U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MINERAL SUMMARIES
for
OREGON

U.S. Bureau of Land Management Wilderness Study Areas

Edited By

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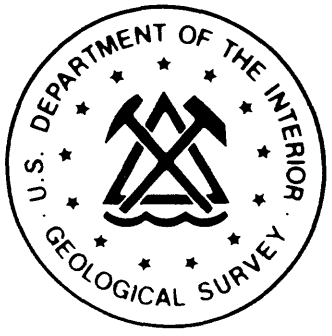
Prepared by the U.S. Geological Survey and the U.S. Bureau of Mines



1991

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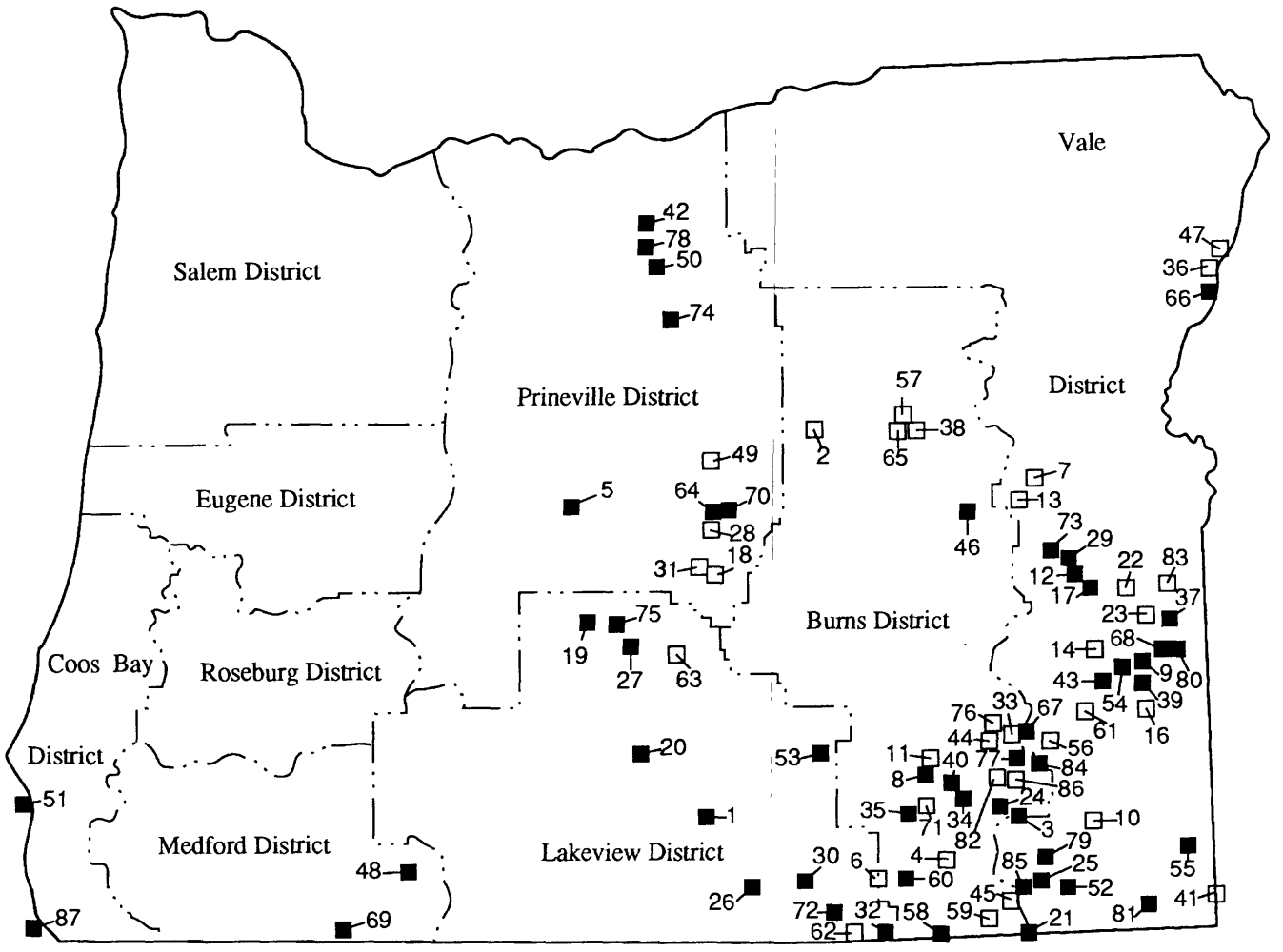
U.S. BUREAU OF LAND MANAGEMENT
WILDERNESS STUDY AREAS IN OREGON

1. Abert Rim
2. Aldrich Mountain
3. Alvord Desert
4. Alvord Peak
5. Badlands
6. Basque Hills
7. Beaver Dam Creek
8. Blitzen River
9. Blue Canyon
10. Bowden Hills
11. Bridge Creek
12. Camp Creek
13. Castle Rock
14. Cedar Mountain
15. Chopaka Mountain
16. Clarks Butte
17. Cottonwood Creek
18. Cougar Well
19. Devils Garden Lava Bed
20. Diablo Mountain
21. Disaster Peak
22. Dry Creek
23. Dry Creek Buttes
24. East Alvord
25. Fifteen Mile Creek
26. Fish Creek Rim
27. Four Craters Lava Bed
28. Gerry Mountain
29. Gold Creek
30. Guano Creek
31. Hampton Butte
32. Hawk Mountain
33. Heath Lake
34. High Steens
35. Home Creek
36. Homestead
37. Honeycombs
38. Indian Creek
39. Jordan Craters
40. Little Blitzen Gorge
41. Lookout Butte
42. Lower John Day
43. Lower Owyhee Canyon
44. Lower Stonehouse
45. Mahogany Ridge
46. Malheur River-Bluebucket Creek
47. McGraw Creek
48. Mountain Lakes
49. North Fork
50. North Pole Ridge
51. North Sisters Rocks
52. Oregon Canyon
53. Orejana Canyon
54. Owyhee Breaks
55. Owyhee Canyon
56. Palomino Hills
57. Pine Creek
58. Pueblo Mountains
59. Red Mountain
60. Rincon
61. Saddle Butte
62. Sage Hen Hills
63. Sand Dunes
64. Sand Hollow
65. Sheep Gulch
66. Sheep Mountain
67. Sheepshead Mountains
68. Slocum Creek
69. Soda Mountain
70. South Fork
71. South Fork Donner Und Blitzen R.
72. Spaulding
73. Sperry Creek
74. Spring Basin
75. Squaw Ridge Lava Bed
76. Stonehouse
77. Table Mountain
78. Thirtymile
79. Twelve Mile Creek
80. Upper Leslie Gulch
81. Upper West Little Owyhee
82. West Peak
83. Wild Horse Basin
84. Wildcat Canyon
85. Willow Creek
86. Winter Range
87. Zwagg Island



EXPLANATION

■ Study area has been partially or completely studied

□ Study area has not been studied

64 Numbers refer to list on page 3

Number 15, Chopaka Mountain, is not shown. It is located in Washington

Figure 1. Map showing distribution and status of U.S. Bureau of Land Management wilderness study areas in Oregon

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INTRODUCTION

The U.S. Geological Survey (Menlo Park, Calif.) in cooperation with the U.S. Bureau of Mines (Spokane, Wash.) prepared this mineral "Briefing Book," that summarizes the mineral resource evaluations on 87 wilderness study areas in or administered from Oregon. These areas are lands administered by the U.S. Bureau of Land Management. This volume for Oregon U.S. Bureau of Land Management wilderness study areas was prepared as background data for the Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) (FLPMA). All of these areas are classified as wilderness study areas. Interspersed throughout many of the federal lands are parcels of private and State land.

This volume covers a total of 2,840,467 acres; the 87 areas treated are shown on figure 1. Part of this mineral resource information was requested under FLPMA, under which the U.S. Bureau of Land Management requested that the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on all or parts of 52 areas to determine the mineral values, if any, that may be present. The request, that covers lands in and administered from Oregon, totals 1,370,241 acres. and covers 20 areas that total 384,824 acres and parts of 32 areas that total 985,417. This briefing book additionally contains information on 1,470,226 acres that consist of the 35 remaining study areas that total 923,884 acres and the unstudied parts of 32 areas that total 546,342 acres. However, the mineral information on the areas that were not studied is tenuous and based on literature searches and, where applicable, discussions with private industry. Table 1 is a list of the U.S. Bureau of Land Management wilderness study areas covered in this volume, along with their number, acreages, and whether they were studied by the U.S. Geological Survey and U.S. Bureau of Mines.

Since the publication of the joint report on the Honeycombs Wilderness Study Area (OR-003-077A), low-grade, high-tonnage epithermal hot-spring gold-silver deposits have been recognized in the region northeast of the wilderness study area. The recognition that this mineral-deposit model is applicable in the region, coupled with new data that has become available to the U.S. Geological Survey, reinterpretation of existing geochemical data, and known-deposit data suggest that similar deposits may be present elsewhere in the region. This report contains an additional assessment of the Honeycombs Wilderness Study Area in light of those new data.

Format of Briefing Book

Each mineral summary in this book includes text describing the identified resources, mineral resource potential, mining activity, mineral setting, recommendations for further study, and references. Each summary also has a figure showing significant mines and prospects in and near the proposed wilderness, along with an indication of the potential for undiscovered resources. A summary map is included as Plate 1 that shows each study area, whether it has identified resources, and the level of resource potential of all or part of the area. In both the figures and the plate, zones with identified resources and areas of high resource potential are shown in red; areas of moderate resource potential are shown in pink. Potential for undiscovered resources is studied by the U.S. Geological Survey and identified mineral resources are studied by the U.S. Bureau of Mines.

Table 2 lists the study areas covered in this volume and shows those that have identified resources or areas of moderate or high mineral resource potential. Table 3 lists designated strategic and critical minerals and table 4 contains a list of mineral commodities in the wilderness study areas, their import reliance, major foreign sources, and principal uses. A geologic time chart is included in the back of this book for reference.

Classification of Mineral Resources

According to a Memorandum of Understanding, the U.S. Bureau of Mines is responsible for studying the known, or identified resources, and the U.S. Geological Survey is responsible for studying unknown, or the undiscovered resources of a study area. The resource classification used by the U.S. Bureau of Mines and the mineral resource classification used by the U.S. Geological Survey are presented in figures 2 and 3.

MINERAL SUMMARY FOR THE STATE OF OREGON

The State of Oregon has experienced an increase of mineral production of about 11 percent between 1987 and 1988, the most recent year for which figures have been compiled. This production was nearly all from industrial minerals. The leading commodities were crushed stone, sand and gravel, cement, diatomite, and lime. Oregon leads the nation in pumice production and is of national importance in diatomite and zeolite production. The State ranked 38th nationally in values of nonfuel minerals produced. (all data from Minerals Yearbook, vols. 1 and 2, 1988, by U.S. Bureau of Mines). The exploration for high-bulk, gold deposits is a major new activity in Oregon. The Grassy Mountain gold deposit in Malheur County has reserves of over a million ounces. Extensive searches are underway for additional similar deposits.

Many of the wilderness study areas in Oregon are in close proximity to areas of mineral production; however, the only identified or known resources in the study areas are building stone, chalcedony, clay, copper, decorative stone, diatomite, gold (lode and placer), jasper, mercury, perlite, pozzolan, sand and gravel, slab lava, and zeolite (table 2). A total of 17 wilderness study areas have high potential for undiscovered resources of chromite, copper, diatomite, geothermal energy, gold, lead, mercury, molybdenum, optical calcite, sand and gravel, silver, uranium, zeolite, and zinc. There are an additional 40 study areas that have moderate potential for undiscovered resources of arsenic, ash, bentonite, boron, bromine, chromite, copper, diatomite, fluorite, geothermal energy, gold, lead, lithium, magnesium, mercury, molybdenum, oil and gas, perlite, potash, salts, sand and gravel, silver, soda ash, sodium, sulfate, thorium, tin, tungsten, uranium, zeolite, and zinc.

LIST OF MEASUREMENT ABBREVIATIONS USED IN THIS BOOK

ft	foot
lb	pound
lb/ton	pound per ton
Ma	million years
mi	mile
mi^2	square mile
oz	troy ounce
oz/ton	troy ounce per ton
ppm	part per million
stu	short ton unit
yd^2	square yard
yd^3	cubic yard
%	percent

Other Abbreviations Used in This Book

BLM	U.S. Bureau of Land Management
MILS	U.S. Bureau of Mines Mineral Industry Location System
MRDS	U.S. Geological Survey Mineral Resources Data System
USBM	U.S. Bureau of Mines
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

Table 1.--Table listing U.S. Bureau of Land Management wilderness study areas in Oregon, their numbers and acreages, and whether they were studied by the U.S. Geological Survey and U.S. Bureau of Mines

Name	Number	Acres	Studied
Abert Rim	OR-001-101	23,760	yes
Aldrich Mountain	OR-002-103	9,395	no
Alvord Desert	OR-002-074	251,060	partially
Alvord Peak	OR-002-083	16,825	no
Badlands	OR-005-021	32,221	partially
Basque Hills	OR-002-084	141,410	no
Beaver Dam Creek	OR-003-027	19,580	no
Blitzen River	OR-002-086E	55,880	partially
Blue Canyon	OR-003-073	12,700	yes
Bowden Hills	OR-003-118	59,900	no
Bridge Creek	OR-002-087	14,545	no
Camp Creek	OR-003-031	20,310	yes
Castle Rock	OR-003-018	6,200	no
Cedar Mountain	OR-003-047	33,600	no
Chopaka Mountain	OR-013-002	5,518	no
Clarks Butte	OR-003-120	31,490	no
Cottonwood Creek	OR-003-032	8,700	partially
Cougar Well	OR-005-043	18,435	no
Devils Garden Lava Bed	OR-001-002	29,680	partially
Diablo Mountain	OR-001-058	113,120	partially
Disaster Peak	OR-003-153/NV-020-859	32,040	partially
Dry Creek	OR-003-053	23,500	no
Dry Creek Buttes	OR-003-056	51,800	no
East Alvord	OR-002-073A	22,240	partially
Fifteen Mile Creek	OR-003-156	51,290	yes
Fish Creek Rim	OR-001-117	16,690	partially
Four Craters Lava Bed	OR-001-022	12,600	partially
Gerry Mountain	OR-005-035	20,700	no
Gold Creek	OR-003-033	15,780	yes
Guano Creek	OR-001-132	10,350	yes
Hampton Butte	OR-005-042	10,600	no
Hawk Mountain	OR-001-146A	69,640	yes
Heath Lake	OR-002-072F	20,520	no
High Steens	OR-002-085F	69,740	partially
Home Creek	OR-002-085H	26,540	partially
Homestead	OR-006-002	14,575	no
Honeycombs	OR-003-077A	39,000	partially
Indian Creek	OR-002-098D	208	no
Jordan Craters	OR-003-128	27,900	partially
Little Blitzen Gorge	OR-002-086F	9,400	partially
Lookout Butte	OR-003-194	99,600	no

Table 1.--(continued)

Name	Number	Acres	Studied
Lower John Day	OR-005-006	19,587	partially
Lower Owyhee Canyon	OR-003-110	75,700	partially
Lower Stonehouse	OR-002-023M	8,090	no
Mahogany Ridge	OR-002-077	27,940	no
Malheur River-Bluebucket Creek	OR-002-014	5,560	yes
McGraw Creek	OR-006-001	497	no
Mountain Lakes	OR-011-001	334	yes
North Fork	OR-005-031	10,985	no
North Pole Ridge	OR-005-008	6,369	partially
North Sisters Rocks	OR-012-008	3	yes
Oregon Canyon	OR-003-157	42,900	yes
Orejana Canyon	OR-001-078	24,600	partially
Owyhee Breaks	OR-003-059	13,380	partially
Owyhee Canyon	OR-003-195	180,680	partially
Palomino Hills	OR-003-114	54,600	no
Pine Creek	OR-002-098A	72,690	no
Pueblo Mountains	OR-002-081/NV-020-642	200	partially
Red Mountain	OR-002-078	16,215	no
Rincon	OR-002-082	103,965	partially
Saddle Butte	OR-003-111	86,300	no
Sage Hen Hills	OR-001-146B	8,520	no
Sand Dunes	OR-001-024	16,440	no
Sand Hollow	OR-005-034	8,791	partially
Sheep Gulch	OR-002-098C	741	no
Sheep Mountain	OR-006-003	7,040	yes
Sheepshead Mountains	OR-002-072C	54,390	partially
Slocum Creek	OR-003-075	7,600	yes
Soda Mountain	OR-011-017	5,640	yes
South Fork	OR-005-033	19,631	partially
South Fork Donner Und Blitzen R.	OR-002-085G	37,555	no
Spaulding	OR-001-139	69,530	partially
Sperry Creek	OR-003-035	5,600	yes
Spring Basin	OR-005-009	5,982	yes
Squaw Ridge Lava Bed	OR-001-003	28,340	partially
Stonehouse	OR-002-023L	21,325	no
Table Mountain	OR-002-072I	40,592	partially
Thirtymile	OR-005-001	7,538	partially
Twelve Mile Creek	OR-003-162	28,600	partially
Upper Leslie Gulch	OR-003-074	3,000	yes
Upper West Little Owyhee	OR-003-173	62,500	yes
West Peak	OR-002-072J	8,535	no
Wild Horse Basin	OR-003-077B	12,100	no
Wildcat Canyon	OR-002-072D	34,830	yes
Willow Creek	OR-003-152	30,565	partially
Winter Range	OR-002-073H	15,440	no
Zwagg Island	OR-012-014	5	yes

Table 2.--U.S. Bureau of Land Management wilderness study areas with identified resources (known) or with high or moderate mineral resource potential (undiscovered)

Wilderness study area	Number	Identified resources (known)	Mineral resource potential (undiscovered)	
			High	Moderate
Abert Rim	OR-001-101	none		geothermal
Aldrich Mountain	OR-002-103	none		
Alvord Desert	OR-002-074	none		gold, silver, mercury, geothermal
Alvord Peak	OR-002-083	none	mercury, copper, gold	perlite, uranium, zeolite
Badlands	OR-005-021	none		
Basque Hills	OR-002-084	none		mercury, copper, gold, diatomite
Beaver Dam Creek	OR-003-027	none		gold
Blitzen River	OR-002-086E	none		geothermal
Blue Canyon	OR-003-073	perlite, sand and gravel, jasper	gold, silver, mercury, molybdenum	gold, bentonite, diatomite, geothermal
Bowden Hills	OR-003-118	none	zeolite, geothermal	gold
Bridge Creek	OR-002-087	none		diatomite
Camp Creek	OR-003-031	diatomite, pozzolan, sand and gravel		gold, silver
Castle Rock	OR-003-018	none		
Cedar Mountain	OR-003-047	none		
Chopaka Mountain	OR-013-002	none	gold, silver, copper, lead, zinc	chromite
Clarks Butte	OR-003-120	none		
Cottonwood Creek	OR-003-032	sand and gravel, slab lava		gold, silver
Cougar Well	OR-005-043	none		oil and gas
Devils Garden Lava Bed	OR-001-002	none		
Diablo Mountain	OR-001-058	none		soda ash, boron, sodium sulfate, magnesium, salts, potash, bromine, lithium, tungsten, geothermal
Disaster Peak	OR-003-153/NV-020-859	none	gold	
Dry Creek	OR-003-053	none	optical calcite	gold
Dry Creek Buttes	OR-003-056	none	gold	
East Alvord	OR-002-073A	none		gold, silver, mercury, geothermal
Fifteen Mile Creek	OR-003-156	none		
Fish Creek Rim	OR-001-117	none		
Four Craters Lava Bed	OR-001-022	none		
Gerry Mountain	OR-005-035	none		oil and gas, bentonite
Gold Creek	OR-003-033	decorative stone, diatomite, sand and gravel	gold	gold, silver, mercury
Guano Creek	OR-001-132	none		
Hampton Butte	OR-005-042	none		oil and gas
Hawk Mountain	OR-001-146A	none		
Heath Lake	OR-002-072F	none		
High Steens	OR-002-085F	perlite	mercury, uranium	mercury, uranium, gold
Home Creek	OR-002-085H	none		sand and gravel
Homestead	OR-006-002	none	copper, gold, silver	
Honeycombs	OR-003-077A	none		uranium, thorium, lithium, mercury, arsenic, lead, zinc, copper, tin, fluorite, zeolite, gold
Indian Creek	OR-002-098D	none		chromite
Jordan Craters	OR-003-128	none		
Little Blitzen Gorge	OR-002-086F	none		
Lookout Butte	OR-003-194	none		
Lower John Day	OR-005-006	none		
Lower Owyhee Canyon	OR-003-110	zeolite, building stone		
Lower Stonehouse	OR-002-023M	none	geothermal	

Table 2.–U.S. Bureau of Land Management wilderness study areas with identified resources (known) or with high or moderate mineral resource potential (undiscovered) (continued)

Wilderness study area	Number	Identified resources (known)	Mineral resource potential (undiscovered)	
			High	Moderate
Mahogany Ridge	OR-002-077	none		diatomite
Malheur River-Bluebucket Creek	OR-002-014	none		
McGraw Creek	OR-006-001	none	copper, silver, gold	
Mountain Lakes	OR-011-001	none		
North Fork	OR-005-031	none		oil and gas
North Pole Ridge	OR-005-008	none		gold
North Sisters Rocks	OR-012-008	none		
Oregon Canyon	OR-003-157	none		mercury, uranium
Orejana Canyon	OR-001-078	sand and gravel		
Owyhee Breaks	OR-003-059	none	gold	gold, bentonite, diatomite, geothermal
Owyhee Canyon	OR-003-195	none		
Palomino Hills	OR-003-114	none		
Pine Creek	OR-002-098A	chromite	chromite	
Pueblo Mountains	OR-002-081/NV-020-642	gold, mercury, building stone, chalcedony, clay, copper, diatomite, sand and gravel	gold, silver, mercury copper, molybdenum	gold, silver, mercury copper, molybdenum
Red Mountain	OR-002-078	none		
Rincon	OR-002-082	none	sand and gravel	silver
Saddle Butte	OR-003-111	none		geothermal
Sage Hen Hills	OR-001-146B	none		
Sand Dunes	OR-001-024	none		oil and gas
Sand Hollow	OR-005-034	none		
Sheep Gulch	OR-002-098C	none		
Sheep Mountain	OR-006-003	none		
Sheepshead Mountains	OR-002-072C	none		geothermal
~~Slocum Creek~~	~~OR-003-075~~	~~none~~		~~uranium, thorium, gold, silver, mercury, zinc,~~ geothermal
Soda Mountain	OR-011-017	none		gold, silver
South Fork	OR-005-033	none		
South Fork Donner Und Blitzen R.	OR-002-085G	none		geothermal
Spaulding	OR-001-139	none		
Sperry Creek	OR-003-035	building and decorative stone		gold, silver, and mercury
Spring Basin	OR-005-009	none		
Squaw Ridge Lava Bed	OR-001-003	none		
Stonehouse	OR-002-023L	none		
Table Mountain	OR-002-072I	none		geothermal
Thirtymile	OR-005-001	placer gold		
Twelve Mile Creek	OR-003-162	none		
Upper Leslie Gulch	OR-003-074	none		uranium, thorium, gold, silver, mercury, zinc, geothermal
Upper West Little Owyhee	OR-003-173	none		
West Peak	OR-002-072J	none		
Wild Horse Basin	OR-003-077B	none	geothermal	oil and gas
Wildcat Canyon	OR-002-072D	none	diatomite	geothermal
Willow Creek	OR-003-152	none		
Winter Range	OR-002-073H	none		geothermal
Zwagg Island	OR-012-014	none		

Table 3. Mineral Commodities designated strategic and critical

1. Aluminum/Bauxite
2. Antimony
3. Asbestos
4. Beryllium/Beryl
5. Bismuth
6. Cadmium
7. Chromium/Chromite*
8. Cobalt
9. Columbium (Niobium)
10. Copper*
11. Diamond
12. Fluorspar*
13. Germanium
14. Graphite
15. Lead*
16. Manganese
17. Mercury*
18. Mica
19. Molybdenum*
20. Nickel
21. Platinum (iridium, platinum, palladium)
22. Quartz crystals
23. Rutile
24. Sapphire/Ruby (Corundum)
25. Silver*
26. Talc
27. Tantalum
28. Thorium*
29. Tin*
30. Tungsten*
31. Vanadium
32. Zinc*

* Indicates commodities that are identified or have moderate or high mineral resource potential in wilderness study areas in Oregon.

Table 4.-- Percent of U.S. consumption from imports, major foreign sources, and principal uses for mineral commodities identified in Oregon wilderness study areas.

Metals and Minerals	Major Foreign Sources	Principal Uses
Net Exports		
Boron	Turkey, Italy, Argentina	Glass products (59%), soap and detergents (7%)
Clays	United Kingdom, Mexico, Canada	Paper, refactories, pottery, title fire bricks, foundry sand, drilling mud, absorbent uses, construction materials
Diatomite	Taiwan, Mexico	Filter aid (67%), fillers (17%)
Feldspar	Mexico, Venezuela	Glass (54%), pottery (46%)
Lithium	Chile, Zimbabwe, Canada	Ceramics and glass (40%), aluminum products and lubricants (45%)
Magnesium (dolimite)	Canada, Norway	Aluminum-base alloys (53%), magnesium castings (23%)
Molybdenum	Canada, Mexico, Chile Federal Republic of Germany	Machinery (30%), oil and gas industry (15%), transportation (15%), chemical (15%), electrical (15%)
Phosphate Rock	Morocco, Republic of Togo, Netherlands, Antilles	Fertilizer (92%), chemicals (8%)
Rare-earth metals and yttrium	Monazite: Australia, Malaysia	Petroleum catalysts (36%), metallurgical uses (31%), ceramic and glass (29%)
Sand and gravel	Canada, Australia, Antigua	Construction sand and gravel: concrete aggregate (28%), road base (15%), asphalt (10%) Industrial sand and gravel: glass (40%), foundry (21%), abrasive (7%)

Table 4.-- Percent of U.S. consumption from imports, major foreign sources, and principal uses for mineral commodities identified in Oregon wilderness study areas (cont.)

Metals and Minerals	Major Foreign Sources	Principal Uses
Sodium carbonate (soda ash)	Canada	Glass (53%), chemicals (20%), soap and detergents (10%)
0-25 Percent Net Import Reliance		
Beryllium	China, Brazil, Republic of South Africa, Switzerland	Alloy and oxides in electrical equipment and components (56%), nuclear reactors and aerospace (22%)
Copper	Chile, Canada, Peru	Construction (42%), electrical and electronic (24%)
Gold	Canada, Switzerland (mostly) Republic of South Africa origin), Uruguay	Jewelry and arts (59%), electronic (33%), dental (8%)
Lead (metal)	Canada, Mexico, Australia, Peru	Transportation with 70% in batteries and gasoline additives
Perlite	Greece	Building construction (70%), filter aid (12%)
Salt	Canada, Mexico, Bahamas	Chemical industry (47%), highway de-icing (26%)
Stone (crushed)		Construction aggregate (63), cement and lime (11%); of the crushed stone, 72% was limestone-dolomite; 15% granite
26-50 Percent Net Import Reliance		
Pumice and pumicite	Greece	Concrete aggregate and building block (90%)

Table 4.-- Percent of U.S. consumption from imports, major foreign sources, and principal uses for mineral commodities identified in Oregon wilderness study areas (cont.)

Metals and Minerals	Major Foreign Sources	Principal Uses
Stone (dimension)	Italy, Canada, Spain	Building construction (47%), monuments (26%), rubble (14%); of the total, 55% was granite, 25% limestone, 11% sandstone
51-90 Percent Net Import Reliance		
Asbestos	Canada, Republic of South Africa	Friction products (22%), roofing products (17%), asbestos-cement pipe (17%), coatings and compounds (15%)
Chromium	Republic of South Africa, Turkey, Zimbabwe, Yugoslavia	Chemical and metalurgical industry (90%), refractory industry (10%)
Fluorspar	Mexico, Republic of South Africa	Hydrofluoric acid (70%), steelmaking (25%)
Nickel	Canada, Australia, Norway, Botswana	Stainless and alloy steel (39%), nonferrous alloys (28%), electroplating (22%)
Potash	Canada, Israel	Fertilizer (95%), chemical industry (5%)
Silver	Canada, Mexico, Peru, United Kingdom	Photography (45%), electrical and electronic (26%), electroplating and jewelry (13%)
Tin	Thailand, Brazil, Indonesia, Bolivia	Electrical (20%), cans and containers (17%) construction (16%), transportation (14%)
Tungsten	Canada, China, Bolivia	Metalworking (76%), lamps and lighting (11%), electrified machinery (10%), transportation (9%)
Zinc	Canada, Peru, Mexico, Honduras	Construction materials (50%), transportations (23%), machinery (12%), electrical (10%)

Table 4.-- Percent of U.S. consumption from imports, major foreign sources, and principal uses for mineral commodities identified in Oregon wilderness study areas (cont.)

Metals and Minerals	Major Foreign Sources	Principal Uses
Net Import Data Withheld		
Antimony	Bolivia, China, Mexico, Republic of South Africa, France	Flame retardants (65%), batteries (10%) chemicals (10%), ceramics and glass (5%)
Bismuth	Peru, Mexico, United Kingdom, Belgium	Pharmaceuticals (50%), machinery (22%), primary metals (26%)
Mercury	Spain, Algeria, Turkey,	Electrical (51%), chlorine productions (19%), paints (11%)
Thorium	France, Netherlands, Canada, Australia, United Kingdom	Nuclear fuel, incandescent lamp mantles, alloys, refractories, ceramics, welding electrodes
Vanadium	Republic of South Africa, European Communities, Canada	Alloying agent for iron and steel
Zirconium	Australia, Republic of South Africa, France	Foundry sand (35%), refractories (30%) ceramics (20%), abrasives (5%)
Minerals not listed in Mineral Commodity Summaries		
Uranium		Nuclear energy
Zeolite		Filter-aid, absorbents

Source: Adapted from U.S. Bureau of Mines, Mineral Commodity Summaries, 1987, 193 p.

RESOURCE/RESERVE CLASSIFICATION

	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	Speculative
ECONOMIC	Reserves		Inferred Reserves		
MARGINALLY ECONOMIC	Marginal Reserves		Inferred Marginal Reserves		
SUB-ECONOMIC	Demonstrated Subeconomic Resources		Inferred Subeconomic Resources		

Major elements of mineral resource classification, excluding reserve base and inferred reserve base. Modified from McKelvey, V.E., 1972, Mineral resource estimates and public policy: American Scientist, v. 60, p. 32-40; and U.S. Bureau of Mines and U.S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U.S. Geological Survey Circular 831, p. 5.

Figure 2.--Resource/reserve classification.

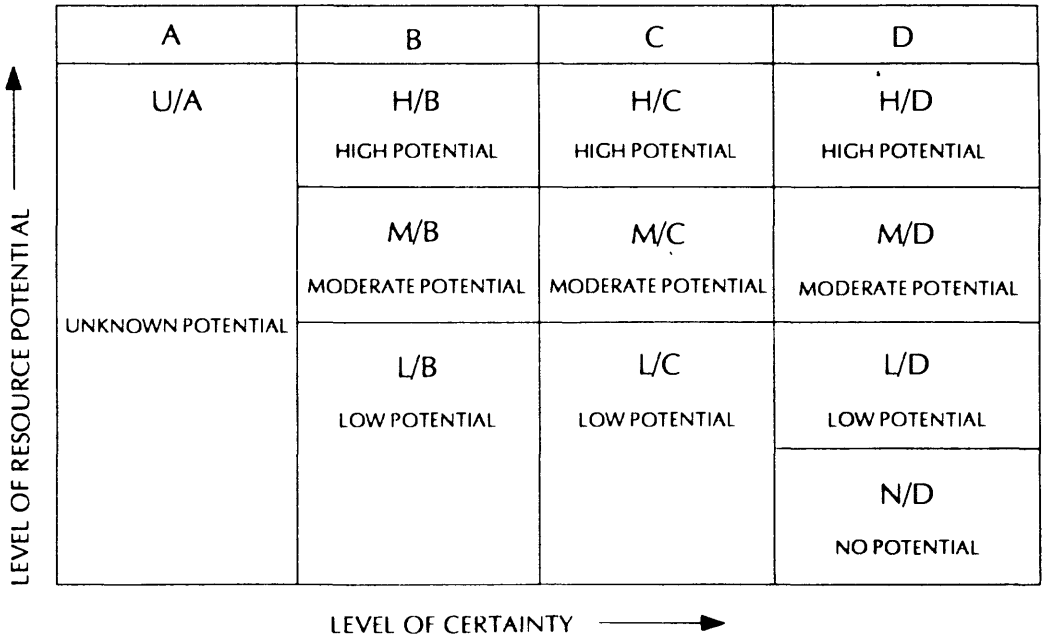
DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

LEVELS OF RESOURCE POTENTIAL

- H **HIGH** mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data support mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.
- M **MODERATE** mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate reasonable likelihood for resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.
- L **LOW** mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is permissive. This broad category embraces areas with dispersed but insignificantly mineralized rock, as well as areas with little or no indication of having been mineralized.
- N **NO** mineral resource potential is a category reserved for a specific type of resource in a well-defined area.
- U **UNKNOWN** mineral resource potential is assigned to areas where information is inadequate to assign a low, moderate, or high level of resource potential.

LEVELS OF CERTAINTY

- A Available information is not adequate for determination of the level of mineral resource potential.
- B Available information only suggests the level of mineral resource potential.
- C Available information gives a good indication of the level of mineral resource potential.
- D Available information clearly defines the level of mineral resource potential.



Abstracted with minor modifications from

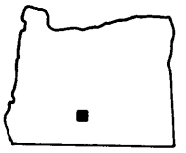
Taylor, R B , and Steven, T.A , 1983, Definition of mineral resource potential Economic Geology, v 78, no 6, p 1268-1270
Taylor, R.B , Stoneman, R J , and Marsh, S P., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado U.S Geological Survey Bulletin 1638, p 40-42
Goudarzi, G H , compiler, 1984, Guide to preparation of mineral survey reports on public lands U S Geological Survey Open-File Report 84-0787, p. 7, 8

Figure 3.--Definition of levels of mineral resource potential and certainty of classification.

Wilderness Study Areas

(in order alphabetically)

Name: Abert Rim
Area number: OR-001-101
Size (acres): 23,760



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Sherlock and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Two thermal springs are present within the study area (Sherlock and others, 1988); however, data are insufficient to determine whether they constitute a geothermal energy resource. Industrial grade rock, sand, and gravel are present in the study area, but development of these materials is unlikely because similar materials of equal or better quality are closer to potential use sites. Zeolite is present in the Rabbit Creek area, but testing suggests the zeolite content is too low to constitute a resource.

Mineral resource potential (undiscovered): Because host rock, known to contain deposits of gold, silver, and uranium in the region, may be present beneath moderately thick cover in parts of the study area, they are considered to have low potential for the occurrence of similar deposits. The presence of two thermal springs contribute to considering the entire study area as having moderate potential for geothermal energy resources. The area is considered to have low potential for the occurrence of oil and gas.

Mining Activity: About 14 placer mining claims are currently located in the wilderness study area. No mines or prospects are known. As of October 1987, no oil and gas, or geothermal leases were held in the study area. Two geothermal leases near Juniper and Poison Creeks, lie just outside the west boundary of the study area. A highway borrow pit is adjacent to the northwest edge of the study area, near U.S. Highway 395.

Mineral setting/ Geology: Basaltic and andesitic flows interlayered with tuffaceous sedimentary rocks, all mainly of middle--but including late--Miocene age, and aggregating nearly 2,000 ft in thickness, occupy nearly all of the study area. One small deposit of felsic tuff of Pliocene age, and Pleistocene and Holocene alluvial deposits underlie the remainder of the study area. Dominant structure in the study area is the north-northeast-striking normal fault that is coincident with Abert Rim; it is downthrown on the west as much as 2,000 ft. Subsidiary northwest-trending normal faults further cut the terrane into a horst-and-graben pattern.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

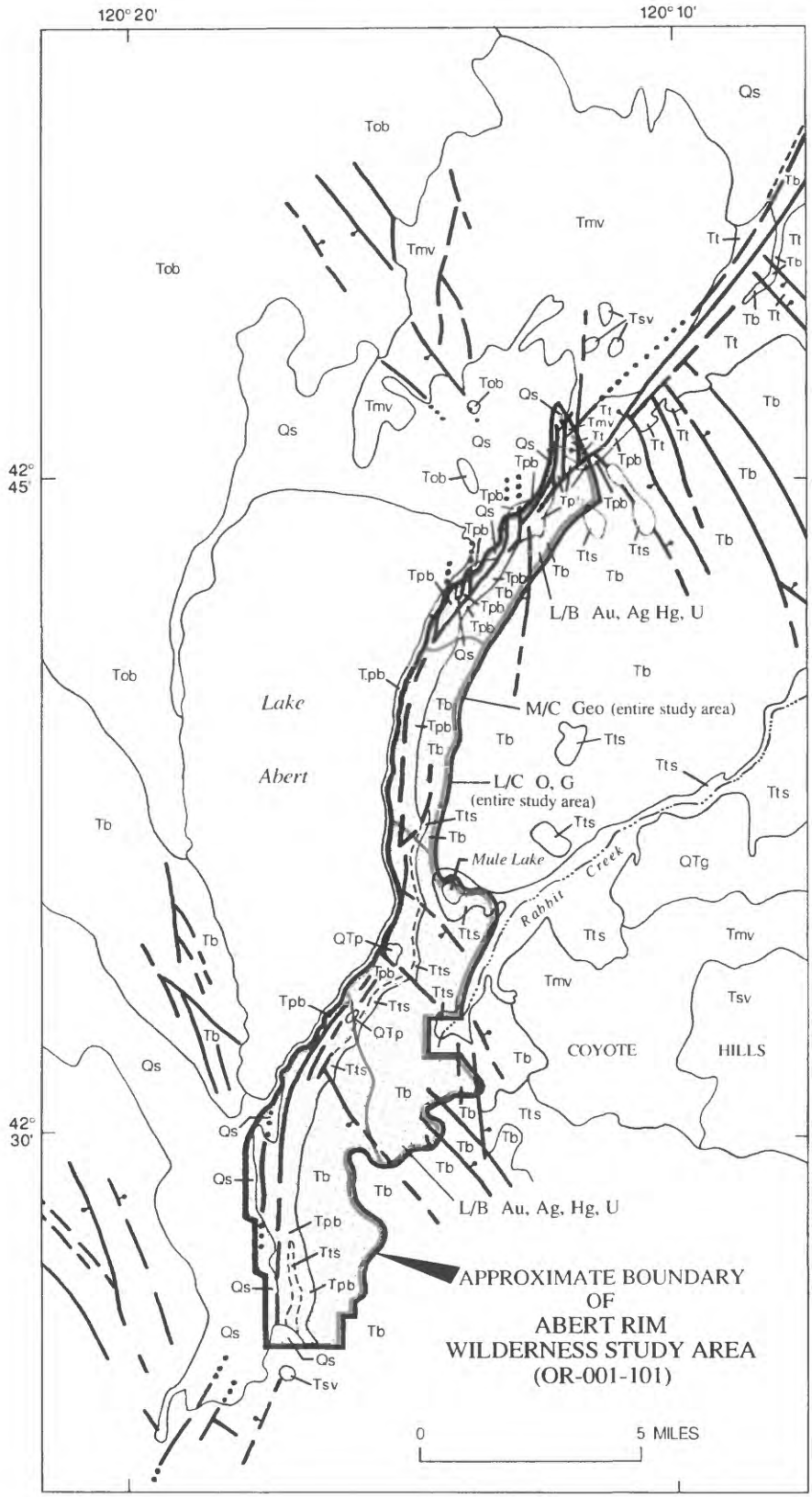
Neumann, T.R., 1987, Mineral resources of the Abert Rim Wilderness Study Area, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 54-87, 13 p.

Mathews, G.W., Blackburn, W.H., and Chappel, D.L., 1983, Assessment of geology, energy, and minerals (GEM) resources, Abert Rim GRA (OR-010-26) Lake County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT@-1042.

Sherlock, M.G., Gettings, M.E., King, H.D., and Neumann, T.R., 1988, Mineral resources of the Abert Rim Wilderness Study Area, Lake County, Oregon: U.S. Geological Survey Bulletin 1738-C, 16 p.

Walker, G.W., 1963, Reconnaissance geologic map of the eastern half of the Klamath Falls (AMS) quadrangle, Lake and Klamath Counties, Oregon: U.S. Geological Survey Mineral Investigations Field Studies Map MF-260, scale 1:250,000.

_____1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000, 2 sheets.



Mineral resources of the Abert Rim Wilderness Study Area. Geology from Walker (1963; 1977)

EXPLANATION

Area having moderate resource potential (M) for geothermal resources

Area having low mineral resource potential (L) for gold, silver, mercury, and uranium in epithermal deposits

Levels of certainty of assessment

B	Data only suggest level of potential
C	Data give good indication of level of potential

Commodities

Au	Gold
Ag	Silver
Hg	Mercury
U	Uranium
Geo	Geothermal
O,G	Oil and gas

Geologic map units

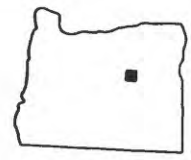
Qs	Surficial deposits (Holocene)
QTg	Pediment gravel (Quaternary and Tertiary)
QTp	Pyroclastic cinder mounds (Quaternary and Tertiary)
Tob	Olivine basalt (Pliocene)
Tt	Tuff (Pliocene)—Semiconsolidated tuff includes lacustrine tuffaceous sandstone and siltstone, ash, diatomite, ash-flow tuff, lapilli tuff, and tuff breccia
Tb	Basalt of Abert Rim (late Miocene)
Tts	Tuff and tuffaceous sedimentary rocks (middle Miocene)
Tpb	Porphyritic basalt and andesite flows of Abert Rim (middle Miocene)
Tmv	Mafic vent rocks (Miocene)
Tsv	Silicic vent rocks (Miocene(?) and Oligocene)

———— Contact—Dashed where approximate

Fault—Dashed where approximate or inferred; dotted where concealed; ball and bar on downthrown side

Explanation, mineral resources of the Abert Rim Wilderness Study Area.

Name: Aldrich Mountain
Area number: OR-002-103
Size (acres): 9,395



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The basalts locally contain abundant zeolites in vugs but basalt-hosted zeolites have not been mined in the United States.

Mineral resource potential (undiscovered): There is a low potential for small occurrences of chromite and asbestos beneath Miocene lava flows of the Columbia River Basalt Group. The southeast part of the study area may have low potential for gravel resources (depending on the degree and type of cementation) and possibly clay mineral associated with tuffaceous strata interbedded with the conglomerates.

Mining Activity: No current mining claims are located within the wilderness study area (July 1990); no mines or prospects are reported. No energy leases existed within the study area as of October 1987. Chromite prospects are located in ultramafic rocks adjacent to the study area.

Mineral setting/ Geology: The study area is underlain dominantly by basaltic lava flows of the Columbia River Basalt Group which are mostly about 15 m.y. in age (middle Miocene), possibly including basalt lavas as young as 6 m.y. old (late Miocene). At and near the southern boundary of the area the sequence of basalt flows, which is several hundreds of feet thick, is overlain by fanglomerate and rhyolitic ash-flow tuff originally included in the Rattlesnake Formation of Thayer and Brown (1966) and Brown and Thayer (1966), considered by them to be of Middle Pliocene age but now considered late Miocene. East of the area the basalt flows are underlain discordantly by volcanic and volcaniclastic rocks of the Eocene Clarno Formation, which, in turn, rests discordantly on a mixed assemblage of ophiolitic and sedimentary rocks of probable Triassic age. These ultramafic rocks, which are composed largely of olivine and pyroxene, are much older than the basalt and conglomerates (245-208 m.y. in age, Triassic). The mafic and ultramafic rocks of the ophiolite contain chromite mines and prospects.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Field mineral evaluation should be done of any areas where mafic and ultramafic rock is exposed (if any) for occurrences of chromite. The western part of Grant County has not received the mineral evaluation common elsewhere in the county where the rock types are conducive to mineralization.

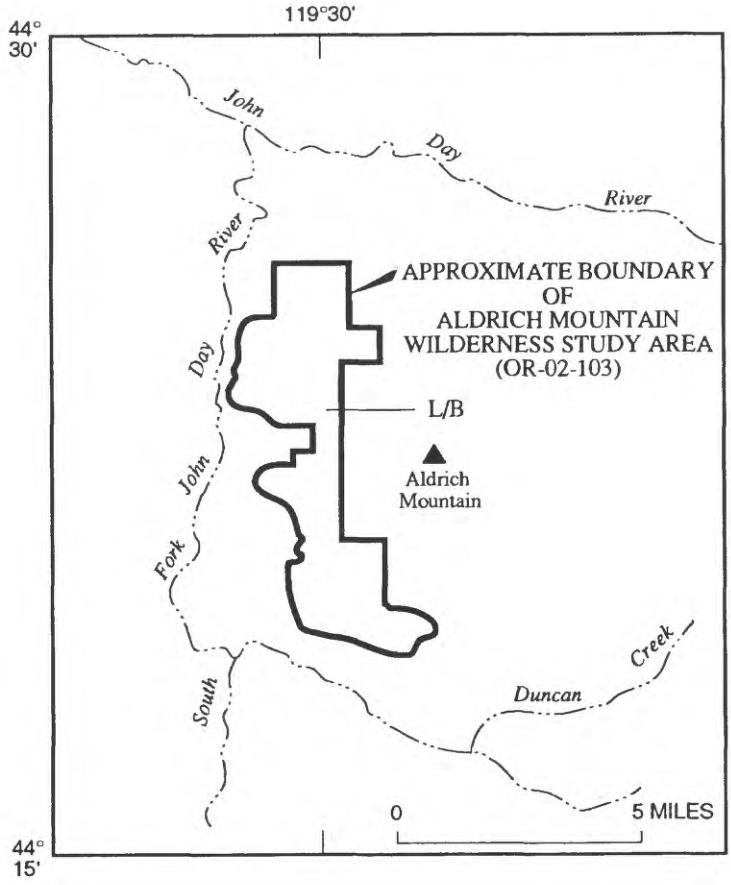
References:

Brown, C.E., and Thayer, T.P., 1966, Geologic map of the Canyon City quadrangle, northeast Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-447, scale 1:250,000.

Ferns, M.L., and Huber, D.F., 1984, Mineral resources map of Oregon.

Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-36, scale 1:500,000.

Thayer, T.P., and Brown, C.E., 1966, Geologic map of the Aldrich Mountain quadrangle, Grant County, Oregon: U.S. Geological Survey Geologic Quadrangle Map GQ-438, scale 1:62,500.

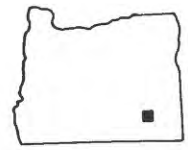


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for chromite, asbestos, gravel, and (or) clay with certainty level B

Mineral resources of the Aldrich Mountain Wilderness Study Area.

Name: Alvord Desert
Area number: OR-002-074
Size (acres): 251,060



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Turrin and others, 1989).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The western part of the Alvord Desert Wilderness Study Area is in the Alvord Valley KGRA (Known Geothermal Resource Area). Geothermal activity is indicated by Tudor Hot Springs in the eastern part of the wilderness study area and high heat flow measurements. The U.S. Department of Energy ranked the Alvord Valley geothermal area in the top 10 areas in the Pacific Northwest. Sand, gravel, and stone from within the study area have been used for local construction projects (mainly road maintenance and improvement). Large quantities of the sand, gravel, and stone remain in the study area. No other mineral resources are known. A boron occurrence is reported in the western part of the study area. Small amounts of chalcedony (banded agate), petrified wood, and common opal are present in the study area, but are not commercially significant. Impure occurrences of diatoms and clay are found in lake sediments.

Mineral resource potential (undiscovered): In the western part of the study area are small areas with both moderate and low potential for the occurrence of small epithermal deposits containing gold, silver, and mercury. In this same area, hot-spring evaporite deposits have low potential for the occurrence of boron. The western part also has moderate potential for low- to medium-temperature geothermal resources. The entire study area has low potential for the occurrence of oil, gas, and uranium.

Mining Activity: Aggregate and rock material have been obtained from within the wilderness study area at one U.S. Bureau of Land Management community pit and seven material sites operated by Malheur County and the Oregon State Highway Division. No mining claims are known in the study area. Two geothermal leases covering 2,000 acres exist in the study area. No oil and gas leases were held as of October 1987; however, such leases were previously held.

Mineral setting/ Geology: A section of Miocene to Pliocene, mainly volcanic and volcaniclastic rocks approximately 1,100 ft thick, overlain by relatively thin Quaternary alluvial and eolian deposits occupies the study area. The stratigraphic section consists of, ascending: Steens Basalt (base not exposed), platy andesite flows and flow breccia, welded rhyolitic ash-flow tuff, tuffaceous sedimentary rocks interbedded with basalt and tuff, and basalt that retains some original flow morphology. The study area is an eastward-tilted fault block, cut and bounded by dominantly north-northwest and north-northeast-trending high-angle normal faults.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 181,895 acres that constitute the balance.

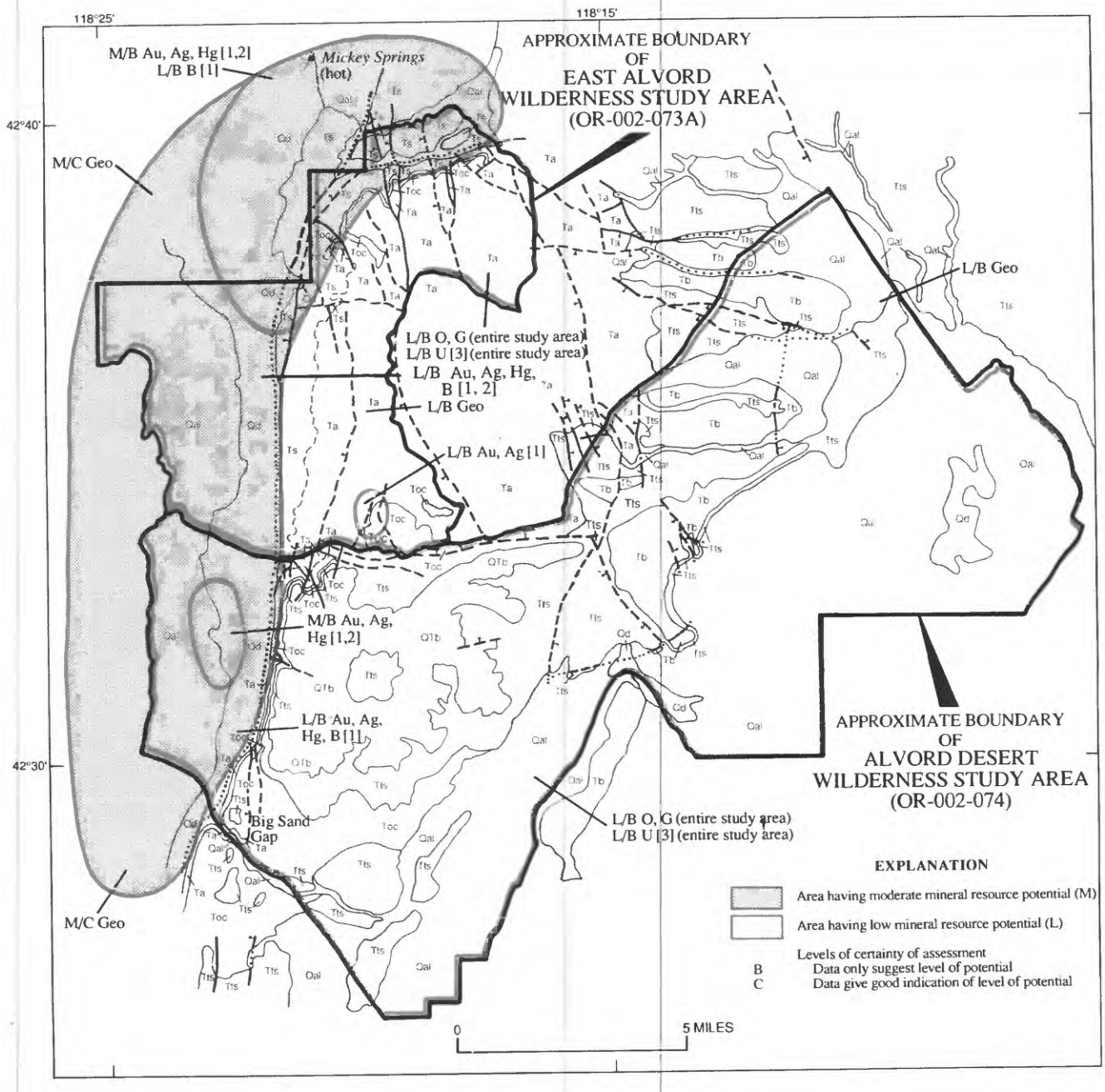
References:

Buehler, A.R., and Graham, D.E., 1987, Mineral resources of the Alvord Desert and East Alvord study areas, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 53-87, 18 p.

Jones, J.L., Erickson, M.S., and Turner, R.L., 1989, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rocks samples from the Alvord Desert and East Alvord Wilderness Study Areas, (OR-002-074 and OR-002-073A) Malheur and Harney Counties, Oregon: U.S. Geological Survey Open-File Report 89-0021, 23 p.

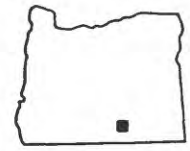
Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources, Alvord Desert GRA (OR-023-19), Harney County, Oregon: Lakewood, CO, Terradata, prepared for the U.S. Bureau of Land Management, contract YA-553-CT2-1042, 33 p.

Turrin, B.D., Griscom, Andrew, Turner, R.L., Lawson, W.A., Buehler, A.R., and Graham, D.E., 1989, Mineral resources of the Alvord Desert and East Alvord Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Bulletin 1739-B, 16 p.



Mineral resources of the Alvord Desert Wilderness Study Area.

Name: Alvord Peak
Area number: OR-002-083
Size (acres): 16,825



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Mercury is present as cinnabar (HgS) in altered felsic volcanic rocks of the Tertiary Pine Creek Formation. The cinnabar is usually found in local faults and fracture zones. Although there are mercury occurrences within the wilderness study area, the only active claim having mercury as a commodity is just outside the wilderness study area's boundaries. Disseminated gold and copper are found in large but low grade quantities within the Tertiary Steens Mountain Volcanics. The volcanics consist mainly of andesite flows, flow breccia, and pyroclastic rocks. Currently, ECM Corporation has located a large claim block in the southern part of the study area. They are in the initial stages of exploration development of these disseminated gold and copper deposits.

Mineral resource potential (undiscovered): The area has a high resource potential for mercury, copper, and gold, a moderate resource potential for perlite, uranium, and zeolite. The area has a low potential for oil and gas resources. Because of the extensive Miocene volcanic activity, the area is too thermally mature to have formed any hydrocarbon reserves (Sandberg, 1983). Moreover, the area lacks suitable source rocks for hydrocarbon generation.

Mining Activity: According to the July 17, 1990 U.S. Bureau of Land Management mining claim recordation files, there are 65 unpatented lode claims from two claim blocks located within the wilderness study area. Thirty-one of these are from the larger Bones claim block containing at least 113 claims. These claims are owned by Western Minerals Corporation of Reno, NV. The remaining 34 are from the Rome claim block containing at least 85 claims. They are owned by ECM Corporation out of Billings, Montana. The Rome claims are also known as the ECM Pueblo Property. According to representatives of ECM, the property contains a large, low grade deposit of disseminated gold and copper.

