there is no coal, oil, or gas. Much of the area is heavily timbered.

Teton County

The Montana School of Mines lands listed for Teton County lie about 5 to 6 miles east and south of Power in high bench lands underlain by strata in about the middle of the Colorado shale formation. Scattered glacial drift may be present.

No metallic mineralization or coal is to be expected.

This part of Montana is possible oil and gas territory, particularly so since it lies along or near the crest of the Sweetgrass arch, a large geanticlinal structure extending from Great Falls northward 150 miles into Canada. However, a number of test wells drilled for oil and gas in this general locality failed to yield commercial amounts of oil or gas. For this reason this general area has been considered just medium in its attractiveness for oil and gas prospecting.

Toole County

One 40-acre tract in Toole County (not sold) listed for Montana School of Mines lies along Willow Creek about 2 miles northwest of Galata in the outcrop area of upper Colorado shale. It lies about 15 miles southeast of the Kevin-Sunburst oil field and about 6 miles southeast of the Devon gas field.

No metallic mineralization or coal is to be expected.

This region is possible oil and gas territory, but no important favorable structure is known on or near the land listed, hence it would not be considered particularly attractive for oil and gas prospecting from a structural point of view alone. Nevertheless, the proximity of this land to producing areas, and the possible existence of stratigraphic traps in this part of Montana definitely makes it worthy of careful consideration.