The Red Hill Nos. 5, 6, and 7 claims, a mercury prospect, are located just outside the study area boundary. The Tip Top Nos. 1 - 6 claims are located near the south border of the wilderness study area. These claims are located within volcanic rocks containing mercury and copper minerals. They were originally known as the Blair Claim Group.

Search of the U.S. Bureau of Mines Mineral Industry Location System (MILS) revealed seven MILS entries within or adjacent to the study area boundaries. All have mercury listed as their main commodity with five of those having both mercury and copper. U.S. Bureau of Land Management township plats shows that the east-most edge of the wilderness study area is part of the larger Alvord Known Geothermal Resource Area (KGRA). There are no other commodity or energy leases within the wilderness study area.

Mineral setting/ Geology: The Alvord Peak area is situated in the transition zone between the Basin and Range and Columbia Plateau physiographic provinces. The Basin and Range Province is an extensive semi-arid to arid tract of subparallel, north-trending en echelon mountain ranges and intervening valleys. The Columbia Plateau physiographic province is a high dissected plateau comprising mostly Tertiary volcanic rocks.

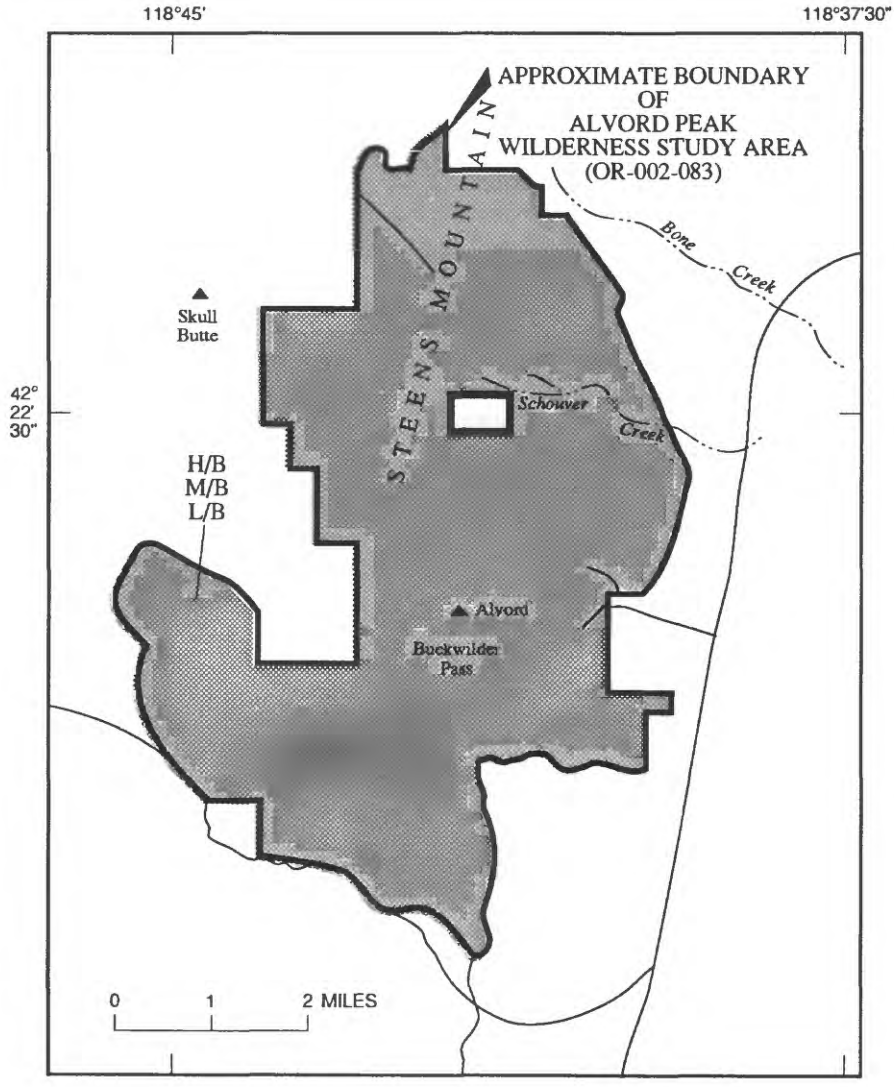
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. The Alvord Peak Wilderness Study Area has sufficient evidence of gold, copper, and mercury mineralization to warrant further investigation.

References:

Esparza, L.E., Peters, T.J., 1986, Mineral resources of the High Steens study area, Harney County, OR: Spokane, WA, U.S. Bureau of Mines Western Field Operations Center unpublished report, 31 p.

Minor, S.A., Plouff, Donald, Esparza, L.E., and Peters, T.J., 1987, Mineral resources of the High Steens and Little Blitzen Gorge Wilderness Study Areas, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-A, 21 p.

Sandberg, C.A., 1983, Petroleum potential of wilderness lands in Nevada: U.S. Geological Survey Circular 902-H, p. H1-H11.



EXPLANATION

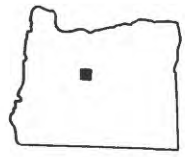
H/B, Geologic terrane having high mineral resource potential for mercury, copper, and (or) gold with certainty level B

M/B, Geologic terrane having moderate mineral resource potential for perlite, uranium, and (or) zeolite with certainty level B

L/B, Geologic terrane having low mineral resource potential for oil and gas with certainty level B

Mineral resources of the Alvord Peak Wilderness Study Area.

Name: Badlands
Area number: OR-005-021
Size (acres): 32,221



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Bergquist and others, 1990).

Identified mineral resources (known): No mineral resources have been identified in the Badlands Wilderness Study Area. Small amounts of slab lava used as facing stone have been removed from the wilderness study area; however, commercial quantities of suitable stone are not available. Sand and gravel were removed from alluvial deposits at the east and west sides of the area. Remaining sand and gravel occurrences may be suitable for local road aggregate, but other sources outside the study area contain sufficient quantities for projected local needs.

Mineral resource potential (undiscovered): Potential for oil and gas in the wilderness study area was determined to be low by Fouch (1983). The geothermal potential of the western United States is discussed on a regional basis in Muffler (1979) which indicates no particular favorability for geothermal resources in the study area or immediate vicinity; the lack of evidence for geothermal resources in the study area and surrounding proximal areas indicates only low potential for geothermal resources. Evidence of alteration or mineralization that might indicate potential for metallic resources was not found in the study area. Slab lava is found in the study area and can be used for facing or building stone. Though the basalt in the study area has an oxide content that makes it suitable for the manufacture of mineral fiber, similar basalt is widespread in the region; and there are no characteristics that differentiate the basalt found in the study area to make it more desirable than any other. Sand and gravel are abundant in the study area, but other sources are closer to existing markets.

Mining Activity: No mining claims are located within the wilderness study area, and as of October 1987, no geothermal or oil and gas leases have been issued.

Mineral setting/ Geology: The study area is located in the northern part of the High Lava Plains physiographic province, in an area of basaltic lava flows that cover the nose of the Blue Mountains anticlinorium, which extends northeast. The High Lava Plains province extends generally west, south, and southeast of the study area and consists of relatively undeformed lava flows, playas, lava buttes, and scattered cinder cones. Most of the region consists of lava-capped rolling hills with abundant blocky or platy outcrops of basalt flows. Two notable volcanic features in the region are the scenic Newberry Crater caldera 20 mi southwest of the study area, and the large number of lava tubes-many of which are found in the northern part of the study area in an area known as the Badlands.

Recommendations: As all but 191 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

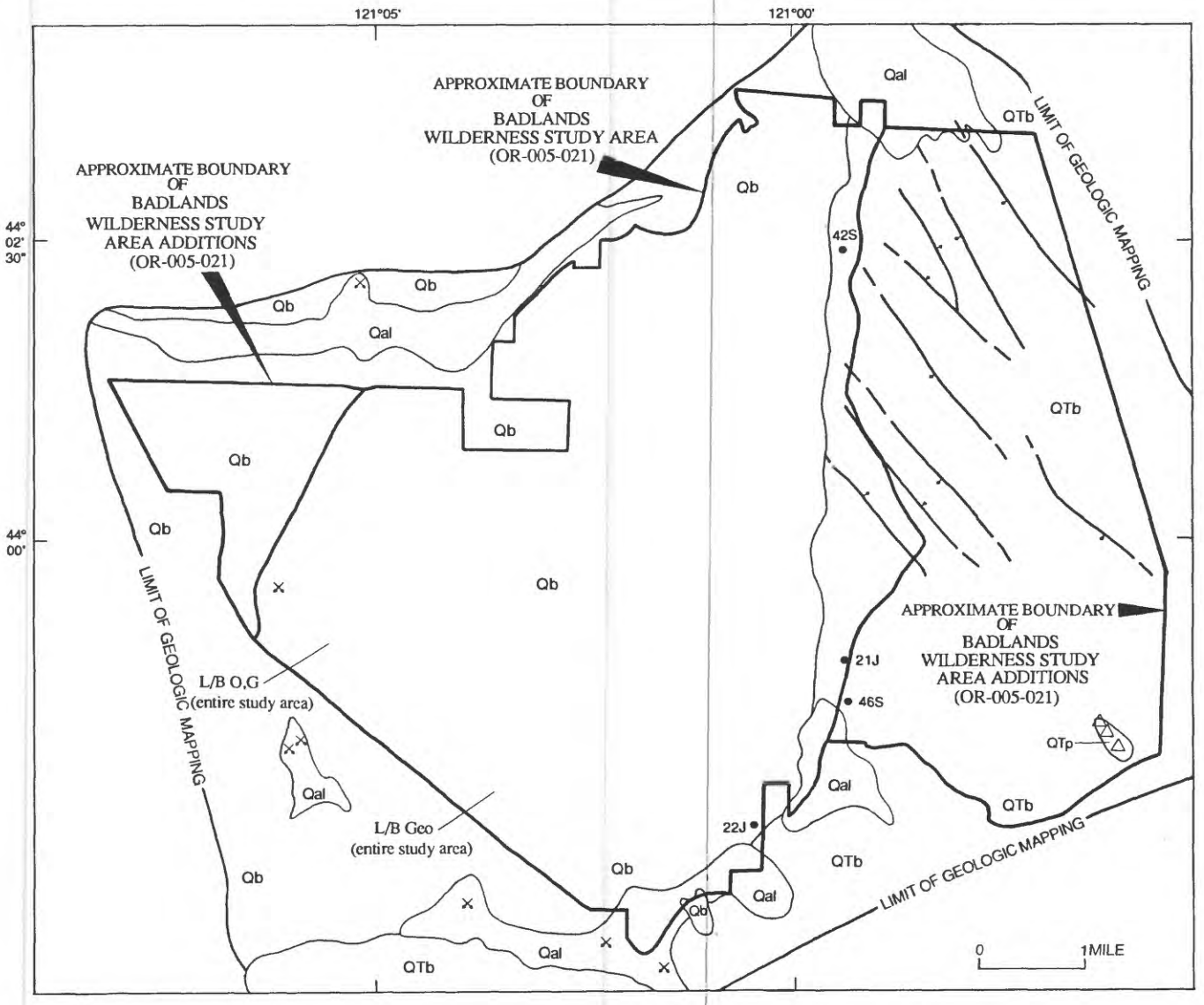
References:

Bergquist, J.R., King, H.D., Blakely, R.J., Sawatzky, D.L., and Olson, J.E., 1990, Mineral resources of the Badlands Wilderness Study Area and the Badlands Wilderness Study Area Additions, Crook and Deschutes Counties, Oregon: U.S. Geological Survey Bulletin 1744-B, 14 p.

Olson, J.E., 1987, Mineral resources of the Badlands study area, Deschutes and Crook Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 36-87, 6 p.

Olson, J.E., 1989, Mineral resources of the Badlands study area additions, Crook and Deschutes Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 8-89, 9 p.

U.S. Bureau of Land Management, 1983, Badlands GEM resource area (OR-005-021), Deschutes and Crook Counties, Oregon: Unpublished report, 11 p.



Mineral resources of the Badlands Wilderness Study Area.

EXPLANATION

Area having low mineral resource potential (L)

B — Certainty level of assessment—Data only suggest level of potential

Commodities

Geo — Geothermal

O,G — Oil and gas

Geologic map units

Qal — Alluvium and colluvium (Holocene and Pleistocene?)—Sand and gravel in stream drainages, eolian sand and silt, and slope wash

Qb — Basalt (Pleistocene)—Pahoehoe and aa basalt, basaltic andesite flows, and cinder cones

QTb — Older basalt flows (Pleistocene to Miocene)—Basalt and basaltic andesite flows and cinder cones

QTp — Pyroclastic rocks (Pleistocene to Miocene)—Semiconsolidated subaerial deposits of basaltic ejecta originating from cinder cones

——— Contact

△ Cinder cone

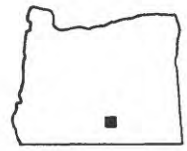
—•— - - Fault—Dashed where assumed; ball and bar on downthrown side

× Gravel pit

• 21J Sample site showing concentrations of gold in parts per billion—S denotes big sagebrush ash sample and J denotes juniper tree ash sample

Explanation, mineral resources of the Badlands Wilderness Study Area.

Name: Basque Hills
Area number: OR-002-084
Size (acres): 141,410



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The rock types as well as the structural similarity and proximity to the Spaulding Wilderness Study Area suggest the possibility that this area has moderate potential for mercury, copper, gold, and diatomite. The area has low potential for saline minerals at depth in basins.

Mining Activity: No mines or prospects are known, and as of July 1990 there were no mining claims located in the wilderness study area. The area contained no energy leases as of October 1987.

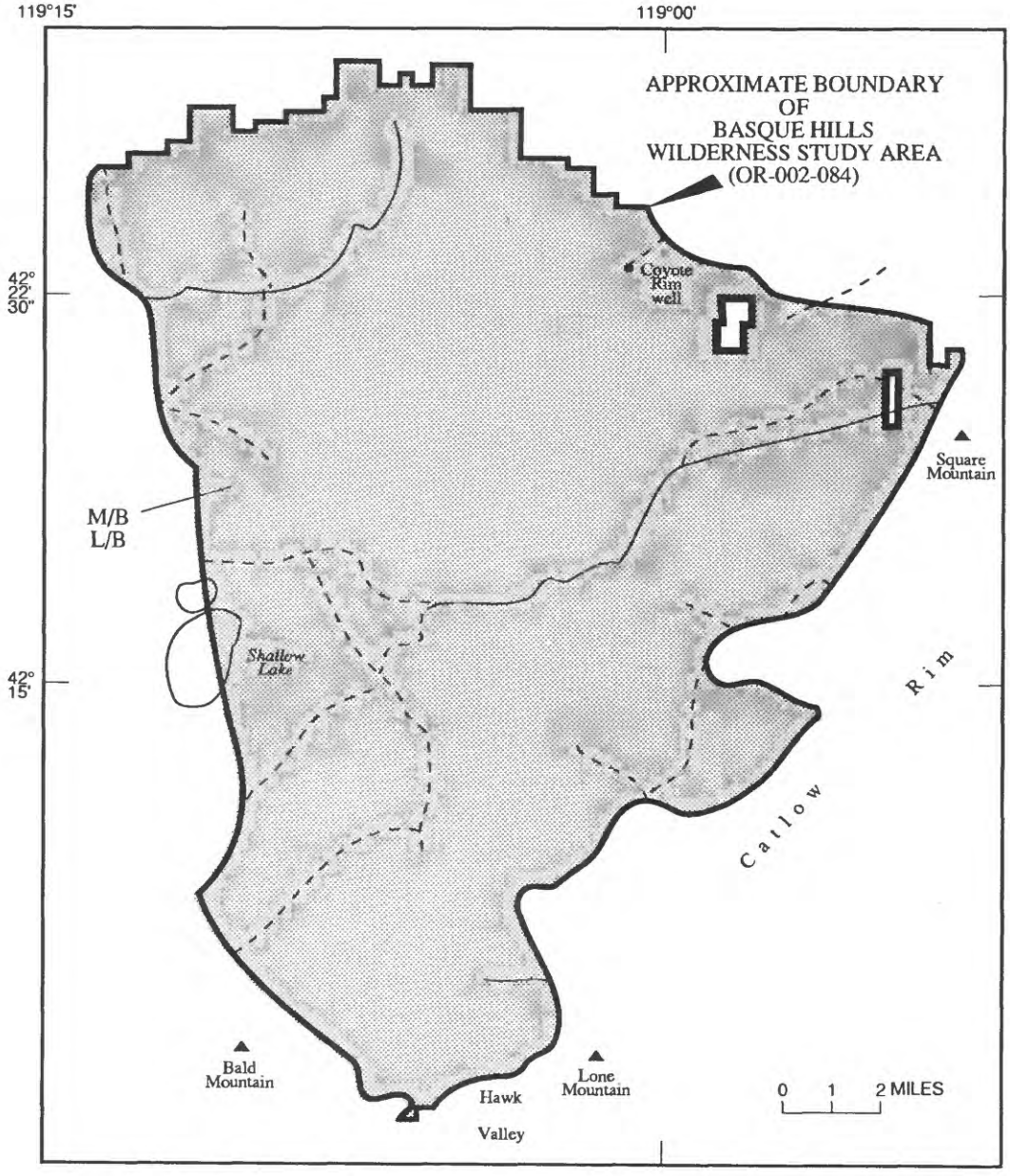
Mineral setting/ Geology: This study area is underlain by Miocene volcanic rocks, dominantly ash-flow tuff and associated tuffaceous sedimentary rocks overlain by mesa-forming basalt flows. The study area includes northwest-trending fault sets similar to those in the Spaulding Study Area (OR-001-139) located 5-10 mi west of the study area.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and mineral (GEM) resources, Lone Mountain GRA (OR-021-022), Harney County, Oregon: Lakewood, CO., Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042.

Vander Meulen, D.B., Plouff, Donald, King, H.D., Mayerle, R.T., and Rains, R.L., 1988, Mineral resources of the Rincon Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-E, 14 p.



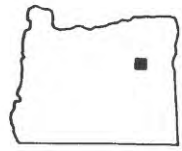
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for mercury, copper, gold, and (or) diatomite with certainty level B

L/B, Geologic terrane having low mineral resource potential for saline minerals with certainty level B

Mineral resources of the Basque Hills Wilderness Study Area.

Name: Beaver Dam Creek
Area number: OR-003-027
Size (acres): 19,580



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The southeastern part of the Beaver Dam Wilderness Study Area has moderate resource potential for gold and low resource potential for silver, copper, lead, and zinc and for diatomite. The entire study area has low resource potential for gold, silver, copper lead, and zinc and for diatomite. This potential is based on geochemical reconnaissance of the study area by Robinson and others, (1984). The resource potential for oil and gas is low (Fouch, 1983).

Mining Activity: No mines or prospects are known, and as of July 1990 there were no mining claims located in the wilderness study area. The area contained no energy leases as of October 1987.

Mineral setting/ Geology: Most of the study area is underlain by Tertiary basalt and andesite flows and breccia and silicic ash-flow tuff. The northwestern part of the study area contains the Jurassic Weatherby Formation (Lowry, 1968; Brooks, 1979) that consists mostly of siltstone, sandstone, and graywacke. Two anomaly areas, Steamboat Creek and No Name Creek, occur in the study area. Stream sediment samples from Steamboat Creek contained 5 to 55 parts per billion gold; the No Name Creek area was determined to be anomalous on the basis of inverse factor loading of manganese, copper, and zinc. The Lost Creek area, just outside the northwest boundary of the study area contained anomalous amounts of gold, silver, arsenic, copper, lead, and zinc in soil and stream sediment samples.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. An accurate assessment of the mineral potential of the study area requires geologic, geochemical, and geophysical studies. The study area needs to be mapped at a scale of 1:24,000, more closely spaced geochemical samples (stream sediment, panned concentrate, and rock) need to be collected and analyzed, and a review of aeromagnetic and gravity surveys of the region that includes the study area need to focus on the possibilities of ore-bearing structures in and near the study area.

References:

Brooks, H.C., Ferns, M.L., Nusbaum, R.W., and Kovich, P.M., 1979, Geologic map of the Rastus quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-79-7, scale 1:24,000.

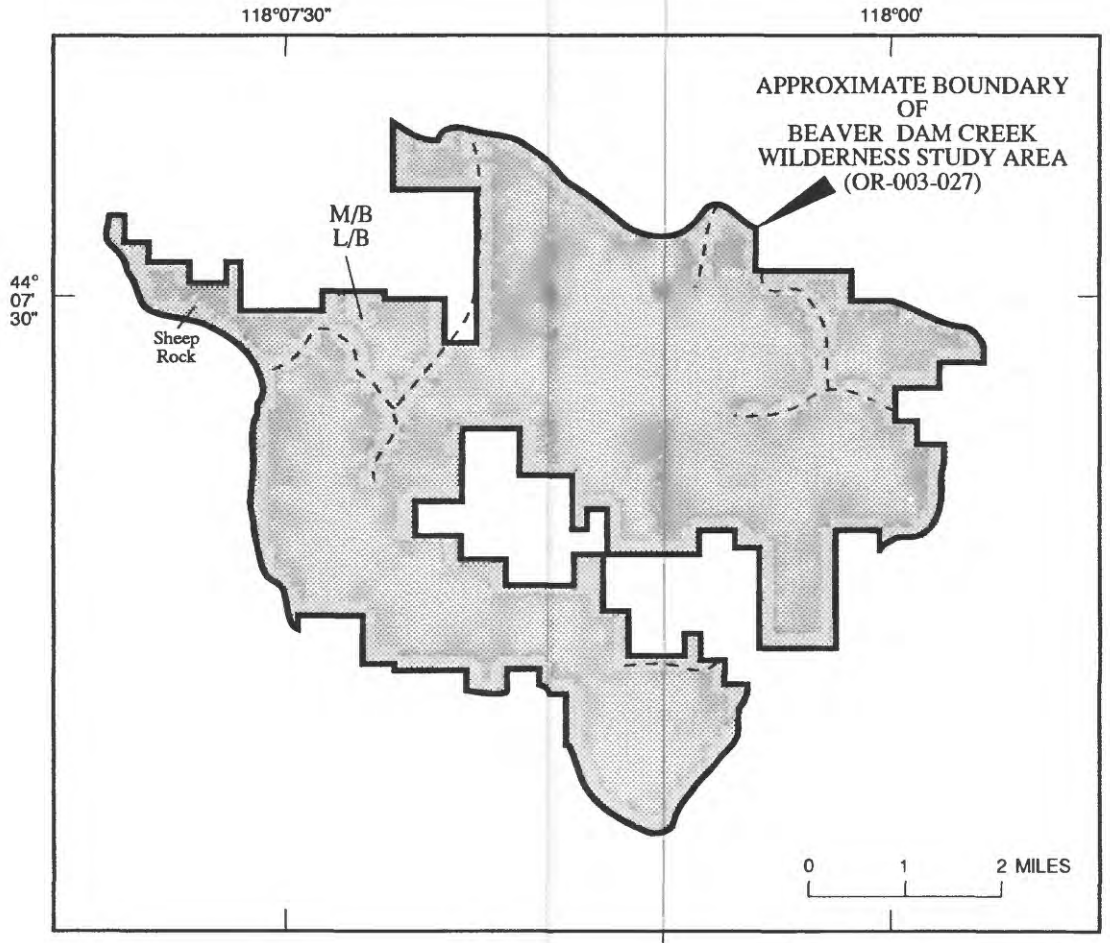
Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Lowry, E.D., 1968, Geology of the Ironside Mountain quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report, scale 1:125,000.

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and mineral (GEM) resources, Castle Rock GRA (OR-032-015), Grant, Harney, and Malheur Counties, Oregon: Lakewood, CO., Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042.

Robinson, M.L., Meyer, W.T., Lovell, J.S., and Klawitter, A.L., 1984, Geologic, energy, and mineral resource survey of Northern Malheur Resource Area, Vale District, Oregon: Golden Colorado, Barringer Resources, Inc., Contract YA-551-CT3-440038, 4 volumes.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.



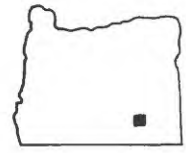
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for gold with certainty level B

L/B, Geologic terrane having low mineral resource potential for silver, copper, lead, zinc, diatomite, and (or) oil and gas with certainty level B

Mineral resources of the Beaver Dam Creek Wilderness Study Area.

Name: Blitzen River
Area number: OR-002-086E
Size (acres): 55,880



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Three low-temperature geothermal springs flow from the flanks of Blitzen Valley (one spring is less than .25 mi outside the wilderness study area boundary). The Oregon Department of Geology and Mineral Industries (1982) classified the area around the springs as ". . . known or inferred to be underlain at shallow depth (less than 350 ft) by thermal water of sufficient temperature for direct heat applications."

Mineral resource potential (undiscovered): The group of northwest-trending faults along the western margin of the study area is considered to have moderate potential for geothermal energy resources because of the presence of several hot springs along an extension of this trend 2-5 mi north of the study area. Because the nearest exposed basement rocks are metamorphosed, and the overlying rocks are volcanic, the study area is considered to have no resource potential for oil and gas.

Mining Activity: No mines, prospects, mining claims, or energy leases are known in the wilderness study area. Within the past 5 years, a mining company has explored for epithermal gold deposits by reconnaissance sampling on the western flank of the Steens Mountains, including parts of the wilderness study area.

Mineral setting/ Geology: Rocks in the study area are on the northwest side of the west-dipping, 30- by 90-mi, north-trending Steens Mountain-Pueblo Mountains structural block. The oldest lithologic unit is the middle Miocene Steens Basalt, comprised of multiple flows 20-30 ft thick, which composes more than 90 percent of the study area. Its maximum exposed thickness is 4,200 ft in Steens Mountain. It is patchily overlain in the study area by about 120 ft of rhyolitic ash-flow tuff--probably the upper Miocene Devine Canyon Ash-flow Tuff--and younger basalt. Structure consists of high-angle normal faults in two groups, one along the western margin of the study area that trends about N. 30° W., and another in the central and southern part that trends N. 60°-70° W. The more westwardly-trending group parallels the northwest extension of a large monocline half a mile to the east.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 33,222 acres that constitute the balance.

References:

Erickson, M.S., King, H.D., Tippitt, F.W., and Hageman, P.L., 1989, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rocks samples from the Blitzen River (OR-002-086E) Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Open-File Report 89-0303, 14 p.

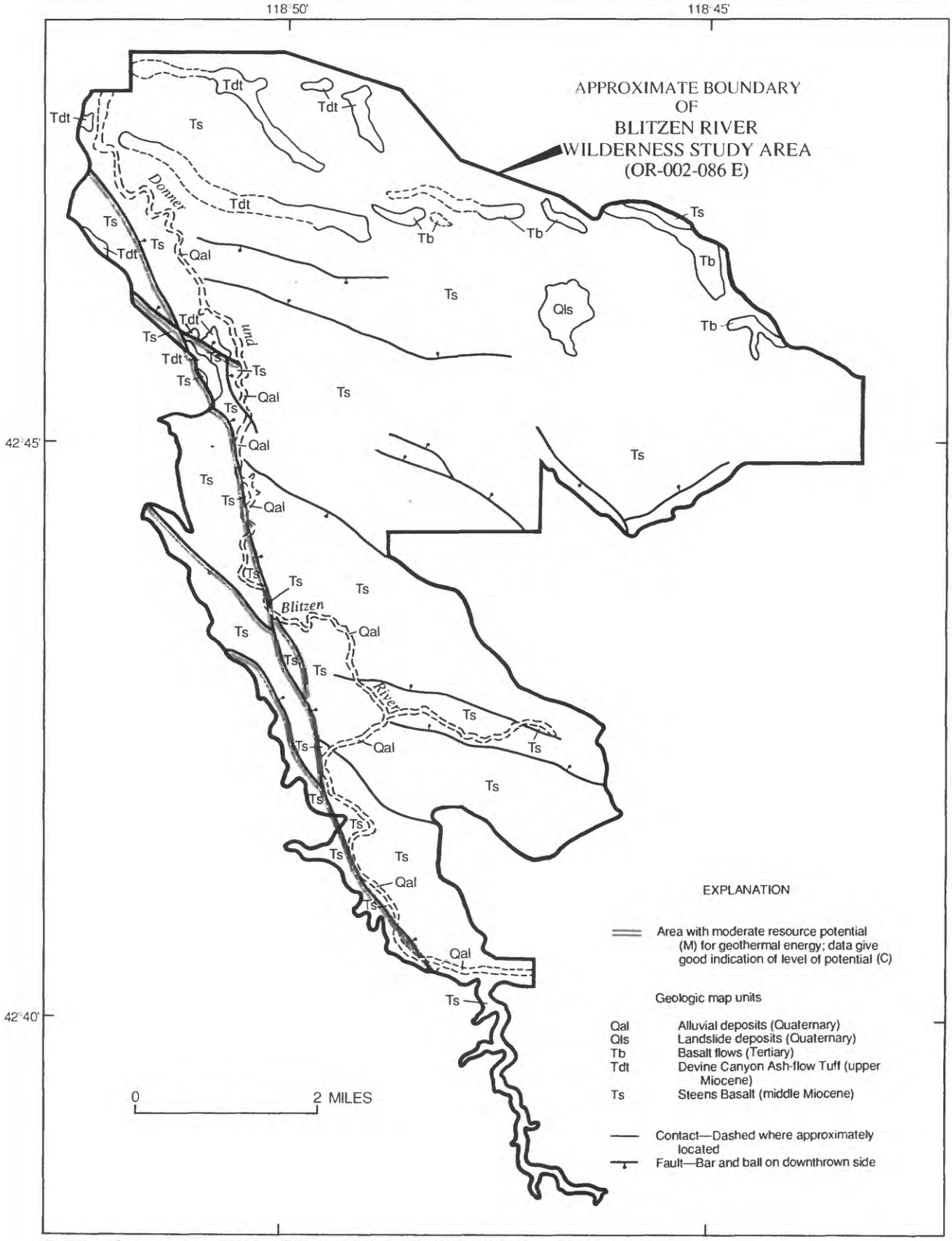
Gray, J.J., Peterson, N.N., Clayton, Janine, and Baxter, Gary, 1983, Geology and mineral resources of 18 BLM wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-83-2, 106 p.

Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources - Catlow Rim GRA (OR-020-020), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 32 p.

Moyle, P.R., 1987, Mineral resources of the Blitzen River study area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 56-87, 14 p.

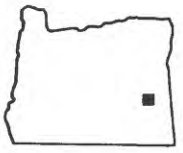
Oregon Department of Geology and Mineral Industries, 1982, Geothermal resources of Oregon: National Oceanic and Atmospheric Administration, National Geophysical Data Center map, produced for U.S. Department of Energy, scale 1:500,000.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., and Moyle, P.R., 1988, Mineral resources of the Blitzen River Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-D, 14 p.



Mineral resources of the Blitzen River Wilderness Study Area.

Name: Blue Canyon
Area number: OR-003-073
Size (acres): 12,700



Status of mineral surveys:

This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1990).

Identified mineral resources (known):

The southern part of the wilderness study area contains the following identified mineral resources:

- 5.8 million tons of subeconomic perlite resources (in the vicinity of the Meadowlark claim)
- 5 million yd^3 of subeconomic sand and gravel resources (benches near the Owyhee River and in the Blue Canyon drainage)
- 125,000 tons of inferred subeconomic resources containing less than 1 percent jasper (unnamed prospect)
- 235 tons of inferred economic reserves containing less than 0.1 percent jasper (Morrison Ranch area)

Jasper resources may be present on the Rocky Rim claim, but all jasper-bearing outcrops were covered during reclamation of the mined area. Heulandite-group zeolite minerals are present in tuff units within the wilderness study area but generally constitute less than 20 percent of the rock or occur in small isolated blocks. A thermal spring is present along the southwest study area boundary.

Mineral resource potential (undiscovered):

Silicified parts of tuff have high potential for gold, silver, mercury, and molybdenum resources. Silicified and brecciated rocks exposed along fault zones have high potential for gold, mercury, and molybdenum resources. The entire study area, except those parts having high resource potential for gold, has moderate potential for gold resources in volcanic- and sediment-hosted deposits. Those parts of the study area underlain by tuff have low resource potential for zinc in volcanogenic disseminated deposits. Sedimentary rocks that underlie the north and central parts of the study area have low potential for fluorite resources; the same rocks have moderate potential for bentonite and diatomite resources. Areas along these fault zones have moderate potential for geothermal energy resources. Sedimentary rocks exposed in the northern part of the study area have low potential for oil and gas energy resources.

Mining Activity: About 12 mining claims for jasper are located along the west border of the wilderness study area. Two of these claims are pre-FLPMA, with "grandfather" rights to continue jasper production. In 1988, Placer Dome US Inc. located a large block of mining claims (about 290 claims) which cover more than 80 percent of the study area. This block was probably located for precious metal exploration purposes. No geothermal or oil and gas leases were present in the study area as of October 1987. "Owyhee picture" jasper and other similar stone has been mined from the study area, both commercially and by hobbyists, for lapidary use. The Rocky Rim and Morrison Ranch areas have produced jasper; the amount of production is unknown, but the operators estimate more than 3 tons of jasper were recovered from 25,000 to 30,000 tons of rock mined between 1986 and 1988. The Morrison Ranch area is covered with numerous small diggings on jasper outcrops.

Mineral setting/ Geology: The Canyon study area is located along the western margin of the Mahogany Mountain caldera. Several intermediate intrusions are located along the caldera margin. Similar intrusions 10 km northeast of the study area are known to contain anomalous silver.

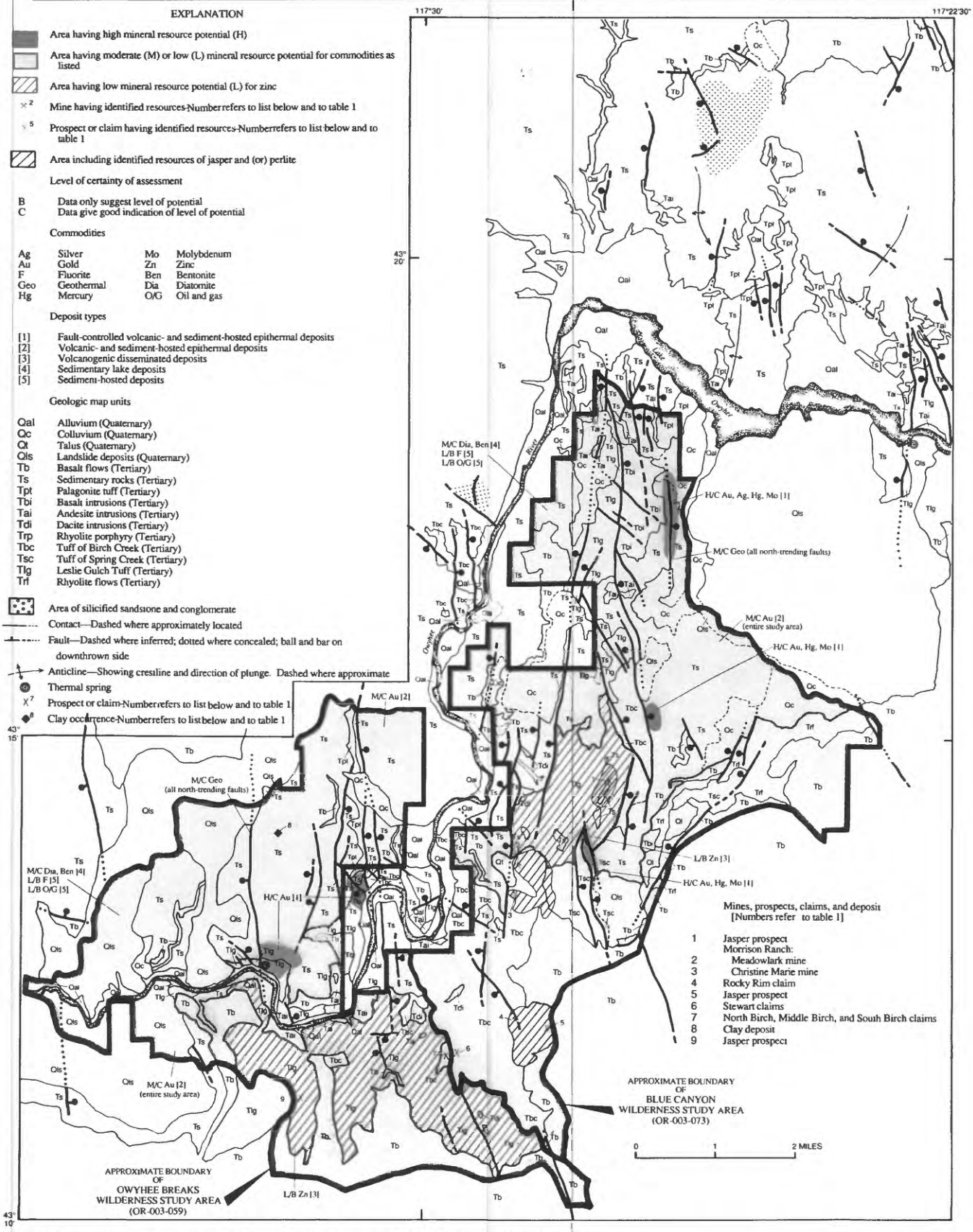
Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Causey, J.D., 1989, Mineral resources of the Blue Canyon study area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 25-89, 45 p.

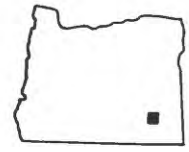
Robinson, M.L., Meyer, W.T., Lovell, J.S., and Park, S., 1985, Geology, energy, and mineral resource survey of the Mahogany Planning Unit, Northern Malheur Resource Area, Vale District, Oregon: Golden, CO, Barringer Resources, Inc. prepared for the U.S. Bureau of Land Management, contract YA-551-CT4-340078, 220 p.

Vander Meulen, D.B., Barlock, V.E., Plumley, P.S., Frisken, J.G., Griscom, Andrew, and Causey, D.J., 1990, Mineral Resources of the Blue Canyon and Owyhee Breaks Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-G, 28 p.



Mineral resources of the Blue Canyon Wilderness Study Area.

Name: Bowden Hills
Area number: OR-003-118
Size (acres): 59,900



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Poorly consolidated gravel veneers some slopes but similar deposits abound outside the study area.

Mineral resource potential (undiscovered): The northwest part of the wilderness study area has a moderate potential for the occurrence of gold. The rest of the area has low resource potential for gold, silver, and molybdenum. Zeolitized strata and diatomite may form a few small mineral occurrences; there is high potential for zeolites in some of the area of late Miocene sedimentary rocks. Any such deposits, however, probably would be small and impure because most of the sedimentary rocks are of fluvial rather than lacustrine origin. The resource potential for geothermal energy is high, especially along the larger faults. The energy resource potential for gas is low: oil is virtually ruled out by the metamorphic grade of possible buried pre-Tertiary source rocks; gas shows have been reported from buried early Tertiary basins elsewhere in the region.

Mining Activity: No mines or prospects are known, and as of July 1990 there were no mining claims located in the study area. The area contained no energy leases as of October 1987.

Mineral setting/ Geology: The Bowden Hills Wilderness Study Area is underlain by middle Miocene andesite lava flows, with slightly younger welded tuff and (or) rhyolite lava capping some ridges. Late Miocene sedimentary rocks are exposed around the margins of the Bowden Hills. Locally welded tuffs and tuffaceous sedimentary rocks are prominent. Quaternary pediment gravels are common on the periphery of the study area. Two sets of faults, one striking northwest and one northeast, affect rocks in the eastern part of the study area.

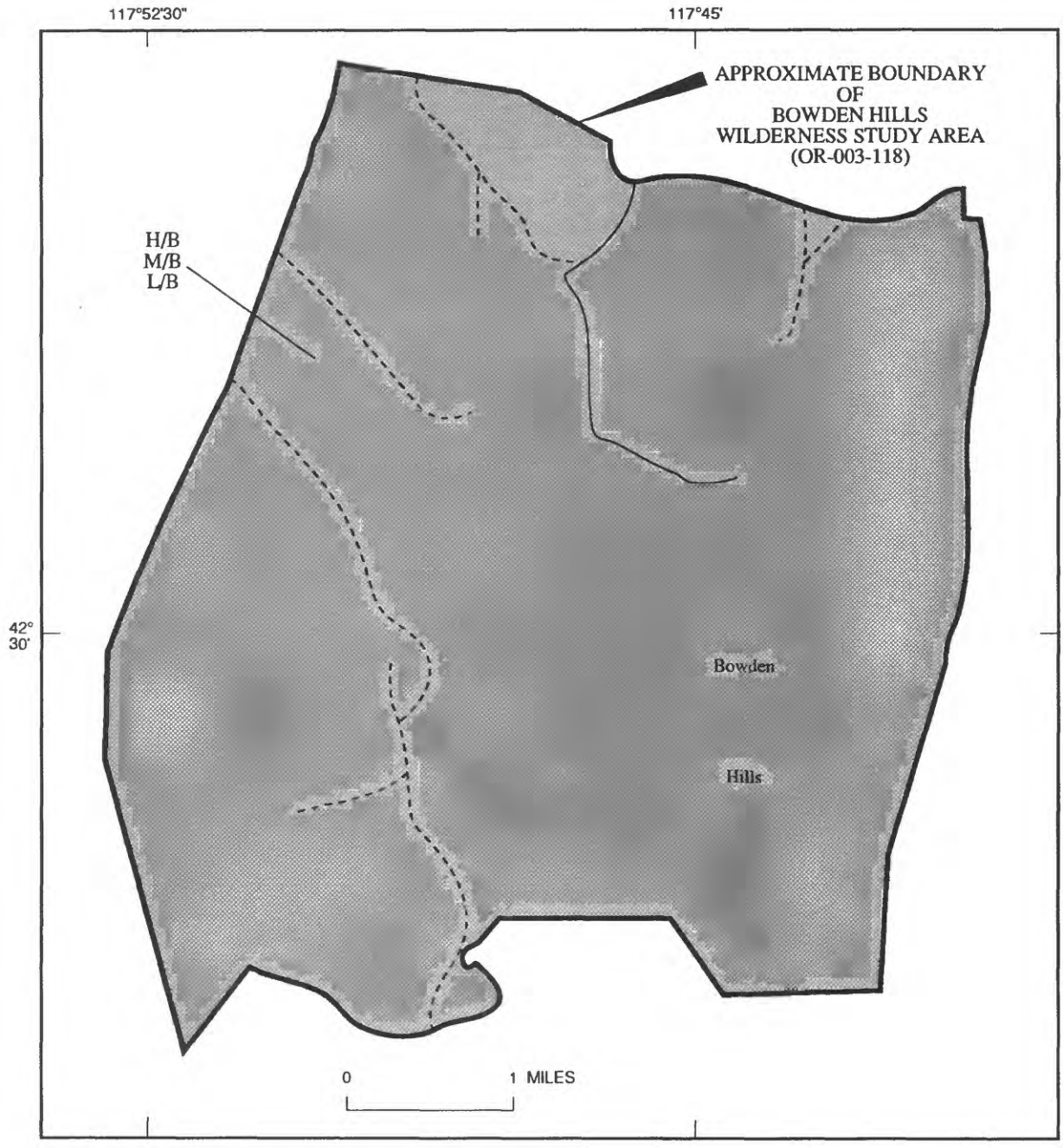
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Because it is near a well-known mineralized area and because its geology is similar, geologic, geochemical, and geophysical reconnaissance studies could determine whether or not significant mineralization is present in the area.

References:

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and mineral (GEM) resources, Bowden Hills GRA (OR-003-118), Malheur County, Oregon: Lakewood, CO., Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042.

Rytuba, J.J., Vander Meulen, D.B., and Barlock, V.E., 1990, Tectonic and stratigraphic controls on epithermal precious metal mineralization in the northern Basin and Range, Oregon, Idaho, and Nevada, in Field Guide to hot-spring gold deposits in the Lake Owyhee volcanic field, eastern Oregon: Geological Society of Nevada and U.S. Geological Survey, 1990 Spring Field Trip Guide Book, Special Publication, no. 10, p. 1-15.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.



EXPLANATION

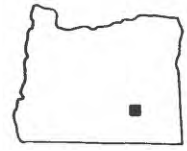
H/B, Geologic terrane having high mineral resource potential for zeolite and geothermal energy with certainty level B

M/B, Geologic terrane having moderate mineral resource potential for gold with certainty level B

L/B, Geologic terrane having low mineral resource potential for gold, silver, molybdenum, and gas with certainty level B

Mineral resources of the Bowden Hills Wilderness Study Area.

Name: Bridge Creek
Area number: OR-002-087
Size (acres): 14,545



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The areas of sedimentary rocks underlain by diatomaceous material have moderate potential for diatomite. Thermal wells in the valley west of the study area suggest a favorable environment for geothermal energy, so the area has low potential for geothermal resources. The basalt may be useful in various construction applications, but on-site examination is required to evaluate its suitability.

Mining Activity: No mines or prospects are known, and as of July 1990 there were no mining claims located in the wilderness study area. The area contained no energy leases as of October 1987.

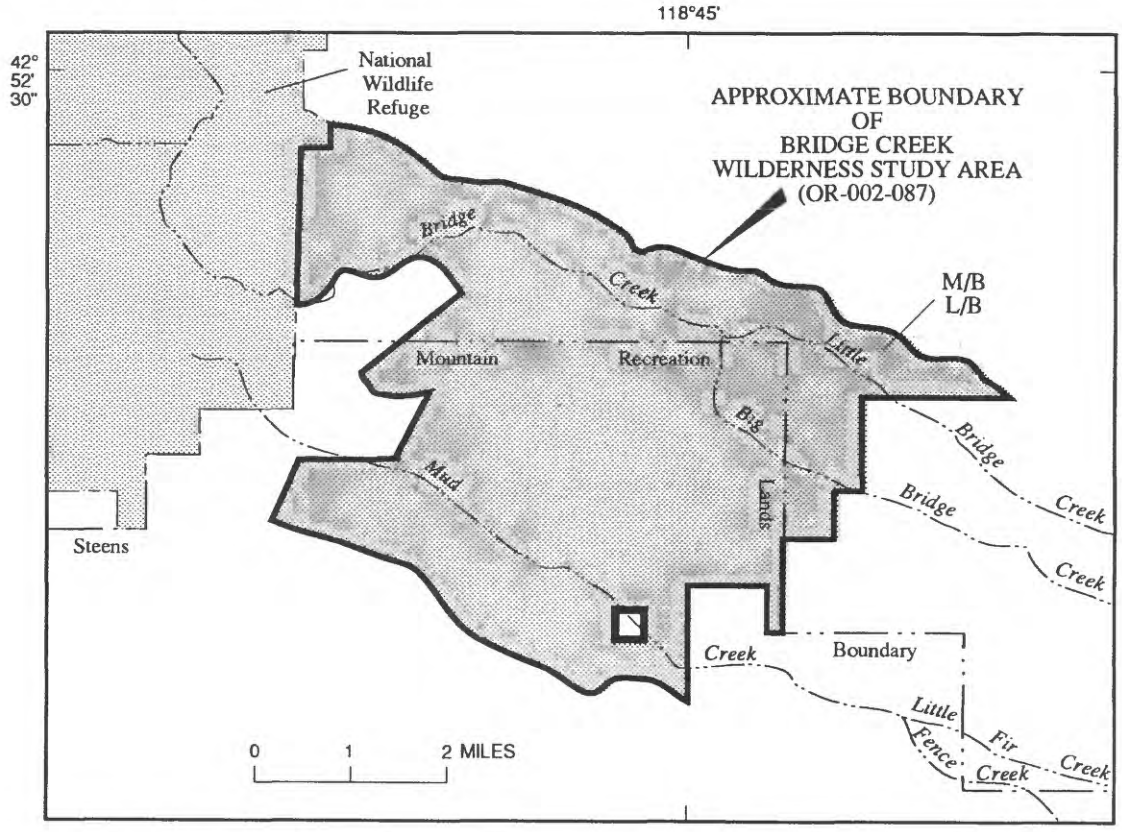
Mineral setting/ Geology: The area lies in the northern part of the Basin and Range physiographic province where structures are characterized by north trending horst and graben. Pre-Tertiary basement rocks are not exposed near the study area. Much of the study area contains exposures of the Steens Mountain Basalt, which is predominantly massive basalt, but which has local interbedded tuffs and tuff breccia. Overlying the Steens Mountain Basalt are exposures of tuffaceous sedimentary rocks including sandstones, siltstones, diatomaceous rocks, conglomerates, and fanglomerates.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources, Catlow Rim GRA (OR-020-020), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 32 p.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., and Moyle, P.R., 1988, Mineral resources of the Blitzen River Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-D, 14 p.



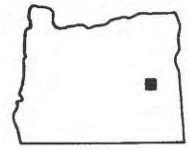
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for diatomite with certainty level B

L/B, Geologic terrane having low mineral resource potential for geothermal energy with certainty level B

Mineral resources of the Bridge Creek Wilderness Study Area.

Name: Camp Creek
Area number: OR-003-031
Size (acres): 19,200



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Keith and others, 1989).

Identified mineral resources (known): The identified mineral resources in and adjacent to the wilderness study area consist of inferred marginal reserves of 10 million tons of cake diatomite and 40 million tons of pozzolanic tuff. There are also at least 2.5 million cubic yards of sand and gravel as inferred marginal reserves.

Mineral resource potential (undiscovered): A fault along the eastern margin of the study area has moderate resource potential for small epithermal gold-silver deposits, indicated by low-level geochemical anomalies, silicification, and alteration. Moderate resource potential for hot-spring-type gold deposits exists throughout the study areas as does low resource potential for zeolite minerals, pozzolan, building stone, geothermal energy, oil and gas, and for diatomite deposits in the eastern parts.

Mining Activity: Two small pits of unknown age are at the north end of the wilderness study area. Otherwise, there has been no known mining activity. No samples from the area contained economic amounts of metallic commodities. As of July 1990 there were no mining claims located in the study area. The area contained no energy leases as of October 1987.

Mineral setting/ Geology: Rocks of the study area consist of a horizontal, conformable, and interlayered sequence of mafic and silicic lava flows, pyroclastic deposits, and associated sedimentary rocks, all of Miocene and (or) Pliocene age. The sedimentary rocks are in the uppermost unit and consist of shale, arkosic sandstone and conglomerate interlayered with vitric tuff, andesite, basalt, ash, and diatomite. Geologic structure consists of several mainly northeast-trending, high-angle normal faults having offsets of tens to hundreds of feet. Little alteration along the faults was seen.

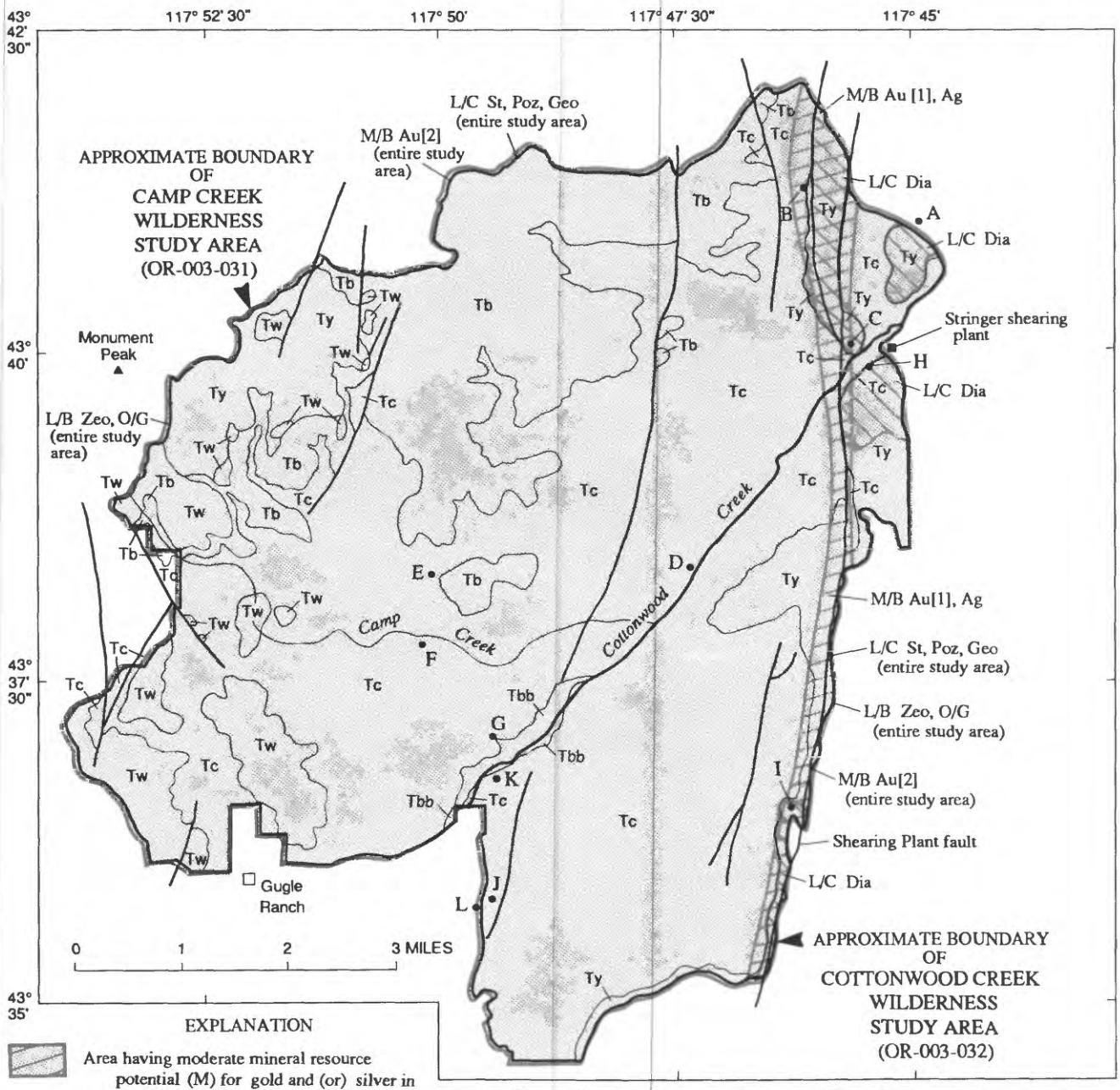
Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Benham, J.R., and Miller, M.S., 1988, Mineral resources of the Camp Creek, Camp Creek addition, and Cottonwood Creek study areas, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 42-88, 40 p.

Jones, J.L., Erickson, M.S., Fey, D.L., Kennedy, Kay, and Gent, Carol, 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rocks samples from the Camp Creek and Cottonwood Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0697, 17 p.

Keith, W.J., Turner, R.L., Griscom, Andrew, Benham, J.R., and Miller, M.S., 1989, Mineral resources of the Camp Creek and Cottonwood Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-C, 16 p.



EXPLANATION

Area having moderate mineral resource potential (M) for gold and (or) silver in epithermal veins

Area having moderate mineral resource potential (M) for epithermal hot-spring gold and low mineral resource potential (L) for other commodities as noted

Area having low mineral resource potential (L) for diatomite

Levels of certainty of assessment

B Data only suggest level of potential

C Data give good indication of level of potential

Commodities

Au	Gold
Ag	Silver
Dia	Diatomite
Geo	Geothermal energy
O/G	Oil and gas
Poz	Pozzolan
St	Building stone
Zeo	Zeolite

[ ] Types of gold deposits

1 Epithermal vein

2 Epithermal hot spring

Geologic map units

Ty Younger volcanic and associated sedimentary rocks (Tertiary)

Tw Wildcat Creek Welded Ash-Flow Tuff of Kittleman and others (1965) (Tertiary)

Tb Basalt flows (Tertiary)—Upper part, Tims Peak Basalt; lower part, basalt flows and volcanic breccias

Tc Crowley Formation of Hagood (1963a,b) (Tertiary)

Tbb Basaltic breccia (Tertiary)—Phase of the unnamed igneous complex of Hagood (1963a)

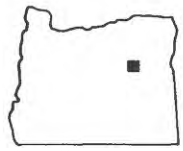
Contact

Fault

• A Sample site—Letter refers to table 1

Mineral resources of the Camp Creek Wilderness Study Area.

Name: Castle Rock
Area number: OR-003-018
Size (acres): 6,200



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No resources have been identified within the Castle Rock Wilderness Study Area.

Mineral resource potential (undiscovered): The study area has low resource potential for gold (Blackburn, 1983). This potential is based on an area of hydrothermally altered basalt about 0.4 mi 2 in the study area, and gold exploration reported at Castle Rock (Ferns, 1988). The study area has low resource potential for oil and gas (Fouch, 1983), and low potential for geothermal resources, as hot springs occur just outside the study area.

Mining Activity: There has been no reported production of minerals or energy from the wilderness study area. Current U.S. Bureau of Land Management mining claim records (July 1990) show no claims in the area. There are no known mines or prospects in or near the area, and no energy leases existed within the study area as of October 1987.

Mineral setting/ Geology: The study area is underlain by Tertiary volcanic and sedimentary rocks and Quaternary deposits. The oldest rocks are interbedded basalt, rhyolite, and dacite flows, and rhyolitic welded tuff (unnamed igneous complex of Kittleman and others, 1965; Dinner Creek Welded Tuff; Strawberry Volcanics). The upper part of the section is dominantly lapilli tuff and welded tuff with interbedded lacustrine sedimentary rocks and basalt flows (Juntura Formation, Drewsey Formation.). These rock units are all middle Miocene (or older) and may be as young as early Pliocene (Drewsey Formation). Quaternary alluvial fans and landslide deposits overlie the Tertiary rocks. Castle Rock itself is a rhyolite dike that intruded the Tertiary rocks and may have influenced the development of a broad north-northwest-trending anticline and a northwest-trending syncline. The study area has numerous steep faults that trend in the northwest quadrant. Rytuba and others (1990) interpreted the Castle Rock area as the southwest part of a caldera.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. An accurate assessment of the mineral potential of the study area requires geologic, geochemical, and geophysical studies. The area needs to be mapped at a scale of 1:24,000, especially to define the boundary of the caldera, geochemical samples (stream sediment, panned concentrate, and rock) need to be collected and analyzed, and a review of aeromagnetic and gravity surveys of the region that includes the study area need to focus on the possibilities of ore-bearing structures in and near the study area.

References:

Ferns, M.L., 1989, Mining activity and exploration in Oregon, 1988: Oregon Geology, v. 51, no. 2, p. 27-32.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Kittleman, L.R., Green, A.R., Hagood, A.R., Johnson, A.M. McMurray, J.M., Russel, R.G., and Weeden, D.A., 1965, Cenozoic stratigraphy of the Owyhee Region, southeastern Oregon: University of Oregon Museum of Natural History Bulletin No. 1, 45 p.

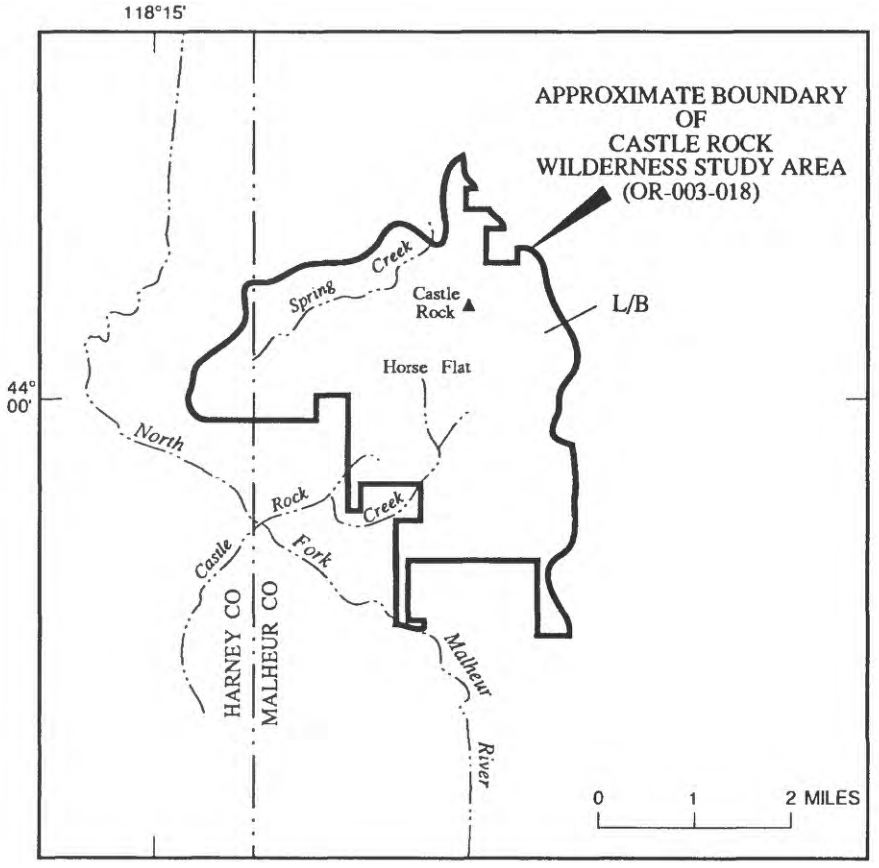
Mathews, G.W., Blackburn, W.H., and Chappel, D.L., 1983, Assessment of Geology, Energy, and Minerals (GEM) Resources, Castle Rock GRA (OR-032-015), Grand, Harney, and Malheur Counties, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 24 p.

Rytuba, J.J., Vander Meulen, D.B., and Barlock, V.E., 1990, Tectonic and stratigraphic controls on epithermal precious metal mineralization in the northern Basin and Range, Oregon, Idaho, and Nevada, in Field guide to hot-spring gold deposits in the Lake Owyhee volcanic field, eastern Oregon: Geological Society of Nevada and U.S. Geological Survey, 1990 Spring Field Trip Guide Book, Special Publication no. 10, p. 1-15.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume IV: Bureau of Land Management Oregon State Office, Portland, OR, 670 p.

Walker, G.W., 1977, Geologic map of Oregon east of the 121 meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Wood, J.D., 1976, Geologic map of the Castle Rock area, Grant, Harney and Malheur Counties, Oregon: Portland, Oregon, Portland State University M.S. thesis, 123 p.

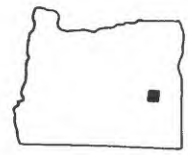


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, oil and gas, and geothermal energy with certainty level B

Mineral resources of the Castle Rock Wilderness Study Area.

Name: Cedar Mountain
Area number: OR-003-047
Size (acres): 33,600



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No resources have been identified within the Cedar Mountain Wilderness Study Area.

Mineral resource potential (undiscovered): Areas underlain by sedimentary rocks have low potential for fluorite, zeolites, bentonite, diatomite, and oil and gas resources. Basins containing Quaternary deposits in the northern part of the study area, have low potential for clay resources. Areas underlain by volcanic rocks have low potential for gold.

Mining Activity: Mathews and Blackburn (1983) state, "The Cedar Mountain GRA is not near any known mineral belts or mining districts. Historically, the area has had no significant production of any GEM [geology, energy, minerals] resources." Current U.S. Bureau of Land Management mining claim records (July 1990) show no claims in the area. At the time of the GEM study, oil and gas leases were pending for a part of the wilderness study area (Mathews and Blackburn, 1983); there were no energy leases as of October 1987. There are no known mines or prospects in or near the study area.

Mineral setting/ Geology: The Cedar Mountain study area is underlain by late Miocene? to Pliocene basalt and andesite flows, and interbedded sedimentary rocks.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

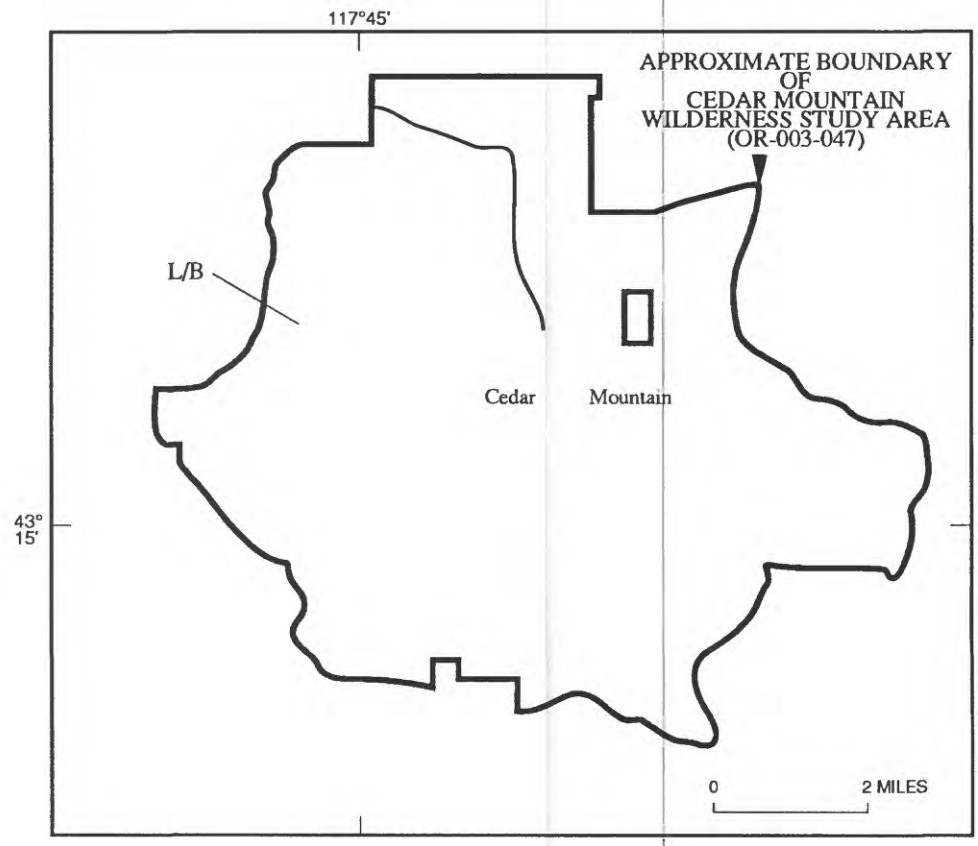
References:

Evans, J.G., Turner, R.L., Griscom, Andrew, Sawatzky, D.L., and Causey, J.D., Mineral resources of the Lower Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-F, 18 p.

Mathews, G.W., and Blackburn, W.H., 1983, Assessment of Geology, Energy, and Minerals (GEM) Resources, Cedar Mountain GRA (OR-030-017), Malheur County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 24 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume IV: Bureau of Land Management Oregon State Office, Portland, OR, 670 p.

Vander Meulen, D.B., Barlock, V.E., Plumley, P.S., Frisken, J.G., Griscom, Andrew, and Causey, D.J., 1990, Mineral Resources of the Blue Canyon and Owyhee Breaks Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-G, 28 p.

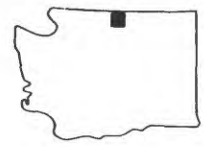


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for fluorite, zeolites, bentonite, diatomite, oil and gas, clay, and (or) gold with certainty level B

Mineral resources of the Cedar Mountain Wilderness Study Area.

Name: Chopaka Mountain
Area number: OR-013-002
Size (acres): 5,518



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the Chopaka Mountain Wilderness Study Area. Resources may exist at the Ruby mine and also at the Golden Zone mine, which is on patented land within the study area, and at the Mountain Sheep and Tenderfoot mines, both of which are just outside the study area. There are subeconomic occurrences of chromite between Chopaka Mountain and Hurley Peak, about 1 mi west of the study area. The occurrences are reportedly insufficient in grade and size to constitute a resource (Wilson and others, 1943).

Mineral resource potential (undiscovered): The study area has high resource potential for gold, silver, copper, lead, and zinc similar to those that were mined at the Ruby mine. Moderate resource potential exists for chromite particularly in the western part of the study area.

Mining Activity: The Chopaka Mountain Wilderness Study Area is located on the west edge of the Loomis mining district, and four mines of the district are located in or just outside the wilderness study area. The Ruby mine has been the most productive of the four. The portal is on the border of the southeastern part of the study area, and the underground workings extend under the study area. Production records maintained by the U.S. Bureau of Mines at Spokane, WA, show that since the year 1903, the Ruby (under that name or one of several others by which it is known: Pyrargyrite, Chloride Queen, Labyrinth, Rush, Mystic Shrine, Beggar's Choice) has produced a total of 185,928 ounces of silver, 440 ounces of gold, 2,680 pounds of copper, 13,609 pounds of lead, and 190 pounds of zinc, from a total of 16,443 tons of ore. The latest year of production for the Ruby was 1977. The Golden Zone mine, inside the northern part of the study area, has recorded a total production of 70 ounces of gold, 210 ounces of silver, 989 pounds of copper, and 42 pounds of lead. There are no records of production for the other two mines, the Mountain Sheep, which is on the east edge of the study area, and the Tenderfoot, which is about .5 mi south of the study area. Umpleby (1911) did report that "some few cars of ore" were shipped from the Mountain Sheep. Several other mines in the Loomis mining district have significant recorded production and are located within 3 mi of the Ruby. The Kaaba (or Kaaba-Texas) mine, one of the most productive, has produced 223,382 ounces of silver, and almost 2 million pounds of lead. The Kaaba mine is about 2.5 mi northeast of the Ruby mine. The Four Metals mine is about 1.5 mi northeast of the Ruby, and has produced a total of 26 ounces of gold, 7,145 ounces of silver, 5,810 pounds of copper, and 59,087 ounces of lead. The Prize mine is about 3 mi east of the Ruby and has produced 1 ounce of gold, 169 ounces of silver, 9 pounds of copper, and 236 pounds of lead. As of 1990, there are two active claims in or near the wilderness study area. They are the Lucky Jo and the Gold Eagle, both of which are lode claims located in section 32 (T. 40 N., R. 25 E.).

Mineral setting/ Geology: The study area is underlain by Cenozoic volcanic rocks, Mesozoic and Tertiary granitic rocks, Late Jurassic and Cretaceous sedimentary rocks, mafic and ultramafic rocks, and pre-Jurassic metamorphic rocks. The granitic rocks include gneissose and migmatitic textures.

Recommendations: The study area has a history of considerable mineral production, and it is almost certain to contain significant mineral resources. The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Hibbard, M.J., 1962, Geology and petrology of crystalline rocks of the Toats Coulee Creek region, Okanogan County, Washington: University of Washington Ph.D. dissertation, 96 p.

_____1971, Evolution of a plutonic complex, Okanogan Range, Washington: Geological Society of America Bulletin, v. 82, no. 11, p. 3013-3047.

Patty, E.N., 1921, The metal mines of Washington: Washington Geological Survey Bulletin no. 23, Olympia, WA, 366 p.

Rinehart, D.C., and Fox, K.F., Jr., 1972a, Geology and mineral deposits of the Loomis Quadrangle, Okanogan County, Washington: Washington Department of Natural Resources Bulletin No. 64, Olympia, WA, 124 p.

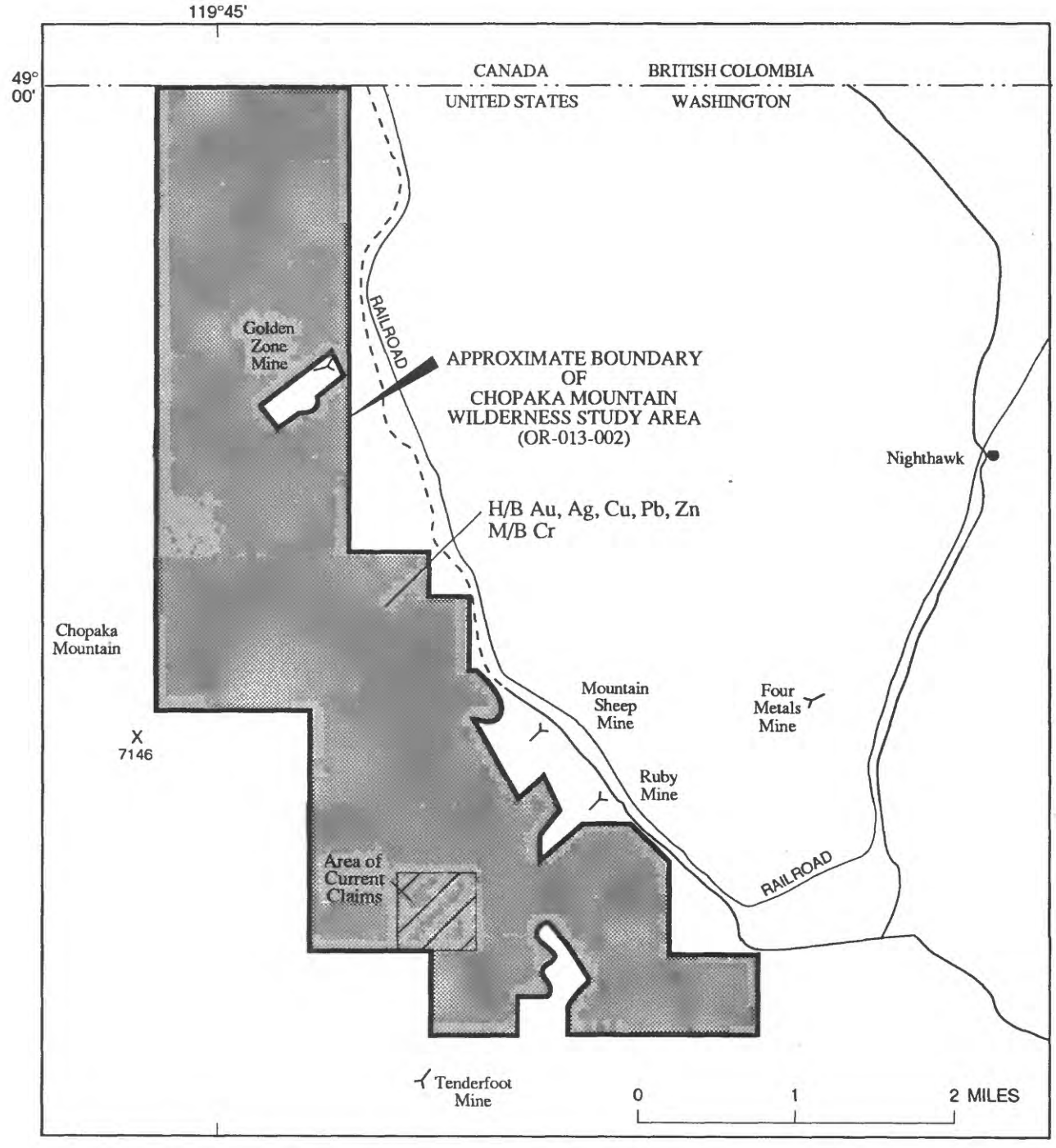
_____1972b, Distribution of copper and other metals in gully sediments of part of Okanogan County, Washington: Washington Department of Natural Resources Bulletin No. 65, Olympia, WA, 38 p.

Umpleby, J.B., 1911, Geology and ore deposits of the Oroville-Nighthawk mining district: Washington Geological Survey Bulletin no. 5, part II, Olympia, WA, p. 53-111.

U.S. Bureau of Land Management, 1986, Chopaka Mountain Wilderness Study Environmental Assessment and Plan Amendment: Bureau of Land Management Spokane District Office, Spokane, WA, 36 p.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Wilson, Hewitt, Skinner, K.G., and Hurst, T.L., 1943, Some refractory properties of Washington chromite: U.S. Bureau of Mines Report of Investigations no. 3694R, 38 p.



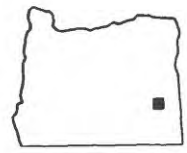
EXPLANATION

H/B, Geologic terrane having high mineral resource potential for gold, silver, copper, lead, and zinc with certainty level B

M/B, Geologic terrane having moderate mineral resource potential for chromite with certainty level B

Mineral resources of the Chopaka Mountain Wilderness Study Area.

Name: Clarks Butte
Area number: OR-003-120
Size (acres): 31,490



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the Clarks Butte Wilderness Study Area.

Mineral resource potential (undiscovered): There is low resource potential for building stone in the study area. Basalt has a number of commercial uses but is not likely to be developed because basalt is abundant in the region and other sources are closer to existing markets. The study area has low resource potential for geothermal energy and for oil and gas.

Mining Activity: There has been no reported production of mineral or energy resources from the wilderness study area. Current U.S. Bureau of Land Management mining claim records show no claims in the area (July 1990). There are no known mines or prospects in or near the study area. No energy leases existed within the wilderness study area as of October 1987.

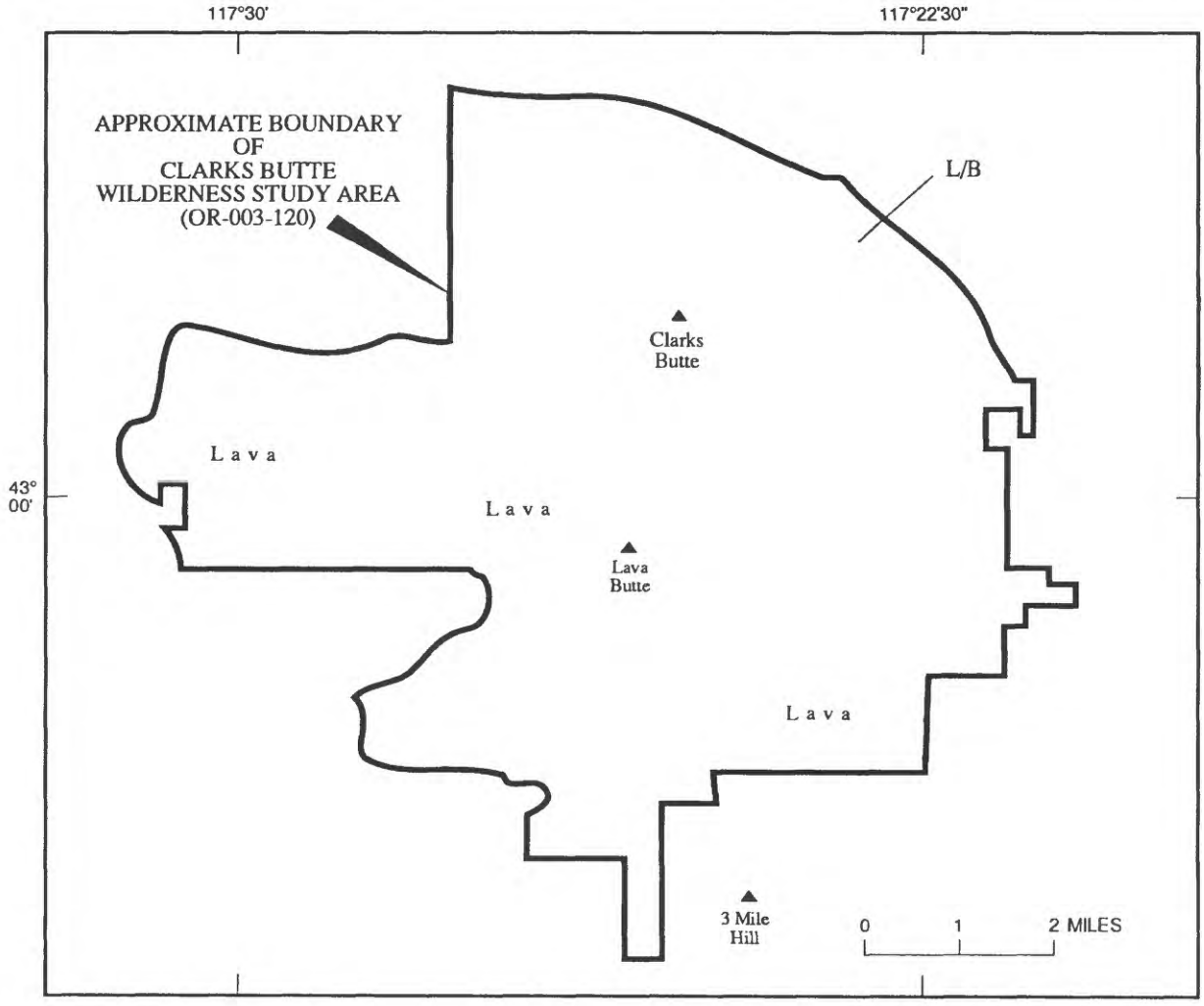
Mineral setting/ Geology: The study area is underlain by Pliocene-to-Pleistocene and Quaternary basalt flows.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Rytuba, J.J., Vander Meulen, D.B., and Barlock, V.E., 1990, Tectonic and stratigraphic controls on epithermal precious metal mineralization in the northern Basin and Range, Oregon, Idaho, and Nevada, in Field Guide to hot-spring gold deposits in the Lake Owyhee volcanic field, eastern Oregon: Geological Society of Nevada and U.S. Geological Survey, 1990 Spring Field Trip Guide Book, Special Publication, no. 10, p. 1-15.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume IV: Bureau of Land Management Oregon State Office, Portland, OR, 670 p.

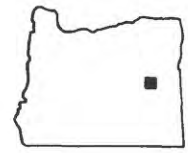


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for building stone, geothermal energy and for oil and gas with certainty level B

Mineral resources of the Clarks Butte Wilderness Study Area.

Name: Cottonwood Creek
Area number: OR-003-032
Size (acres): 8,700



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Keith and others, 1989).

Identified mineral resources (known): The identified mineral resources in and adjacent to the wilderness study area consist of 2.5 million tons of sand and gravel. There are also an estimated 740,000 tons of slab lava rock suitable for building stone in and adjacent to the wilderness study area as inferred marginal reserves.

Mineral resource potential (undiscovered): A fault along the eastern margin of the study area has moderate resource potential for small epithermal gold-silver deposits, indicated by low-level geochemical anomalies, silicification, and alteration. Moderate resource potential for hot-spring-type gold deposits exists throughout the study areas as does low resource potential for zeolite minerals, pozzolan, building stone, geothermal energy, oil and gas, and for diatomite deposits in the eastern parts.

Mining Activity: No mines, prospects, or claims were identified within the wilderness study area during the joint USBM/USGS investigation. As of July 1990 there still were no mining claims located in the study area. No energy leases existed within the study area as of October 1987.

Mineral setting/ Geology: Rocks of the study area consist of a horizontal, conformable, and interlayered sequence of mafic and silicic lava flows, pyroclastic deposits, and associated sedimentary rocks, all of Miocene and (or) Pliocene age. The sedimentary rocks are in the uppermost unit and consist of shale, arkosic sandstone and conglomerate interlayered with vitric tuff, andesite, basalt, ash, and diatomite. Geologic structure consists of several mainly northeast-trending, high-angle normal faults having offsets of tens to hundreds of feet. Little alteration along the faults was seen.

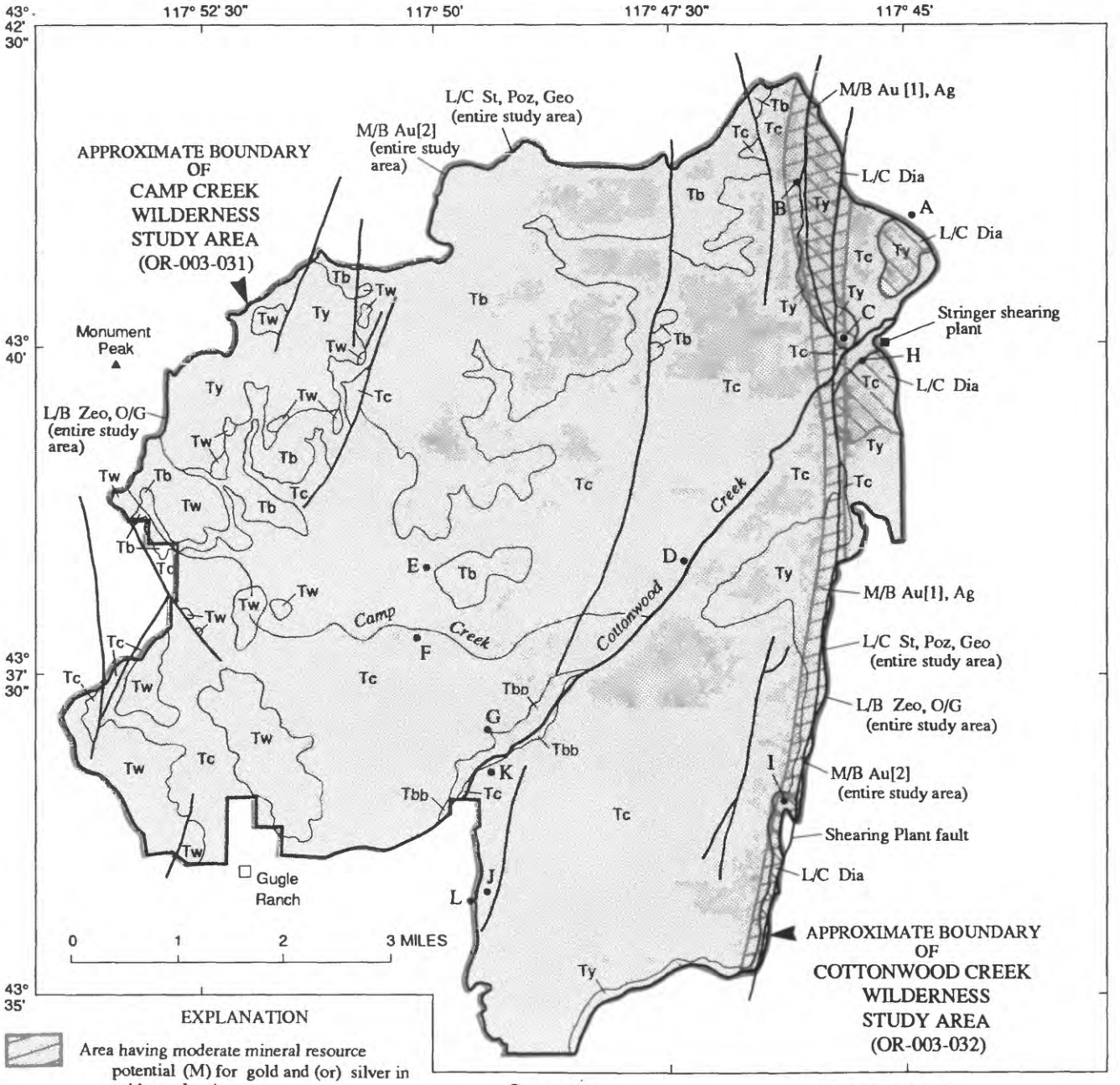
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 1,000 acres that constitute the balance.

References:

Benham, J.R., and Miller, M.S., 1988, Mineral resources of the Camp Creek, Camp Creek addition, and Cottonwood Creek study areas, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 42-88, 40 p.

Jones, J.L., Erickson, M.S., Fey, D.L., Kennedy, Kay, and Gent, Carol, 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rocks samples from the Camp Creek and Cottonwood Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0697, 17 p.

Keith, W.J., Turner, R.L., Griscom, Andrew, Benham, J.R., and Miller, M.S., 1989, Mineral resources of the Camp Creek and Cottonwood Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-C, 16 p.



EXPLANATION

Area having moderate mineral resource potential (M) for gold and (or) silver in epithermal veins

Area having moderate mineral resource potential (M) for epithermal hot-spring gold and low mineral resource potential (L) for other commodities as noted

Area having low mineral resource potential (L) for diatomite

Levels of certainty of assessment

B Data only suggest level of potential

C Data give good indication of level of potential

Commodities

Au	Gold
Ag	Silver
Dia	Diatomite
Geo	Geothermal energy
O/G	Oil and gas
Poz	Pozzolan
St	Building stone
Zeo	Zeolite

[ ] Types of gold deposits

1 Epithermal vein

2 Epithermal hot spring

Geologic map units

Ty Younger volcanic and associated sedimentary rocks (Tertiary)

Tw Wildcat Creek Welded Ash-Flow Tuff of Kittleman and others (1965) (Tertiary)

Tb Basalt flows (Tertiary)—Upper part, Tims Peak Basalt; lower part, basalt flows and volcanic breccias

Tc Crowley Formation of Hagood (1963a,b) (Tertiary)

Tbb Basaltic breccia (Tertiary)—Phase of the unnamed igneous complex of Hagood (1963a)

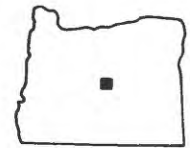
Contact

Fault

• A Sample site—Letter refers to table 1

Mineral resources of the Cottonwood Creek Wilderness Study Area.

Name: Cougar Well
Area number: OR-005-043
Size (acres): 18,435



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the Cougar Well Wilderness Study Area.

Mineral resource potential (undiscovered): The area has low potential for geothermal resources and moderate potential for oil and gas resources. There is also low potential for mercury since mercury is being mined in a geologically similar area near the southern edge.

Mining Activity: There has been no reported production of mineral or energy resources from the wilderness study area. Current U.S. Bureau of Land Management mining claim records (July 1990) show a total of 17 placer claims in secs. 34 and 35, T. 21 E., R. 21 S. A mining location about 2 mi south of the study area is likely a gravel pit. No energy leases existed within the study area as of October 1987.

Mineral setting/ Geology: Area is underlain largely by basalt with exposures of tuffaceous sedimentary rocks increasing to the north. The southern margin of the Cretaceous-to-early-Tertiary-age Columbia River Basin includes this area and provides the basis for the petroleum resource classification (J.A. Ach, written commun., 1988).

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Detailed mapping and geochemistry in this area could identify altered areas and also any mercury anomalies.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

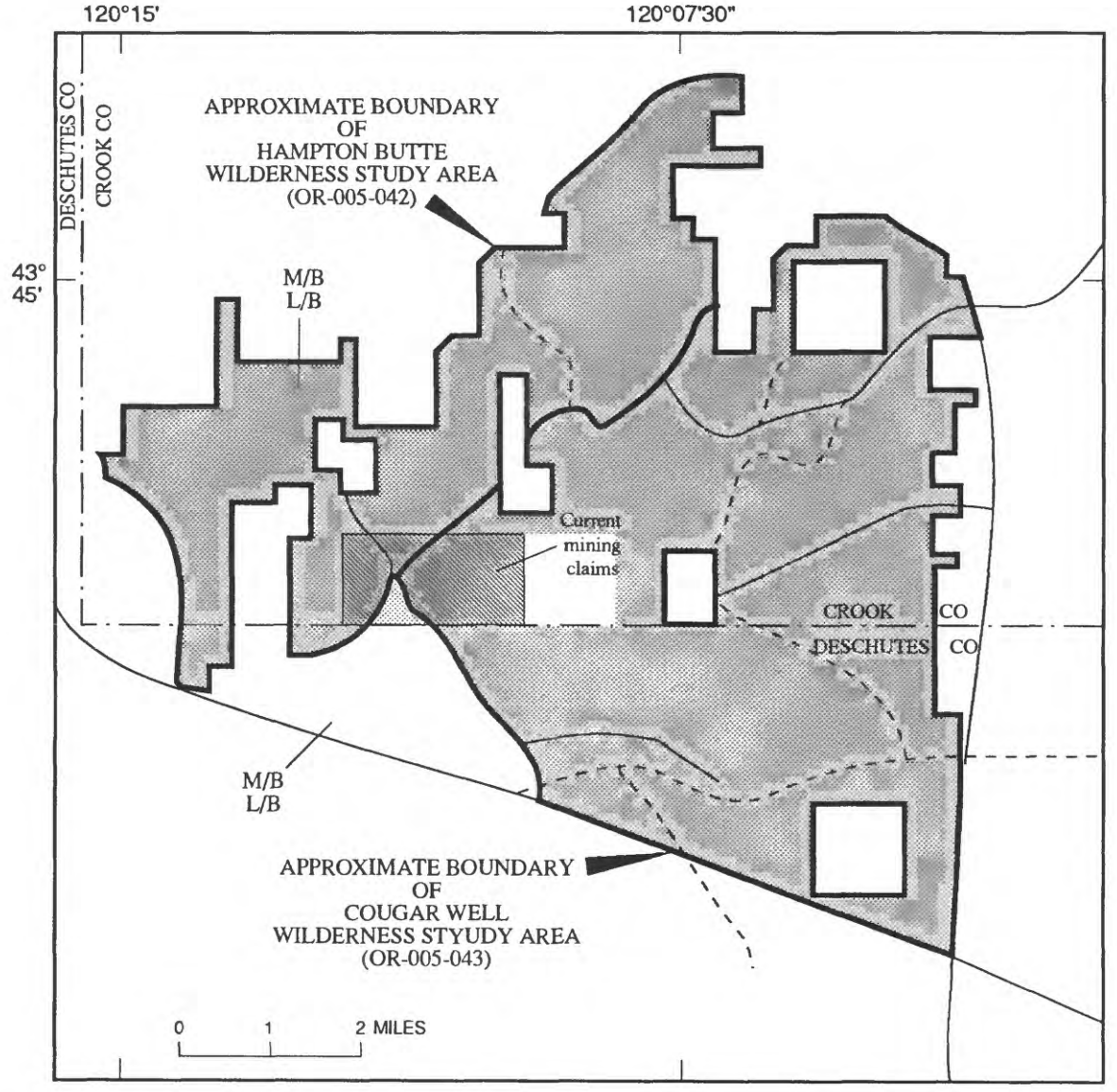
Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Mathews G.W., Blackburn, W.H., and Chapell, D.L., 1983, Assessment of Geology, Energy, and Minerals (GEM) Resources Gerry Mountain GRA (OR-050-014) Crook and Deschutes Counties, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 25 p.

Muffler, L.J.P., 1979, Assessment of geothermal resources of the United States--1978: U.S. Geological Survey Circular 790, 163 p., 3 maps, scales 1:2,500,000, 1:5,000,000, 1:1,000,000.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume II: Bureau of Land Management Oregon State Office, Portland, OR, 626 p.

Walker, G.W., and McHugh, E.L., 1980, Mineral resources and mineral resource potential study of the Lost Forest Instant Wilderness Study Area, Oregon: U.S. Geological Survey Open-File Report 80-846, 19 p.



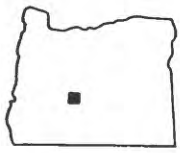
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for oil and gas with certainty level B

L/B, Geologic terrane having low mineral resource potential for geothermal energy and mercury with certainty level B

Mineral resources of the Cougar Well Wilderness Study Area.

Name: Devils Garden Lava Bed
Area number: OR-001-002
Size (acres): 29,680



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Keith and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area although slab lava has been removed from numerous sites along the edges of lava flows. Transportation costs, relatively low unit prices, difficult access, generally poor quality, and the scattered, sparse distribution of the slab lava make mining and marketing of this building stone unprofitable. Cinder and sand and gravel occurrences in the study area are suitable for many construction purposes; however, mining and marketing costs would far exceed their value.

Mineral resource potential (undiscovered): Potential for oil and gas and for low-temperature geothermal resources is low for the study area. A small area within the Devils Garden study area has low potential for perlite resources. The study area has low potential for the occurrence of slab lava (building stone) resources.

Mining Activity: Four mining claims for uranium were staked in the 1950's. Slab lava has been removed from several sites within the wilderness study area; some are situated within the area recommended for wilderness. As of July 1990 there were no mining claims located in the study area. The area contained no leases for energy resources as of October 1987.

Mineral setting/ Geology: Pliocene, Pleistocene, and Holocene basaltic lavas, including lesser andesite, dacite, and rhyolite, associated with the older basalt, underlie the study areas and aggregate more than 1,200 ft in thickness. Dacite and rhyolite locally form domes as well as flows. Structure consists of a few northwest-trending high-angle normal faults and associated tension fractures.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 1,520 acres that constitute the balance.

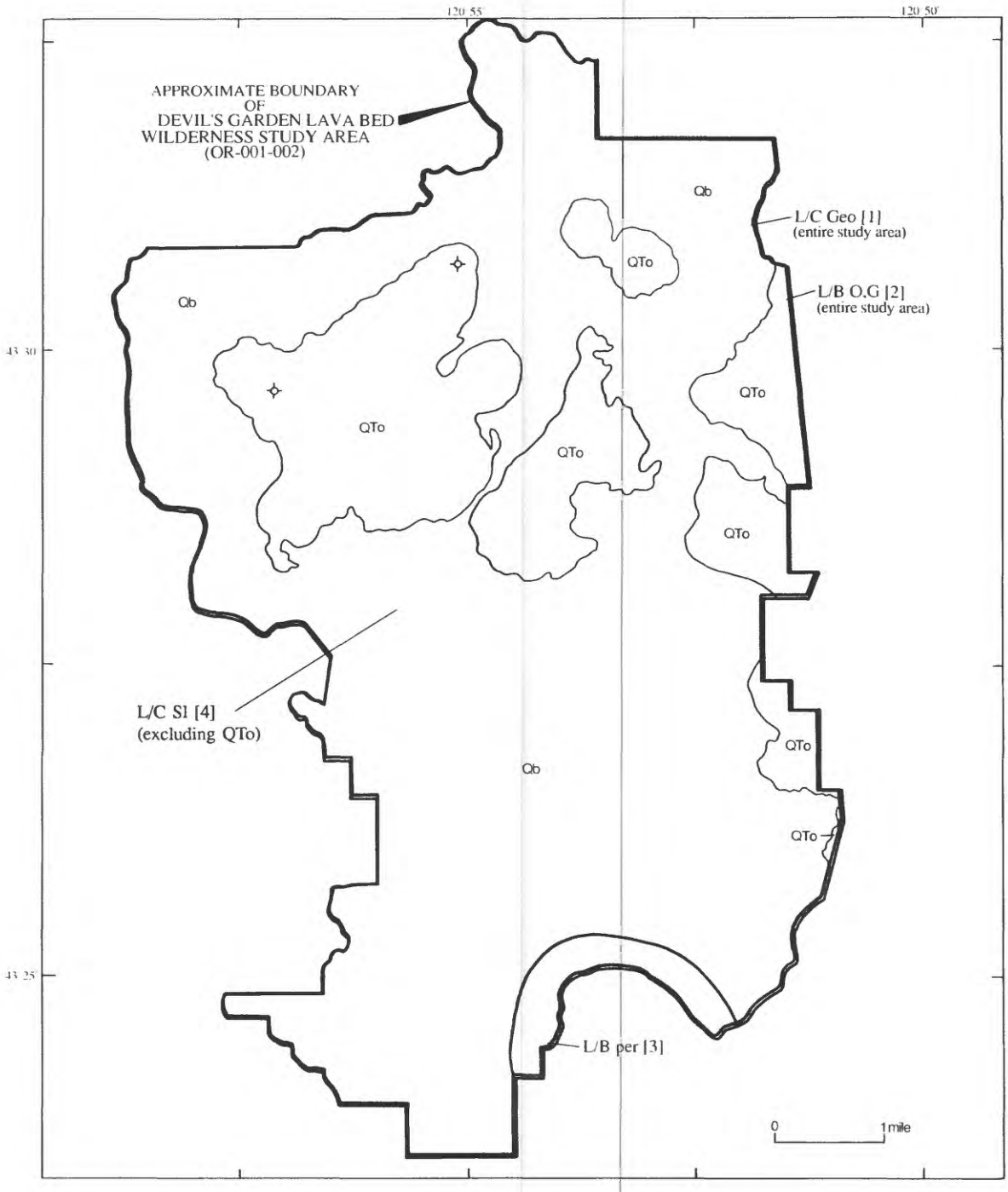
References:

Engineers International, Inc., 1980, Geological investigations and mineral inventory of Devil's Garden, Four Craters, and Squaw Ridge in Lake County, Oregon: Report prepared for the U.S. Bureau of Land Management, contract OR-910-CT9-16, 135 p.

Erickson, M.S., Hopkins, R.T., Fey, D.L., and King, H.D., 1989, Analytical results and sample locality map of rock samples from the Devil's Garden Lava Bed (OR-001-002), Squaw Ridge Lava Bed (OR-001-003), and Four Craters Lava Bed (OR-001-022) Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Open-File Report 89-0307, 10 p.

Johnson, F.L., 1987, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed study areas, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 37-87, 10 p.

Keith, W.J., King, H.D., Gettings, M.E., and Johnson, F.L., 1988, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Bulletin 1738-A, 14 p.



Mineral resources of the Devils Garden Lava Bed Wilderness Study Area.

EXPLANATION

☐ Area with low mineral resource potential—See appendixes for definition of levels of mineral and energy resource potential (L) and certainty of assessment (B, C)

Commodities

Geo Geothermal
O,G Oil and gas
Sl Slab lava
per Perlite

[ ] Type of deposit or occurrence

1 Geothermal water
2 Source beds and (or) traps
3 Silicic glass
4 Surficial deposits

Geologic map units

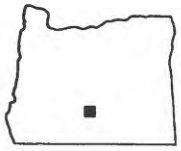
Qb Basalt (Holocene or Pleistocene)—Pahoehoe and aa type basalt flows, agglutinates, and cinder cones

QTo Older lava flows (Pleistocene and (or) Pliocene)—Older basalt, andesite, dacite, and rhyolite flows and domes. Locally includes tuffaceous sediments and basin-fill material

—— Contact
⌖ Cinder cone

Explanation, mineral resources of the Devils Garden Lava Bed Wilderness Study Area.

Name: Diablo Mountain
Area number: OR-001-058
Size (acres): 113,120



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Diggles and others, 1990).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area, but samples from shallow auger holes suggest that brines within lake and playa sediments in the western part of the study area may have economic concentrations of sodium carbonate (soda ash), borate compounds, and sodium sulfate. Possible byproducts include salt, potash, bromine, lithium, magnesium compounds, and tungsten. The southern tip of the area lies within the Summer Lake Known Geothermal Resource Area.

Mineral resource potential (undiscovered): The western part of the Diablo Mountain Wilderness Study Area has moderate mineral resource potential for commodities associated with brines: soda ash, boron compounds, sodium sulfate, magnesium compounds, salts, potash, bromine, lithium, and tungsten. A low mineral resource potential in the area of Tenmile Ridge for low-grade, high-tonnage epithermal hot-spring gold-silver deposits is suggested by the presence of opal in some altered-basalt outcrops and by the presence of mercury in a nearby prospect. The mineral resource potential is low for magnesium from dolomitic limestone in the area of Tenmile Ridge. The entire study area has moderate geothermal energy resource potential for low-temperature thermal water useful for agricultural and building heating. The Summer Lake KGRA is 2 mi south of the study area. Thermal springs at Ana Springs and Summer Lake Hot Spring are near the study area, and two known thermal-water springs were observed within the study area. Oil and gas resource potential is low throughout the study area.

Mining Activity: A block of 326 mining claims, the Oregon Group, were located in 1901 to include all of Summer Lake and extending as much as 3 mi east into the study area. The claims were for deposits and solutions of sodium and potassium compounds. An evaporation pond in the southern part of the area, built in 1918, testifies to past interest in brines in the Summer Lake basin. A group of seven mining claims were located for limestone in the Ten Mile Butte area in 1974. No current mining claims (July 1990) or energy leases (October 1987) are located in the study area.

Mineral setting/ Geology: The Diablo Mountain Wilderness Study Area lies on the northwest edge of the Basin and Range physiographic province, in the volcanic plateau region lying south of the Blue Mountains and east of the Cascade Range. The region west of Summer Lake and continuing south of the study area is part of the poorly defined Modoc Plateau physiographic province that separates the Basin and Range and the Cascade Range physiographic provinces. Consolidated rocks within the study area consist mostly of Tertiary basalt and tuffaceous sedimentary rocks. The low-lying areas are covered by Quaternary alluvial-fan, sand-dune, playa, lacustrine, fluvial, and landslide deposits. The principal structural features of the area are normal faults that have large vertical offsets. These faults are concentrated at the margins of large horst and graben typical of the Basin and Range Province.

Recommendations: Due to the possible economic importance of various mineral commodity occurrences in the study area (in bleaching of paper pulps and fluxing of metals), further work is recommended. More detailed work and site-specific studies, including drilling, should probably be carried out to determine depths and thickness of these occurrences. In addition, as only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 23,070 acres that constitute the balance.

References:

Adrian, B.M., and others, 1990, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, rock, vegetation, lake-sediment, and evaporite samples from the Diablo Mountain Wilderness Study Area, OR-001-058), Lake County, Oregon: U.S. Geological Survey Open-File Report 90-506, 35 p.

Conrad, C.F., 1953, Geology of the Ana River Section, Summer Lake, Oregon: unpublished M.S. thesis, Oregon State University, 92 p.

Diggles, M.F., Conrad, J.E., and Soreghan, G.S., 1990, Geologic map of the Diablo Mountain Wilderness Study Area, Lake County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-2121, scale 1:48,000.

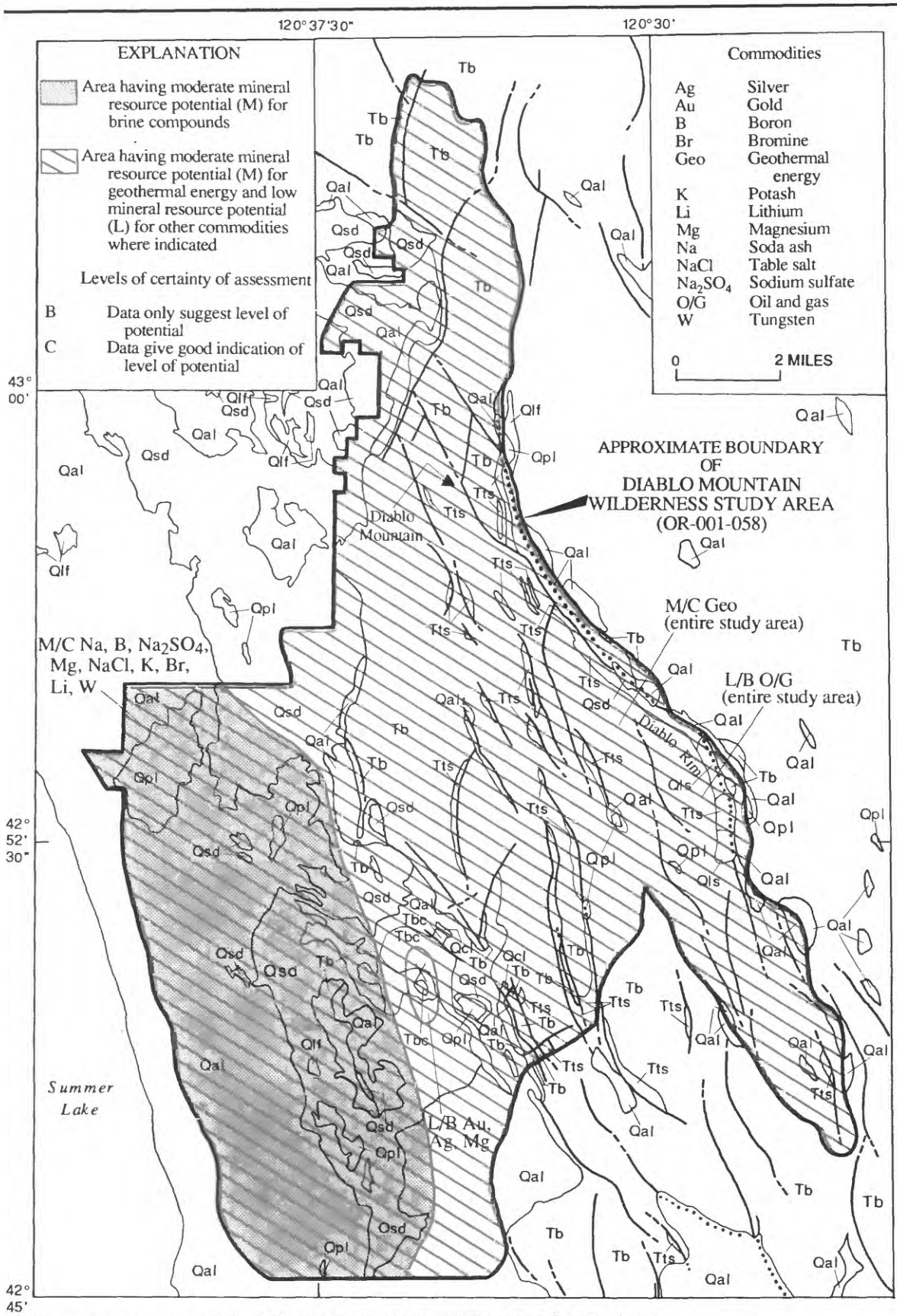
Diggles, M.F., King, H.D., Gettings, M.E., Conrad, J.E., Sawatzky, D.L., Soreghan, G.S., Peters, T.J., and Willett, S.L., 1990, Mineral resources of the Diablo Mountain Wilderness Study Area, Lake County, Oregon: U.S. Geological Survey Bulletin 1738-D.

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and mineral (GEM) resources, Summer Lake GRA (OR-010-027), Lake County, Oregon: Lakewood, CO., Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042.

Peters, T.J., and Willett, S.L., 1989, Mineral resources of the Diablo Mountain (additional) study area, Jackson County, Oregon: U.S. Bureau of Mines Open-File Report MLA 31-89, 48 p.

Travis, P.L., 1977, Geology of the area near the north end of Summer Lake, Lake County, Oregon: unpublished M.S. thesis, University of Oregon, 95 p.

Willett, S.L., 1987, Mineral resources of the Diablo Mountain study area, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 30-87, 10 p.



Mineral resources of the Diablo Mountain Wilderness Study Area.

Description of map units

Qal Alluvium (Quaternary)—Alluvial fan deposits and stream deposits of gravel, sand, and silt

Qsd Sand dunes (Quaternary)—Large areas of windblown sand composed of ash, pumice, and rock-forming mineral grains, mostly alkali feldspar and quartz

Qpl Playa deposits (Quaternary)—Clay, silt, sand, and some evaporite deposits. Contains tephra at depth

Qlf Lacustrine and fluvial deposits (Quaternary)—Unconsolidated clay, silt , and gravel

Qls Landslide deposits (Quaternary)—Unstratified mixtures of basaltic and tuffaceous sedimentary rocks. Includes faulted blocks, rubble, and talus

Qcl Claystone (Quaternary)—Mostly montmorillonite; locally includes marl, micrite, caliche, and opal-bearing travertine

Tbc Basaltic cinders (Tertiary)—Red and reddish black cinders and near-vent flows; scoriacious rocks and altered basalt

Tb Basalt (Tertiary)—Gray to dark-gray plagioclase-phyric olivine basalt flows having subophitic to diktytaxitic texture. Includes minor basalt-flow breccia. Crystals of labradorite are partly to completely enveloped in clinopyroxene. Pyroxene also forms interstitial grains. Locally interbedded with dolomitic limestone of Pliocene(?) age in vicinity of Tenmile Ridge (see fig. 1)

Tts Tuffaceous sedimentary rocks (Tertiary)—Semi-consolidated interbedded white, light-yellow, and cream-colored lacustrine and fluvial sedimentary rocks that consist mostly of tuffaceous sandstone and siltstone and locally contain arkosic sandstone and pebble conglomerate. Contains alkali feldspar, clay minerals, zeolites, and secondary silica minerals. Age and correlation uncertain but presumably mostly of middle and late Miocene age (Walker, 1977)

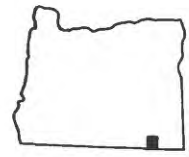
——— Contact

—·—·— Fault—Dashed where approximately located, dotted where concealed

X Tenmile prospect

Explanation of map units, mineral resources of the Diablo Mountain Wilderness Study Area.

Name: Disaster Peak
Area number: OR-003-153/NV-020-859
Size (acres): 30,490 (32,040 acres Oregon and Nevada combined)



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Minor and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): There is high and low mineral resource potential for gold in quartz veins in the southern part (in Nevada) and low mineral resource potential for epithermal gold, silver, mercury, and uranium resources in the northeastern part (Oregon) of the study area.

Mining Activity: About 100 mining claims have been located in or near the wilderness study area since 1892. Recent work has focused on the Albisu prospect just to the east, and the Au claim group in the south part of the study area. According to Bureau of Land Management claim records (July 1990) both prospects were held by current claims. The Albisu claims were drilled for gold mineralization by the McDermitt Mine Company in 1986; results are proprietary. The Au claims are explored by about 24 pits and trenches and have yielded some gold.

Mineral setting/ Geology: The southern (Nevada) part of the study area is underlain by Cretaceous granitic rocks. The rest of the area contains Tertiary volcanic and pyroclastic flows. The Long Ridge caldera lies just east of the study area. Ring faults from this caldera displace rocks in the northeastern part of the study area. Unrelated faults strike north-northwest.

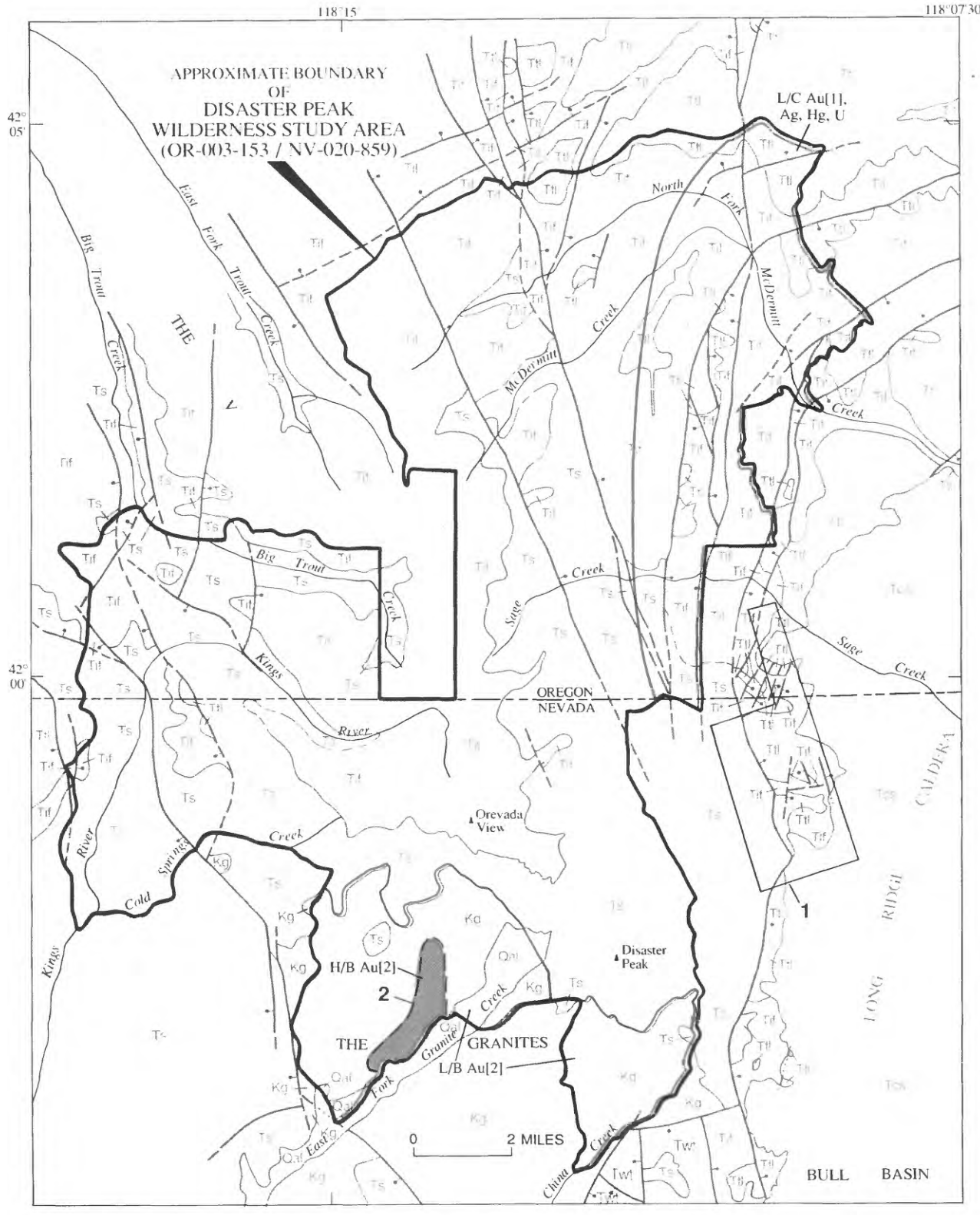
Recommendations: Detailed studies of the northeastern part of the study area may be warranted to determine the extent and detailed character of the mineralization in that area. There are two areas in particular. The Au claim group about 4 mi west of Disaster Peak has a high resource potential for gold as delineated by several samples with a gold content that ranged from 0.11 to 1.12 troy ounces gold per ton. An area on the east edge of the northern half of the area should be studied as it is a northern extension of the Albisu prospect, just outside of the east-central part of the study area boundary. At the same time, The remaining 295 acres of the wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Erickson, M.S., and Jones, Janet, 1989, Analytical results and sample locality map for stream-sediment, heavy-mineral-concentrate, and rock samples from the Disaster Peak Wilderness Study Area (OR-003-153/NV-020-859), Harney and Malheur Counties, Oregon, and Humboldt County, Nevada: U.S. Geological Survey Open-File Report 89-0328, 15 p.

Leszcykowski, A.M., 1987, Mineral resources of the Disaster Peak study area, Harney and Malheur Counties, Oregon and Humboldt County, Nevada: U.S. Bureau of Mines Open-File Report MLA 65-87, 17 p.

Minor, S.A., Turner, R L., Plouff, Donald, and Leszcykowski, A.M., 1988, Mineral resources of the Disaster Peak Wilderness Study Area, Harney and Malheur Counties, Oregon, and Humboldt County, Nevada: U.S. Geological Survey Bulletin 1742-A, 18 p.



Mineral resources of the Disaster Peak Wilderness Study Area.

EXPLANATION

Area having high mineral resource potential (H)

Area having low mineral resource potential (L)

Level of certainty of assessment

B	Data only suggest level of potential
C	Data give good indication of level of potential

Commodities

Au	Gold
Ag	Silver
Hg	Mercury
U	Uranium

[ ] Type of deposit or occurrence

1	Epithermal
2	Quartz veins

Prospects and claims—See table for description

1	Albisu prospect
2	Au claim group

Geologic map units

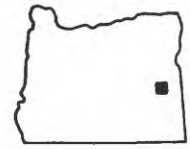
Qal	Alluvium (Quaternary)
Tcs	Caldera-fill sedimentary rocks (Miocene)
Ttl	Tuff of Long Ridge and, locally, tuff of Trout Creek Mountains (Miocene)
Tif	Intermediate lava flows (Miocene)
Ts	Steens Basalt (Miocene)
Twt	Dacitic welded tuff (Eocene)
Kg	Granitic rocks (Cretaceous)

——— Contact—Dashed where approximately located

——— Fault—Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side

Explanation, mineral resources of the Disaster Peak Wilderness Study Area.

Name: Dry Creek
Area number: OR-003-053
Size (acres): 23,500



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area, although gold-exploration targets in the western part of the area might make favorable drilling sites. Hot-springs type epithermal gold mineralization is in silicified sandstone about 4 mi northeast of the wilderness study area at Grassy Mountain. Drilling by Atlas Gold Corporation since 1988 has delineated a gold reserve of 1.19 million ounces in the deposit, which averages 0.06 oz/ton gold. Numerous exposures of possibly optical-grade calcite are present as veins and impregnations in flat-lying sediments, mainly south of Dry Creek in the vicinity of Dead Horse Canyon. About 55 tons of calcite were exposed during examination of veins on one claim in 1944.

Mineral resource potential (undiscovered): The study area has high potential for optical grade calcite. There is moderate resource potential for gold deposits similar to those at Grassy Mountain within the study area. The sedimentary rocks have low potential for zeolites, bentonite, and diatomite.

Mining Activity: In the late 1920's and early 1930's, a flurry of claims were located on occurrences of clear, crystalline calcite. Shallow pits and open cuts were dug on calcite veins in the vicinity of Dead Horse Canyon. Some calcite may have been mined and sold. In 1943-44, additional work was done to determine if optical-grade calcite was present that might aid the war effort. No subsequent production is reported. Recent work has focussed on the search for gold. Interim management, as of September 30, 1990, precludes exploration that would require reclamation within the wilderness study area. Recent work by several companies has been limited to surface sampling and geologic mapping. One exploration company submitted a plan of operations in 1989 to test claims for ore-grade gold mineralization; approval of the plan was appealed and no work was allowed. About 380 current mining claims are located in or partly in the study area (July 1990); most are in the eastern part of the study area and were located in 1988 and 1989. Major claim holders include Noranda Exploration, Atlas Precious Metals, ASARCO Inc., and Whelan Mineral Exploration. As of October 1987, no oil and gas leases existed within the study area.

Mineral setting/ Geology: The study area is underlain by late Miocene? to Pliocene sedimentary rocks and basalt flows.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

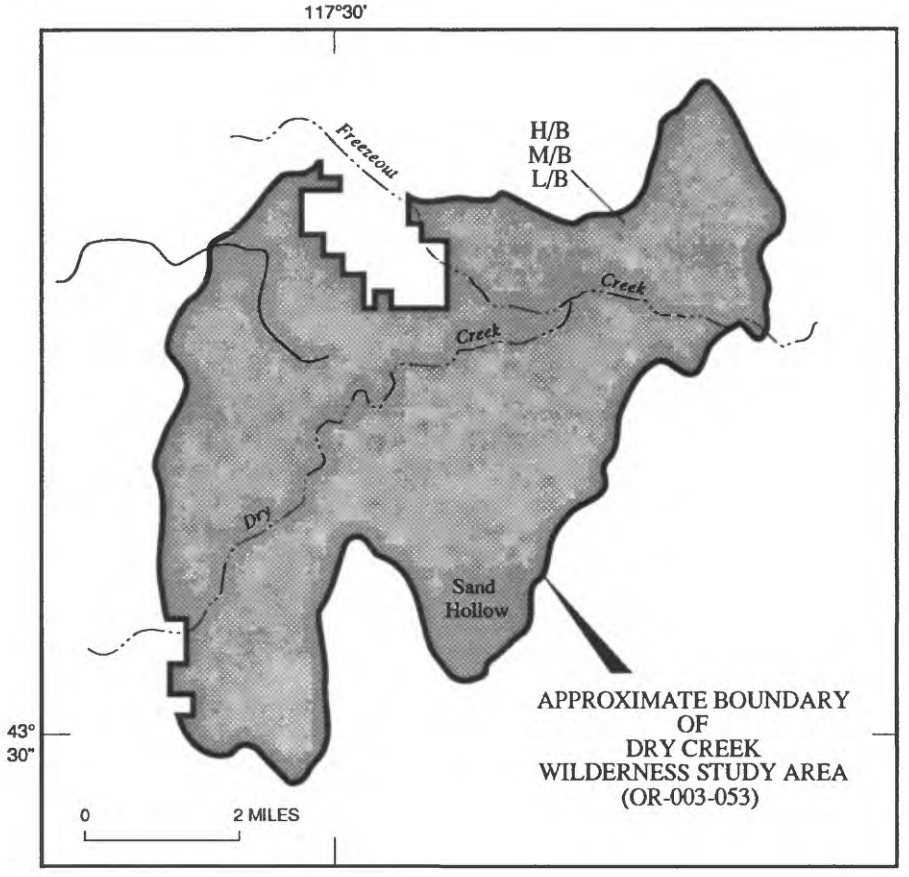
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-531-CT3-440045, 94 p.

Ferns, M.L. and Ramp, Len, 1989, Geology and mineral resources map of the Grassy Mountain quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-57, scale 1:24,000.

Mason, R.S., 1944, Bombsight claim (optical calcite), Malheur County: Oregon Department of Geology and Mineral Industries: unpublished report available at U.S. Bureau of Mines, E. 360 3rd Ave., Spokane, WA, 10 p.

Peterson, J.A., and Tegtmeyer, K.J., 1987, Geologic map of the Dry Creek Bench quadrangle, Malheur County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1940, scale 1:24,000.

Vander Meulen, D.B., Barlock, V.E., Plumley, P.S., Frisken, J.G., Griscom, Andrew, and Causey, D.J., 1990, Mineral Resources of the Blue Canyon and Owyhee Breaks Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-G, 28 p.



EXPLANATION

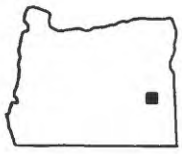
H/B, Geologic terrane having high mineral resource potential for optical calcite with certainty level B

M/B, Geologic terrane having moderate mineral resource potential for gold with certainty level B

L/B, Geologic terrane having low mineral resource potential for zeolites, bentonite, and diatomite with certainty level B

Mineral resources of the Dry Creek Wilderness Study Area.

Name: Dry Creek Buttes
Area number: OR-003-056
Size (acres): 51,800



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area, although gold-exploration targets near Dry Creek Buttes and on Red Butte might made favorable drilling sites. Hot-springs type epithermal gold mineralization is in silicified sandstone about 7 mi north of the wilderness study area at Grassy Mountain. Drilling of the deposit by Atlas Gold Corporation, beginning in 1988, has delineated reserves of 1.19 million ounces gold that average 0.06 oz/ton gold.

Mineral resource potential (undiscovered): In the southern part of the study area, gold is associated with hot spring deposits and hydrothermal explosion breccias. Silicified and altered sedimentary and volcanic rocks that included parts of Red Butte have high potential for gold resources similar to those at Grassy Mountain. Areas underlain by a intermediate intrusion located near the east-central boundary of the study area have low potential for silver resources. Area underlain by sedimentary rocks have low potential for zeolites, bentonite, diatomite, and oil and gas.

Mining Activity: Interim management, as of September 30, 1990, precludes exploration that would require reclamation within the wilderness study area. Recent work by several companies has been limited to surface sampling and geologic mapping. Some trenching, since reclaimed, was done in the Red Butte area in 1988. Two mining companies submitted plans of operations in 1989 to test for ore-grade gold mineralization in the northern part of the study area; approval of the plans was appealed and no work was allowed. One exploration company (Noranda) drilled six holes in the Nannys Nipple area after an appeal to prevent operations was denied by the Interior Board of Land Appeals; reclamation is not yet (1990) complete. About 1500 current mining claims are located in or partly in the study area (July 1990). Most were located between 1982 and 1989. Major claim holders include ASARCO Inc., Noranda Exploration, Atlas Precious Metals, Manville Sales Corp., Whelan Mineral Exploration, Nerco Exploration, Placer Dome US Inc., and Bond Gold Exploration Inc. As of October 1987, no oil and gas leases existed within the study area.

Mineral setting/ Geology: The Dry Creek Buttes study area is underlain by middle Miocene? to Pliocene sedimentary rocks and basalt flows, and silicic to mafic intrusions.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

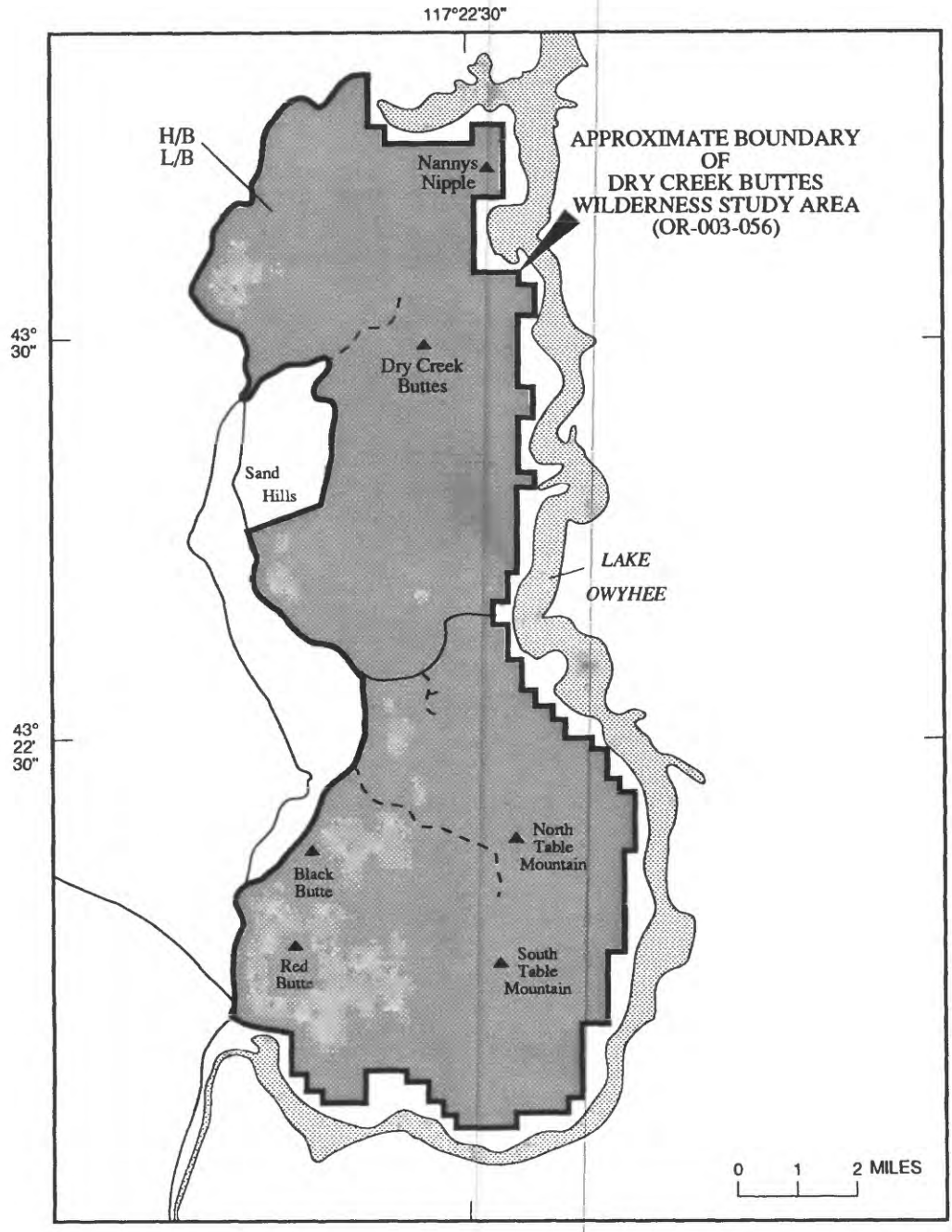
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-531-CT3-440045, 94 p.

Ferns, M.L. and Ramp, Len, 1989, Geology and mineral resources map of the Grassy Mountain quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-57, scale 1:24,000.

Gray, J.J., Peterson, N.N., Clayton, Janine, and Baxter, Gary, 1983, Geology and mineral resources of 18 BLM wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-file Report O-83-2, 106 p.

Peterson, J.A., and Tegtmeyer, K.J., 1987, Geologic map of the Dry Creek Bench quadrangle, Malheur County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1940, scale 1:24,000.

Vander Meulen, D.B., Barlock, V.E., Plumley, P.S., Frisken, J.G., Griscom, Andrew, and Causey, D.J., 1990, Mineral Resources of the Blue Canyon and Owyhee Breaks Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-G, 28 p.

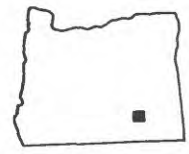


EXPLANATION

H/B, Geologic terrane having high mineral resource potential for gold with certainty level B
L/B, Geologic terrane having low mineral resource potential for silver, zeolites, bentonite, diatomite, and oil and gas with certainty level B

Mineral resources of the Dry Creek Buttes Wilderness Study Area.

Name: East Alvord
Area number: OR-002-073A
Size (acres): 22,240



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Turrin and others, 1989).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The western part of the East Alvord Wilderness Study Area is in the Alvord Valley KGRA (Known Geothermal Resource Area). Geothermal activity is indicated by Mickey Hot Springs in the northern part of the wilderness study area and high heat flow measurements. The U.S. Department of Energy ranked the Alvord Valley geothermal area in the top 10 areas in the Pacific Northwest. Small amounts of chalcedony (banded agate), petrified wood, and common opal are present in the study area, but are not commercially important. Impure occurrences of diatoms and clay are found in lake sediments.

Mineral resource potential (undiscovered): In the western part of the study area are small areas with both moderate and low potential for the occurrence of small epithermal deposits containing gold, silver, and mercury. In this same area, hot-spring evaporite deposits have low potential for the occurrence of boron. The western part also has moderate potential for low- to medium-temperature geothermal resources. The entire study area has low potential for the occurrence of oil, gas, and uranium.

Mining Activity: Exploratory drilling for low-temperature geothermal resources has occurred near the north border of the wilderness study area. The East Alvord Wilderness Study Area contains neither mining claims, nor oil, gas, or geothermal leases.

Mineral setting/ Geology: A section of Miocene to Pliocene, mainly volcanic and volcaniclastic rocks approximately 1,100 ft thick, overlain by relatively thin Quaternary alluvial and eolian deposits occupies the study area. The stratigraphic section consists of, ascending: Steens Basalt (base not exposed), platy andesite flows and flow breccia, welded rhyolitic ash-flow tuff, tuffaceous sedimentary rocks interbedded with basalt and tuff, and basalt that retains some original flow morphology. The study area is an eastward-tilted fault block, cut and bounded by dominantly north-northwest and north-northeast-trending high-angle normal faults.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 5,815 acres that constitute the balance.

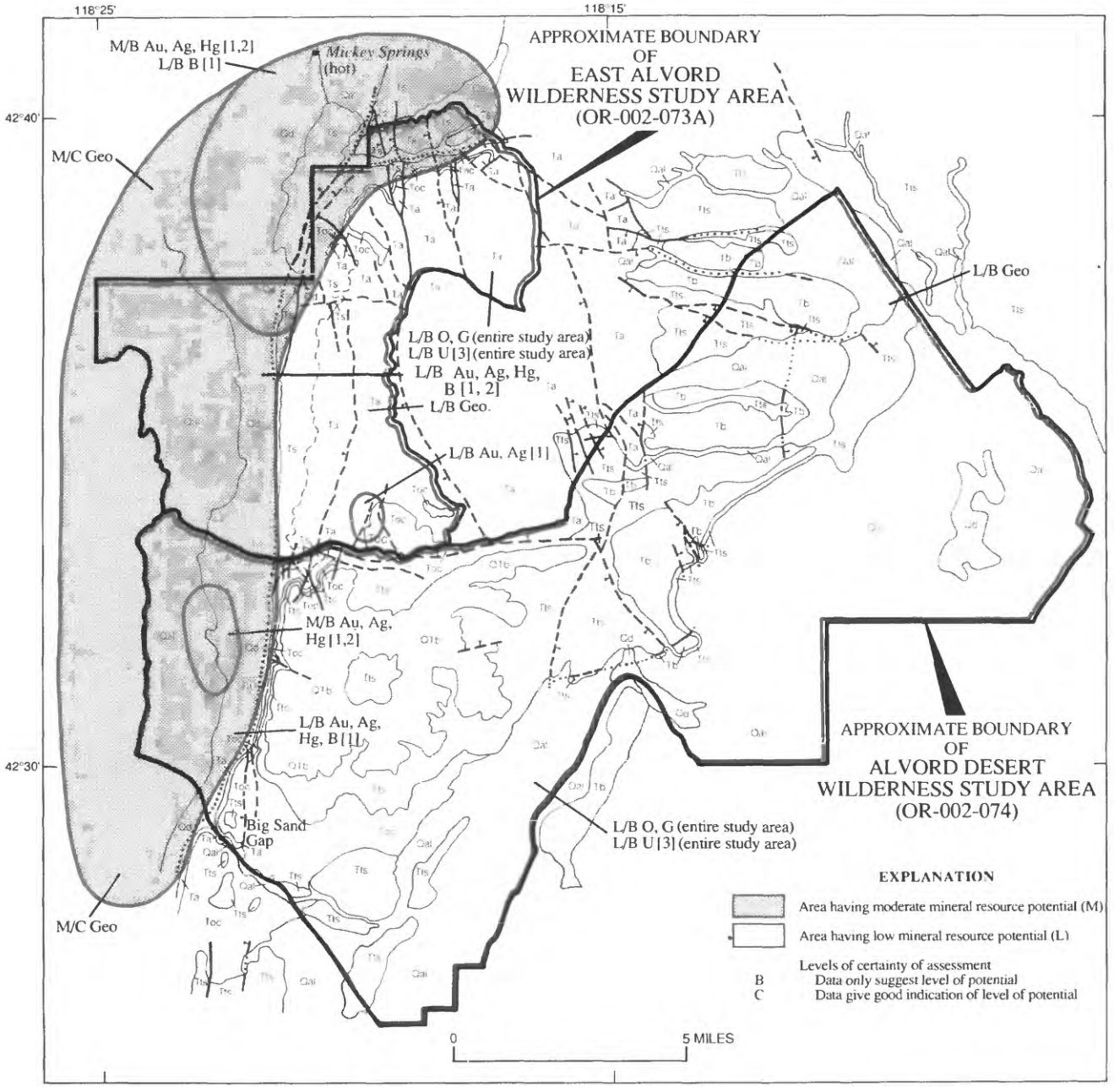
References:

Buehler, A.R., and Graham, D.E., 1987, Mineral resources of the Alvord Desert and East Alvord study areas, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 53-87, 18 p.

Jones, J.L., Erickson, M.S., and Turner, R.L., 1989, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rocks samples from the Alvord Desert and East Alvord Wilderness Study Areas, (OR-002-074 and OR-002-073A) Malheur and Harney Counties, Oregon: U.S. Geological Survey Open-File Report 89-0021, 23 p.

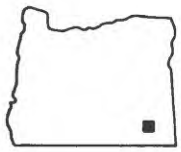
Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources, Alvord Desert GRA (OR-023-019), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 33 p.

Turrin, B.D., Griscom, Andrew, Turner, R.L., Lawson, W.A., Buehler, A.R., and Graham, D.E., 1989, Mineral resources of the Alvord Desert and East Alvord Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Bulletin 1739-B, 16 p.



Mineral resources of the East Alvord Wilderness Study Area.

Name: Fifteen Mile Creek
Area number: OR-003-156
Size (acres): 51,290



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Peterson and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Sand and gravel accumulations along creeks are not resources because suitable material is available closer to prospective markets.

Mineral resource potential (undiscovered): The southern part of the Fifteen Mile Creek study area has low potential for mercury and uranium resources near caldera ring fractures. The southern and northwestern parts of the area have low potential for antimony, bismuth, mercury, silver, molybdenum, and zinc resources in epithermal deposits. Tin geochemical anomalies in the southwest corner of the Fifteen Mile Creek study area suggest a terrane having low potential for tin resources of unknown origin, possibly related to the basaltic rocks in that part of the study area. The area has low potential for zeolite resources because of its volcanic terrane. The northwest tip of the Fifteen Mile Creek study area has low potential for pumice as scattered fragments in tuff. The study area has a low potential for geothermal energy resources because of its proximity to warm-water wells and springs nearby. There are no oil and gas leases in the area and it has low potential for resources of oil and gas. The tuff of Trout Creek Mountains, exposed in the study area, has a low potential for resources of light rare-earth elements and zirconium in local accumulations of aenigmatite, a sodium-iron-titanium mineral. This same rock unit is locally attractive enough to be used as decorative building stone; therefore, this unit has low potential for decorative stone resources. Sand and gravel accumulations are present locally in the study area, but material of similar quality is available elsewhere, closer to potential markets.

Mining Activity: Two mining claims are held in the south central part of the wilderness study area. As of October 1987, no geothermal, oil and gas, or other mineral leases were held. Four prospect pits are near the confluence of Whitehorse and Minehole Creeks. No other evidence of mining activity is known.

Mineral setting/ Geology: The study area is comprised of four contiguous wilderness study areas in the northern part of the Basin and Range physiographic province, and additionally, is in a region where Tertiary volcanic calderas are numerous, and are the sources for most of the underlying rocks. The oldest rocks, and the only ones unrelated to nearby calderas, are multiple flows of porphyritic basalt that average about 20 ft thick and may correlate with the middle Miocene Steens Basalt. Progressively overlying the basalt is a zoned ash-flow tuff and a flow sequence of basalt, andesite, and rhyolite, interbedded with tuff and flow breccia; all the foregoing units dip northwestward 3° to 5°. Nearly 600 ft of rhyolitic ash-flow tuff overlie the flow sequence and, in the southeasternmost part of the study area, also overlie a small cluster of rhyolite domes and dikes which cut the older rocks. Most of the Tertiary units in the local stratigraphic section have been radiometrically dated at 15 to 16 Ma, hence, all are middle Miocene in age. Quaternary alluvial deposits consist of poorly sorted, locally derived material in canyons and along margins of mountains. Structure in the southern part of the study area is dominated by intersecting northern rims of Washburn and Long Ridge calderas--part of the McDermitt caldera complex--and their associated sub-parallel fault systems. Displacements along these ring-fault systems, which are typically stepped downward toward the caldera center, are generally less than 1,000 ft, but are locally as much as 1,500 ft. Structure in the central and northern parts consists of scattered, north- to northwest-striking, high-angle, typical basin and range faults.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

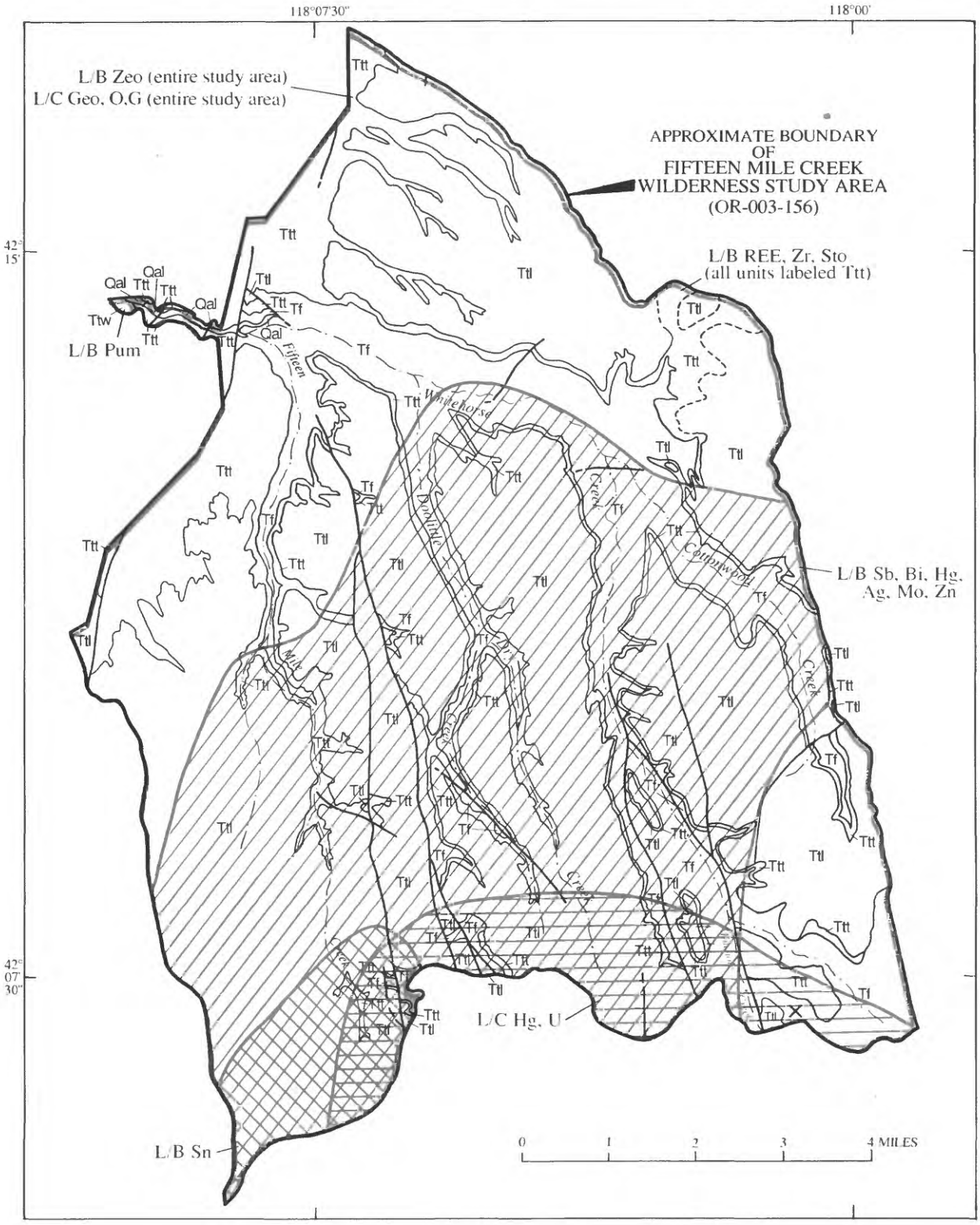
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Gray, J.J., Peterson, N.N., Clayton, J., and Baxter, G., 1983, Geology and mineral resources of the 18 wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-2, 106 p.

Jones, J.L., Erickson, M.S., and Fey, D.L., 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Fifteen Mile Creek, Twelve Mile Creek, Oregon Canyon, and Willow Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0696, 48 p.

Leszcykowski, A.M., 1987, Mineral resources of the Fifteen Mile Creek Wilderness Study Area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 41-87, 10 p.

Peterson, J.A., Rytuba, J.J., Plouff, Donald, Vercoutere, T.L., Turner, R.L., Sawatzky, D.L., Leszcykowski, A.M., Peters, T.J., Schmauch, S.W., and Winters, R.A., 1988, Mineral resources of the Fifteen Mile Creek, Oregon Canyon, Twelve Mile Creek, and Willow Creek Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1742-B, 24 p.



Mineral resources of the Fifteen Mile Creek Wilderness Study Area.

EXPLANATION

Geologic terrane having low mineral resource potential (L) for Sb, Bi, Hg, Ag, Mo, and Zn in epithermal vein deposits

Geologic terrane having low mineral resource potential (L) for Sn

Geologic terrane having low mineral resource potential (L) for Hg, and U in caldera-related deposits

Geologic terrane having low mineral resource potential (L) for Zeo, Geo, Pum, and O,G

Geologic terrane having low mineral resource potential (L) for REE, Zr, and Sto

Levels of certainty of assessment

B	Data only suggest level of potential
C	Data give good indication of level of potential

Commodities

Ag	Silver	Sb	Antimony
Bi	Bismuth	Sn	Tin
Geo	Geothermal	Sto	Decorative building stone
Hg	Mercury	U	Uranium
Mo	Molybdenum	Zeo	Zeolite minerals
O,G	Oil and gas	Zn	Zinc
Pum	Pumice	Zr	Zirconium
REE	Rare-earth elements		

Description of map units

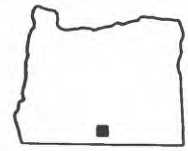
Qal	Alluvium (Quaternary)
Ttw	Tuff of Whitehorse Creek (Tertiary)
Ttl	Tuff of Long Ridge (Tertiary)
Ttt	Tuff of Trout Creek Mountains (Tertiary)
Tf	Basaltic andesite, andesite, and rhyolite flows (Tertiary)

——— Contact—Dashed where approximately located
——— Fault—Dashed where approximately located

× Prospects

Explanation, mineral resources of the Fifteen Mile Creek Wilderness Study Area.

Name: Fish Creek Rim
Area number: OR-001-117
Size (acres): 16,690



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Conrad and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The easternmost portions of the wilderness study area is within the Crump Geyser Known Geothermal Resource Area (KGRA). Several test wells have been drilled just east of the study area, but no energy resources have been identified in or near the study area (See Conrad and others, 1988, p. 6.).

Mineral resource potential (undiscovered): The only resource potential in the study area is for oil and gas, which is low over the entire area, and for geothermal energy, which is low in the eastern part.

Mining Activity: There has been no known mineral production in or near the wilderness study area. Four mineral localities are situated in or near the study area. One of them is associated with the Adel Hot Springs and another is associated with a related geothermal energy site. The third locality is an occurrence of mercury, and the last is associated with an occurrence of possible building stone. The mercury deposit or occurrence was not found during field studies nor was there any evidence of any metallic resources although several small gravel pits were found to have supplied construction material for local use (Conrad and others, 1988). No current mining claims are located within the study area (July 1990); there were no energy leases as of October 1987.

Mineral setting/ Geology: The study area exposes a stratigraphic section as much as 1,900 ft thick comprising/ascending 150 ft of andesite overlain by 750 ft of Steens Basalt, both of Miocene age; as much as 900 ft of bedded, light-colored clastic and tuffaceous rocks, which are overlain by about 100 ft of flow-basalt and basalt breccia. Quaternary surficial deposits cover less than one-fourth of the area and include fluvial, landslide, aeolian, and lacustrine deposits. Structure consists of two northwest-trending, parallel, high-angle normal faults with modest offsets, downdropped on the northeast, that traverse the northern part of the study area.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 4,150 acres that constitute the balance.

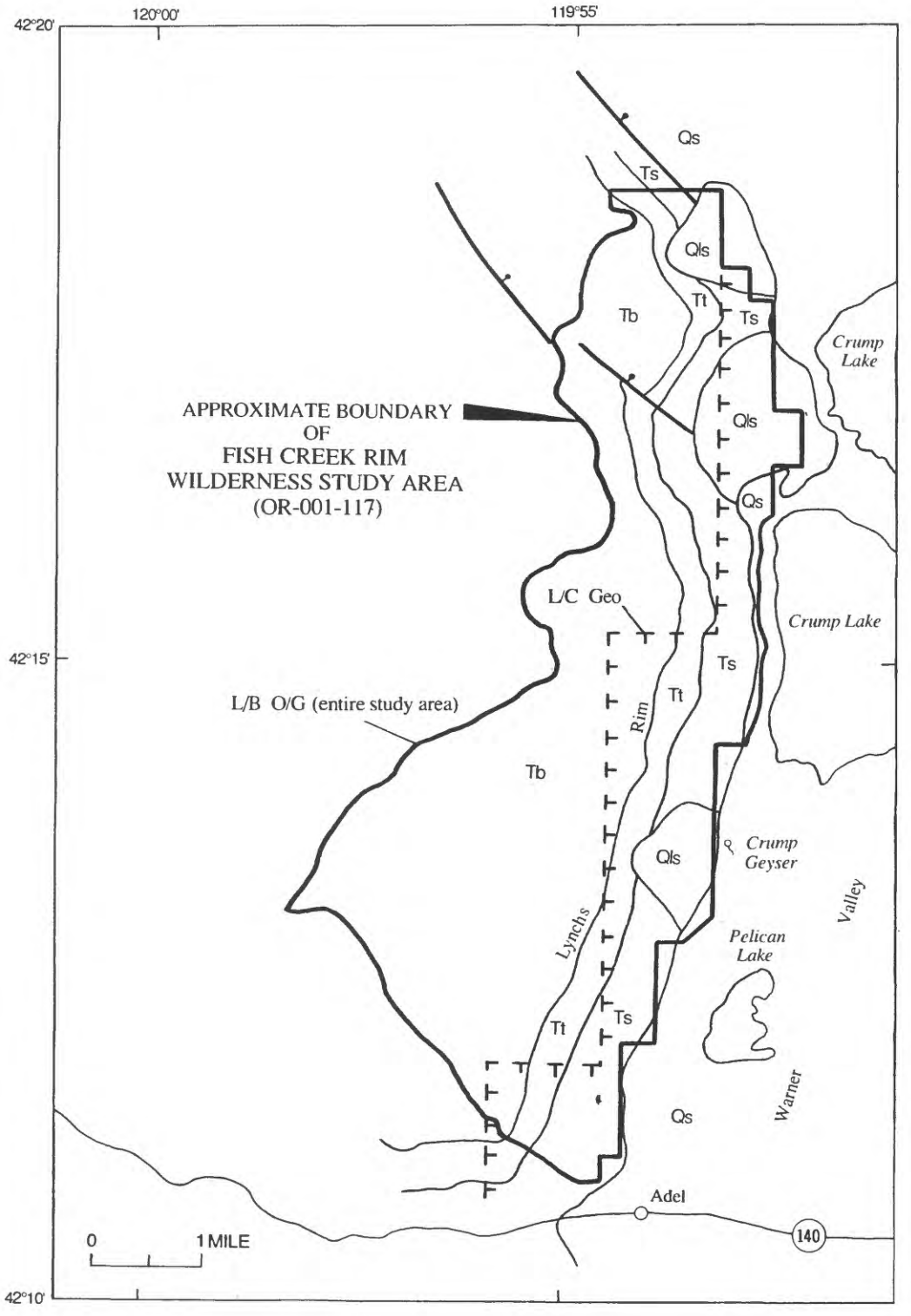
References:

Benjamin, D.A., 1987, Mineral resources of the Fish Creek Rim study area, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 60-87, 11 p.

Conrad, J.E., King, H.D., Plouff, Donald, Diggles, M.F., Sawatzky, D.L., and Benjamin, D.A., 1988, Mineral resources of the Fish Creek Rim Wilderness Study Area, Lake County, Oregon: U.S. Geological Survey Open-File Report 88-0442, 14 p.

Erickson, M.S., King, H.D., Hageman, P.L., and Tippitt, F.W., 1989, Analytical results and sample locality map for stream-sediment, heavy-mineral-concentrate, and rock sample from the Fish Creek Rim (OR-1-117) and Guano Creek (OR-1-132) Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Open-File Report 89-0360, 16 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume II: U.S. Bureau of Land Management Oregon State Office, Portland, OR, 626 p.



Mineral resources of the Fish Creek Rim Wilderness Study Area.

EXPLANATION

L — Area having low resource potential for specified commodity

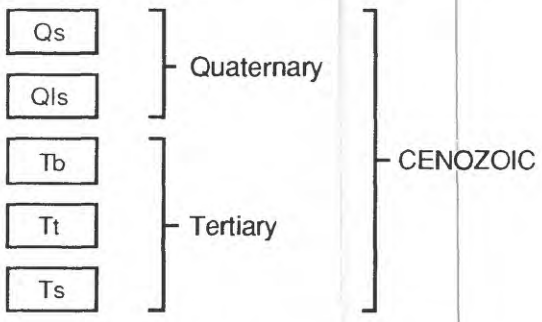
Levels of certainty of assessment

B — Data suggest level of potential
C — Data give good indication of level of potential

Commodities

Geo — Geothermal
O/G — Oil and Gas

Correlation of map units



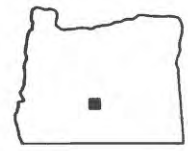
Description of map units

Qs — Surficial deposits (Holocene or Pleistocene)--Mostly stream sand and gravel, fanglomerate, and eolian and lacustrine sediments
Qls — Landslides (Holocene or Pleistocene)
Tb — Basalt (Miocene)--Black to brown, commonly aphyric, vesicular basalt flows
Tt — Tuffaceous sedimentary rocks (Miocene)--Includes air fall tuff and associated sedimentary rocks
Ts — Steens Basalt (Miocene)--Black to dark-brown, vesicular to nonvesicular flows containing phenocrysts of plagioclase--Includes about 150 ft of older andesite

——— Contact
———•——— Normal fault--Bar and ball on downthrown side; dashed where approximately located
T T T Boundary of Crump Geyser Known Geothermal Resource Area; potential lies east of the boundary

Explanation, mineral resources of the Fish Creek Rim Wilderness Study Area.

Name: Four Craters Lava Bed
Area number: OR-001-022
Size (acres): 12,600



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Keith and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the Four Craters Lava Bed Wilderness Study Area.

Mineral resource potential (undiscovered): The potential for oil and gas and for low-temperature geothermal resources is low for study area.

Mining Activity: No known mines or prospects are located in or near the wilderness study area. No current mining claims (July 1990) or energy leases (October 1987) exist within the study area.

Mineral setting/ Geology: Pliocene, Pleistocene, and Holocene basaltic lavas, including lesser andesite, dacite, and rhyolite, associated with the older basalt, underlie the study areas and aggregate more than 1,200 ft in thickness. Dacite and rhyolite locally form domes as well as flows. Structure consists of a few northwest-trending high-angle normal faults and associated tension fractures.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 2,860 acres that constitute the balance.

References:

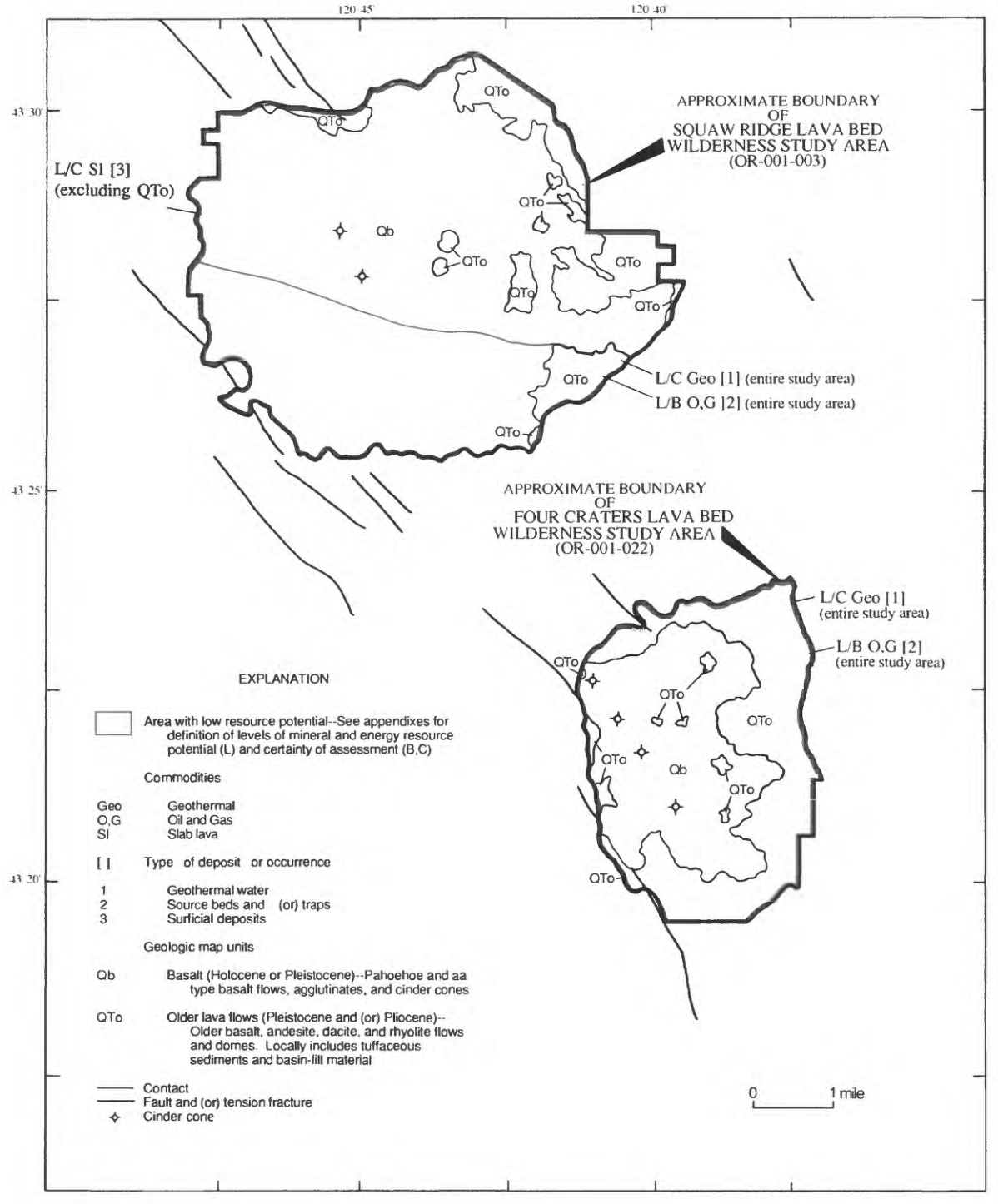
Engineers International, Inc., 1980, Geological investigation and mineral inventory of Devil's Garden, Four Craters, and Squaw Ridge in Lake County, Oregon: Report prepared for the U.S. Bureau of Land Management, contract OR-910-CT9-16, 135 p.

Erickson, M.S., Hopkins, R.T., Fey, D.L., and King, H.D., 1989, Analytical results and sample locality map of rock samples from the Devil's Garden Lava Bed (OR-001-002), Squaw Ridge Lava Bed (OR-001-003), and Four Craters Lava Bed (OR-001-022) Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Open-File Report 89-0307, 10 p.

Johnson, F.L., 1987, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed study areas, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 37-87, 10 p.

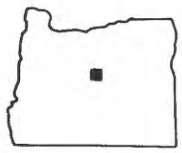
Keith, W.J., King, H.D., Gettings, M.E., and Johnson, F.L., 1988, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Bulletin 1738-A, 14 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume II: Bureau of Land Management Oregon State Office, Portland, OR, 626 p.



Mineral resources of the Four Craters Lava Bed Wilderness Study Area.

Name: Gerry Mountain
Area number: OR-005-035
Size (acres): 20,700



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for low temperature (less than 194 °F) geothermal resources and moderate potential for oil and gas resources. It also has moderate potential for bentonite resources in the northeast part of the area.

Mining Activity: According to U.S. Bureau of Land Management claim records (July 1990), there are no current mining claims inside the study area boundary. Three mining claims for bentonite/zeolites, covering about 60 acres at the northern tip of the wilderness study area, were current in October 1987. Approximately 18,720 acres within the study area were leased for oil and gas as of October 1987; there were no leases for geothermal resources. Two operations mine bentonite clay just northwest of the study area in the vicinity of Camp Creek. Central Oregon Bentonite Co. and Oregon Sun Ranch Inc. have been mining the clay since the mid 1980's. The clay has been used for drilling mud, pond sealant, and pet waste absorbant.

Mineral setting/ Geology: The western part of the study area is underlain by andesite and the eastern part is largely ash-flow tuff. A section in the northwest includes tuffaceous sedimentary rocks of the John Day Formation. The southern margin of the Cretaceous-to-early-Tertiary-age Columbia River Basin includes this area and provides the basis for the petroleum resource classification (J.A. Ach, written commun., 1988).

Recommendations: The close proximity of bentonite mining operations to the study area suggests that mineral resources may exist. The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

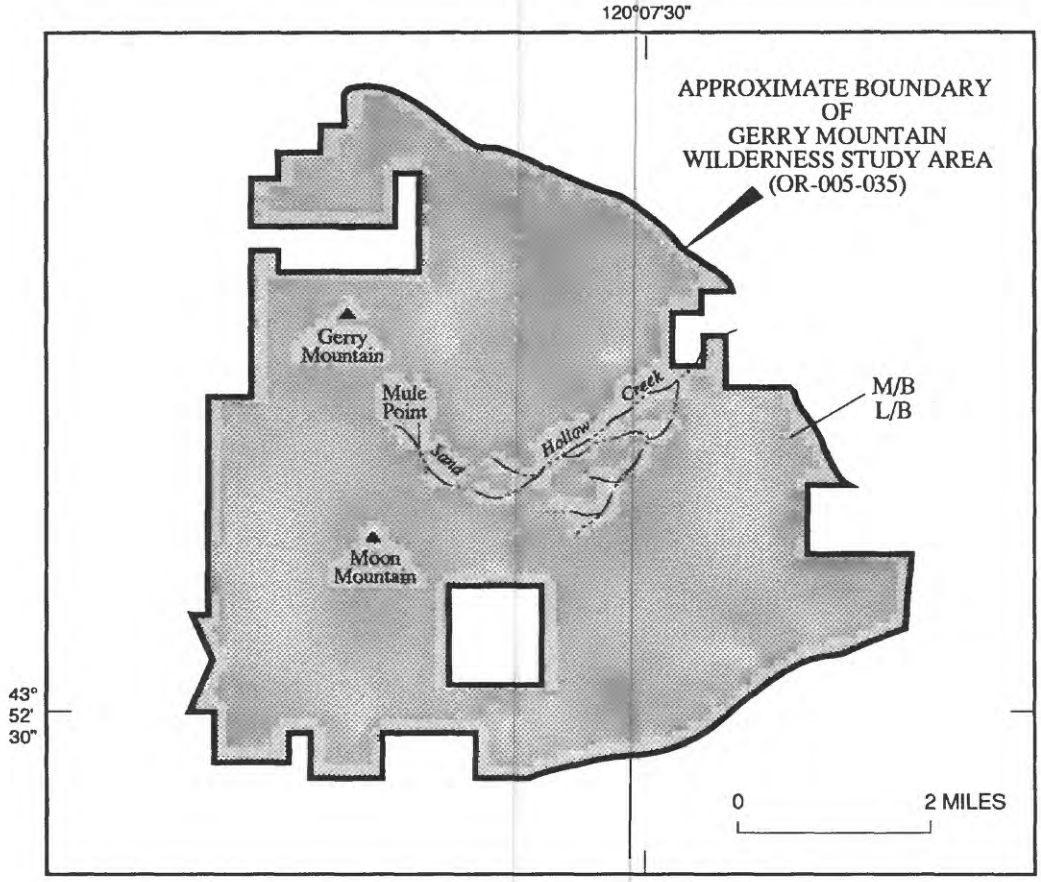
Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Mathews, G.W., Blackburn, W.H., and Chapell, D.L., 1983, Assessment of geology, energy, and minerals (GEM) resources, Gerry Mountain GRA (OR-050-014), Crook and Deschutes Counties, Oregon: Lakewood CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-533-CT2-1042, 25 p.

Muffler, L.J.P., 1979, Assessment of geothermal resources of the United States--1978: U.S. Geological Survey Circular 790, 163 p., 3 maps, scales 1:2,500,000, 1:5,000,000, 1:1,000,000.

Rice, W.L., 1987, The mining industry of Oregon: U.S. Bureau of Mines Minerals Yearbook, 9 p.

Walker, G.W., and McHugh, E.L., 1980, Mineral resources and mineral resource potential study of the Lost Forest Instant Wilderness Study Area, Oregon: U.S. Geological Survey Open-File Report 80-846, 19 p.



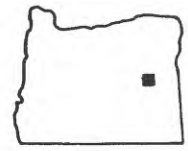
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for oil and gas and (or) bentonite with certainty level B

L/B, Geologic terrane having low mineral resource potential for geothermal energy with certainty level B

Mineral resources of the Gerry Mountain Wilderness Study Area.

Name: Gold Creek
Area number: OR-003-033
Size (acres): 13,600



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Evans and others, 1990).

Identified mineral resources (known): At least 40,000 tons of marginally economic inferred resources of building and decorative stone (basalt) and 100,000 tons of marginally economic inferred diatomite resources are identified within the wilderness study area. At least 2,000,000 tons of marginally economic inferred diatomite resources are present just outside the study area boundary and to the east. An inferred subeconomic resource of about 900,000 yd^3 of sand and gravel is identified in terrace and stream valley deposits within the study area. Hot springs west of the mouth of Gold Creek may be suitable for domestic space heating.

Mineral resource potential (undiscovered): The geologic environment, which includes at least one large rhyolite intrusion, silicified tuff and volcanic breccias, suggests that mineralization may have occurred. By analogy with the nearby region, part of the study area has high resource potential for gold, and a very small part of that has low resource potential for geothermal energy. The northern part of the study area has moderate resource potential for gold, silver, and mercury. The entire study area has low potential for oil and gas energy resources.

Mining Activity: At least six historic mining claims and a group of 34 current claims have been located in the wilderness study area. Several small pits and trenches are on or near quartz veins in the northern part of the study area. Samples from these workings contained as much as 1,960 ppb gold. Crushed stone has been mined along the north side of the study-area addition. According to Bureau of Land Management claim records (July 1990), Manville Corp. has 35 active claims within the study area in the vicinity of the diatomite deposits. As of October 1987, there were no leases for energy resources.

Mineral setting/ Geology: The contiguous Gold Creek and Sperry Creek Wilderness Study Areas are underlain by 3,000 ft of Miocene to Pliocene basalt, welded tuff, rhyolite, and volcaniclastic rocks.

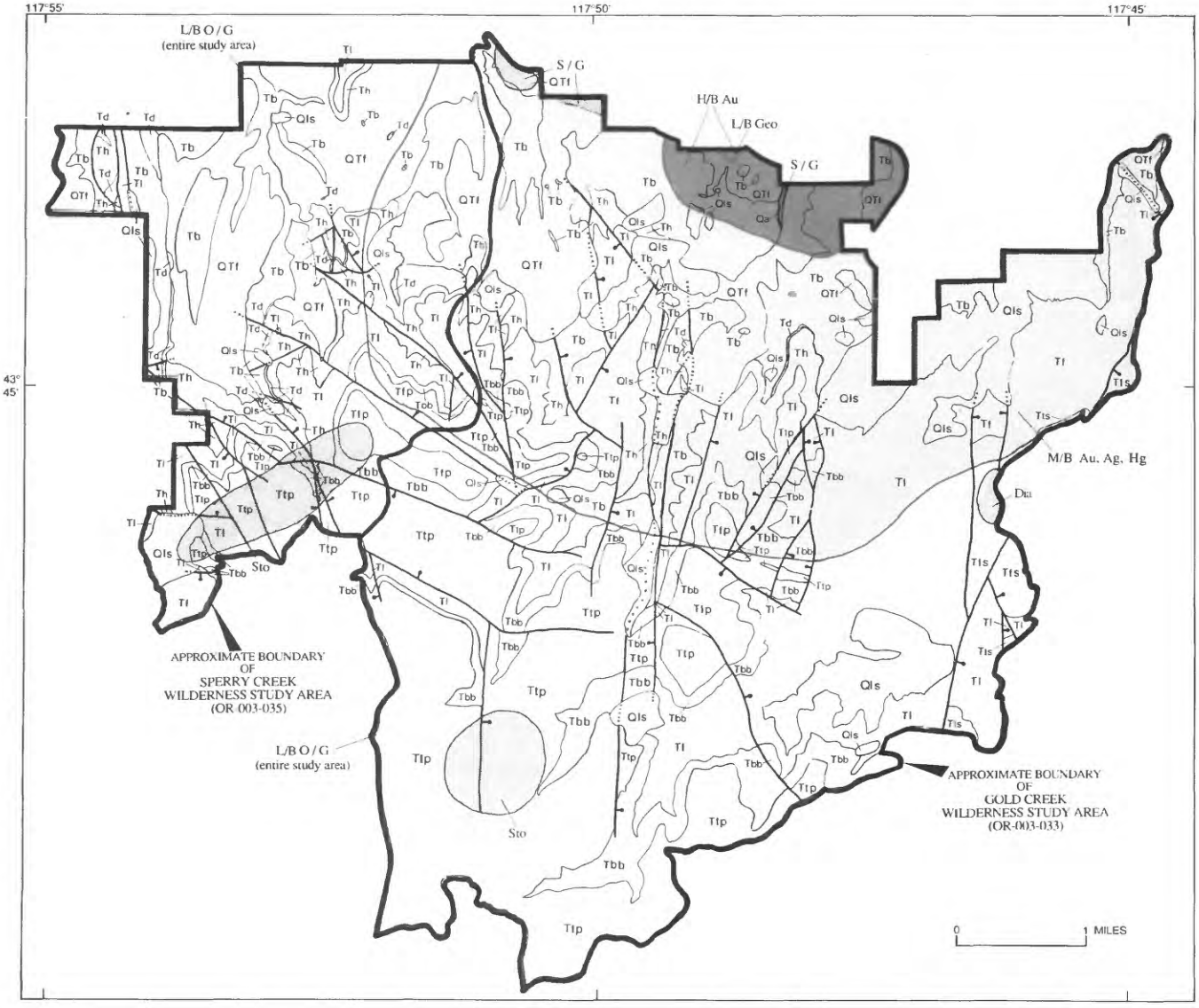
Recommendations: Additional mapping, sampling, and possibly drilling are recommended to further assess the gold occurrences near the mouth of Gold Creek and in the Simmons Gulch area. Drilling, sampling, and beneficiation and cost studies are recommended to evaluate the diatomite deposits. Testing of the hot springs vicinity is recommended to determine geothermal reservoir characteristics.

References:

Evans, J.G., Frisken, J.G., Griscom, Andrew, Sawatzky, D.L., and Miller, M.S., 1990, Mineral resources of the Gold Creek and Sperry Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-E.

Miller, M.S., 1989, Mineral resources of the Sperry Creek Wilderness Study Area and Gold Creek Wilderness Study Area and addition, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 22-89, 71 p.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.



Mineral resources of the Gold Creek Wilderness Study Area.

EXPLANATION

Area having high mineral resource potential (H)

Area having moderate mineral resource potential (M)

Area having low mineral resource potential (L)

Level of certainty of assessment

B Data only suggest level of potential

Area having identified mineral resources for commodities as labeled

Commodities

Au	Gold
Ag	Silver
Dia	Diatomite
Geo	Geothermal resources
Hg	Mercury
O / G	Oil and gas
Sto	Building and decorative stone
S / G	Sand and Gravel

Geologic map units

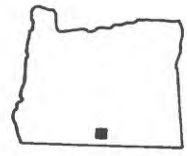
Qa	Alluvium (Quaternary)
Qls	Landslide deposits (Quaternary)
QTf	Fanglomerate (Quaternary and Pliocene)
Tts	Tuff and tuffaceous siltstone (Pliocene or Miocene)
Ttp	Tims Peak Basalt of Kittleman and others (1965) (Miocene)
Tbb	Pillow-basalt breccia (Miocene)
Tl	Littlefield Rhyolite of Kittleman and others (1965) (Miocene)
Th	Hunter Creek Basalt of Kittleman and others (1965) (Miocene)
Td	Dinner Creek Welded Ash-Flow Tuff of Kittleman and others (1965) (Miocene)
Tb	Basaltic complex (Miocene or older)—Equivalent to unnamed igneous complex of Kittleman and others (1965)

Contact

Fault—Dotted where concealed. Bar and ball on downthrown side

Explanation, mineral resources of the Gold Creek Wilderness Study Area.

Name: Guano Creek
Area number: OR-001-132
Size (acres): 10,350



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Diggles and others, 1988).

Identified mineral resources (known): No mineral resources have been identified within the wilderness study area.

Mineral resource potential (undiscovered): Areas of the Guano Creek Wilderness Study Area that are underlain by tuff and tuffaceous sediments have low mineral resource potential for zeolites. The entire study area has low oil and gas resource potential. The wilderness study area has no geothermal energy or energy mineral resource potential.

Mining Activity: There has been no known mineral production in or near the wilderness study area, nor are there any mining claims in or near it (July 1990). There are no known mineral localities in or near the area. As of October 1987, no energy leases existed within the study area.

Mineral setting/ Geology: The bedrock geology of the area consists of a lower unit of basalt, a middle unit of ash-flow and air-fall rhyolitic tuff and tuffaceous sedimentary rocks, and an upper unit of basalt. The surficial geology of the study area consists of Quaternary alluvium and colluvium in the valley floor and lacustrine deposits in Billy Burr Lake and a lake 1 mi to the southeast. Landslide scarps are conspicuous along the eastern slopes of the area. The structural geology of the study area mostly consists of high-angle normal faults that have cut the range into blocks. The Brothers fault zone extends across the study area. The middle tuff unit is less competent than the overlying basalt cap and therefore tends to erode when exposed in steep fault scarps. This results in landslides and basalt-cobble talus slopes.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

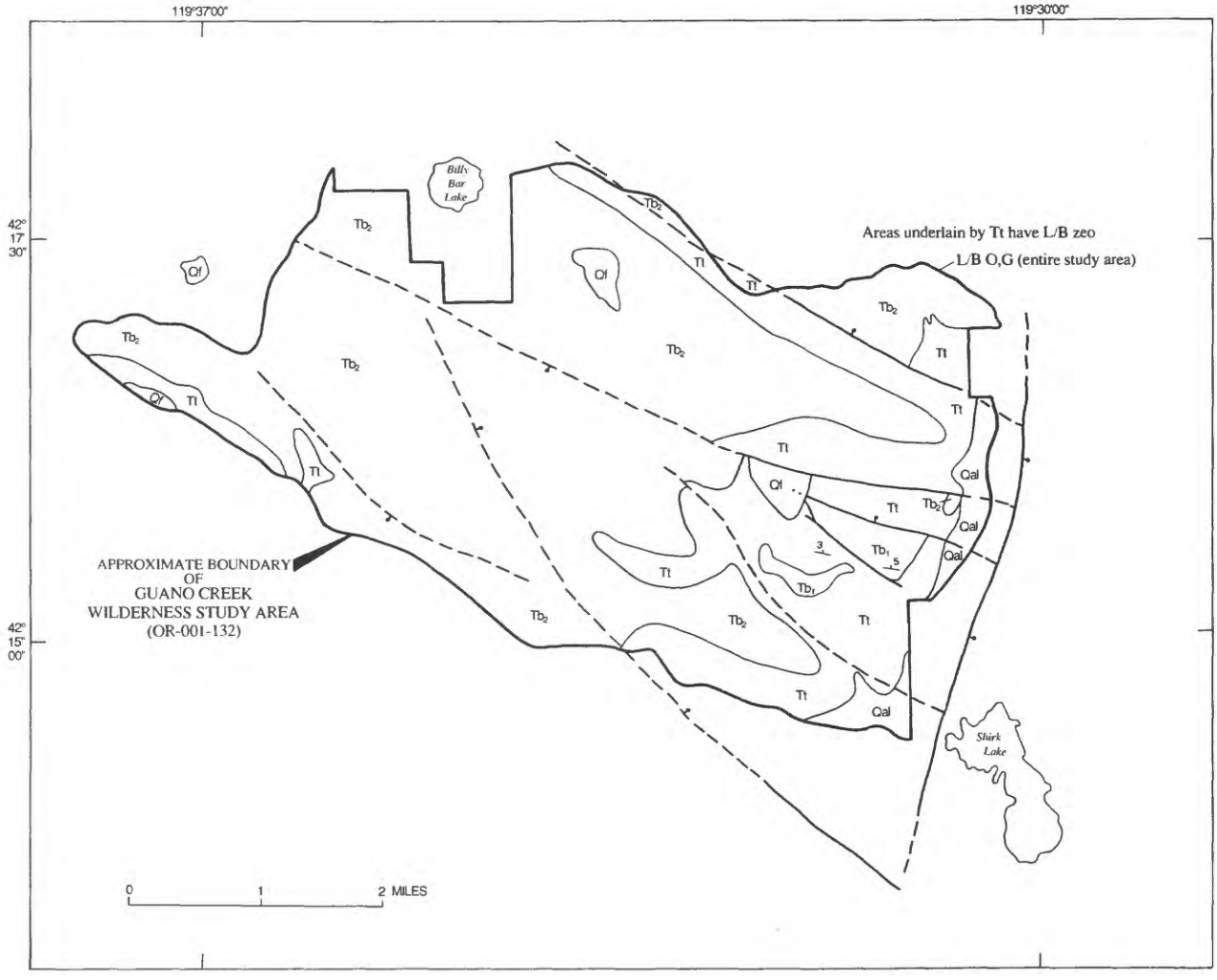
Benjamin, D.A., 1987, Mineral resources of the Guano Creek study area, Lake County, Oregon: U.S. Bureau of Mines Mineral Land Assessment 63-87, 12 p.

Diggles, M.F., King, H.D., Plouff, Donald, Conrad, J.E., Sawatzky, D.L., and Benjamin, D.A., 1988, Mineral resources of the Guano Creek Wilderness Study Area, Lake County, Oregon: U.S. Geological Survey Open-File Report 88-0297, 12 p.

Erickson, M.S., King, H.D., Hageman, P.L., and Tippitt, F.W., 1989, Analytical results and sample locality map for stream-sediment, heavy-mineral-concentrate, and rock sample from the Fish Creek Rim (OR-1-117) and Guano Creek (OR-1-132) Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Open-File Report 89-0360, 16 p.

Mathews, G.W., Blackburn, W.H., 1983, Assessment of geology, energy, and mineral (GEM) resources, Guano Valley GRA (OR-010-024), Lake and Harney Counties, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 22 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume II: Bureau of Land Management Oregon State Office, Portland, OR, 626 p.



Mineral resources of the Guano Creek Wilderness Study Area.

EXPLANATION

Area having low mineral resource (L) potential

Levels of certainty of assessment

B — Data suggest level of potential

Commodities

O-G — Oil and gas
Zeo — Zeolites

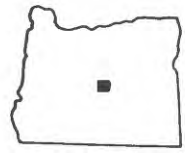
Geologic map units

Qal — Alluvium (Quaternary)—Unconsolidated silt, sand, gravel deposited by fluvial processes; also includes colluvial, aeolian, and landslide deposits
Qt — Talus (Quaternary)
Qf — Fluvial deposits (Quaternary)
Tb_2 — Upper basalt (Tertiary)—Olivine basalt flows consisting of plagioclase-phyric medium-grained vesicular rocks that contain phenocrysts of olivine (less than 1 mm), commonly altered to iddingsite or with iddingsite rims. Potassium-argon age is 7.7±1.2 Ma
Tt — Tuff and tuffaceous sediments (Tertiary)—Consists of interbedded buff-colored pumice lapilli tuff, gray lapilli tuff, crystal lithic ash-flow and water-lain tuff, and tuffaceous sediments
Tb_1 — Lower basalt (Tertiary)—Olivine basalt flows similar to Upper basalt. Potassium-argon age is 12.0±0.4 Ma

Contact
Fault—Dashed where inferred, dotted where concealed; ball and bar on downthrown side
Dip and strike of flows and beds

Explanation, mineral resources of the Guano Creek Wilderness Study Area.

Name: Hampton Butte
Area number: OR-005-042
Size (acres): 10,600



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for geothermal resources and moderate potential for oil and gas resources. There is low potential for mercury since mercury is being mined in a geologically similar area near the southern edge. There is low potential for silver and molybdenum based on geochemical anomalies (Bukofski and others, 1984).

Mining Activity: No known mines or prospects are located in the wilderness study area. According to U.S. Bureau of Land Management claim records (July 1990), 16 claims are located in or near the southeastern corner of the study area. The claims are both placer and lode, but the mineral commodity sought is not known. No energy leases (October 1987) exist within the wilderness study area.

Mineral setting/ Geology: Area is underlain largely by tuffaceous sedimentary rocks with exposures of ash-flow tuff in the northeast and southwest. The southern margin of the Cretaceous-to-early-Tertiary-age Columbia River Basin includes this area and provides the basis for the petroleum resource classification (J.A. Ach, written commun., 1988).

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Detailed mapping and geochemistry in this area could identify altered areas, follow up on two anomalies (silver and molybdenum; Bukofski and others, 1984), and also delineate any mercury anomalies. The anomalies lie near the east and west sides of the study area.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

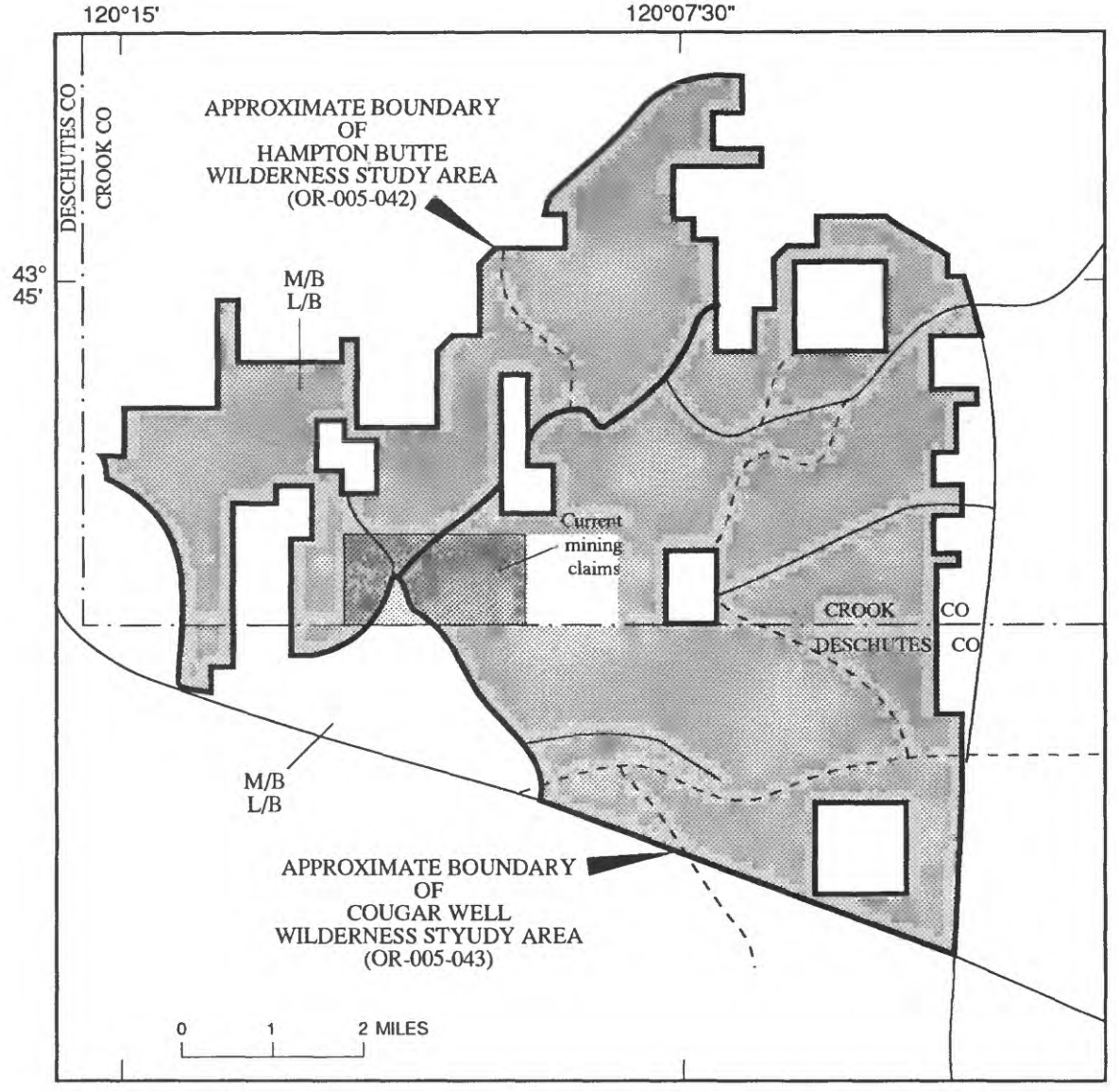
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Mathews, G.W., Blackburn, W.H., and Chapell, D.L., 1983, Assessment of geology, energy, and minerals (GEM) resources, Gerry Mountain GRA (OR-050-014), Crook and Deschutes Counties, Oregon: Lakewood CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 25 p.

Muffler, L.J.P., 1979, Assessment of geothermal resources of the United States--1978: U.S. Geological Survey Circular 790, 163 p., 3 maps, scales 1:2,500,000, 1:5,000,000, 1:1,000,000.

Walker, G.W., and McHugh, E.L., 1980, Mineral resources and mineral resource potential study of the Lost Forest Instant Wilderness Study Area, Oregon: U.S. Geological Survey Open-File Report 80-846, 19 p.



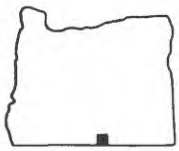
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for oil and gas with certainty level B

L/B, Geologic terrane having low mineral resource potential for geothermal energy, mercury, silver, and molybdenum with certainty level B

Mineral resources of the Hampton Butte Wilderness Study Area.

Name: Hawk Mountain
Area number: OR-001-146A
Size (acres): 69,640



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Turrin and others, 1989).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): In this region, altered rocks may host deposits of mercury, silver, and gold, and industrial minerals (clay and zeolite). In addition, the geologic setting of the study area is favorable for rhyolite-hosted tin deposits. No evidence of mercury, silver, or tin mineralization or of clay and zeolites was found in the study area. However, geochemical data indicate that the western half of the study area has low resource potential for gold in epithermal deposits. Low potential for uranium in localized, small-volume deposits is associated with the tuffaceous sedimentary rock exposed in the south-central and eastern parts of the study area. Secondary uranium minerals (carnotite and schroeckingerite?) are reportedly associated with opalized zones in tuffaceous lacustrine sedimentary rock exposed south of the study area. The entire study area has low potential for geothermal resources and low potential for oil and gas resources.

Mining Activity: Mineral surveys revealed no evidence of mining activity within the wilderness study area. According to Bureau of Land Management claim records (July 1990) there are no current mining claims inside the study area boundaries. As of October 1987, no energy leases existed inside the study area.

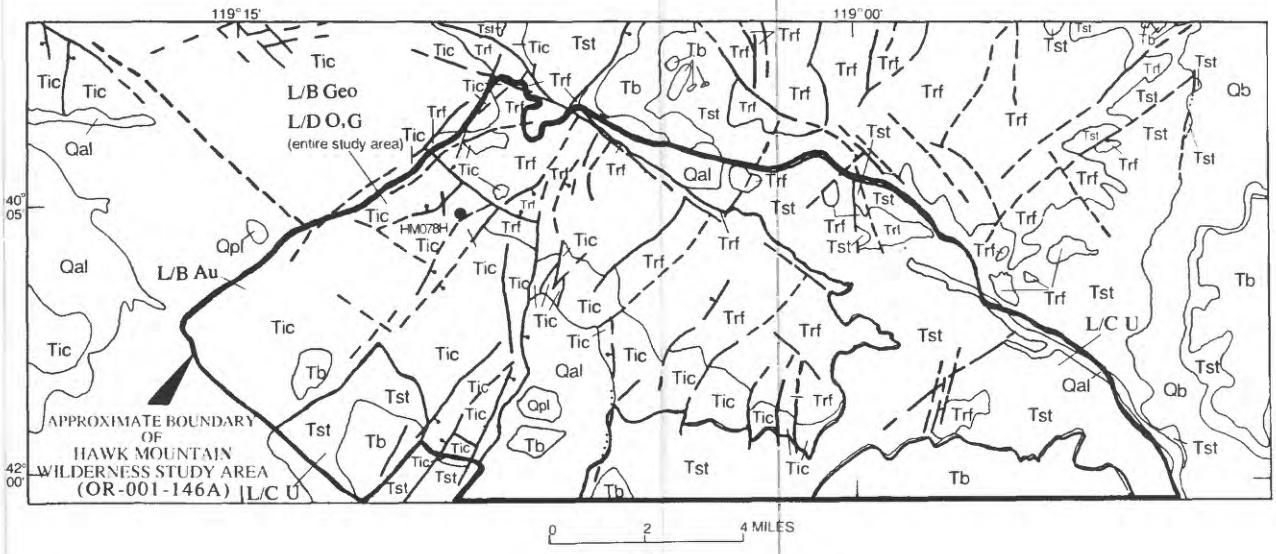
Mineral setting/ Geology: The Hawk Mountain Wilderness Study Area is underlain by a sequence of late Tertiary volcanic flows, volcaniclastic, and continental sedimentary rocks and Quaternary alluvium and playa deposits. Although the basal contact of the Tertiary section is not exposed, local relief indicates that the volcanic section is more than 1,500 ft thick. Major fault trends within the study area, northwest and northeast, are typical of this part of the Basin and Range province.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Mayerle, R.T., and Rains, R.L., 1988, Mineral resources of the Hawk Mountain Wilderness Study Area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 21-88, 16 p.

Turrin, B.D., Conrad, J.E., Plouff, Donald, King, H.D., Swischer, C.C., III, Mayerle, R.T., and Rains, R.L., 1989, Mineral resources of the Hawk Mountain Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-F, 16 p.



EXPLANATION

Area having low mineral resource potential (L)

Levels of certainty of assessment

- B — Data only suggest level of assessment
- C — Data give good indication of assessment
- D — Data clearly define level of assessment

Commodities

- Au — Gold
- Geo — Geothermal
- O,G — Oil and Gas
- U — Uranium

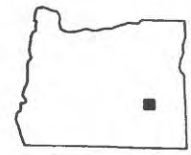
• HM078H — Sample locality—See text for discussion

Geologic map units

- Qal — Alluvium (Quaternary)
- Qpl — Playa deposits (Quaternary)
- Qb — Basalt of Railroad Point of Greene (1984) (Quaternary)—Olivine basalt
- Tb — Basalt of Catnip Creek of Greene (1984) (Tertiary)—Discontinuous outcrops unconformably overlying and interbedded with tuffaceous sedimentary rock of Tst
- Tst — Tuffaceous sedimentary rock (Tertiary)—Consists of Virgin Valley and Thousand Creek Formations of Merriam (1910, 1911), undivided
- Trf — Canon Rhyolite of Merriam (1910) (Tertiary)—Rhyolite flows, domes, and pyroclastic deposits
- Tic — Idaho Canyon Tuff of Noble and others (1970) (Tertiary)—Densely welded, devitrified ash-flow tuff
- —— Contact
- —— Normal fault—Dashed where approximate; dotted where concealed. Bar and ball on downthrown side

Mineral resources of the Hawk Mountain Wilderness Study Area.

Name: Heath Lake
Area number: OR-002-072F
Size (acres): 20,520



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas resources. The diatomite would be present most likely as impure, low-tonnage deposits. The geothermal energy would be present along range-bounding faults.

Mining Activity: No known mines or prospects are located in the wilderness study area. No current mining claims (July 1990) or energy leases (October 1987) are present within the study area.

Mineral setting/ Geology: The contiguous Heath Lake and West Peak Wilderness Study Areas enclose several fault blocks of 17-14 million-year-old basalt lava flows, with intervening graben (basins) that contain shallow fill of upper Miocene to Quaternary sedimentary rocks. Some basins are sufficiently large to possess mineral resource potential for diatomite and zeolite, although the deposits would likely be relatively impure and of low tonnage. Otherwise, the mineral and energy resource potential, summarized above, follows the same reasoning explained for Stonehouse Wilderness Study Area.

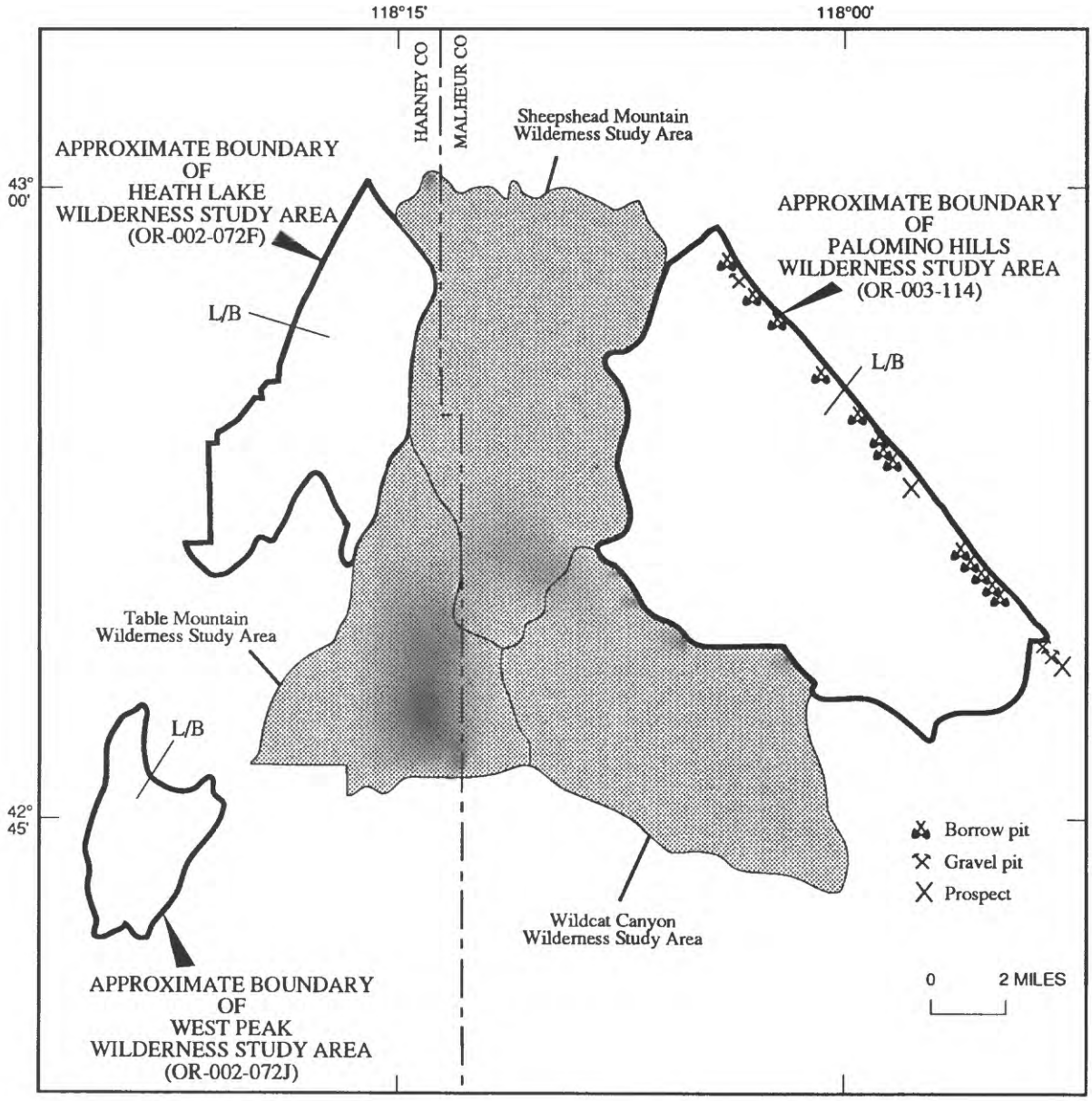
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. A mineral survey should evaluate an anomaly (arsenic, copper, molybdenum, and lead) described by Bukofski and others (1984). This anomalous area lies in the vicinity of Ten Cent Lake on west side of the study area. Exposures of basin-filling sediment are limited, and interested parties would have to drill shallow holes to delineate the occurrence of diatomite or zeolite. Geophysical surveys, mainly seismic and gravity, might aid in predicting the thickness of sedimentary deposits.

References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Mathews, G.W., Blackburn, W.H., and Chapell, D.L., 1983, Assessment of geology, energy, and minerals (GEM) resources, Sheepshead Mountain GRA (OR-023-018), Harney and Malheur Counties, Oregon: Lakewood CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 22 p.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

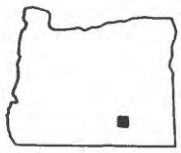


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas with certainty level B

Mineral resources of the Heath Lake Wilderness Study Area.

Name: High Steens
Area number: OR-002-085F
Size (acres): 69,740



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Minor and others, 1987).

Identified mineral resources (known): A Perlite deposit in the southeastern part of the area contains an estimated 400,000 tons of inferred marginal resources. The Alvord Known Geothermal Resource Area is along and partly within the east boundary of the wilderness study area.

Mineral resource potential (undiscovered): The suitable part of the study area has a local zone along the southeastern border with high resource potential for deposits containing mercury and uranium, and an irregular zone along part of the eastern border with moderate and low potential for those metals and for gold, and with low potential for deposits of zeolite and perlite. A zone along the entire east margin is considered to have low potential for geothermal energy. The entire suitable area is assigned low potential for resources of oil and gas.

The lower part of the range-front escarpment in the non-suitable study area contains hydrothermally altered and mineralized rocks and mercury and uranium prospects and mines, has high to low resource potential for mercury, uranium, and geothermal energy, moderate to low potential for gold resources, and low resource potential for zeolite minerals (used mainly in industrial applications) and perlite (volcanic glass used mainly for construction purposes). The other parts of the non-suitable study area are underlain by a thick sequence of basalt flows, and there is a remote chance that the basalts conceal hydrocarbon-source or -reservoir rocks; these parts of the study area have low resource potential for oil and gas.

Mining Activity: Since 1891, 450 lode and 50 placer mining claims have been staked inside the wilderness study area; 52 claims were current during mineral surveys in 1985. Twenty-seven mines and prospects are located within the study area. Prospecting was for gold, mercury, and uranium. About 55 flasks of mercury were produced from two mines in the southeast part of the study area. Several companies were exploring for precious metals in the same area during late 1970's. As of October 1987, three geothermal leases had been issued in the study area; 19 oil and gas lease covered 60,973 acres.

Mineral setting/ Geology: Besides an irregular but generally shallow Quaternary cover of alluvial and glacial deposits, rocks of the study area comprise four Oligocene(?) and Miocene formations: Alvord Creek Formation, interstratified tuff and tuffaceous to volcaniclastic rocks; Pike Creek Formation, more than 2,000 ft of rhyolite and dacite domes and flows and minor associated tuff and tuffaceous sedimentary rocks, commonly silicified or argillized; Steens Mountain Volcanics, 3,000 ft of interstratified andesitic flows, flow breccia, and pyroclastic rocks; Steens Basalt, 4,300 feet of multiple, thin(~20 ft thick) basalt flows that host many steeply dipping, northeast-striking dikes that penetrate both the flows and the underlying rocks. The rocks are exposed in the uplifted and gently westward-tilted Steens Mountain fault block, defined on the east by an irregular north-trending fault-controlled escarpment where a throw of more than 10,000 ft can be demonstrated. Subsidiary north-northeast- and north-northwest-trending normal faults with modest offsets locally traverse the study area. A conspicuous oblique structure is a northwest-trending monocline that traverses the area along the southwestern study area boundary.

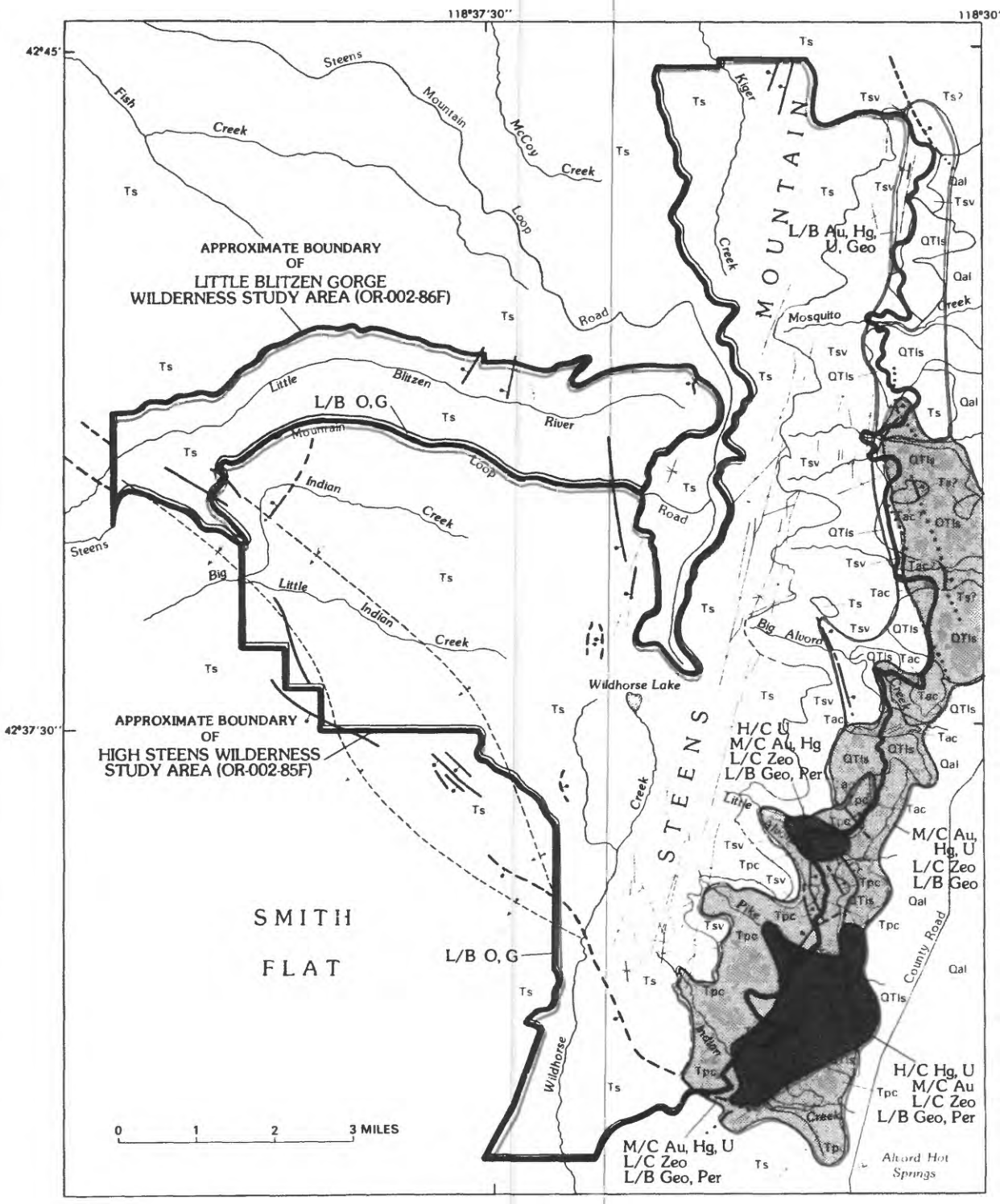
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 28,210 acres that constitute the balance.

References:

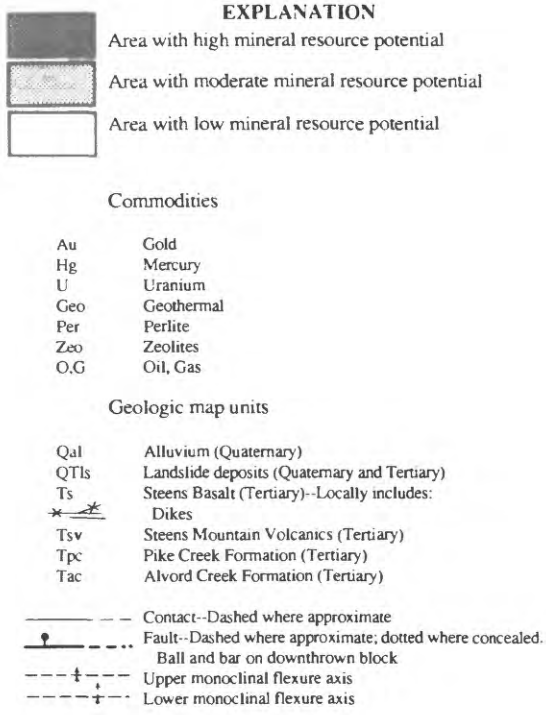
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale Districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-531-CT3-440045, 94 p.

Minor, S.A., Plouff, Donald, Esparza, L.E., and Peters, T.J., 1987, Mineral resources of the High Steens and Little Blitzen Gorge Wilderness Study Areas, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-A, 21 p.

Minor, S.A., Rytuba, J.J., Grubensky, M.J., Vander Meulen, D.B., Goeldner, C.A., and Tegtmeyer, K.J., 1987, Geologic map of the High Steens and Little Blitzen Gorge Wilderness Study Areas, Harney County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1876, scale 1:24,000.

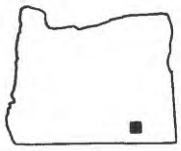


Mineral resources of the High Steens Wilderness Study Area.



Explanation, mineral resources of the High Steens Wilderness Study Area.

Name: Home Creek
Area number: OR-002-085H
Size (acres): 26,540



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Sources of road aggregate are reportedly abundant in the study area.

Mineral resource potential (undiscovered): One small area of ash-flow tuff is considered to have low potential for deposits of silver, based on anomalous silver concentrations in a heavy mineral concentrate downslope from exposures of the tuff. Lacustrine bar deposits along the western border of the study area are considered to have moderate potential for deposits of sand and gravel. The entire study area is considered to have low potential for the occurrence of geothermal energy resources. The study area is considered to have no potential for occurrence of oil and gas.

Mining Activity: No mines, prospects, mining claims, or energy leases are known within the wilderness study area.

Mineral setting/ Geology: More than ninety percent of the study area is occupied by the middle Miocene Steens Basalt, a unit composed of multiple lava flows, each 20 to 30 ft thick, that here total at least 1,900 ft in thickness. It is unconformably and patchily overlain by what is probably the Devine Canyon Ash-flow Tuff, a 9 million-year-old, 50-ft-thick volcanic sheet interpreted to have erupted from a caldera 50 miles to the north. Local surficial cover includes lacustrine shoreline deposits of sand and gravel along the western margin of the study area, and local sand dunes. Structure consists of a westward tilt of 2° to 6°, of the Steens Mountain block, and a group of north to northwestward-trending high-angle normal faults along and near the western border of the study area.

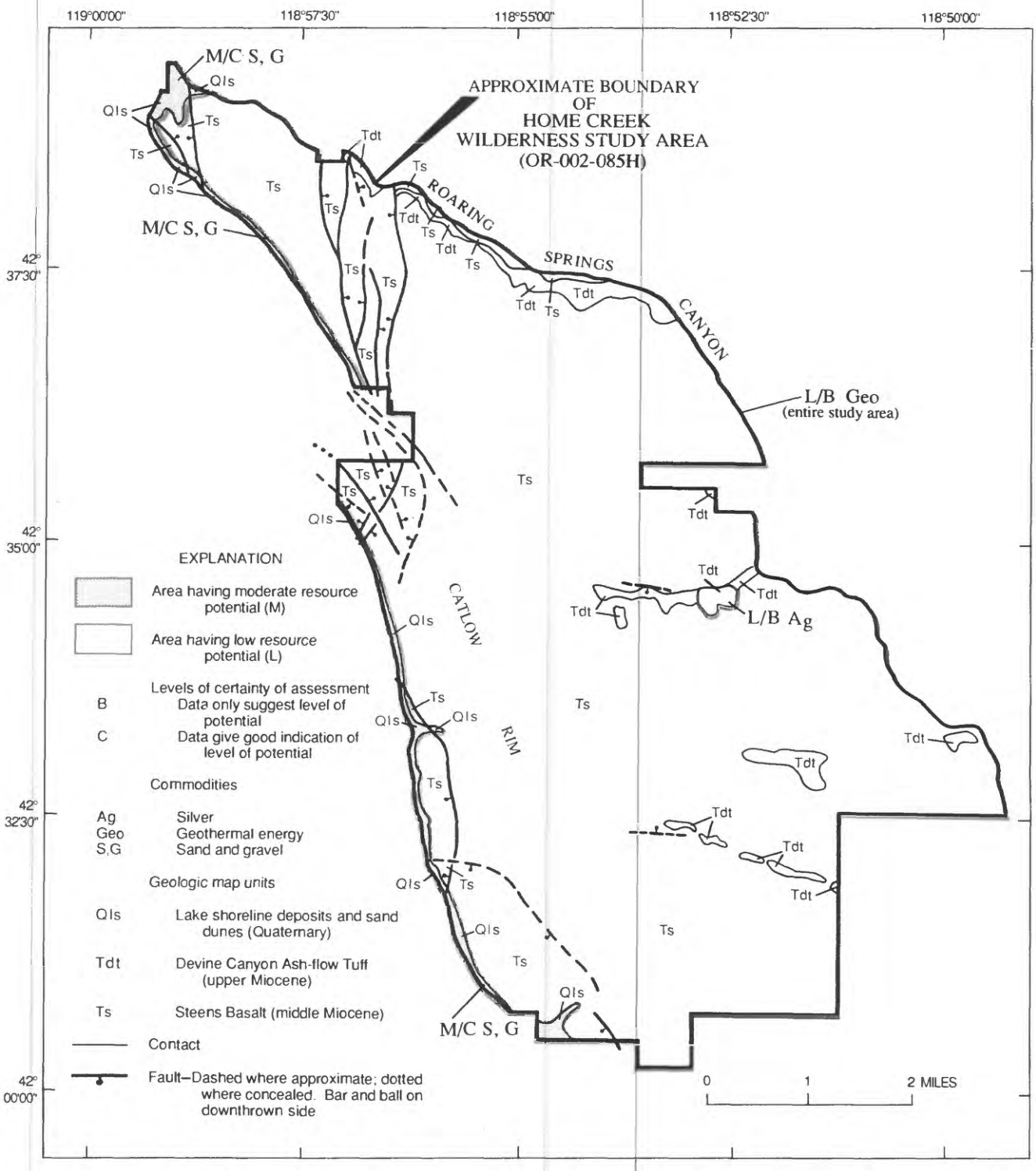
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 3,105 acres that constitute the balance.

References:

Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources - Catlow Rim GRA (OR-020-020), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management contract YA-553-CT2-1042, 32 p.

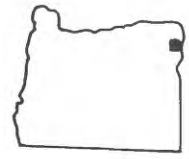
Moyle, P.R., 1987, Mineral resources of the Home Creek study area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 58-87, 13 p.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., Vercoutere, T.L., and Moyle, P.R., 1988, Mineral resources of the Home Creek Wilderness Study Area Harney County, Oregon: U.S. Geological Survey Bulletin 1740-C, 12 p.



Mineral resources of the Home Creek Wilderness Study Area.

Name: Homestead
Area number: OR-006-002
Size (acres): 6,921 (BLM land), 7,654 (USFS land); total 14,575



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Reported resources remaining at the Iron Dyke mine, outside the study area, totalled 1,786,000 tons that contain 0.116 oz/ton gold, 0.69 oz/ton silver, and 1.51 percent copper. (Fredrickson and Fernette, 1983, p. 20).

Mineral resource potential (undiscovered): The Iron Dyke deposit, as well as several other deposits and many prospects, are located in a belt of favorable metamorphic host rocks that extends from the Iron Dyke more than 10 miles northeast into Idaho, and also extends southwest into the Homestead area. Four mineral occurrences belonging to this belt are located within the study area. Deposits similar to those outside the area may be present at depth beneath the Miocene basaltic lava flow cover within the area. The area has high potential for metallic deposits containing copper, gold, and silver. Basalt exposed at the northwestern edge of the area, although suitable for construction stone, is inaccessible and located too far from potential markets. It is unlikely that potential exists for energy minerals, oil and gas, geothermal energy, or other non-metallic minerals.

Mining Activity: Gold, copper, and silver mineralization has been discovered at several locations along the east edge, in the northern part of the wilderness study area. One mine, the Iron Dyke mine (an underground, copper, gold and silver mine just outside the study area) has been a recent producer. Fifty-one current mining claims are located within or partly within the study area (July 1990). As of October 1987 no energy leases existed within the study area.

Mineral setting/ Geology: This study area covers the west side of Hells Canyon from Pine Creek to Homestead Creek, a distance of distance of about 8 miles. The study area is mostly underlain by Miocene basaltic lava flows of the Columbia River Basalt Group. The lava flows unconformably overlie volcanic and sedimentary rocks of late Paleozoic and Mesozoic age locally dominated by greenstones (altered volcanic flows and breccias).

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Any areas where the Paleozoic and Mesozoic greenstones are exposed should be checked geologically and geochemically for copper mineralization.

References:

Ashley, R.P., Roback, R.C., Turner, R.L., Jachens, R.C., Close, T.J., and Rains, R.L., 1988, Mineral resources of the Sheep Mountain Wilderness Study Area, Baker County, Oregon: U.S. Geological Survey Bulletin 1741-B, 14 p.

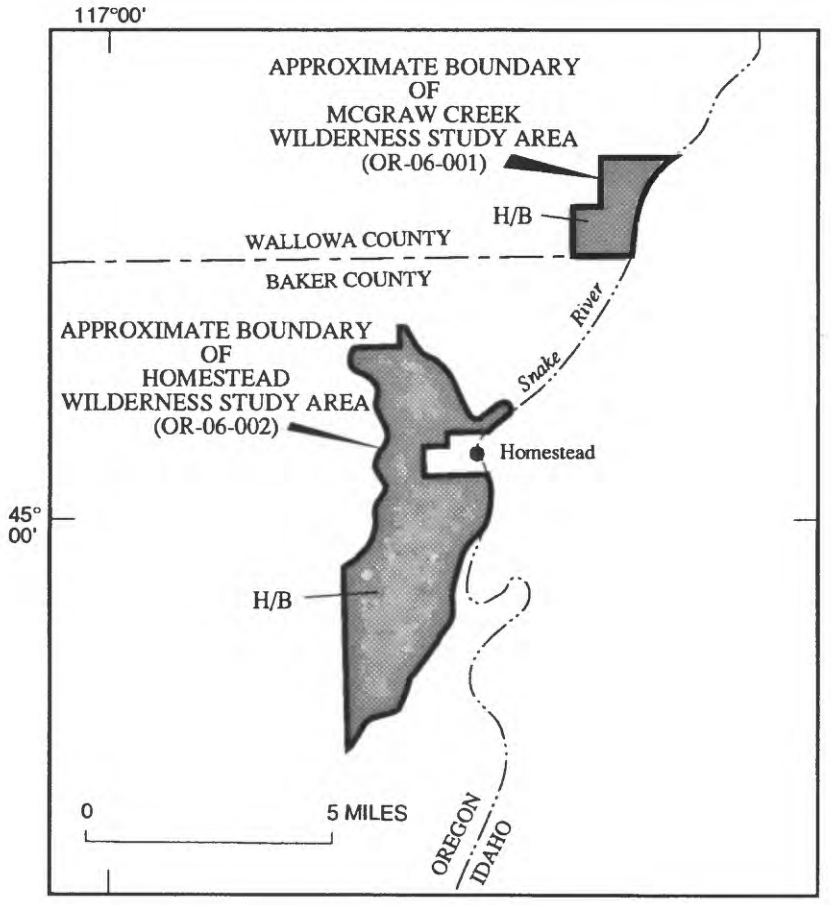
Brooks, H.C., McIntyre, J.R., and Walker, G.W., 1976, Geology of the Oregon part of the Baker 1° by 2° quadrangle: Oregon Department of Geology and Mineral Industries Geologic Map Series GMS-7, scale 1:250,000.

Fredrickson, R.S., and Fernette, Greg, 1983, Geology, energy, and mineral (GEM) resource evaluation of the Homestead GRA, Oregon-Idaho, including the McGraw Creek (OR-006-001), Homestead (OR-006-002), and Sheep Mountain (OR-006-003) Wilderness Study Areas: Anchorage, AK, WGM Inc., Mining and Geological Consultants, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1039, 54 p.

Hyndman, P.C., 1983, Mineral Investigation of the Homestead RARE II Area (No. 6291) Baker and Wallowa Counties, Oregon, 9 p.

Simmons, G.C., Gualtieri, J.L., Close, T.J., Federspiel, F.E., Leszcykowski, A.M., Hyndman, P.C., 1983, Mineral resource potential of the Hells Canyon Wilderness and contiguous roadless areas, Wallowa County, Oregon, and Idaho, Nez Perce and Adams Counties, Idaho: U.S. Geological Survey Open-File Report 83-397, 20 p.

Vallier, T.L., 1974, A preliminary report on the geology of part of the Snake River Canyon, Oregon and Idaho: Oregon Department of Geology and Mineral Industries Geologic Map Series GMS-6, scale 1:125,000.

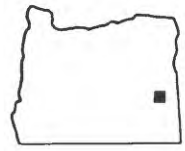


EXPLANATION

H/B, Geologic terrane having high mineral resource potential for copper, gold, and silver with certainty level B

Mineral resources of the Homestead Wilderness Study Area.

Name: Honeycombs
Area number: OR-003-077A
Size (acres): 39,000



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1987).

Identified mineral resources (known): No mineral resources are identified within the wilderness study area, although jasper suitable for lapidary work is present throughout the east part of the area. Zeolite occurrences of mineable grade are present within the study area, but are too erratic and discontinuous to constitute resources. Mineable zeolite deposits might be identified with further detailed mapping.

Mineral resource potential (undiscovered): North-central and southern parts of the study area have moderate potential for uranium and thorium, based on both aerial gamma-ray surveys, and anomalous concentrations of these elements in rock samples. North-central and southern parts of the study area have moderate potential for strata-bound lithium resources. Adjacent to the topographic expression of the Mahogany Mountain caldera margin, a wide zone of locally altered and silicified rock has moderate potential for resources of mercury, arsenic, lead, and zinc. Except for lead, these same elements are present in sufficiently anomalous amounts in rhyolite intrusions in the central and southern parts of the study area, that their assigned resource potential is moderate. The entire area is assigned moderate potential for copper, tin, and fluorite resources; copper appears to be associated with fracture fillings in mafic and intermediate intrusions; tin is related to rhyolite intrusions, and anomalous fluorite probably reflects diagenetic concentrations in lacustrine deposits.

The entire area has moderate potential for zeolite resources in tuff, and geothermal resources. Tertiary sedimentary rocks in the northern and central parts of the study area have low potential for resources of oil and gas. Low potential for resources of picture jasper is assigned to a narrow zone along the east boundary, explored by several mines and prospects.

Since the publication of Vander Meulen and others (1987), low-grade, high-tonnage epithermal hot-spring gold-silver deposits of the type defined by Berger (1985; 1986) and Berger and Singer (1987) have been recognized in the region northeast of the wilderness study areas (Rytuba, 1989).

The recognition that this mineral-deposit model is applicable in the region, coupled with new data that has become available to the U.S. Geological Survey (R.J. Shepard, FMC Gold Company, written commun., 1989; E.J., Demeter, Bond Gold Corp., written commun., 1989), reinterpretation of existing geochemical data (Erickson and others, 1986), and known-deposit data (Scott, 1986) suggest that similar deposits may be present elsewhere in the region. This report contains an additional assessment of the Honeycombs Wilderness Study Area in light of those new data. Geologic, geochemical, and mineral-deposit data as well as new use of a mineral-occurrence model suggest that there is moderate potential, certainty level B, for undiscovered resources of low-grade, epithermal hot-spring gold and silver in the Honeycombs Wilderness Study Area.

Mining Activity:

A large block of current (July 1990) mining claims is centered east of the wilderness study area. These claims, the Goldfinger Group held by Euro Nevada (Reno, NV), extend into the east-central part of the study area. Several mining exploration companies are actively prospecting in and near the study area for disseminated silver and gold deposits.

The most significant past mining activity has been the collecting of jasper for lapidary use (picture jasper) in the eastern part of the study area. Picture jasper is present in small quantities at six prospects, ten claim groups, and one mine in or just outside the study area boundary . Some of these sites are worked on a seasonal basis. No energy leases (October 1987) exist within the study area.

Mineral setting/ Geology:

Rhyolitic air-fall and ash-flow tuffs of late Miocene and younger age are the dominant rocks of the study area, associated and interbedded with substantial amounts of volcaniclastic and sedimentary rocks. Two major eruptive centers, the Honeycombs volcanic center in the north-central part of the study area, and the Mahogany Mountain caldera, the north rim of which crosses the study area about 2 1/2 mi north of the southern boundary. Scattered rhyolite dikes, domes, and irregular intrusive bodies intrude the pyroclastic rocks from both centers. Dikes and sills of pyroxene andesite--some of the latter 2 to 3 mi long, intrude volcanic and sedimentary rocks in the north-central part of the study area, and flows, dikes, and sills of basalt cap and intrude the entire sequence of sedimentary rocks in the northern part. North- to northwest-trending high-angle normal faults with associated horst and graben dominate the local structure, although deviations toward a more east-west pattern occur locally, especially in the southern part of the study area where they are associated with the east-west segment of the Mahogany caldera margin.

The study area is situated southwest of the DeLamar-Silver City mining districts, which have yielded considerable quantities of gold and silver from epithermal-type vein deposits. The mineralization in these districts occurred along a regionally extensive northwest-trending fracture zone along the southwestern margin of the Snake River Plain. DeLamar-Silver City mineralization was related to about 15 to 16 million-year-old (Ma) basalt-rhyolite volcanic activity along the zone (Rytuba, 1989). The ore-controlling fault zone projects southeastward towards the study areas, and hydrothermal activity is known to have occurred along the southeastern extension of this fault zone in the Triangle Ranch area northeast of the study areas.

In the region of the study area, the Swisher Mountain Tuff is underlain by an undated basalt. This basalt has a strong resemblance to the 15.5-Ma Steens Basalt (Baksi and others, 1967). If this basalt is of the same age as the volcanism in the DeLamar area, it may be part of the dome rift-related basalt-rhyolite (bimodal) volcanic suite related to mineralization at DeLamar. In any case, the occurrence of this basalt suggests that deep-seated rifting has taken place in the vicinity, possibly within the study area.

The overlap of regional north-northwest trending fault zones with older caldera structures and silicic volcanic centers is emerging as one of the most viable means of locating gold-silver mineral deposits in the northern Basin and Range (Rytuba, 1988; 1989). In this part of the Basin and Range, precious-metal-bearing systems are associated with silicic domes and plugs that intruded these extensional north-northwest-trending fault zones (Rytuba, 1989). The DeLamar and Milestone gold-silver deposits, and the Mahogany, Katie, and Grassy Mountain gold prospects are situated along the northwest extension of the DeLamar-Duck Valley fault zone (Rytuba and others 1989). Similar northwest-trending fault zones extend across both study areas, following the general trend of the Owyhee River.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 2,716 acres that constitute the balance. Additional work should be done to assess the potential for undiscovered hot-springs gold deposits with greater certainty.

References:

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Berger, B.R., and Singer, D.A., 1987, Grade-tonnage model of hot-spring gold-silver: a supplement to U.S. Geological Survey Bulletin 1693: U.S. Geological Survey Open-File Report 87-272-C, 6 p.

Erickson, M.S., Malcolm, M.J., Hoffman, J.D., and King, H.D., 1986, Analytical results and sample locality maps of the stream-sediment and heavy-mineral-concentrate samples from the Honeycombs (OR-003-077A) and the Owyhee Canyon (OR-003-195) Bureau of Land Management Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Open-File Report 86-0628, 48 p.

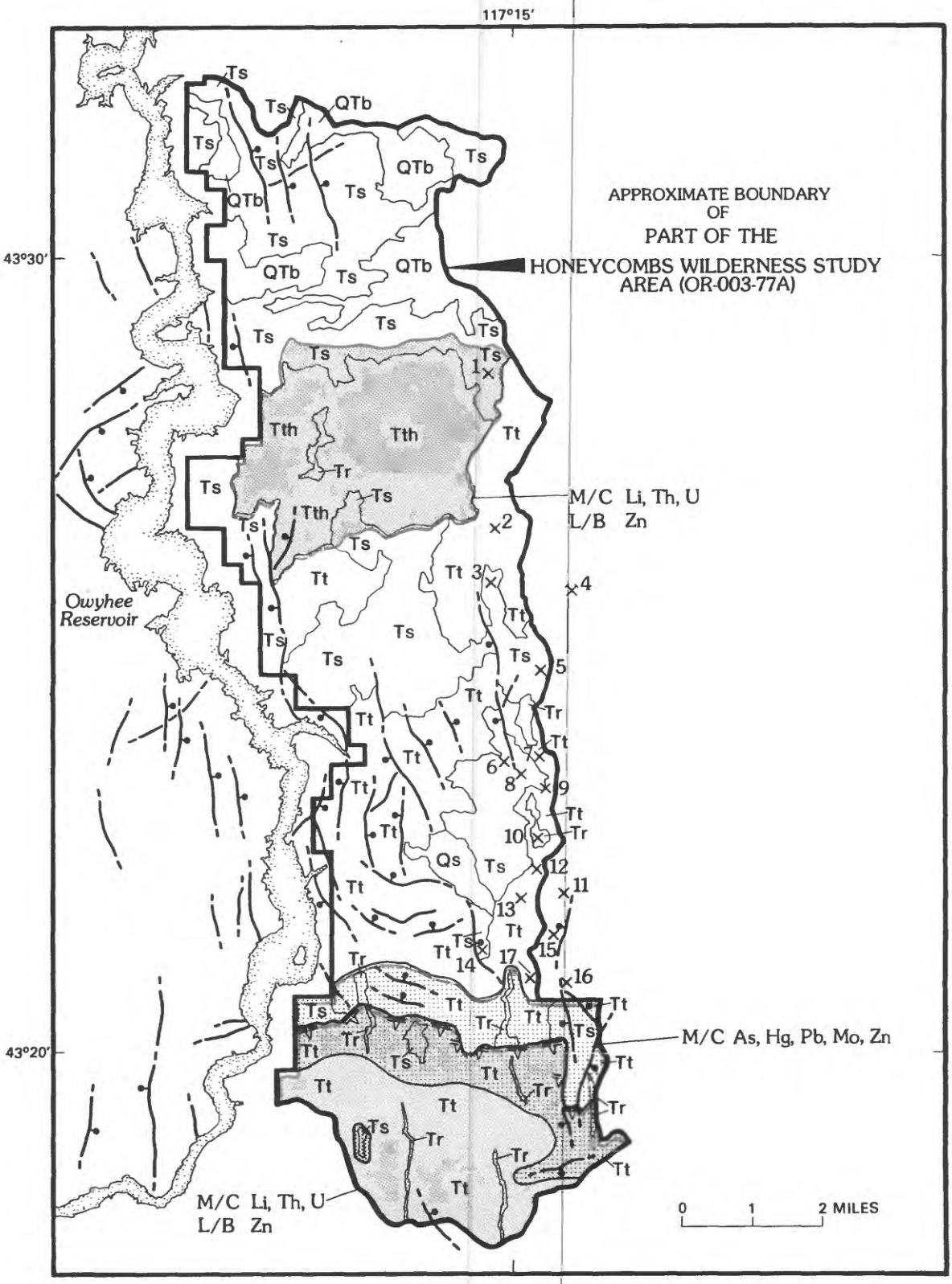
Rytuba, J.J., 1988, Volcanism, extensional tectonics, and epithermal systems in the northern Basin and Range, CA, NV, OR, and ID, [abs.]: Geological Society of Nevada Newsletter, May, 1988.

Rytuba, J.J., 1989, Volcanism, extensional tectonics, and epithermal mineralization in the northern Basin and Range province, California, Nevada, Oregon, and Idaho, in Schindler, K.S., ed., USGS research on mineral resources - program and abstracts: Fifth Annual V.E. McKelvey Forum on Mineral and Energy Resources, U.S. Geological Survey Circular 1035, p. 59-61.

Rytuba, J.J., Vander Meulen, D.B., Minor, S.A., and McKee, E.H., 1989, Geologic evolution of the Three Fingers caldera, Malheur Co., Oregon [abs.]: Geological Society of America Abstracts with Programs, v. 21, no. 5, p. 138.

Scott, D.F., 1986, Mineral resources of the Honeycombs Study Area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report, MLA 30-86, 26 p.

Vander Meulen, D.B., Rytuba, J.J., King, H.D., Plouff, Donald, and Scott, D.F., 1987, Mineral resources of the Honeycombs Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-A, 15 p.



Mineral resources of the Honeycombs Wilderness Study Area.

EXPLANATION

AREA WITH MODERATE MINERAL RESOURCE POTENTAIL--Lithium, thorium, and uranium. See appendix 1 and figure 3 for definition of mineral resource potential and certainty of assessment.

AREA WITH MODERATE MINERAL RESOURCE POTENTIAL-Arsenic, mercury, molybdenum, lead, and zinc.

COMMODITIES

As	Arsenic
Hg	Mercury
Li	Lithium
Mo	Molybdenum
Pb	Lead
Th	Thorium
U	Uranium
Zn	Zinc

MINES, PROSPECTS, AND CLAIMS

1. Painted Rock Canyon No. 1 claim
2. Pinto claim
3. unnamed prospect
4. Wild Horse mine
5. unnamed prospect
6. Madonna No. 3 claim
7. Betty No. 1 and Thunder Ridge claims
8. unnamed prospect
9. unnamed prospect
10. unnamed prospect
11. Desert Queen No. 2 claim
12. Owyhee Green Streak claim
13. Big 4 and More No. 1 and 2 claims
14. Lucky Sunday prospect
15. Jackpot No. 2 and J.B. No. 1 claims
16. O.R.T. 1-4 claims
17. Hobnob claim

CORRELATION OF MAP UNITS

Qs — QUATERNARY

Unconformity

QTb — QUATERNARY AND TERTIARY

Unconformity

Tth, Ts, Tt, Ts — Possibly correlative — Tr — TERTIARY

GEOLOGIC MAP UNITS

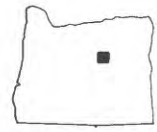
Qs	SURFICIAL DEPOSITS (QUATERNARY)
QTb	BASALT FLOWS, DIKES, AND SILLS (QUATERNARY AND TERTIARY)
Ts	SEDIMENTARY ROCKS (TERTIARY)
Tr	RHYOLITE FLOWS, DOMES, AND DIKES (TERTIARY)
Tth	TUFF OF HONEYCOMBS VOLCANIC CENTER (TERTIARY)
Tt	TUFF (TERTIARY)

MAP SYMBOLS

- CONTACT
- FAULT-Bar and ball on downthrown side; dashed where uncertain
- CALDERA TOPOGRAPHIC MARGIN-Teeth on downthrown side (Mahogany Mountain caldera)
- MINE
- PROSPECT OR CLAIM

Explanation, mineral resources of the Honeycombs Wilderness Study Area.

Name: Indian Creek
Area number: OR-002-098D
Size (acres): 208



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The Marks-Thompson mine, located on the north boundary of the study area has produced chromite. The wilderness study area does contain chromite but of unknown quantity and quality. Limekiln Hot Springs is situated about 0.25 mi north of the study area; however, the study area contains no known geothermal resources.

Mineral resource potential (undiscovered): The area has moderate potential for marginally economic or subeconomic chromite deposits. Chromite deposits in the Strawberry Mountains are characteristically small (less than 100 tons). Hot springs are located along faults north of the study area, but are not included within the study area. The area has low potential for gold, copper, and geothermal energy.

Mining Activity: There is no active mining in or near the Indian Creek Wilderness Study Area. As of July 1990, there are 13 active mining claims. Several chromite prospects are present within or adjacent to the study area. No energy leases exist in the wilderness study area (October 1987).

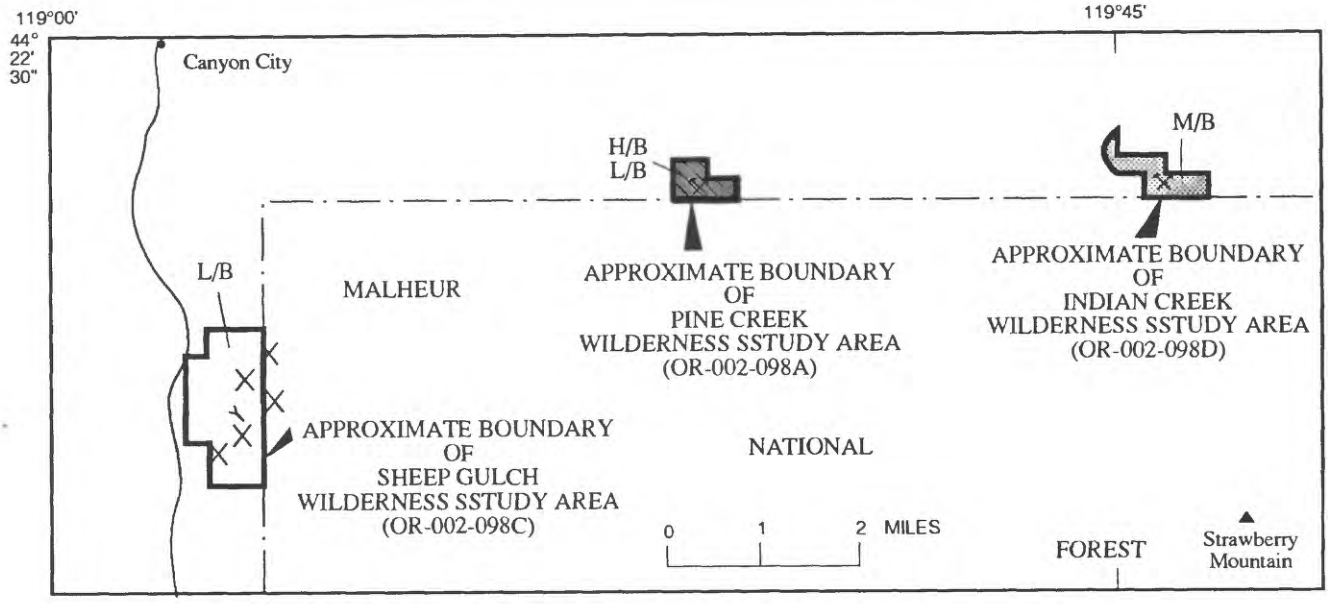
Mineral setting/ Geology: The study area is underlain by olivine-rich peridotite. In the Strawberry Mountains area, this peridotite is the main host rock of chromite deposits which occur as small pods or lenses within the peridotite.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

U.S. Bureau of Land Management, 1989, Oregon Wilderness Final Environmental Impact Statement: 4 volumes.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

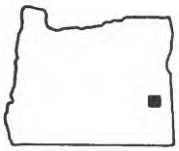


EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for chromite with certainty level B

Mineral resources of the Indian Creek Wilderness Study Area.

Name: Jordan Craters
Area number: OR-003-128
Size (acres): 27,900



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Calzia and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): Low potential for oil and gas resources, over the entire study area, represent the only mineral or energy resource potential believed to be present in the study area.

Mining Activity: According to Bureau of Land Management claim records (July 1990) there are no current claims inside the study area boundaries. As of October 1987, no energy leases existed within the wilderness study area.

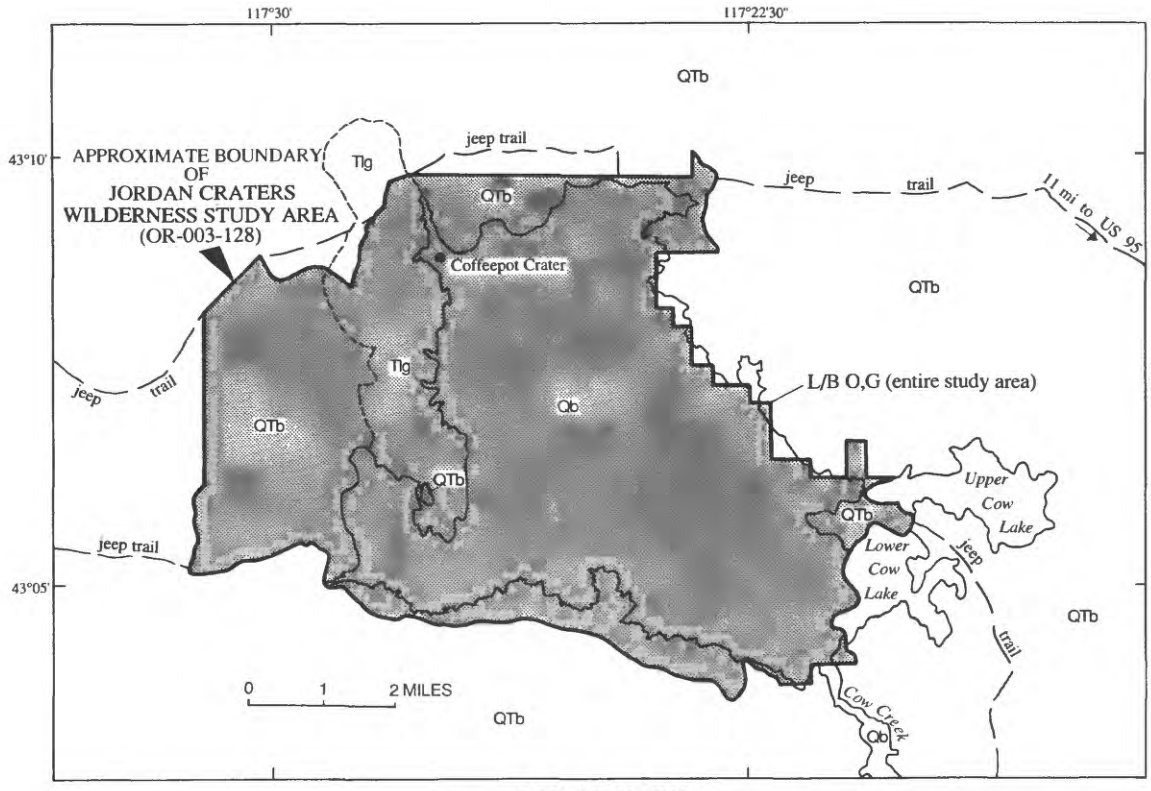
Mineral setting/ Geology: More than half the study area is underlain by Pleistocene alkaline basalt, youngest features of which are cinder- and spatter-cones, and craters. About a fifth is occupied by older basalt flows of Pliocene age, and perhaps a sixth by upper Miocene Leslie Gulch Ashflow Tuff of Kittleman (1962). No mappable faults were found in the study area.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 4,335 acres that constitute the balance.

References:

Calzia, J.P., Hubbard-Sharpless, Susan, Turner, R.L., Griscom, Andrew, Sawatzky, D.L., and Linne, J.M., 1988, Mineral resources of the Jordan Craters Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Open-File Report 88-0572, 11 p.

Linne, J.M., 1987, Mineral resources of the Jordan Craters study area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 78-87, 9 p.



EXPLANATION

Area having low mineral resource potential (L); data only suggest level of potential (B)

Contact--Dashed where approximately located

Commodity

O,G Oil and gas

Geologic map units

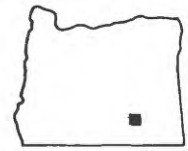
Qb Alkaline olivine basalt of Jordan Craters (Quaternary)
QTb Basalt (Quaternary and (or) Tertiary)
Tlg Leslie Gulch Tuff of Kittleman (1962a) (Tertiary)

Correlation of map units

Qb — Quaternary
QTb — Quaternary/Tertiary
Tlg — Tertiary
CENOZOIC

Mineral resources of the Jordan Craters Wilderness Study Area.

Name: Little Blitzen Gorge
Area number: OR-002-086F
Size (acres): 9,400



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Minor and others, 1987).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The entire area is assigned low potential for resources of oil and gas.

Mining Activity: There are no mines or prospects in the wilderness study area. As of October 1987, no geothermal leases or current mining claims existed within the study area; two oil and gas leases covered 5,223 acres.

Mineral setting/ Geology: Besides an irregular but generally shallow Quaternary cover of alluvial and glacial deposits, rocks of the study area comprise four Oligocene(?) and Miocene formations: Alvord Creek Formation, interstratified tuff and tuffaceous to volcaniclastic rocks; Pike Creek Formation, more than 2,000 ft of rhyolite and dacite domes and flows and minor associated tuff and tuffaceous sedimentary rocks, commonly silicified or argillized; Steens Mountain Volcanics, 3,000 ft of interstratified andesitic flows, flow breccia, and pyroclastic rocks; Steens Basalt, 4,300 feet of multiple, thin (about 20 ft thick) basalt flows that host many steeply dipping, northeast-striking dikes that penetrate both the flows and the underlying rocks. The rocks are exposed in the uplifted and gently westward-tilted Steens Mountain fault block, defined on the east by an irregular north-trending fault-controlled escarpment where a throw of more than 10,000 ft can be demonstrated. Subsidiary north-northeast- and north-northwest-trending normal faults with modest offsets locally traverse the study area. A conspicuous oblique structure is a northwest-trending monocline that traverses the area along the southwestern study area boundary.

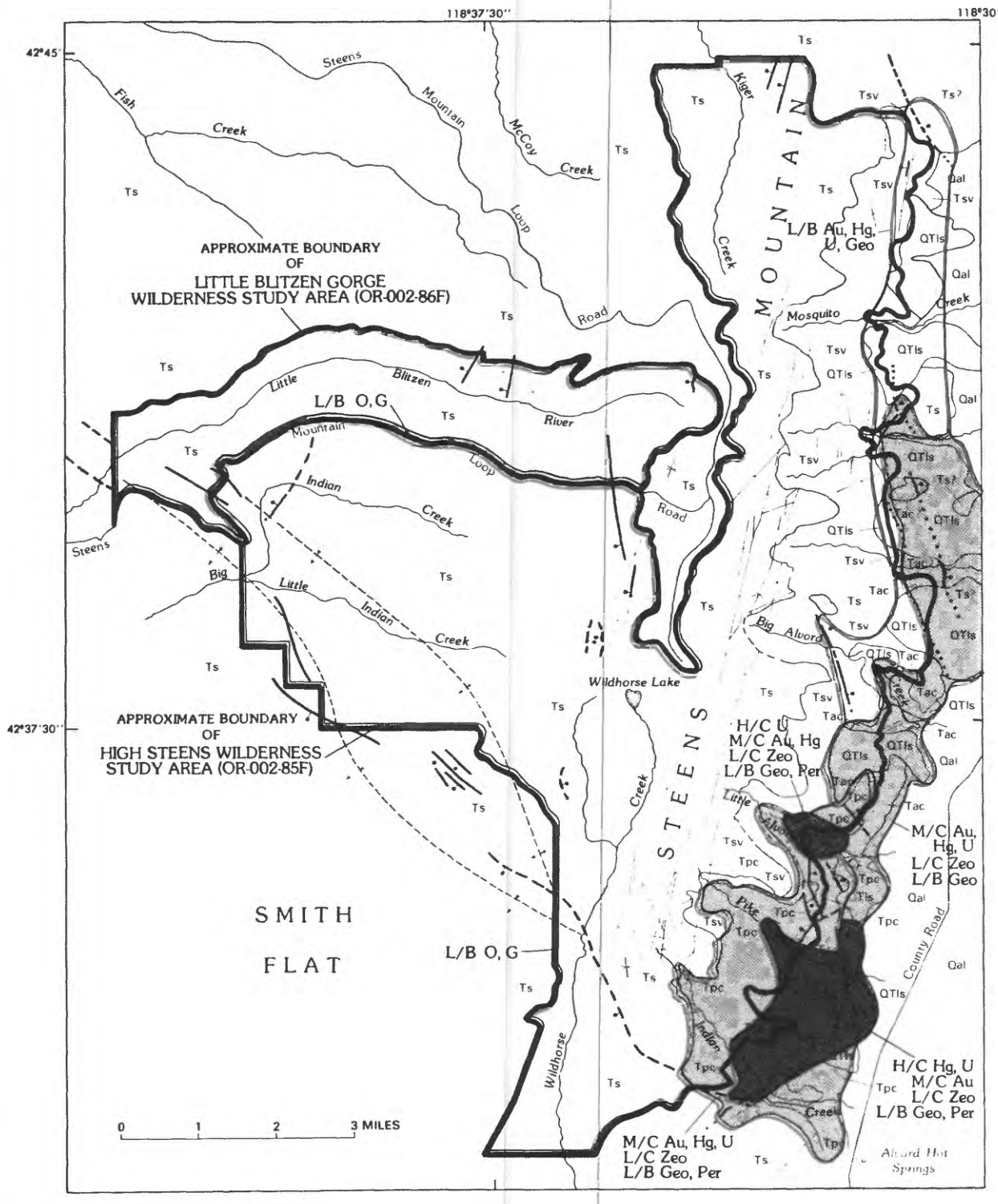
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 2,810 acres that constitute the balance.

References:

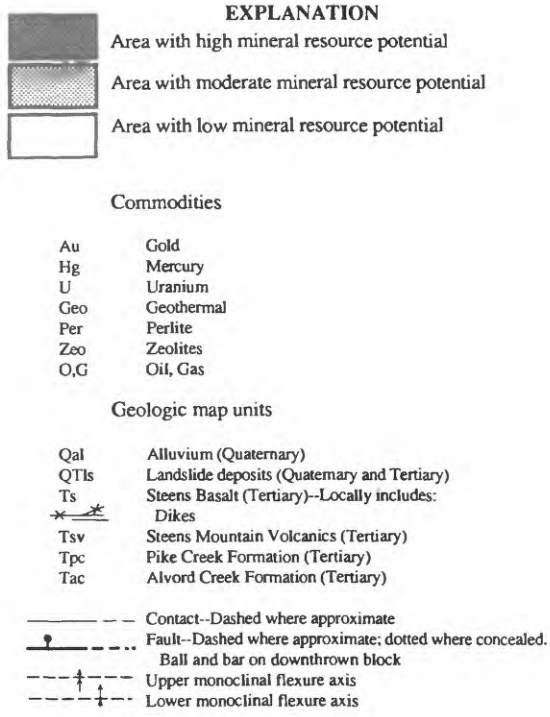
Minor, S.A., Plouff, Donald, Esparza, L.E., and Peters, T.J., 1987, Mineral resources of the High Steens and Little Blitzen Gorge Wilderness Study Areas, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-A, 21 p.

Minor, S.A., Rytuba, J.J., Grubensky, M.J., Vander Meulen, D.B., Goeldner, C.A., and Tegtmeyer, K.J., 1987, Geologic map of the High Steens and Little Blitzen Gorge Wilderness Study Areas, Harney County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1876, scale 1:24,000.

Peters, T.J., and Esparza, L.E., 1986, Mineral resources of the Little Blitzen Gorge study area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 32-86, 14 p.

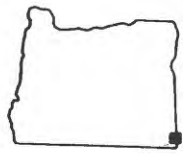


Mineral resources of the Little Blitzen Gorge Wilderness Study Area.



Explanation, mineral resources of the Little Blitzen Gorge Wilderness Study Area.

Name: Lookout Butte
Area number: OR-003-194
Size (acres): 99,600



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): Geochemical studies in nearby wilderness areas to the west and northwest suggest that the study area may have areas of anomalous concentrations of metals near one or more of the volcanic centers. Based on comparison of known geochemistry and geological environments in the region, parts of the study area may have low potential for the following metals; lead, mercury, silver, beryllium, uranium, and tin. The potential for sand and gravel is low because the deposits are small and distant from markets. The potential for rock aggregate is low because this resource is distant from possible sites of use. The potential for oil and gas is low.

Mining Activity: No mines, prospects, mining claims, or energy leases (as of October, 1987) are known within the wilderness study area.

Mineral setting/ Geology: The study area is characterized by four basalt volcanos that formed on flat-lying Miocene basalt flows.

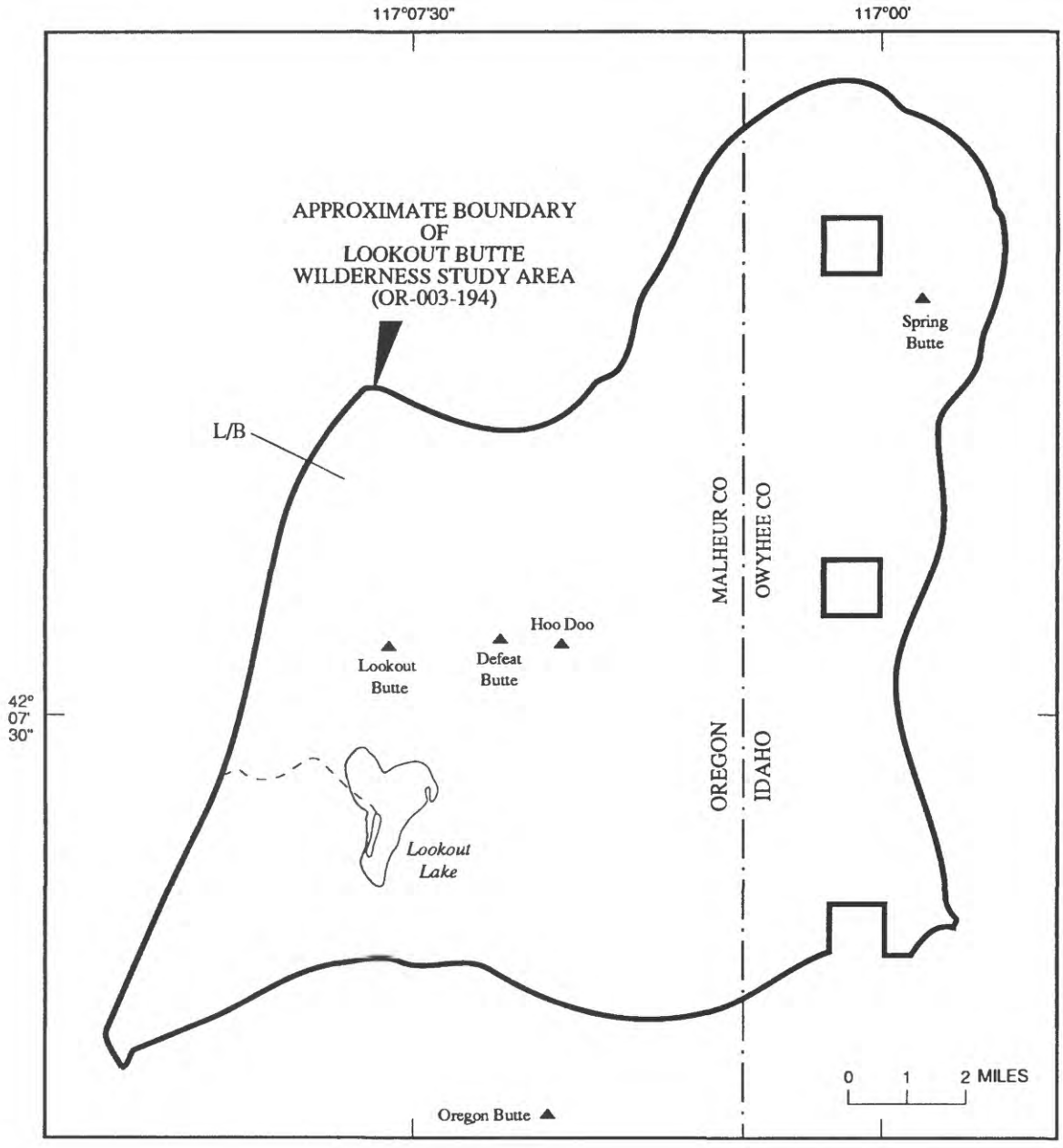
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Evans, J.G., Hoffman, J.D., Kulik, D.M., and Linne, J.M., 1987, Mineral Resources of the Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1719-E, 18 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Final Environmental Impact Statement: 4 volumes.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

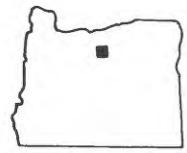


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for lead, mercury, silver, beryllium, uranium, tin, sand and gravel, building stone, and oil and gas with certainty level B

Mineral resources of the Lookout Butte Wilderness Study Area.

Name: Lower John Day
Area number: OR-005-006
Size (acres): 19,587



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ach and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the Lower John Day Wilderness Study Area; however, five river bars containing a total of about 1 million yd^3 of gravel have placer gold occurrences averaging 0.0004 oz/yd^3. This grade is too low to be considered a resource under foreseeable economic conditions. Stone, sand, and gravel from the wilderness study area could be quarried and used for construction material, but other suitable material is plentiful elsewhere in the region and more accessible to possible markets.

Mineral resource potential (undiscovered): The study area is under lease for oil and gas and are therefore, despite any intrinsic evidence, assigned low potential for oil and gas resources. The area also has low potential for placer gold resources along the canyon of the John Day River; it has no potential for geothermal energy resources.

Mining Activity: No mines, prospects, or mining claims are known. As of October 1987, a total of 9,240 acres of the Lower John Day Wilderness Study Area were leased for oil and gas exploration. Current U.S. Bureau of Land Management practice preserves the natural character of the area viewed from the John Day River (12,067 acres) from oil and gas exploration and development by use of "no surface occupancy" lease stipulations where the mineral estate is owned by the Federal Government. Three wells were drilled near Clarno between 1929 and 1957. One had a gas show, but none contained oil or commercial quantities of gas. An additional dry hole was drilled near Condon in 1957 to a depth of 8,726 ft. No geothermal leases exist in the wilderness study area.

Mineral setting/ Geology: Basalt of the Miocene Columbia River Basalt Group, consisting of a thick accumulation of lava in flows 50 to 100 ft thick, 1,800 ft of which is locally exposed, is the only bedrock unit exposed in the study area. Flows are typically columnar jointed and have vesicular, readily eroded tops. Lying unconformably beneath the basalt are interlayered tuff, tuffaceous sedimentary rocks, and mafic lava flows of the latest Eocene to early Miocene John Day Formation. Nearest exposures of the John Day are 7 mi south of the study area in the canyon of the John Day River. Documenting the existence of the John Day and Clarno beneath the Columbia River Basalt in this region, are the results of Standard Oil Company's test hole drilled 14 mi east of the study area. The hole penetrated 2,440 ft of basalt, below which it penetrated 4,255 ft of John Day and possibly Clarno rocks. The Columbia River Basalt dips northward about 5° and is cut by high-angle, normal and oblique-slip, northwest-striking faults in the northern part of the study area and by a north-northwest-striking high-angle normal fault near the southern boundary. Quaternary alluvial deposits of sand and gravel occur chiefly along the inner banks of the present channel of the John Day River, but include patchy remnants in old, higher-level, abandoned meander scars.

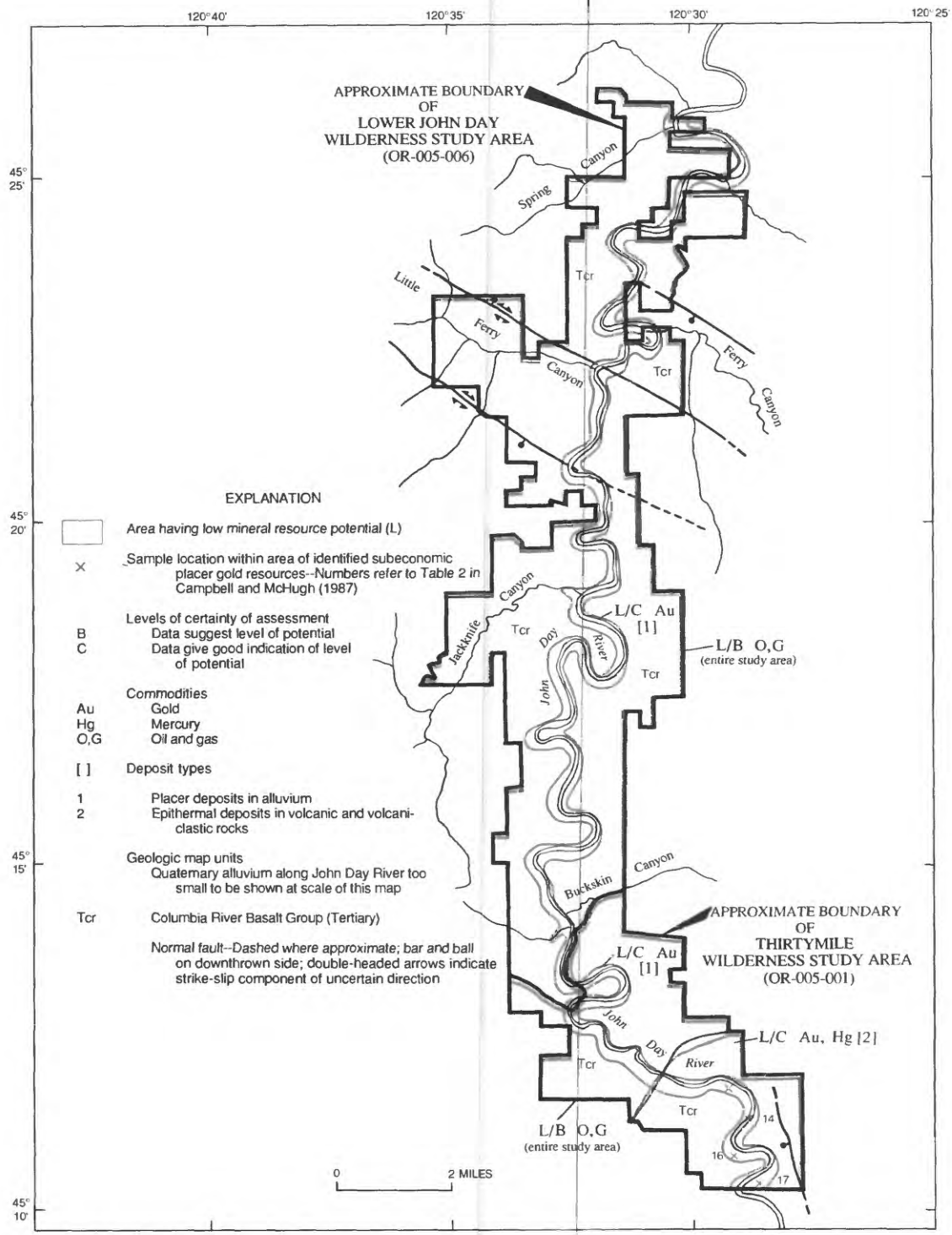
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 1,521 acres that constitute the balance.

References:

Ach, J.A., Minor, S.A., Frisken, J.G., Blakely, R.J., Campbell, H.W., and McHugh, E.L., 1988, Mineral resources of the Lower John Day and Thirtymile Wilderness Study Areas, Sherman and Gilliam Counties, Oregon: U.S. Geological Survey Bulletin 1743-A, 18 p.

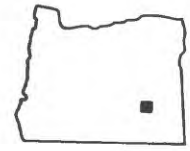
Campbell, H.W., and McHugh, E.L., 1987, Mineral resources of the Lower John Day and Thirtymile study areas, Gilliam and Sherman Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 52-87, 17 p.

Davis, Dennis, 1983, Lower John Day GEM resource area: U.S. Bureau of Land Management Open-File Report, 13 p.



Mineral resources of the Lower John Day Wilderness Study Area.

Name: Lower Owyhee Canyon
Area number: OR-003-110
Size (acres): 75,700



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Evans and others, 1990).

Identified mineral resources (known): An estimated 7.7 million tons of inferred subeconomic resources of zeolite has been identified in the east-central part of the study area. Other zeolite-bearing beds are too thin and too deep to have probable value. One occurrence of clay suitable for bricks and other structural products is known. Two small areas of decorative building stone are known that contain less than 2,000 tons of white, porous tuff. Gold associated with sand and gravel is classified as an occurrence rather than a resource. No other industrial or metallic minerals were observed during the investigation. Hot springs indicate an elevated geothermal gradient.

Mineral resource potential (undiscovered): The analyses available from rock and stream-sediment samples indicate low-level anomalous concentrations of antimony, arsenic, lead, mercury, molybdenum, silver, tungsten, and zinc in the study area. Some of the anomalies previously reported by the Oregon Department of Geology and Mineral Industries were not detected at current U.S. Geological Survey detection limits (0.05 ppm). Based on comparison of known geochemistry and geological environments in the region, parts of the study area has low potential for mercury and (or) silver. The potential for sand and gravel is low because the deposits are small and not easily accessible. The potential for rock aggregate is low because other deposits closer to possible sites of use are common in the region. The potential for geothermal energy and oil and gas is low.

Mining Activity: Decorative stone was mined intermittently in the west central part of the wilderness study area from 1961 through 1985. Production totaled less than 200 tons of stone. Nitrate salts in Owyhee Canyon were claimed as recently as 1967. As of October 1987, three placer claims were located in or partly in the study area covering stone quarry sites in Chalk Basin; no energy leases existed in the study area.

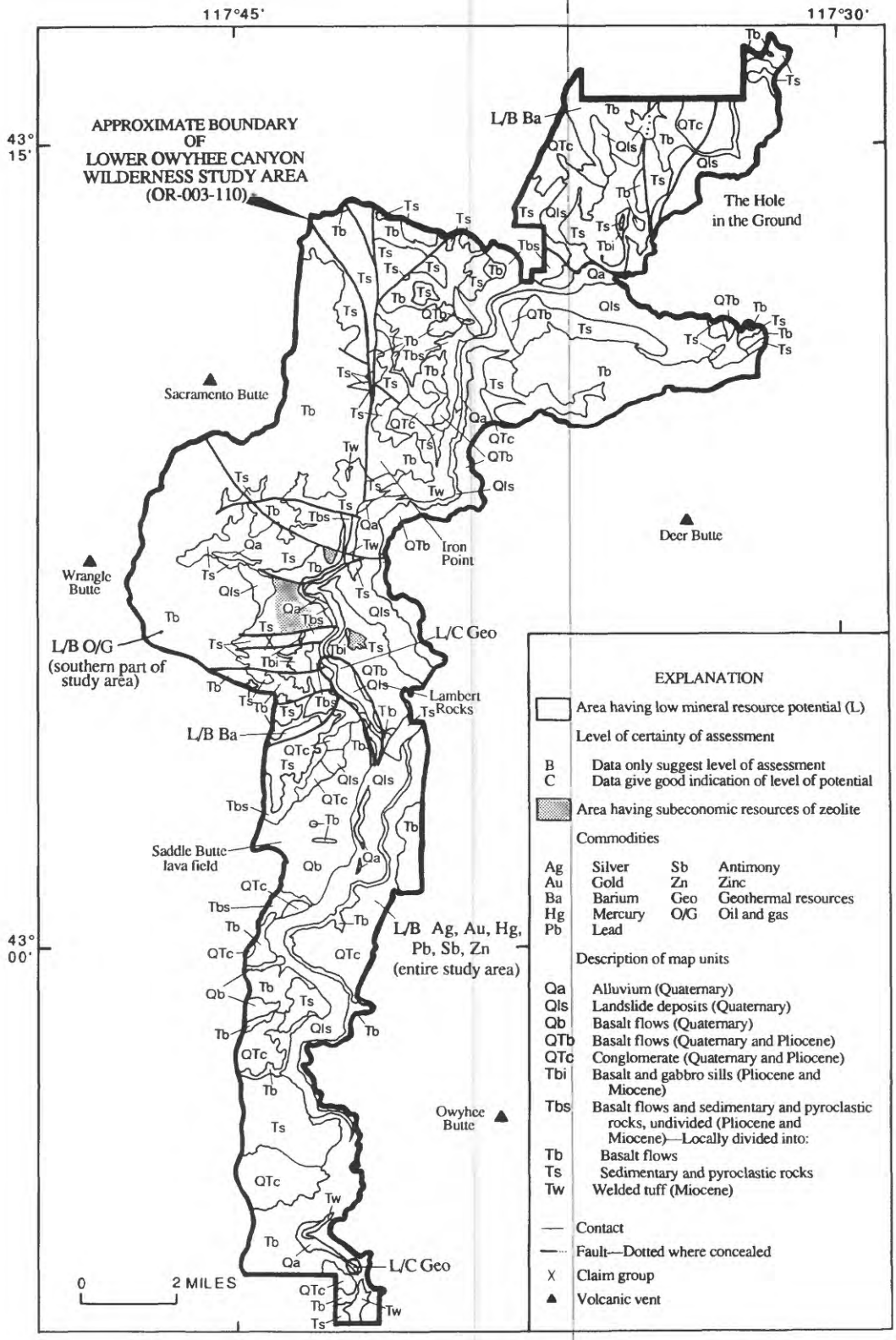
Mineral setting/ Geology: The study area is underlain by flat-lying Miocene to Quaternary volcanic, sedimentary, and pyroclastic rocks.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 3,470 acres that constitute the balance.

References:

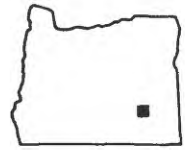
Causey, J.D., 1989, Mineral resources of the Lower Owyhee Canyon study area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 6-89, 37 p.

Evans, J.G., Turner, R.L., Griscom, Andrew, Sawatzky, D.L., and Causey, J.D., 1990, Mineral resources of the Lower Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-F.



Mineral resources of the Lower Owyhee Canyon Wilderness Study Area.

Name: Lower Stonehouse
Area number: OR-002-023M
Size (acres): 8,090



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The study area has low resource potential for gold, silver, diatomite, and oil and gas. It also has low geothermal energy potential along range-bounding faults.

Mining Activity: There are no known mines or prospects in the study area. No current mining claims and no energy leases (as of October 1987) are located in the wilderness study area.

Mineral setting/ Geology: The contiguous Lower Stonehouse and Stonehouse Wilderness Study Areas, which lie at the north end of the Steens Mountain south of State Highway 78, are underlain almost entirely by 17-14 million-year-old lava flows of Steens Basalt. Probably no areas have significant mineralization, although geothermal fluids moving upward along the range-front fault system may have deposited trace amounts of gold and silver. Diatomite potential is nil, even in those parts of the Alvord Valley that are enclosed by the study area, because any lake environment would have been too small to allow the accumulation of sufficiently pure diatomite. Geothermal energy resource potential is conceivably high along the major range-front escarpment. Oil and gas potential is low; small reservoirs containing chiefly gas may be buried several thousand feet in lower Tertiary basin deposits.

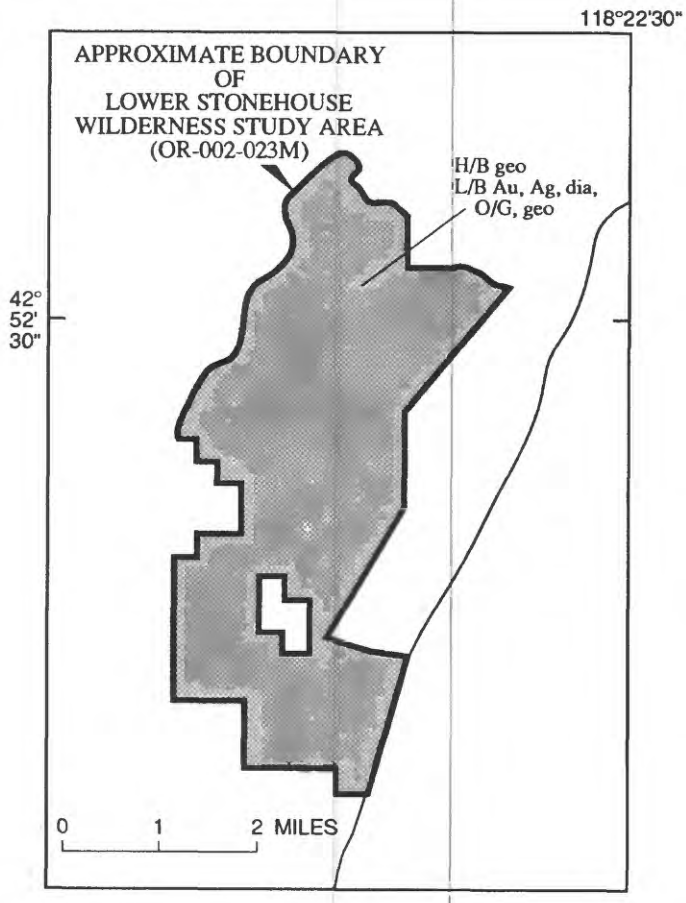
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Mathews, G.W., Blackburn, W.H., Chappell, D.L., 1983, Assessment of Geology, Energy, and Minerals (GEM) Resources, Sheepshead Mountain GRA (OR-023-018), Harney and Malheur Counties, Oregon: Lakewood, CO, Terradata, prepared for the U.S. Bureau of Land Management, contract YA-553-CT2-1042.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Final Environmental Impact Statement: 4 volumes.



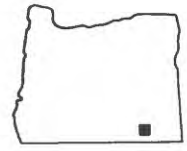
EXPLANATION

H/B, Geologic terrane having high mineral resource potential for geothermal energy with certainty level B

L/B, Geologic terrane having low mineral resource potential for gold, silver, diatomite, and oil gas, and (or) geothermal energy with certainty level B

Mineral resources of the Lower Stonehouse Wilderness Study Area.

Name: Mahogany Ridge
Area number: OR-002-077
Size (acres): 27,940



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area, although diatomite is known to be present as interbeds within tuffaceous sedimentary rocks.

Mineral resource potential (undiscovered): Based on the mineral resource potential of adjacent wilderness study areas, this study area has low potential for antimony, bismuth, copper, mercury, silver, molybdenum, zinc, and gold in epithermal deposits in areas containing caldera-related faults. As area containing younger caldera-fill sedimentary rocks in the northwesternmost part of the study area has moderate resource potential for diatomite. Diatomite is used as a construction material and in industrial applications. The area has low mineral resource potential for zeolite minerals, decorative building stone, rare-earth elements, and zirconium. The less-elevated northernmost part of the study area, which is near some active hot springs, has low potential for geothermal energy resources. The area's geology is not conducive for the accumulation of geothermal or oil and gas resources; therefore its potential for them is low.

Mining Activity: No mines, prospects, mining claims, or energy leases (as of October 1987) are known within the study area.

Mineral setting/ Geology: The study area is located in the western Trout Creek Mountains, a gently north-tilted plateau dissected by several deep, extensive canyons. The plateau is capped by several rhyolitic volcanic flows and minor interbedded tuff and sedimentary rocks that, in turn, overlie a thick sequence of basalt and andesite lava flows. Large, widely spaced, northerly trending faults cut rocks throughout the study area and are cross cut in the north by easterly trending faults associated with an aerially extensive volcanic caldera (circular collapse structure) located just north of the study area.

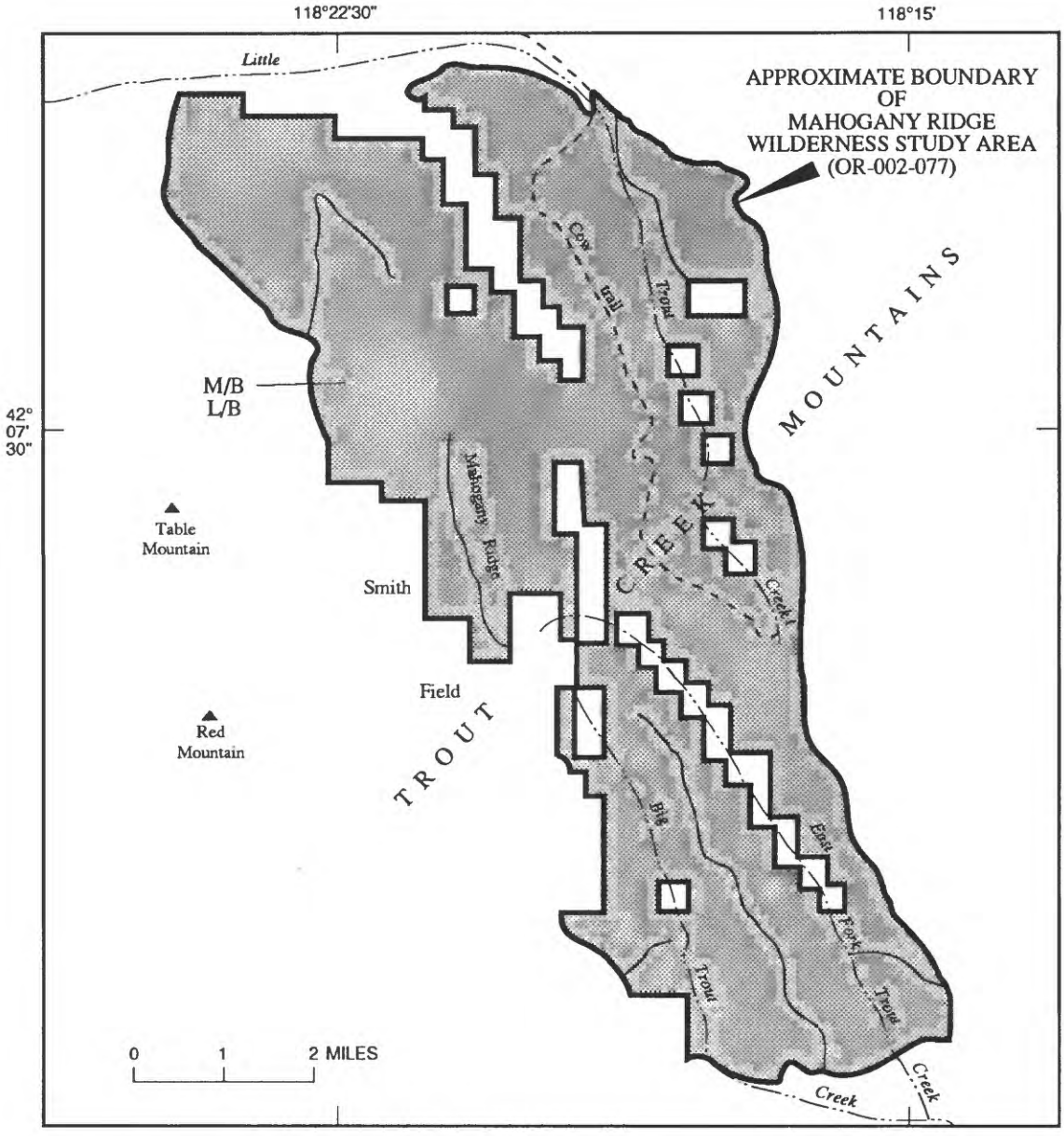
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Because it lies in a well-mineralized region, geologic, geochemical, and geophysical reconnaissance studies could determine whether the study area is likely to contain significant mineralization.

References:

Minor, S.A., Turner, R L., Plouff, Donald, and Leszcykowski, A.M., 1988, Mineral resources of the Disaster Peak Wilderness Study Area, Harney and Malheur Counties, Oregon, and Humboldt County, Nevada: U.S. Geological Survey Bulletin 1742-A, 18 p.

Peterson, J.A., Rytuba, J.J., Plouff, Donald, Vercoutere, T.L., Turner, R.L., Sawatzky, D.L., Leszcykowski, A.M., Peters, T.J., Schmauch, S.W., and Winters, R.A., 1988, Mineral resources of the Fifteen Mile Creek, Oregon Canyon, Twelve Mile Creek, and Willow Creek Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1742-B, 24 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Final Environmental Impact Statement: 4 volumes.



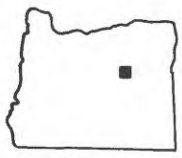
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for diatomite with certainty level B

L/B, Geologic terrane having low mineral resource potential for antimony, bismuth, copper, mercury, silver, molybdenum, zinc, gold, zeolite, building stone, rare-earth elements, zirconium, geothermal energy, and (or) oil and gas with certainty level B

Mineral resources of the Mahogany Ridge Wilderness Study Area.

Name: Malheur River-Bluebucket Creek
Area number: OR-002-014
Size (acres): 5,560



Status of mineral surveys: This wilderness study area has been studied for known resources (Peters and Winters, 1987, and as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (M.G. Sawlan, R.L. Turner, R.C. Jachens, T.J. Peters, and R.A. Winters, unpub. data, 1990).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Abundant basalt is too far from any potential markets to be considered a resource. Small exposures of impure diatomite occur along the southwest margin of the study area.

Mineral resource potential (undiscovered): Geologic mapping and geochemistry of stream sediment and rock samples show no evidence of ore-forming processes, and no prospects or mines are located in or near the study area. A small part of the study area is considered to have low potential, at best, for diatomite.

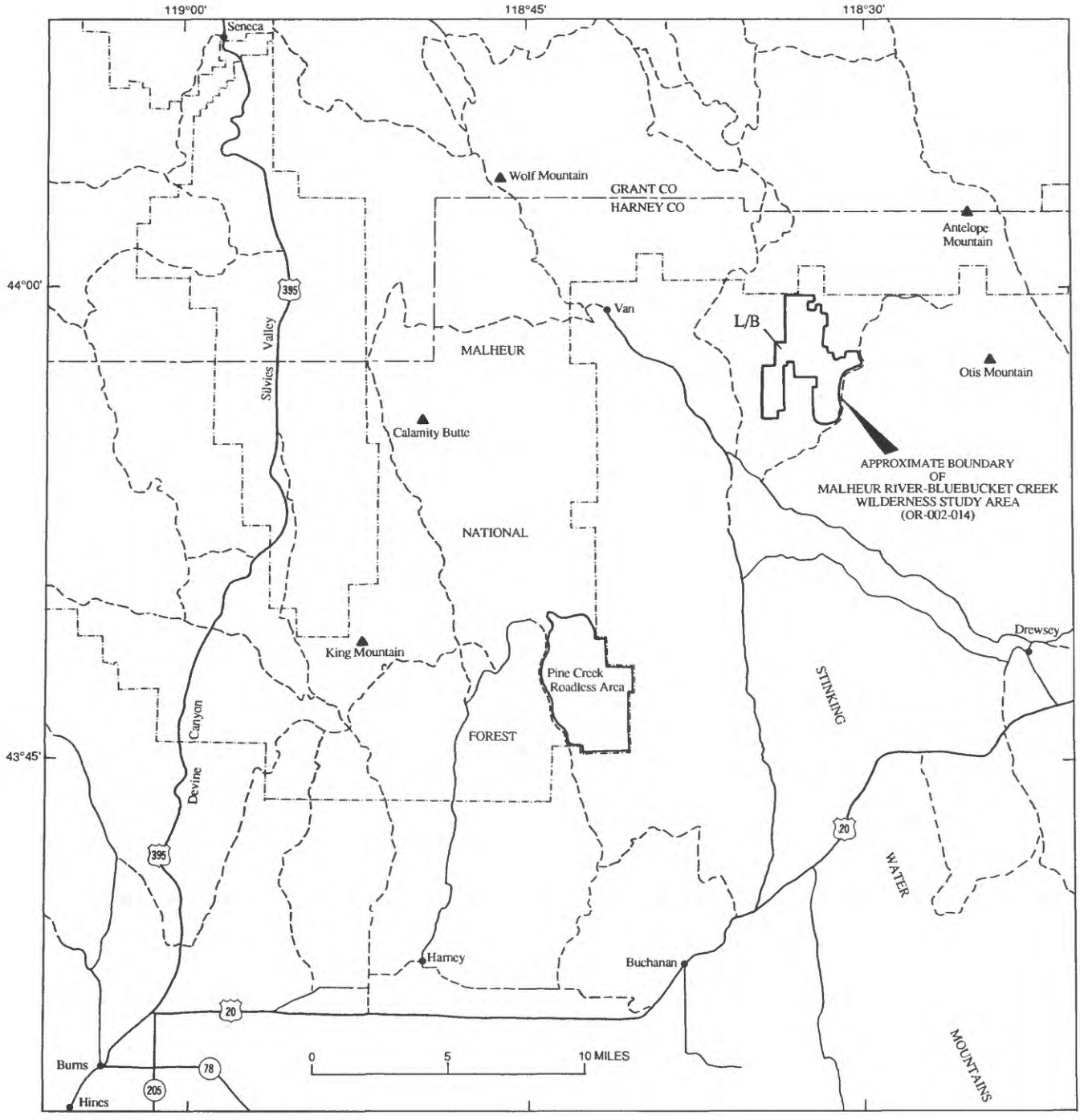
Mining Activity: There are no mines or prospects in the study area. As of October 1987, no mines or energy leases existed within the wilderness study area. Approximately 15-20 mi southeast of the study area, deposits of nearly pure diatomite are currently being mined by Eagle-Picher Industries. This deposit was chosen following an exploration drilling program in diatomite throughout the region.

Mineral setting/ Geology: The study area is underlain mainly by mesa-forming basalt lavas which overlie tuffaceous and diatomaceous siltstone and sandstone; andesite lavas underlie the northernmost part of the area.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Peters, T.J., and Winters, R.A., 1987, Mineral resources of the Malheur River-Bluebucket Creek Wilderness Study Area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 67-87, 11 p.

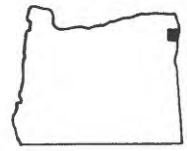


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for diatomite with certainty level B

Mineral resources of the Malheur River-Bluebucket Creek Wilderness Study Area.

Name: McGraw Creek
Area number: OR-006-001
Size (acres): 497



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area, although at least seven mineralized shear and breccia zones 30 to 200 ft wide trend north to north-northwest on the McDougall patented mining claims just to the south. Occurrence of native copper is reported over an area of several acres north of the patented claims.

Mineral resource potential (undiscovered): Metals mined nearby may be present in Triassic volcanic rocks that characterize the study area. The entire area has high potential for deposits containing copper, silver, and gold. Basalt exposed at the western edge of the area, although suitable for construction stone, is inaccessible and located too far from potential markets.

Mining Activity: No current (July 1990) mining claims are located within the wilderness study area. Claims were located in the drainages of Copper and Nelson Creeks as early as 1900 and as recently as 1976, but all were abandoned by 1985. A block of 19 claims that form the southeast margin of the wilderness study area were located between 1900 and 1904 and were patented in 1906. Underground workings on the claims total more than 1500 ft; no production is reported. Two prospects with underground workings are just north of the study area. The largest single copper producer in Oregon (Iron Dyke mine) is 5 mi to the south. As of October 1987, no oil and gas leases existed within the study area.

Mineral setting/ Geology: This study area is located on the west side of Hells Canyon, 10 miles south of Hells Canyon Dam. The study area is underlain by Triassic marine sedimentary and volcanic rocks, all representing parts of the Doyle Creek Formation of Vallier (1974). Dominant rock types include volcanic breccia, metabasalt, keratophyre, volcanic sandstone and shale, tuff, conglomerate, and limestone. These are in fault contact with Permian volcaniclastic rocks, some keratophyre, conglomerate, mudstone, and minor limestone.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Ashley, R.P., Roback, R.C., Turner, R.L., Jachens, R.C., Close, T.J., and Rains, R.L., 1988, Mineral resources of the Sheep Mountain Wilderness Study Area, Baker County, Oregon: U.S. Geological Survey Bulletin 1741-B, 14 p.

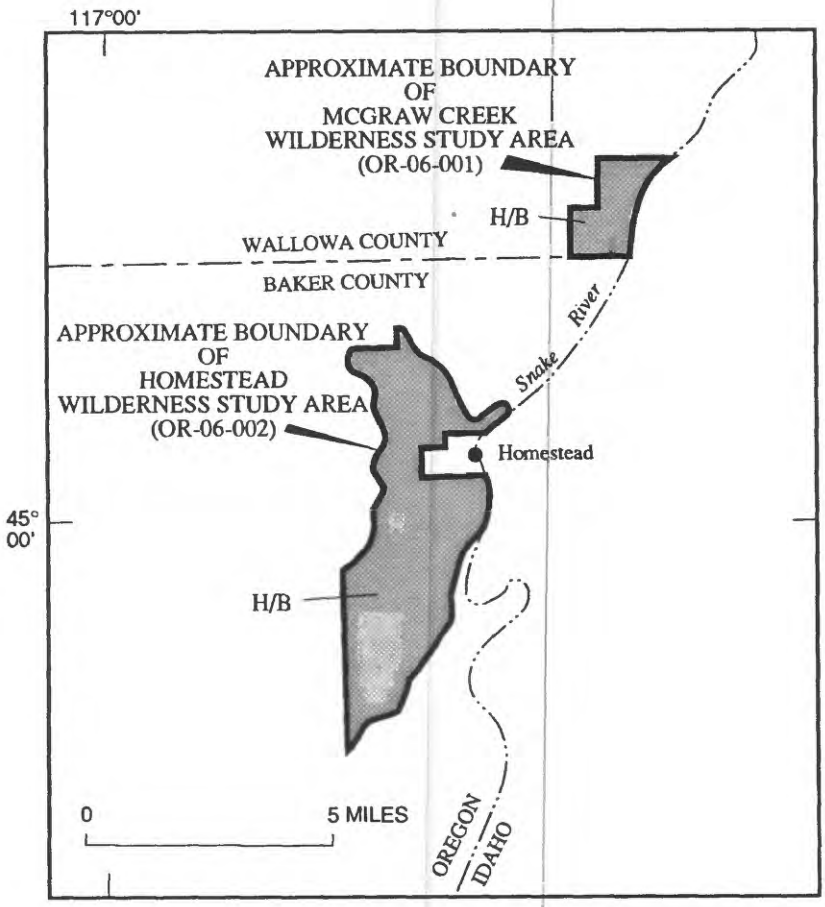
Forrest, R.A., 1971, McDougall Group: unpublished report for Sunshine Mining Company, available at U.S. Bureau of Mines, E. 360 3rd Ave. Spokane, WA, 99216, 2 p.

Fredrickson, R.S., and Fernette, Greg, 1983, Geology, energy, and mineral (GEM) resource evaluation of the Homestead GRA, Oregon-Idaho, including the McGraw Creek (6-1), Homestead (6-2), and Sheep Mountain (6-3) Wilderness Study Areas: prepared by WGM Inc., Mining and Geological Consultants, contract YA-553-CT2-1039 for the U.S. Bureau of Land Management, 54 p.

Hyndman, P.C., 1983, Mineral investigation of the McGraw Creek RARE II area (No. 6292), Wallowa County, Oregon: U.S. Bureau of Mines MLA Open-file Report 99-83, 16 p.

Simmons, G.C., Gualtieri, J.L., Close, T.J., Federspiel, F.E., Leszcykowski, A.M., and Hyndman, P.C., 1983, Mineral resource potential of the Hells Canyon Wilderness and contiguous roadless areas, Wallowa County, Oregon, and Idaho Nez Perce and Adams Counties, Idaho: U.S. Geological Survey Open-File Report 83-397, 20 p.

Vallier, T.L., 1974, A preliminary report on the geology of part of the Snake River Canyon, Oregon and Idaho: Oregon Department of Geology Geologic Map Series GMS-6, scale 1:125,000.

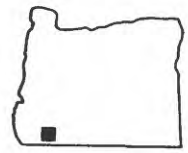


EXPLANATION

H/B, Geologic terrane having high mineral resource potential for copper, silver, and gold with certainty level B

Mineral resources of the McGraw Creek Wilderness Study Area.

Name: Mountain Lakes
Area number: OR-011-001
Size (acres): 334



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Sawlan and Winters, 1989).

Identified mineral resources (known): No mineral resources have been identified within the wilderness study area, and no mining claims are located in or adjacent to the study area. The lava that underlies the study area is largely covered by soil and vegetation and possesses no special characteristics that would make it desirable for use as building or decorative stone. Lavas such as these in the study area are abundant throughout the Cascade Range from northern California to Washington.

Mineral resource potential (undiscovered): The present field examinations confirm the conclusions of the earlier studies by Smith and others (1983) that there are no indications of any undiscovered resources. There are no signs of alteration in this area, nor are the rocks in the study area likely to host mineral deposits. Previous studies by Smith and others (1983) document that these lava and glacial deposits are nonmineralized elsewhere in the Mountain Lakes Wilderness and the adjacent Sky Lakes Roadless Area. We conclude that there is no potential for undiscovered mineral resources. The study area has no potential for oil and gas. Most likely, the study area is underlain at depth by plutonic rocks that are the nonerupted equivalents of the High Cascades volcanic rocks. This geologic environment is not conducive for the generation of hydrocarbons, the lavas would make poor reservoirs for hydrocarbons due to low permeability and porosity, and excessive heat associated with this magmatic environment would be destructive for hydrocarbons in the unlikely event that any have existed in the region. The study area lies in a region previously evaluated by Fouch (1982, 1983) as having no potential for oil and gas. There are no hot springs and no geothermal leases, exploration or development in the area. The study area has no potential for geothermal energy resources.

Mining Activity: No mines, prospects, or current mining claims (July 1990) are located within the wilderness study area. No energy leases existed within the wilderness study area as of October 1987.

Mineral setting/ Geology: The study area is underlain by Pliocene basaltic andesite lava, which, along the northern margin, is overlain by Pleistocene glacial deposits.

Recommendations: As all but 14 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Fouch, T.D., 1982, Petroleum potential of wilderness lands, Oregon: U.S. Geological Survey Miscellaneous Investigations Series Map I–1544, scale 1:1,000,000.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902–J, 5 p.

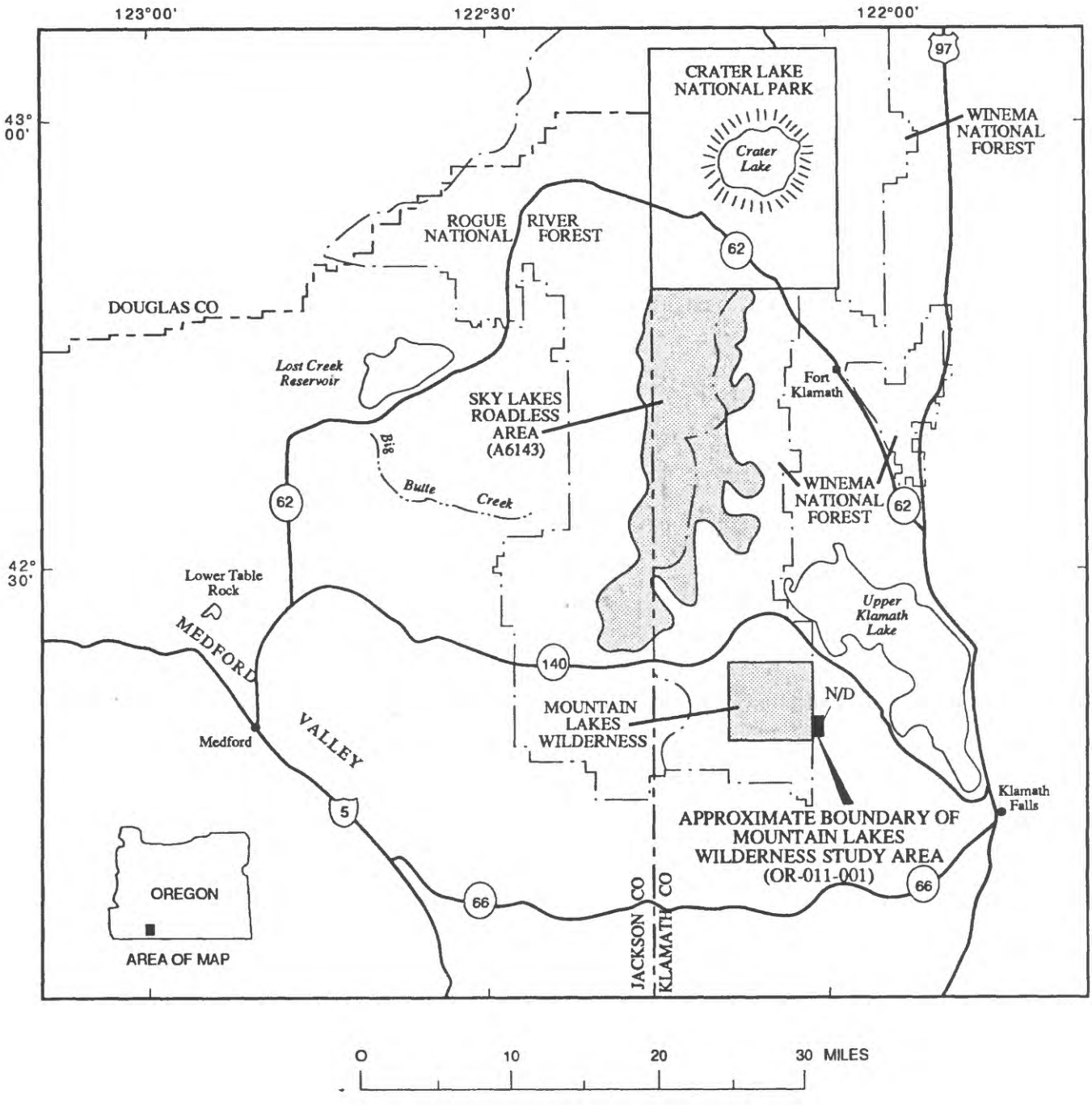
Sawlan, M.G., and Winters, R.A., 1989, Mineral resources of the Mountain Lakes Wilderness Study Area, Klamath County, Oregon: U.S. Geological Survey Open-File Report 89-0541, 10 p.

Smith, J.G., 1983, Geologic map of the Sky Lakes Roadless Area and the Mountain Lakes Wilderness, Jackson and Klamath Counties, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1507-A, scale 1:62,500.

Smith, J.G., Benham, J.R., and Johnson, F.L., 1983, Mineral resource potential map of the Sky Lakes Roadless Area and Mountain Lakes Wilderness, Jackson and Klamath Counties, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1507-B, scale 1:62,500.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Winters, R.A., 1988, Mineral resources of the Mountain Lakes Wilderness Study Area, Klamath County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 1-88, 10 p.

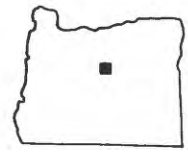


EXPLANATION

N/D, Geologic terrane having no mineral resource potential with certainty level D

Mineral resources of the Mountain Lakes Wilderness Study Area.

Name: North Fork
Area number: OR-005-031
Size (acres): 10,985



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for gold, mercury, low temperature (less than 194 °F) geothermal resources and moderate potential for oil and gas resources.

Mining Activity: No current (July 1990) mining claims are located within the wilderness study area, and no mining activity is reported. As of October 1987, 2,040 acres within the study area were leased for oil an gas; there were no geothermal or coal leases.

Mineral setting/ Geology: Much of the area is underlain by Picture Gorge Basalt. Sedimentary rocks and welded tuffs of the John Day Formation crop out in the southwest part of the area and basalt flows and ash-flow tuffs. The area lies in the Cretaceous-to-early-Tertiary-age Columbia River Basin and provides the basis for the petroleum resource classification (J.A. Ach, written commun., 1988).

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Detailed geologic mapping and geochemistry in this area would provide the base for a more complete evaluation.

References:

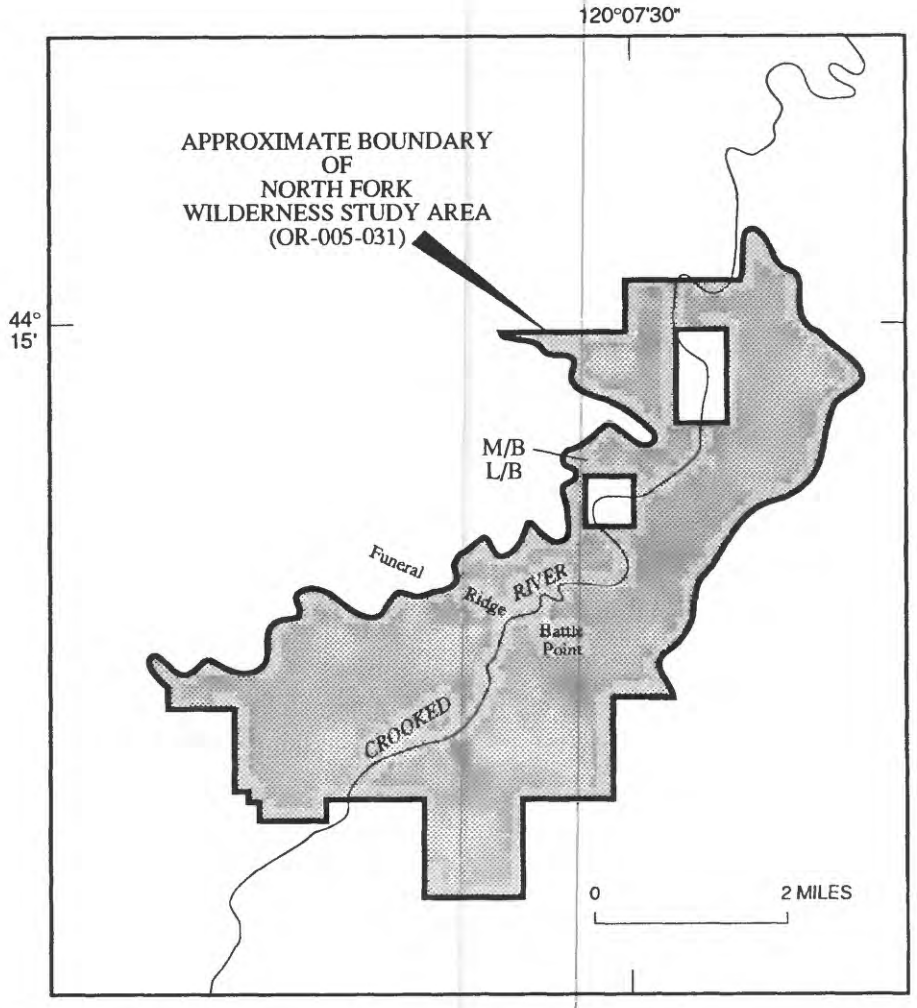
Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and minerals (GEM), North Fork Crooked River GRA (OR-050-012), Crook County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, Contract YA-553-CT2-1042, p. I1-A2.

Muffler, L.J.P., 1979, Assessment of geothermal resources of the United States--1978: U.S. Geological Survey Circular 790, 163 p., 3 maps, scales 1:2,500,000, 1:5,000,000, 1:1,000,000.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.



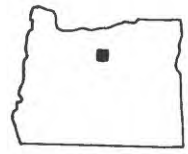
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for oil and gas with certainty level B

L/B, Geologic terrane having low mineral resource potential for gold, mercury, and geothermal energy with certainty level B

Mineral resources of the North Fork Wilderness Study Area.

Name: North Pole Ridge
Area number: OR-005-008
Size (acres): 6,369



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Minor and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the North Pole Ridge Wilderness Study Area. Stone, sand, and gravel could be quarried and used for construction purposes; however, suitable material is common in the region and more accessible to potential markets.

Mineral resource potential (undiscovered): The eastern part of the study area has moderate potential, and the remaining area has low potential for gold resources in small epithermal deposits. Low potential for placer gold deposits exists along the John Day River. The entire area has low potential for oil and gas resources, and no potential for geothermal energy resources.

Mining Activity: No mines, prospects, or mining claims are located in the wilderness study area. The Micron claim group (11 inactive claims in the southern part of the study area) was located at the site of a previously reported geochemical gold anomaly. No gold or other mineral resources were identified at these claims. As of October 1987, a total of 680 acres in the southwest part of the study area were leased for oil and gas. Current U.S. Bureau of Land Management practice restricts oil and gas exploration and development in the area seen from the John Day River (5,332 acres) by stipulating "no surface occupancy" on all leases. No geothermal leases exist in the study area. Four test holes were drilled in the vicinity (12 to 13 mi from the study area) between 1929 and 1957. One hole near Clarno, OR had a gas show.

Mineral setting/ Geology: Basalt of the Miocene Columbia River Basalt Group, consisting of a thick accumulation of lava in flows 50 to 100 ft thick, 1,600 ft of which is locally exposed, is the only bedrock unit exposed in the study area. Flows are typically columnar jointed and have vesicular, readily eroded tops. Lying unconformably beneath the basalt are interlayered tuff, tuffaceous sedimentary rocks, and mafic lava flows of the latest Eocene to early Miocene John Day Formation. Nearest exposures of the John Day are 1 mi south of the study area in the canyon of the John Day River. Unconformably underlying the John Day is the Eocene Clarno Formation consisting of interfingering andesitic flows, domes, plugs, breccia, and associated volcaniclastic and tuffaceous rocks. Documenting the existence of the John Day and Clarno beneath the Columbia River Basalt in this region, are the results of Standard Oil Company's Kirkpatrick No. 1 petroleum test hole drilled 13 mi northeast of the study area. The hole penetrated 2,440 ft of basalt, below which it penetrated 4,255 ft of John Day and possibly Clarno rocks. Quaternary alluvial deposits of sand and gravel occur chiefly along the inner banks of the present channel of the John Day River, but include patchy remnants in old, higher-level, abandoned meander scars. In addition, large landslide deposits, some more than a mile in length, are common along this segment of the river. The Columbia River Basalt dips northward about 5°, and is cut by a north-striking high-angle normal fault, somewhat discontinuous, and with variation in offset of 600 ft, near the southern boundary of the study area, near the center, and 200 ft near the northern boundary.

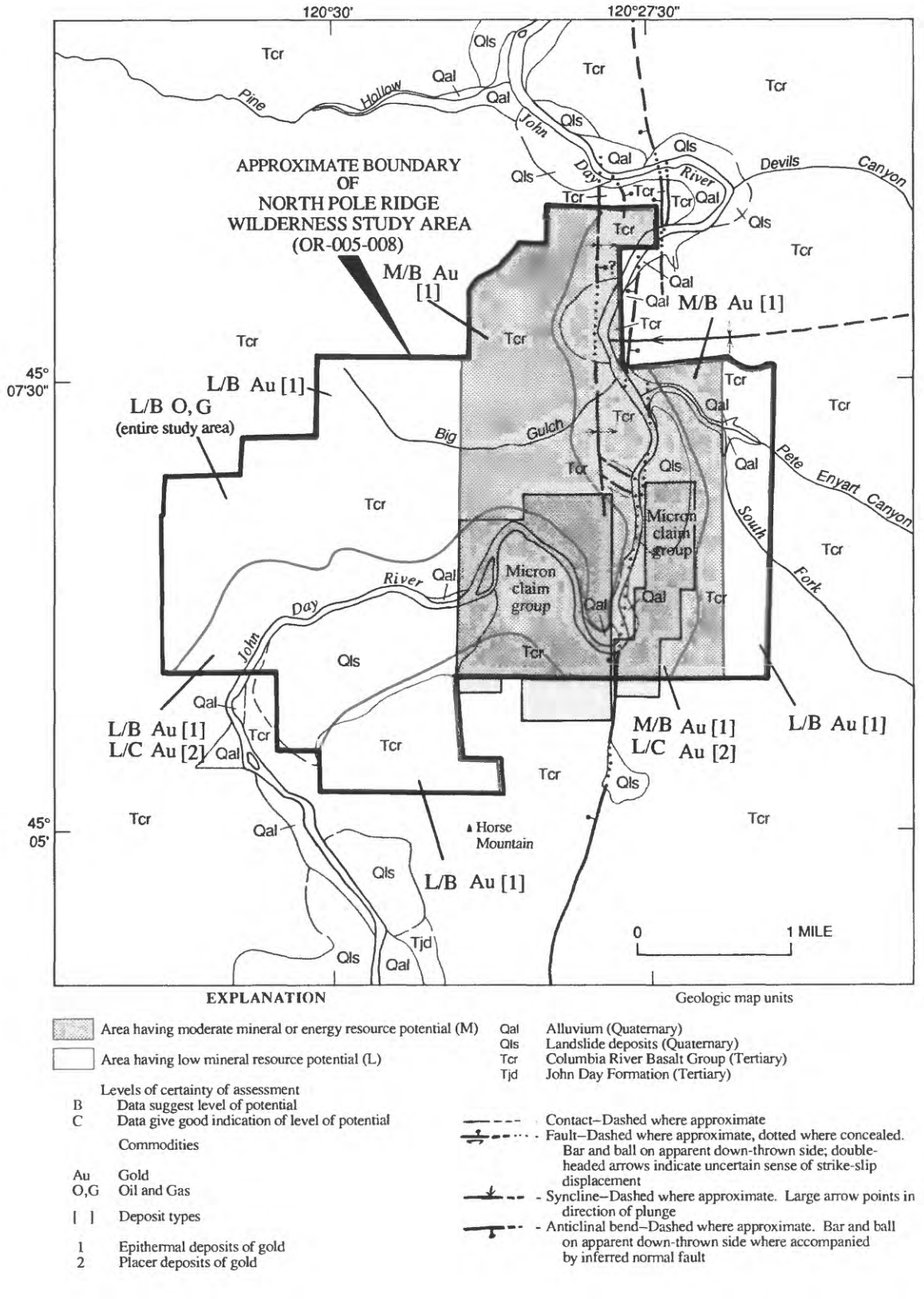
Recommendations: As all but 419 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Campbell, H.W., 1987, Mineral resources of the North Pole Ridge study area, Gilliam and Sherman Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 55-87, 12 p.

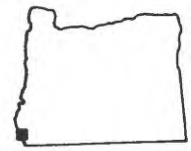
Davis, Dennis, 1983, Lower John Day GEM resource area: U.S. Bureau of Land Management Open-File Report, 13 p.

Minor, S.A., Ach, J.A., Frisken, J.G., Blakely, R.J., and Campbell, H.W., 1988, Mineral resources of the North Pole Ridge Wilderness Study Area, Sherman and Gilliam Counties, Oregon: U.S. Geological Survey Bulletin 1743-B, 18 p.



Mineral resources of the North Pole Ridge Wilderness Study Area.

Name: North Sisters Rocks
Area number: OR-012-008
Size (acres): 3



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Minor and other, 1988).

Identified mineral resources (known): No mineral resources have been identified in the North Sisters Rocks Wilderness Study Area. Stone from the wilderness study area does not constitute a resource because of unfavorable physical properties, and nearby quarries have sufficient stone resources to satisfy local demand for construction materials.

Mineral resource potential (undiscovered): The study area has been determined to have neither mineral nor energy resource potential.

Mining Activity: No mines, prospects, mining claims, or energy leases are located in the wilderness study area. An inactive gold beach-placer mine is located 1 mi north of the study area and three gold and chromite beach-placer prospects are located within 3 mi south. Two inactive stone quarries are located 0.5 mi south and east of the study area.

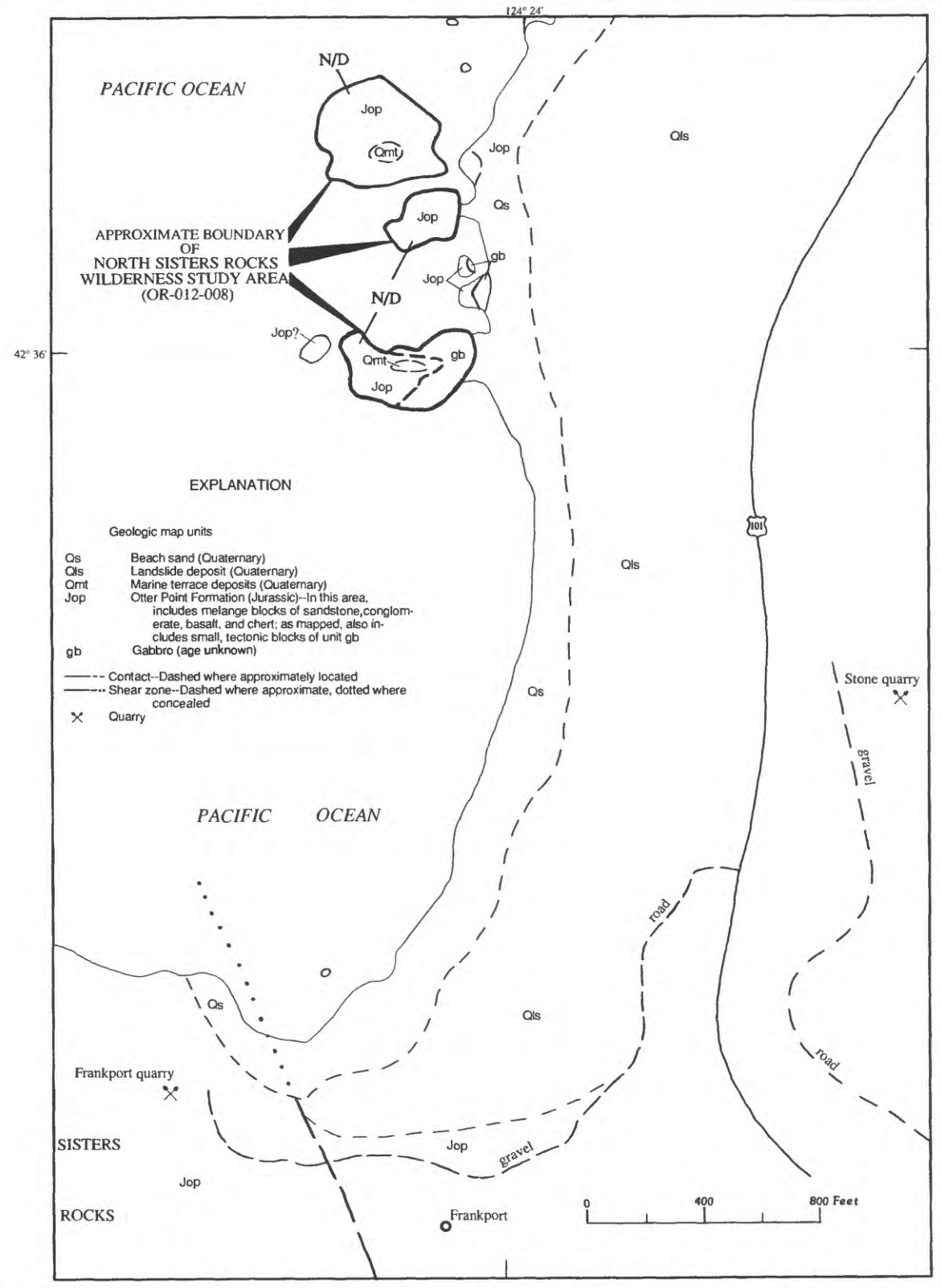
Mineral setting/ Geology: The study area consists of a group of rugged rocks, partly or completely detached from the coastal mainland by wave erosion (seastacks), that are composed of a complex assemblage of individual, fault-bounded assemblages of highly deformed rocks of varied compositions. The rocks are considered to be Jurassic or younger and assemblages consist of variably sheared blocks of sedimentary and volcanic rocks and gabbro enclosed in a highly sheared serpentinite-bearing matrix. Much of the deformation resulted from Jurassic and Cretaceous thrusting, but high-angle Tertiary faulting and shearing has added to overall complexity. Lack of consistent structural trends throughout the study area suggests that the seastacks are parts of nearby large coastal landslides.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Campbell, H.W., 1987, Mineral resources of the North Sisters Rocks Wilderness Study Area, Curry County, Oregon: U.S. Bureau of Mines Open-File Report MLA 29-87, 11 p.

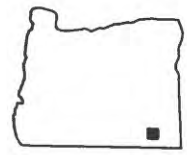
Minor, S.A., King, H.D., and Campbell, H.W., 1988, Mineral resources of the North Sisters Rocks Wilderness Study Area, Curry County, Oregon: U.S. Geological Survey Open-File Report 88-0012, 14 p.



N/D, Geologic terrane having no mineral resource potential with certainty level D

Mineral resources of the North Sisters Rocks Wilderness Study Area.

Name: Oregon Canyon
Area number: OR-003-157
Size (acres): 42,900



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Peterson and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the Oregon Canyon Wilderness Study Area. Sand and gravel along creek beds and stone are not classified resources because suitable material is available closer to prospective markets.

Mineral resource potential (undiscovered): The southern part of the Oregon Canyon study area has moderate and low potential for mercury and uranium resources near caldera ring fractures. The oldest tuff unit and the caldera rim have low potential for gold and silver resources in epithermal veins. The southern part of the area has low potential for antimony, bismuth, mercury, silver, molybdenum, and zinc resources in epithermal deposits. Tin geochemical anomalies in the southeastern part of the Oregon Canyon study area suggest a terrane having low potential for tin resources of unknown origin, possibly related to the basaltic rocks in that part of the study area. The area has low potential for zeolite resources because of its volcanic terrane. The study area has a low potential for geothermal energy resources because of its proximity to warm-water wells and springs nearby. There are no oil and gas leases in the area and it has low potential for resources of oil and gas. The tuff of Trout Creek Mountains, exposed in the study area, has a low potential for resources of light rare-earth elements and zirconium in local accumulations of aenigmatite, a sodium-iron-titanium mineral. This same rock unit is locally attractive enough to be used as decorative building stone; therefore, this unit has low potential for decorative stone resources. Sand and gravel accumulations are present locally in the study area, but material of similar quality is available elsewhere, closer to potential markets.

Mining Activity: No mines or mineralized areas are known. According to April 1990 U.S. Bureau of Land Management claim recordation indices, about 45 mining claims (Halloween group) are held in the southeastern part of the wilderness study area and one claim is held in the southwestern panhandle of the study area. Several large blocks of mining claims, probably located for uranium, blanketed the southern part of the study area during the 1970's and 1980's, but were dropped. Eight mining claims were located in 1914 in the southeastern part of the study area. As of October 1987, no geothermal or other mineral leases existed in the Oregon Canyon Wilderness Study Area.

Mineral setting/ Geology: The study area is comprised of four contiguous wilderness study areas in the northern part of the Basin and Range physiographic province, and additionally, is in a region where Tertiary volcanic calderas are numerous, and are the sources for most of the underlying rocks. The oldest rocks, and the only ones unrelated to nearby calderas, are multiple flows of porphyritic basalt that average about 20 ft thick and may correlate with the middle Miocene Steens Basalt. Progressively overlying the basalt is a zoned ash-flow tuff and a flow sequence of basalt, andesite, and rhyolite, interbedded with tuff and flow breccia; all the foregoing units dip northwestward 3° to 5°. Nearly 600 ft of rhyolitic ash-flow tuff overlie the flow sequence and, in the southeasternmost part of the study area, also overlie a small cluster of rhyolite domes and dikes which cut the older rocks. Most of the Tertiary units in the local stratigraphic section have been radiometrically dated at 15 to 16 Ma, hence, all are middle Miocene in age. Quaternary alluvial deposits consist of poorly sorted, locally derived material in canyons and along margins of mountains. Structure in the southern part of the study area is dominated by intersecting northern rims of Washburn and Long Ridge calderas--part of the McDermitt caldera complex--and their associated sub-parallel fault systems. Displacements along these ring-fault systems, which are typically stepped downward toward the caldera center, are generally less than 1,000 ft, but are locally as much as 1,500 ft. Structure in the central and northern parts consists of scattered, north- to northwest-striking, high-angle, typical basin and range faults.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

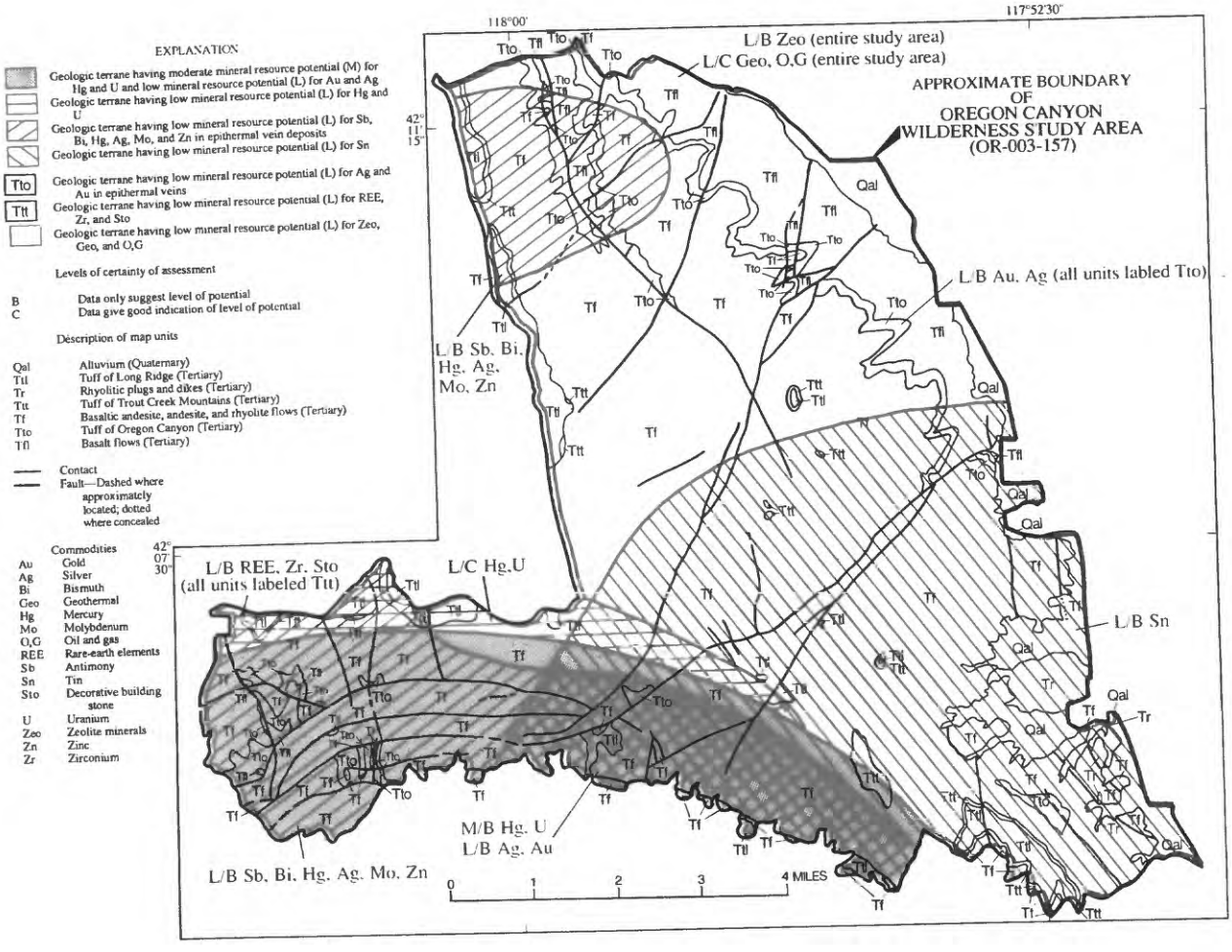
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Gray, J.J., Peterson, N.N., Clayton, J., and Baxter, G., 1983, Geology and mineral resources of the 18 wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-2. 106 p.

Jones, J.L., Erickson, M.S., and Fey, D.L., 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Fifteen Mile Creek, Twelve Mile Creek, Oregon Canyon, and Willow Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0696, 48 p.

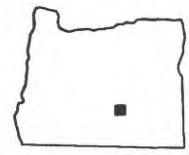
Peterson, J.A., Rytuba, J.J., Plouff, Donald, Vercoutere, T.L., Turner, R.L., Sawatzky, D.L., Leszcykowski, A.M., Peters, T.J., Schmauch, S.W., and Winters, R>A., 1988, Mineral resources of the Fifteen Mile Creek, Oregon Canyon, Twelve Mile Creek, and Willow Creek Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1742-B, 24 p.

Winters, R.A., and Peters, T.J., 1987, Mineral resources of the Oregon Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 38-87, 14 p.



Mineral resources of the Oregon Canyon Wilderness Study Area.

Name: Orejana Canyon
Area number: OR-001-078
Size (acres): 24,600



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Conrad and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The study area is determined to have low resource potential for gold, silver, and tin. Oil and gas potential is unknown because bedrock beneath the thick volcanic cover is not exposed.

Mining Activity: There is no evidence of exploration or mining activity in the area studied; no mining claims or energy leases are current.

Mineral setting/ Geology: The dominant rock in the study area is a Miocene welded rhyolitic ash-flow tuff, as much as 100 ft thick that forms the surface of a plateau. Beneath the tuff, Orejana Canyon and Rim expose a 400-ft sequence composed of three basaltic to andesitic lava flows and interbedded tuffaceous sedimentary rocks, also of Miocene age. The terrane is cut by several north-south-trending steeply dipping basin-and-range faults.

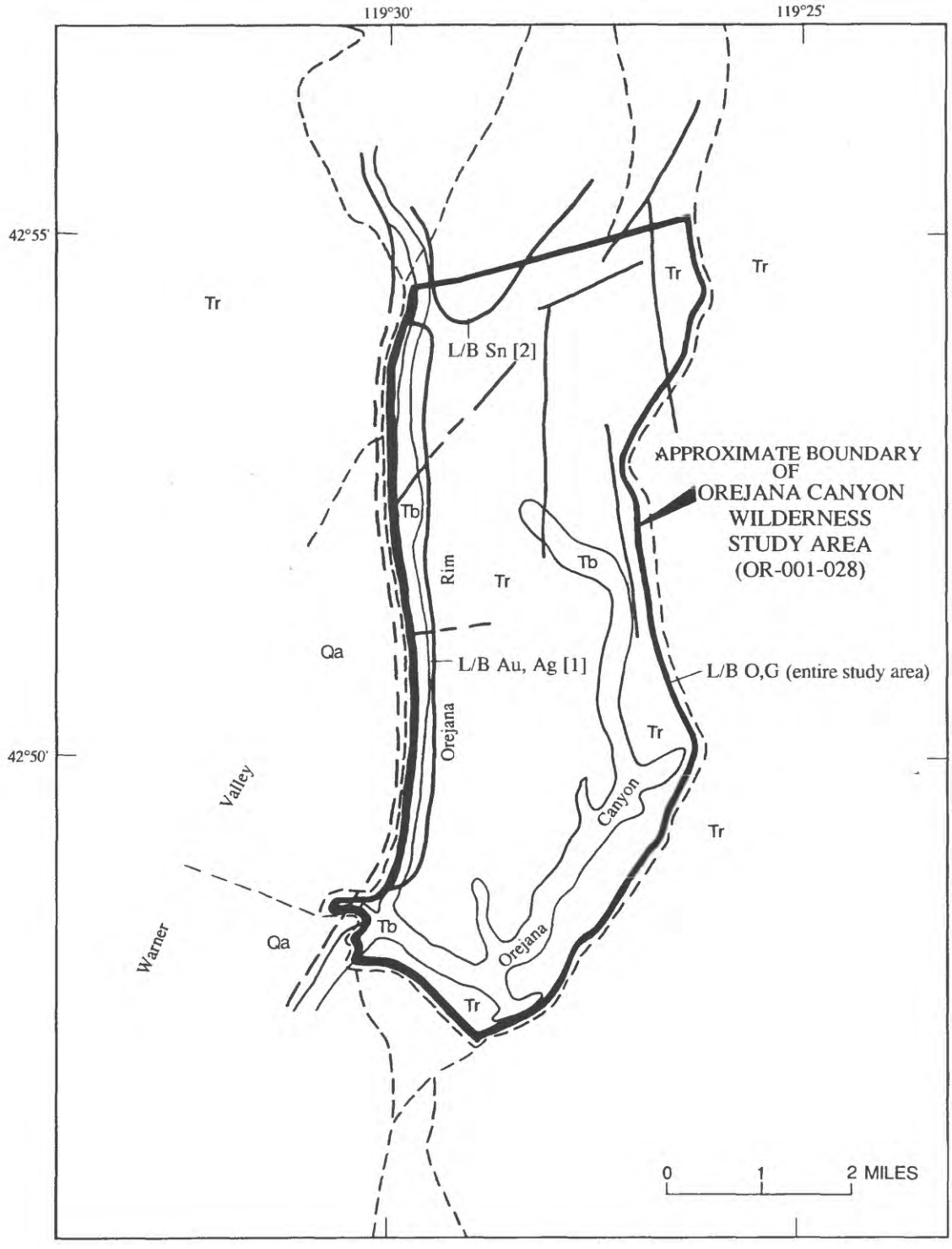
Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 9,800 acres that constitute the balance.

References:

Benjamin, D.A., 1987, Mineral resources of the Orejana Canyon study area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 46-87, 12 p.

Conrad, J.E., King, H.D., Gettings, M.E., Diggles, M.F., Sawatzky, D.L., and Benjamin, D.A., 1988, Mineral resources of the Orejana Canyon Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1738-B, 9 p.

Erickson, M.S., King, H.D., Tippitt, F.W., and Hageman, P.L., 1989, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Orejana Canyon (OR-001-078) Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Open-File Report 89-0302, 14 p.



Mineral resources of the Orejana Canyon Wilderness Study Area.

Area having low resource potential for specified commodity

B — Certainty level of assessment—Data suggest level of potential

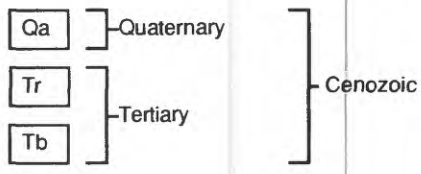
Commodities

Ag	Silver
Au	Gold
Sn	Tin
O/G	Oil and gas

[ ] Deposit types

1	Epithermal or hot-spring gold-silver low-grade bulk-mineable
2	Rhyolite-hosted tin

Correlation of map units



Description of map units

Qa	Alluvium, colluvium, and talus (Holocene or Pleistocene)—Mostly stream sand and gravel, fanglomerate, and aeolian and lacustrine sediments
Tr	Rhyolite (Miocene)—Rhyolite welded tuff. Contains phenocrysts of quartz, sanidine, and plagioclase in a eutaxitic groundmass of devitrified glass shards. Abundant lithophysae in the lower two-thirds of the flow, commonly weathering out to give the rock a "swiss cheese" appearance
Tb	Basalt flows and tuffaceous sedimentary rocks (Miocene)—Includes basalt flows and flow breccia, air fall tuff, and associated sedimentary rocks

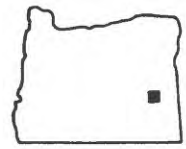
——— Contact

—T— — Normal fault—Bar and ball on downthrown side; dashed where approximately located

— — — Dirt road or jeep trail

Explanation, mineral resources of the Orejana Canyon Wilderness Study Area.

Name: Owyhee Breaks
Area number: OR-003-059
Size (acres): 13,380



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1990).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Occurrences of jasper and associated zeolite are present along Birch Creek on the east side of the study area. An occurrence of bentonitic clay in the north part of the study area contains less than 40,000 tons. Sand and gravel in and near the Owyhee River are too small in volume and too inaccessible to be mined; little gold is present in the gravel.

Mineral resource potential (undiscovered): Gold resources have been discovered in similar rocks in a similar geologic setting to silicified tuff along northwest-trending faults in the study area at the Red Butte gold prospect, 8 mi to the north-northeast. Therefore, this area is considered to have high resource potential for gold in volcanic- and sediment-hosted hot-springs deposits. The remaining study area has moderate potential for gold resources in volcanic- and sediment-hosted deposits. Parts of the study area underlain by tuff from the Mahogany Mountain caldera have low potential for zinc resources in volcanogenic disseminated deposits. Sedimentary rocks that underlie the northwestern part of the study area have low potential for fluorite resources. Thin beds of diatomaceous earth are also exposed in the northern and northwestern parts of the study area. The sedimentary rocks have moderate potential for bentonite and diatomite resources. North-trending fault zones within and adjacent to the study area have moderate potential for geothermal energy resources. A 1,000-ft-thick sequence of lacustrine and fluvial sedimentary rocks that underlie the northwestern part of the study area could serve as source rocks for oil and gas resources. These rocks have low potential for oil and gas energy resources.

Mining Activity: Bulldozer scrapings along a ridge in the eastern part of the study area near Birch Creek are evidence of past exploration and possible small scale mining of jasper. A prospect pit in jasper is at the west side of the study area. A geochemical survey identified low-level anomalies of gold, silver, arsenic, and molybdenum in the central part of the study area. As of July 1990, six current mining claims covered the known jasper occurrence on the east side of the study area, and Placer Dome US, Inc. held at least 130 mining claims within 1 mi east of the study area. As of October 1987, there were no energy leases in the wilderness study area.

Mineral setting/ Geology: The Owyhee Breaks study area is underlain by two extensive rhyolite ash-flow tuffs, several rhyolite intrusions, and a thick sequence of late Miocene and Pliocene sedimentary rocks and basalt flows. The lowermost ash-flow tuff erupted from the Mahogany Mountain caldera located 7 km northeast of the study area.

Recommendations: As all but 280 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

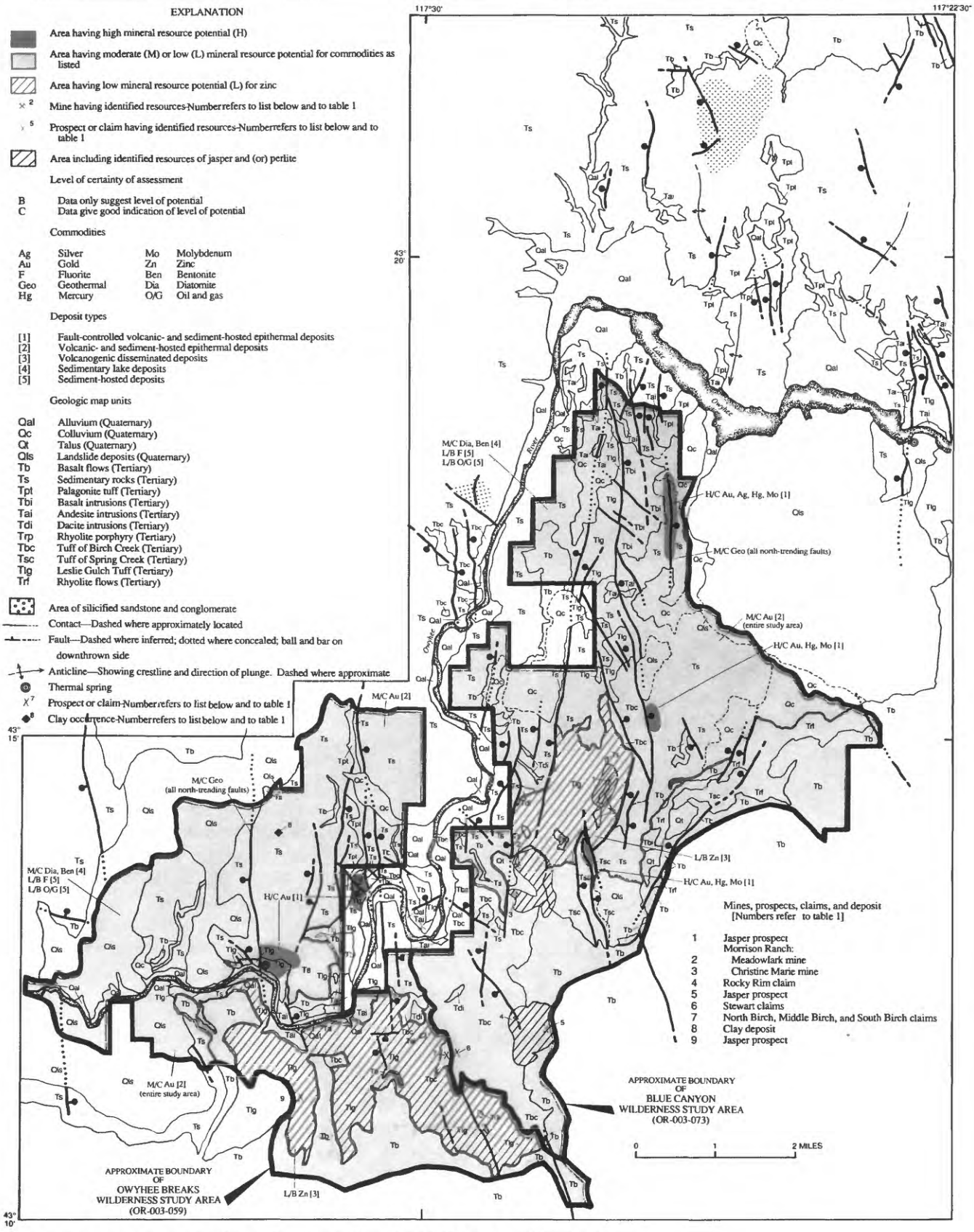
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, Co, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-531-CT3-440045, 94 p.

Causey, J.D., 1989, Mineral resources of the Owyhee Breaks study area, Malheur County, Oregon: U.S. Bureau of Mines Open File Report MLA 15-89, 21 p.

Gray, J.J., Peterson, N.N., Clayton, Janine, and Baxter, Gary, 1983, Geology and mineral resources of 18 BLM wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-file Report O-83-2, 106 p.

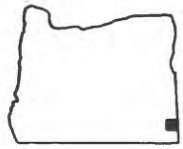
Robinson, M.L., Meyer, W.T., Lovell, J.S., and Park, S., 1985, Geology, energy, and mineral resource survey of the Mahogany Planning Unit, Northern Malheur Resource Area, Vale District, Oregon: Golden, CO, Barringer Resources, Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT4-340078, 220 p.

Vander Meulen, D.B., Barlock, V.E., Plumley, P.S., Frisken, J.G., Griscom, Andrew, and Causey, D.J., 1990, Mineral Resources of the Blue Canyon and Owyhee Breaks Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-G, 28 p.



Mineral resources of the Owyhee Breaks Wilderness Study Area.

Name: Owyhee Canyon
Area number: OR-003-195
Size (acres): 180,680



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Evans and others, 1987).

Identified mineral resources (known): About 100 million yd^3 of inferred subeconomic sand and gravel resources have been identified at three localities in the northern part of the study area. No metallic mineral resources have been were identified within or adjacent to the wilderness study area. The sand and gravel appears to be suitable for aggregate or road-base uses. Limited sampling suggests the gravel contains traces of gold, less than $0.05/$yd^3$ at a gold price of $400/troy ounce. Platy, medium-grained rhyolite that may be suitable for decorative building stone is present in a 2 mi^2 area at the south end of the study area.

Mineral resource potential (undiscovered): The study area has low resource potential for deposits of silver, lead, and tin in zones of weak epithermal alteration. Potential for geothermal energy is also low. Because of the young volcanic cover, the potential for the occurrence of oil and gas is unknown. The placer-gold and building-stone resources are not expected to exceed the extent already identified.

Mining Activity: Evidence of prospecting activity was found at three sites in and near the wilderness study area. Chalcedony occurrences are exposed in hand dug pits near the north end of the study area and in bulldozer scrapings in the central part along Toppin Creek. The third site is a gravel pit also at the north end of the study area. A geochemical survey showed several areas within the study area with low-level anomalies for gold, silver, molybdenum, lead, tin, and fluorine. Subsequent sampling revealed no evidence of significant mineralization. No current mining claims are located in the study area (as of July 1990). Oil and gas leases dating from 1982 and covering 21,000 acres in the northern part of the study area were terminated by 1984; no drilling or geophysical work was done.

Mineral setting/ Geology: The oldest and dominant rock in the study area is the middle Miocene Swisher Mountain Tuff, a rhyolitic, welded ash-flow tuff, which is overlain by a subhorizontal sequence of poorly consolidated and unconsolidated sedimentary and tuffaceous rocks and basalt flows that range in age from middle Miocene to Pleistocene. Closely spaced, steeply dipping normal faults that strike mainly northwest are numerous in the northern part of the study area, and show stratigraphic separations of a few feet to a few hundred feet.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 28,640 acres that constitute the balance. Additional sampling of gravel in the northern part of the wilderness study area should be done to test the extent, grade, and mineability of possible placer gold deposits.

References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-531-CT3-440045, 94 p.

Erickson, M.S., Malcolm, M.J., Hoffman, J.D., and King, H.D., 1986, Analytical results and sample locality maps of the stream-sediment and heavy-mineral-concentrate samples from the Honeycombs (OR-003-077A) and the Owyhee Canyon (OR-003-195) Bureau of Land Management Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Open-File Report 86-0628, 48 p.

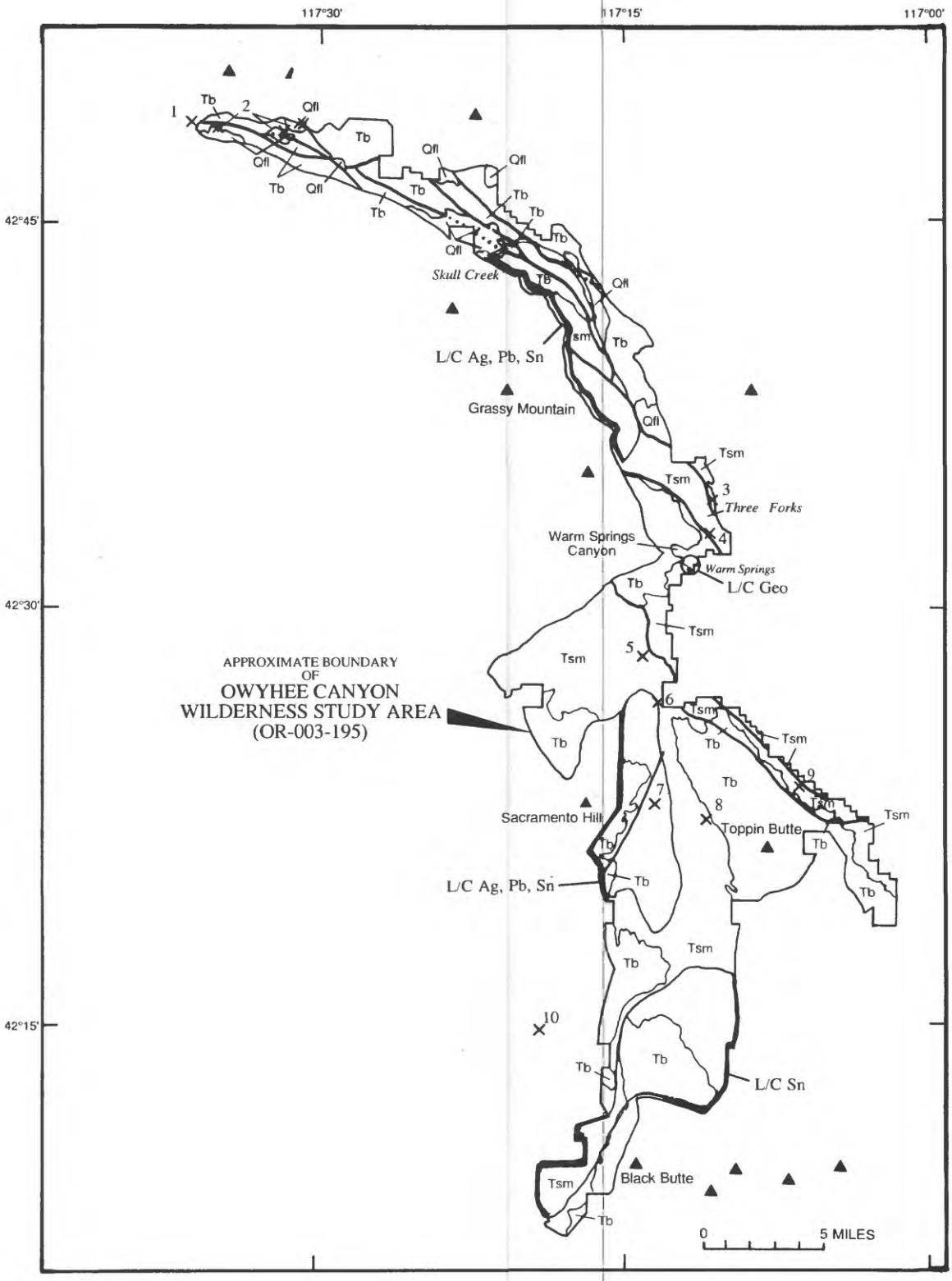
Evans, J.G., 1987, Geologic map of the Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1926, scale 1:62,500.

Evans, J.G., Hoffman, J.D., Kulik, D.M., and Linne, J.M., 1987, Mineral resources of the Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1719-E, 18 p.

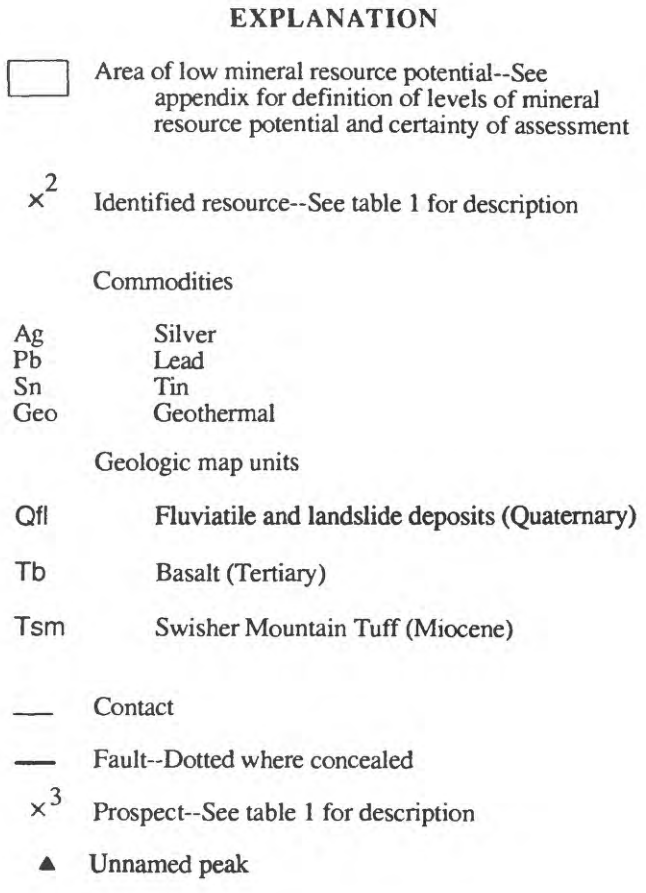
Gray, J.J., Peterson, N.N., Clayton, Janine, and Baxter, Gary, 1983, Geology and mineral resources of 18 BLM wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-file Report O-83-2, 106 p.

Linne, J.M., 1986, Mineral resources of the Owyhee Canyon Study Area, Malheur County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report MLA 22-86, 14 p.

U.S. Bureau of Land Management, 1989, Owyhee Canyonlands Wilderness, final environmental impact statement: Boise District Office, p. I1-X2.

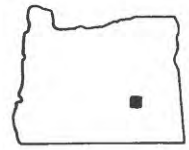


Mineral resources of the Owyhee Canyon Wilderness Study Area.



Explanation, mineral resources of the Owyhee Canyon Wilderness Study Area.

Name: Palomino Hills
Area number: OR-003-114
Size (acres): 54,600



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area; borrow pits, gravel pits and prospects along Oregon Highway 78 suggest the presence of stone and gravel resources.

Mineral resource potential (undiscovered): The area has low potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas resources. The diatomite would be present most likely as impure, low-tonnage deposits. The geothermal energy would be present along range-bounding faults.

Mining Activity: Topographic maps show numerous borrow pits along Oregon Highway 78, which forms the east margin of the wilderness study area. In addition, gravel pits and groups of prospect pits are shown at four places along the highway. All these workings are likely associated with construction and maintenance of the highway. No current mining claims are located within the study area (July 1990). As of October 1987, no oil and gas leases existed within the study area.

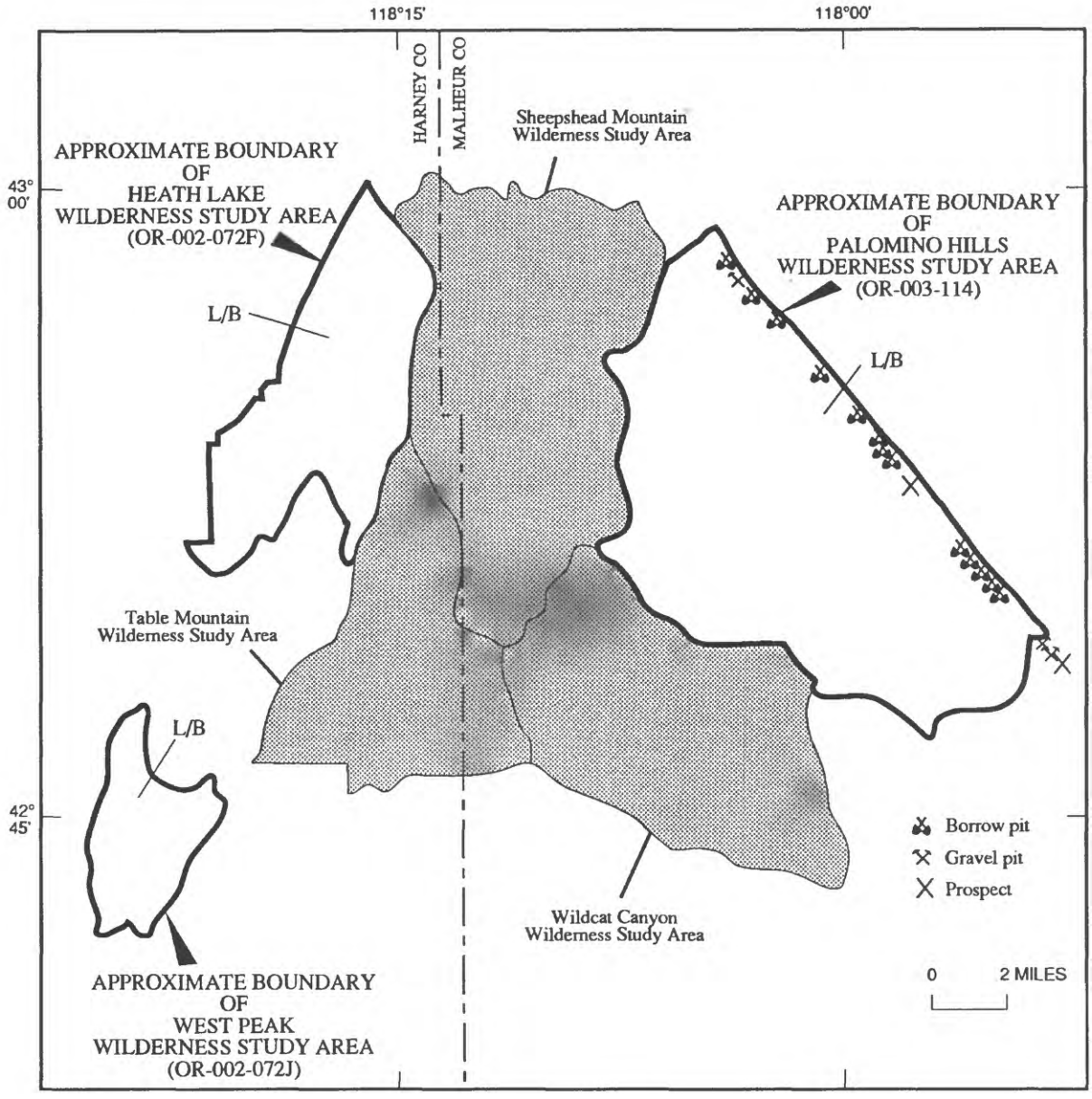
Mineral setting/ Geology: The Palomino Hills (OR-003-114) Wilderness Study Area is underlain by lava flows and domes that range in composition from basalt to dacite and probably range in age from 14 to 11 million years old. Some relatively young (less than 2 million years old) basalt is exposed in the northwestern part of the study area.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Resource surveys should include establishing the quantity and quality of construction materials present, and estimating additional costs of obtaining such materials elsewhere.

References:

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and minerals (GEM), Sheepshead Mountain GRA (OR-023-018), Harney and Malheur Counties, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, Contract YA-553-CT2-1042, p. I1-A2.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

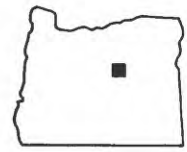


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas with certainty level B

Mineral resources of the Palomino Hills Wilderness Study Area.

Name: Pine Creek
Area number: OR-002-098A
Size (acres): 200



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): The Anderson Accident property is a known chromite producer and has additional resources. Other occurrences of unknown extent include chrysolite asbestos, vein-type gold, copper-silver mineralization and bentonite.

Mineral resource potential (undiscovered): Chromite deposits in the Strawberry Mountains are characteristically small (less than 100 tons). The area has high potential for marginally economic or subeconomic deposits of chromite. The area has low potential for asbestos, gold, copper, silver, and bentonite.

Mining Activity: Mining activity within the wilderness study area began about 1900 with prospects and mines active between 1915 and 1920. The Anderson Accident mine has past production of 400 tons of chromite in 1916 and 1917. As of July 1990, U.S. Bureau of Land Management records showed 15 active lode claims but no active placer claims within the study area. As of October 1987, no energy leases existed within the study area.

Mineral setting/ Geology: The study area is underlain by olivine-rich peridotite. This rock is part of the Canyon Mountains Complex, a group of rocks which formed as oceanic crust in Permian time (286 to 245 m.y. ago). In the Strawberry Mountains area, this peridotite is the main host rock of chromite deposits which occur as small pods or lenses within the peridotite.

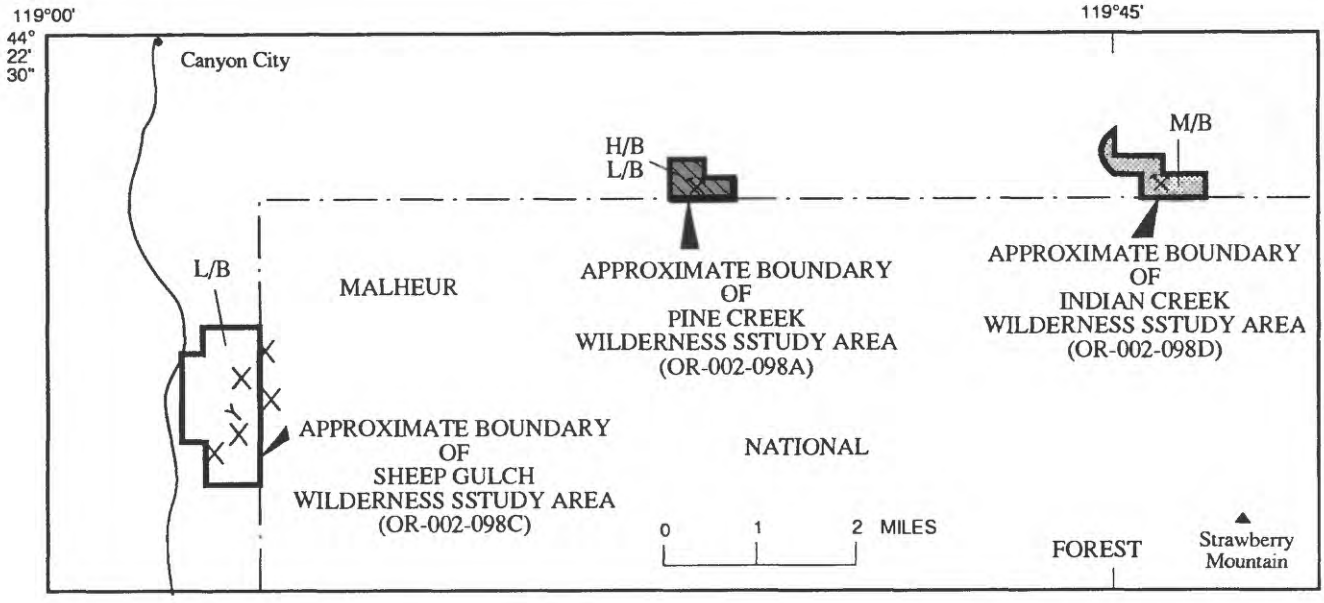
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Westgate, L.G., 1922, Deposits of chromite in eastern Oregon: U.S. Geological Survey Bulletin 725-A, p. 37-60.

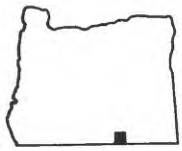


EXPLANATION

H/B, Geologic terrane having high mineral resource potential for chromite with certainty level B
L/B, Geologic terrane having low mineral resource potential for asbestos, gold, copper, silver, and bentonite with certainty level B

Mineral resources of the Pine Creek Wilderness Study Area.

Name: Pueblo Mountains
Area number: OR-002-081/NV-020-642
Size (acres): 72,090



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Roback and others, 1987).

Identified mineral resources (known): This area contains in excess of 1,000,000 tons of inferred marginal resources of low grade (from 0.09 to 0.01 oz. gold per ton) gold. Other resources include: small marginally economic resources of mercury; large subeconomic resources of building stone; small subeconomic resources of chalcedony; medium-sized subeconomic resources of clay; small subeconomic resources of copper; small subeconomic resources of diatomite; and small locally economic resources of sand and gravel (Munts and Willett, 1987). Although there are no Known Geothermal Resource Areas (KGRA) and no low temperature geothermal resources known within the wilderness study area (Riccio, 1978), both hot springs and the Alvord KGRA exist to the northeast of the study area.

Mineral resource potential (undiscovered): Several zones of altered and locally silicified rock along faults peripheral to the east boundary of the study area are assigned high and moderate resource potential for the occurrence of deposits containing gold, silver, mercury, copper and molybdenum, on the basis of anomalously high geochemical concentrations of either those elements, or of pathfinder elements such as arsenic. A dacite flow near the center of the study area has low potential for deposits containing silver, zinc, mercury, and molybdenum. A zone more than ten miles long along the west boundary of the study area has low resource potential for silver and mercury in rhyolitic ash-flow tuff. Tertiary sedimentary rocks have low resource potential for oil and gas, and the entire study area has low potential for geothermal energy resources.

Mining Activity: Past recorded production includes approximately 500 lbs of mercury and less than 25 oz of gold, primarily from lode claims. The wilderness study area is part of the historic Pueblo Mountain mining district and in excess of 700 claims have been staked since 1894. At least 400 of these claims were filed after 1983. This study area has been prospected by both individuals for gold, mercury, and copper, and by mining companies for porphyry copper deposits and bulk-tonnage low-grade gold deposits. Large claim blocks were first located in 1984 for bulk tonnage gold. At least one large claim block within and near the east edge of the study area is currently receiving active exploration for low-grade gold deposits. As of July 1990, U.S. Bureau of Land Management records showed at least 375 active lode mining claims within or near the study area; mining companies have been reexamining an additional 300 dormant claims. As of October 1987, no energy leases existed within the study area.

Mineral setting/ Geology: Rocks of the study area are exposed in a fault-block range bounded on the east by a zone of high-angle normal faults of more than 15,000 ft in aggregate vertical offset. Basement rocks are a Jurassic igneous and metamorphic crystalline complex that was intruded by granitoid plutons in the Cretaceous. The complex is unconformably overlain by Oligocene and Miocene volcanic rocks, mainly flows, that range from basalt to latite, and are interlayered with tuff, rhyolitic ash-flow tuff, and sedimentary rocks. These rocks are discontinuously overlain by Quaternary alluvial, lacustrine, and eolian deposits. Strong but locally developed northeast-trending, southeast-dipping foliation is the dominant pre-Tertiary structure. Quartz veins and elongated gossan zones may be in part contemporaneous with the metamorphism. The young basin and range faults that define the eastern margin of the Pueblo Mountains are deflected northwestward, from a regional northeast trend, along the northeast margin of the study area. There, they coincide with the western ring-faults that define the Pueblo Mountains caldera and locally juxtapose Tertiary rocks against metamorphic basement.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 30,775 acres that constitute the balance. Additional work is recommended in several locations for several commodities. Work should include additional mapping and sampling, and some geophysics. Areas for further evaluation include the eastern half of the wilderness study area for epithermal gold (possibly two separate occurrences); the southwest corner of the study area for porphyry copper mineralization; the west edge for clay, zeolites, and possibly precious metals; and the northwestern corner of the study area for uranium, lithium and molybdenum deposits near the Pueblo Caldera. The study area should also be evaluated for geothermal resources.

References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral Resource Assessment Through Geochemical Studies of Heavy Mineral Concentrates from Wilderness Study Areas in the Burns, Prineville, and Vale Districts, Southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT3-440045, 250 p.

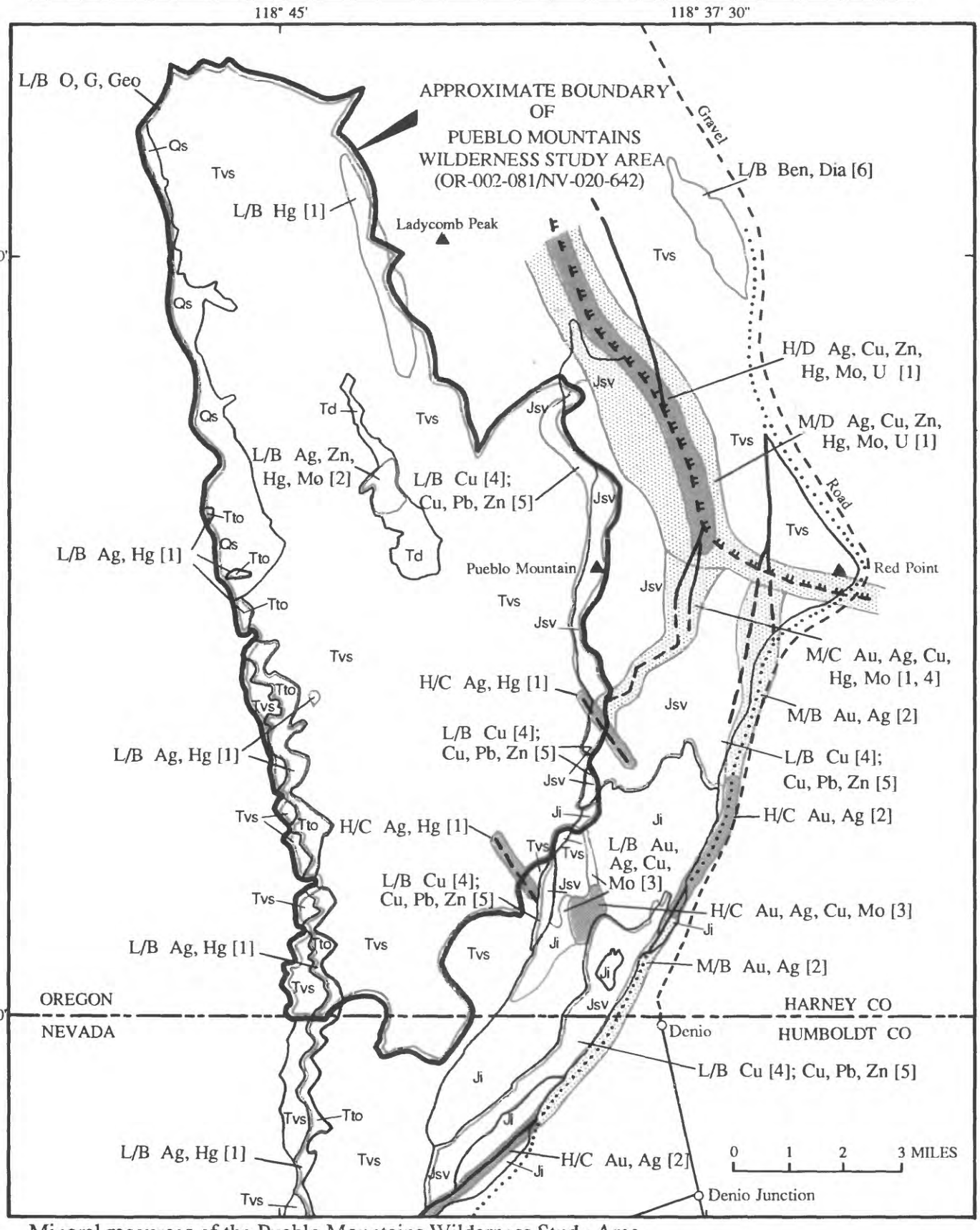
Evans, J.G., Hoffman, J.D., Kulik, D.M., and Linne, J.M., 1987, Mineral resources of the Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1719-E, 18 p.

Munts, S.R., and Willett, S.L., 1987, Mineral resources of the Pueblo Mountains study area, Harney County, Oregon and Humboldt County Nevada: U.S. Bureau of Mines Open-File Report MLA 8-87, 43 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

Roback, R.C., Vander Meulen, D.B., King, H.D., Plouff, Donald, Munts, S.R., and Willett, S.L., 1987, Mineral resources of the Pueblo Mountains Wilderness Study Area, Harney County, Oregon, and Humboldt County, Nevada: U.S. Geological Survey Bulletin 1740-B, 30 p.

U.S. Geological Survey, 1985, Aeromagnetic map of the Pueblo Mountains, southeastern Oregon: U.S. Geological Survey Open-File Report 85-0671



Mineral resources of the Pueblo Mountains Wilderness Study Area.

EXPLANATION

Area with high mineral resource potential

Area with moderate mineral resource potential

Area with low mineral resource potential

See appendix for definition of levels of mineral resource potential and certainty of assessment

Commodities

Ag	Silver
Au	Gold
Cu	Copper
Hg	Mercury
Mo	Molybdenum
Pb	Lead
U	Uranium
Zn	Zinc
Ben	Bentonite
Dia	Diatomite
O,G	Oil and Gas
Geo	Geothermal

[ ] Types of deposits

1	Hydrothermal caldera-related deposits
2	Epithermal vein deposits
3	Porphyry deposits
4	Base- and precious-metal deposits
5	Volcanogenic massive sulfide deposits
6	Sedimentary lake deposits

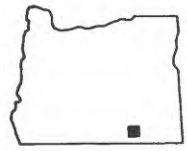
Geologic map units

Qs	Surficial deposits (Quaternary)
Tto	Tuff of Oregon Canyon (Miocene)
Td	Dacite (Miocene)
Tvs	Volcanic and sedimentary rocks (Tertiary)
Ji	Intrusive rocks (Jurassic)
Jsv	Schist and volcanic rocks (Jurassic)

——— Contact
———·— Fault—Dashed where approximate; dotted where concealed
⊥ ⊥ ⊥ Approximate margin of Pueblo Mountains caldera

Explanation, mineral resources of the Pueblo Mountains Wilderness Study Area.

Name: Red Mountain
Area number: OR-002-078
Size (acres): 16,215



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The wilderness study area contains occurrences of diatomite primarily in the western half and along the east edge.

Mineral resource potential (undiscovered): Areas containing tuffaceous sedimentary rocks in the northwestern and southeastern parts of the study area have low resource potential for diatomite and zeolites. These commodities are used in construction materials and (or) industrial applications. The westernmost, low-lying part of the study area overlaps the eastern edge of Pueblo Valley, which is cut by recent basin-bounding faults. This part of the study area has low potential for geothermal-energy resources. The study area has low potential for mercury, copper, silver, gold and in epithermal deposits. The rocks exposed in the study area and metamorphic and granitic basement rocks exposed nearby are not likely sources or reservoirs for hydrocarbons and preclude any potential for oil and gas.

Mining Activity: Several major mining companies have explored (Wheeler, 1987) and continue to explore for bulk tonnage gold deposits northeast of the wilderness study area. According to U.S. Bureau of Land Management records as of July 1990, there were no active lode or placer mining claims recorded within the study area. As of October 1987, no geothermal or oil and gas leases existed within the study area.

Mineral setting/ Geology: The study area is located in the southwestern Trout Creek Mountains of southeastern Oregon, which consists of several northwest-trending hogback ridges and intervening valleys containing intermittent streams. The hogback ridges consist of northeast-tilted fault blocks composed chiefly of Tertiary basalt and andesite lava flows capped by several mafic to felsic flows and welded and nonwelded ash-flow tuffs. Overlying these volcanic rocks but exposed only near the valley bottoms are tuffaceous and conglomeratic sedimentary rocks and Quaternary lacustrine sedimentary rocks.. The tilted fault blocks are bounded by several major northwest-trending down-to-the-northeast faults and are cores cut by widely distributed northeast-trending faults.

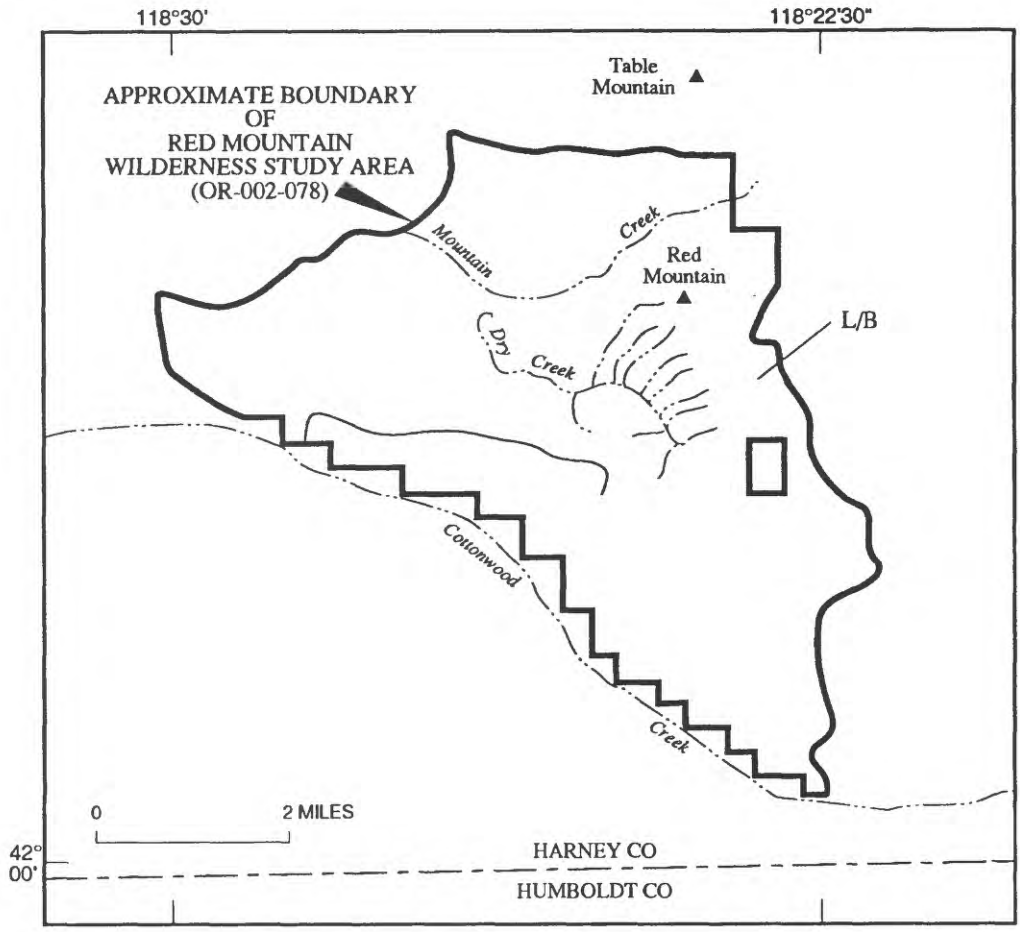
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Because it is on the periphery of a well-known mineralized area, geologic, geochemical, and geophysical reconnaissance studies could determine whether or not the study area contains significant mineralization.

References:

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Wheeler, G., 1987, Sediment Hosted Epithermal gold Deposits in Eastern Oregon: Society of Mining Engineers Annual Meeting preprint no. 87-5, 5 p.

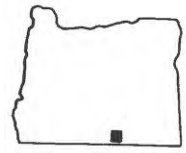


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for diatomite, zeolites, geothermal energy, mercury, copper, silver, and gold with certainty level B

Mineral resources of the Red Mountain Wilderness Study Area.

Name: Rincon
Area number: OR-002-082
Size (acres): 103,965



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. One of seven alluvial samples contained a small amount of gold but was not suggestive of resources.

Mineral resource potential (undiscovered): Rhyolite ash-flow tuff near the center of the study area is assigned moderate potential for silver deposits, based on anomalous silver concentrations of both a rock sample and a sample of sediment from a stream that drains an area underlain by the tuff. The shoreline lacustrine deposits along the northwestern margin of the study area are assigned high potential for commercial deposits of sand and gravel. The entire study area is assigned low potential for geothermal energy resources, inasmuch as hot springs issue from faults similar to those that traverse the study area, as near as ten miles from the boundaries. The study area is considered to have no potential for the occurrence of oil and gas.

Mining Activity: One prospect is shown on a topographic map (Acty Mountain NE 7.5' quadrangle) in the western part of the wilderness study area; extent of development and commodities are unknown. Gravel has been mined from pits within 1 mi north of the study area. About 35 current (July 1990) mining claims are located in or partly in the northern part of the study area; most were located by ECM, Inc in 1988. About 60 claims were located by FMC Minerals Corp. in the same area in 1981 but were allowed to lapse in 1984. As of October 1987, no energy leases existed within the study area.

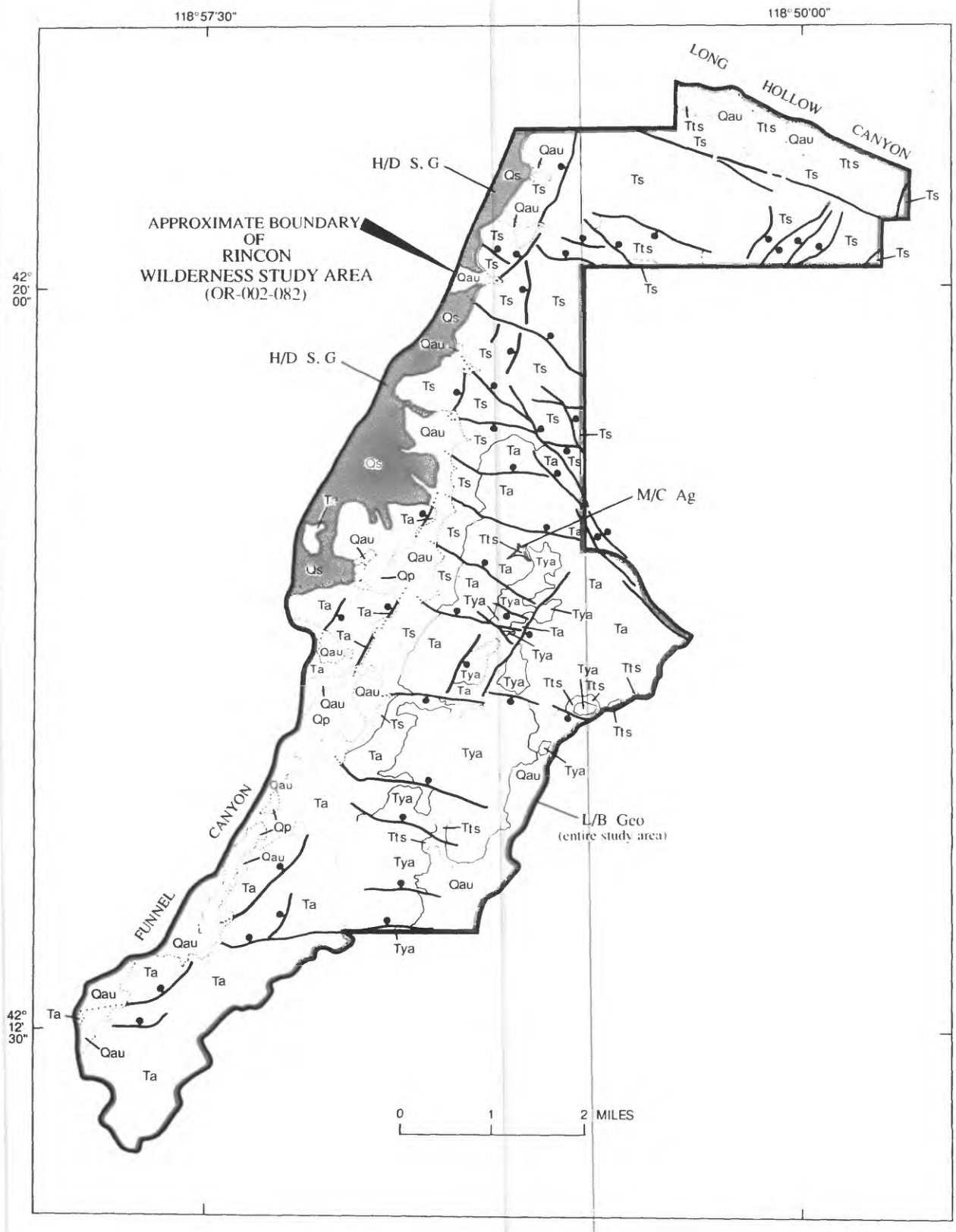
Mineral setting/ Geology: Oldest lithologic unit in the study area is the middle Miocene Steens Basalt, comprised of multiple flows 20-40 ft thick, aggregating at least 1,600 ft thick in the northern part of the study area, in which direction it becomes increasingly abundant. It is overlain by platy or vesicular andesite 800 ft thick, which becomes more abundant southward in reciprocal relation to the Steens Basalt. The andesite is overlain--ascending--by tuffaceous sedimentary rocks, partly welded lithic tuff, and younger andesite flows. In the northern part, this sequence includes sedimentary rocks and three ash-flow tuff units, the lower two of which are middle Miocene, and the uppermost probably equivalent to the upper Miocene Devine Canyon Ash-flow Tuff. The younger andesite does not occur in the northern part of the study area. Shoreline deposits of sand and gravel from Pleistocene Catlow Lake extend a mile or less into the study area along the northwestern border. Holocene alluvium, colluvium, and talus deposits are common near the shoreline deposits. Structure consists of a 2° to 6° southeastward tilt, expressed by the Steens Basalt, and three sets of high-angle normal faults: range-front faults that trend northeast; an orthogonal set that form horst and graben; a northwest-trending set, fewer in number, that virtually bisects the angle between the other two sets.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 77,045 acres that constitute the balance.

References:

Mayerle, R.T., and Rains, R.L., 1987, Mineral resources of the Rincon study area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 66-87, 11 p.

Vander Meulen, D.B., Plouff, Donald, King, H.D., Mayerle, R.T., and Rains, R.L., 1988, Mineral resources of the Rincon Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-E, 14 p.



Mineral resources of the Rincon Wilderness Study Area.

EXPLANATION

Area with high resource potential (H)

Area with moderate resource potential (M)

Area with low resource potential (L)

Levels of certainty of assessment

B	Data only suggest level of potential
C	Data give good indication of level of potential
D	Data clearly define level of potential

Commodities

Ag	Silver
S,G	Sand and gravel
Geo	Geothermal

Geologic map units

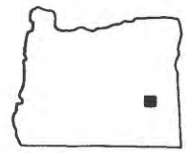
Qp	Playa deposits and sand dunes (Quaternary)
Qau	Alluvium, colluvium, and talus deposits; undifferentiated (Quaternary)
Qs	Shoreline deposits (Quaternary)
Tya	Younger andesite flows (Tertiary)
Tts	Ash-flow tuff and sedimentary rocks (Tertiary)—Includes Devine Canyon Ash-flow Tuff, tuff of Oregon Canyon, and tuff of Trout Creek Mountains
Ta	Andesite flows (Tertiary)
Ts	Steens Basalt (Tertiary)

Contact—Dotted where approximate

Fault—Dotted where concealed; ball and bar on downthrown side

Explanation, mineral resources of the Rincon Wilderness Study Area.

Name: Saddle Butte
Area number: OR-003-111
Size (acres): 86,300



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Known mineral occurrences include building and decorative stone.

Mineral resource potential (undiscovered): The study area has low resource potential for antimony, gold, lead, mercury, silver, molybdenum, and zinc. This level of potential is based on the proximity of the study area to the adjacent Lower Owyhee Wilderness Study Area (OR-003-110) which has the same resource potential for the same commodities (Evans and others, 1990). The Saddle Butte Wilderness Study Area also has a geologic setting similar to that of the Lower Owyhee Wilderness Study Area and some of the gold found in pan concentrate samples at sites in the Lower Owyhee Canyon Wilderness Study Area by Bukofski and others (1984) could have come from the Saddle Butte Wilderness Study Area. The Saddle Butte Wilderness Study Area has low resource potential for oil and gas (Fouch, 1983) probability chiefly as gas trapped in small, lower Tertiary basin deposits, moderate potential for geothermal resources and low potential for perlite associated with silicic vent rocks.

Mining Activity: Several major mining companies are continuing to explore for bulk disseminated gold deposits in areas northeast of the wilderness study area (Wheeler, 1987). As of July 1990, U.S. Bureau of Land Management records showed no active lode or placer mining claims within the study area. As of October, no active energy leases existed within the study area.

Mineral setting/ Geology: The study area is underlain by flat-lying Tertiary and Quaternary volcanic and sedimentary rocks that range in age from late Miocene(?) to Holocene. The volcanic rocks are mostly basalt flows, but include basalt vents and a rhyolitic dome or butte of welded tuff. Interbedded with the volcanic rocks are sedimentary rocks, mostly lacustrine, that include claystone, siltstone, sandstone, and conglomerate that have tuffaceous components. Minor clay, silt, sand, gravel and fanglomerate are widespread. The study area has been a site of deposition of volcanic flows from Miocene to Holocene apparently through vents within or adjacent to the study area boundary.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. An accurate assessment of the mineral potential of the study area requires geologic, geochemical, and geophysical studies. The study area needs to be mapped at a scale of 1:24,000, geochemical samples (stream sediment, panned concentrate, and rock) need to be collected and analyzed, and a review of aeromagnetic and gravity surveys of the region that includes the study area need to focus on the possibilities of ore-bearing structures in and near the study area.

References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Barringer Resources, Inc., prepared for U.S. Department of the Interior, Bureau of Land Management, Oregon State Office, Portland, 94 p.

Evans, J.G., Turner, R.L., Griscom, Andrew, Sawatzky, D.L., and Causey, J.D., 1990, Mineral resources of the Lower Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-F.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

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Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

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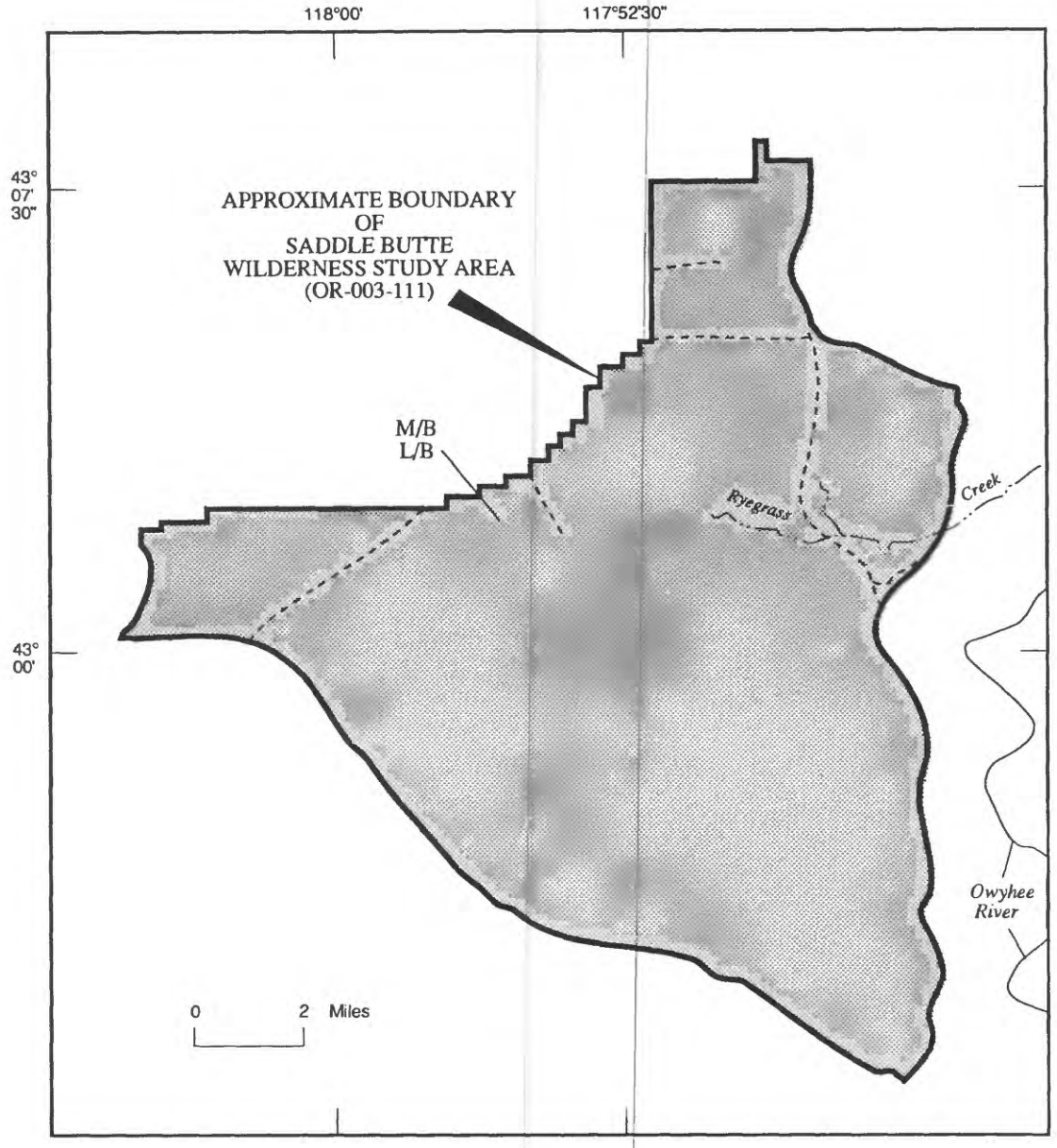
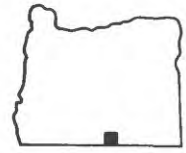


EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for geothermal energy with certainty level B

L/B, Geologic terrane having low mineral resource potential for antimony, gold, lead, mercury, silver, molybdenum, zinc, oil and gas, and perlite with certainty level B

Mineral resources of the Saddle Butte Wilderness Study Area.



Name: Sage Hen Hills
Area number: OR-001-146B
Size (acres): 8,520

Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No resources have been identified within the wilderness study area.

Mineral resource potential (undiscovered): The study area has low potential for gold, silver, mercury, and copper metallic resources and low potential for local geothermal energy resources.

Mining Activity: According to U.S. Bureau of Land Management records (July 1990), there are currently no active lode or placer mines or prospects within the wilderness study area. No energy leases existed within the wilderness study area as of October 1987.

Mineral setting/ Geology: The Sage Hen Hills (OR-001-146B) Wilderness Study Area encloses relatively flat terrain underlain by volcanic rocks of Miocene age (about 24-5 million years old). The large, western part of the area is underlain entirely by the Idaho Canyon tuff, which was erupted about 18-16 million years ago; the smaller, eastern part includes that tuff, ashy sandstone and siltstone, and a mesa-forming basalt lava.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

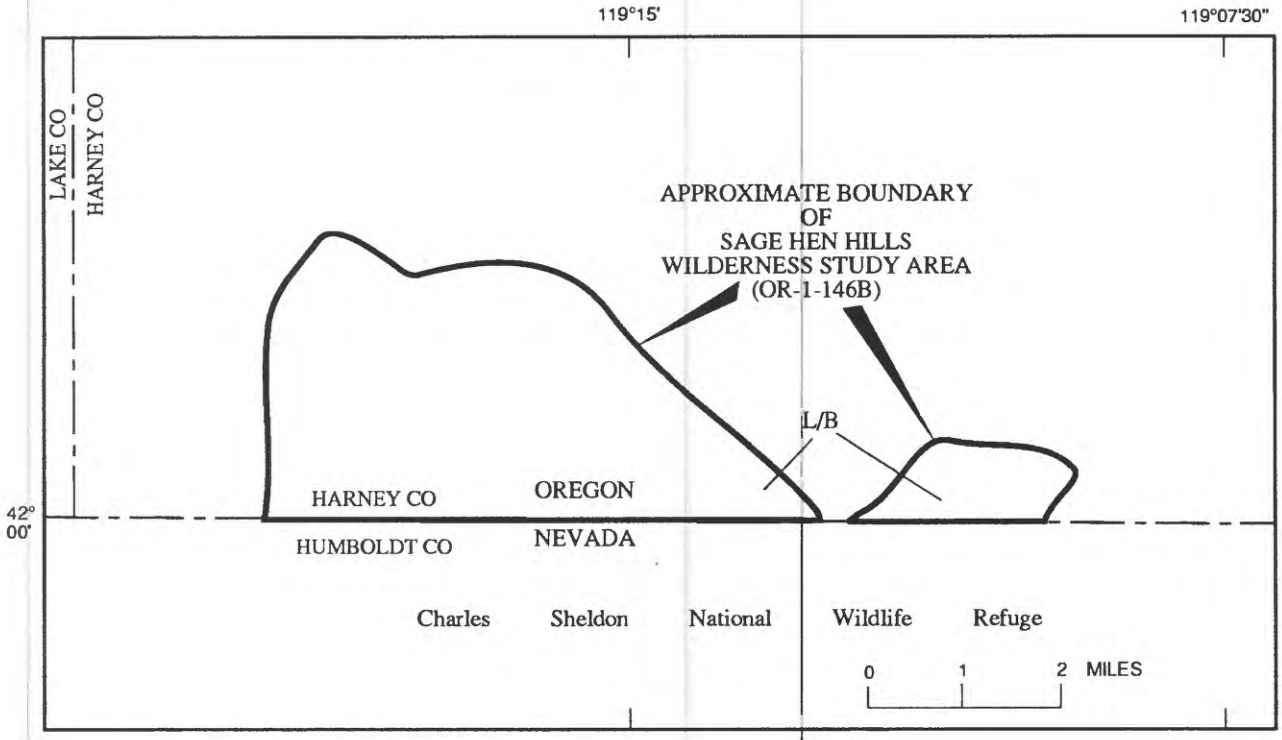
References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral Resource Assessment Through Geochemical Studies of Heavy Mineral Concentrates from Wilderness Study Areas in the Burns, Prineville, and Vale Districts, Southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 250 p.

Mayerle, R.T., and Rains, R.L., 1988, Mineral resources of the Hawk Mountain Wilderness Study Area, Harney County, Oregon: U.S. Bureau of Mines Open-File Report MLA 21-88, 16 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

Turrin, B.D., Conrad, J.E., Plouff, Donald, King, H.D., Swischer, C.C., III, Mayerle, R.T., and Rains, R.L., 1989, Mineral resources of the Hawk Mountain Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-F, 16 p.

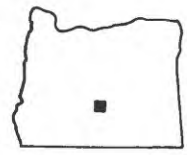


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, silver, mercury, copper, and geothermal energy with certainty level B

Mineral resources of the Sage Hen Hills Wilderness Study Area.

Name: Sand Dunes
Area number: OR-001-024
Size (acres): 16,440



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for geothermal resources and moderate potential for oil and gas resources. The area has low potential for diatomite, mercury, copper, and silver.

Mining Activity: No claims or other mining related activity is known within the study area. Diatomite is being mined approximately 20 mi to the east, but no significant diatomite beds were found in or near the study area (Walker and McHugh, 1980, p. 14). No energy leases existed within the wilderness study area as of October 1987.

Mineral setting/ Geology: Area is underlain largely by dune sand with minor amounts of tuff exposed. The area could be underlain by petroleum source rocks at depth but this is unknown (J.A. Ach, written commun., 1988).

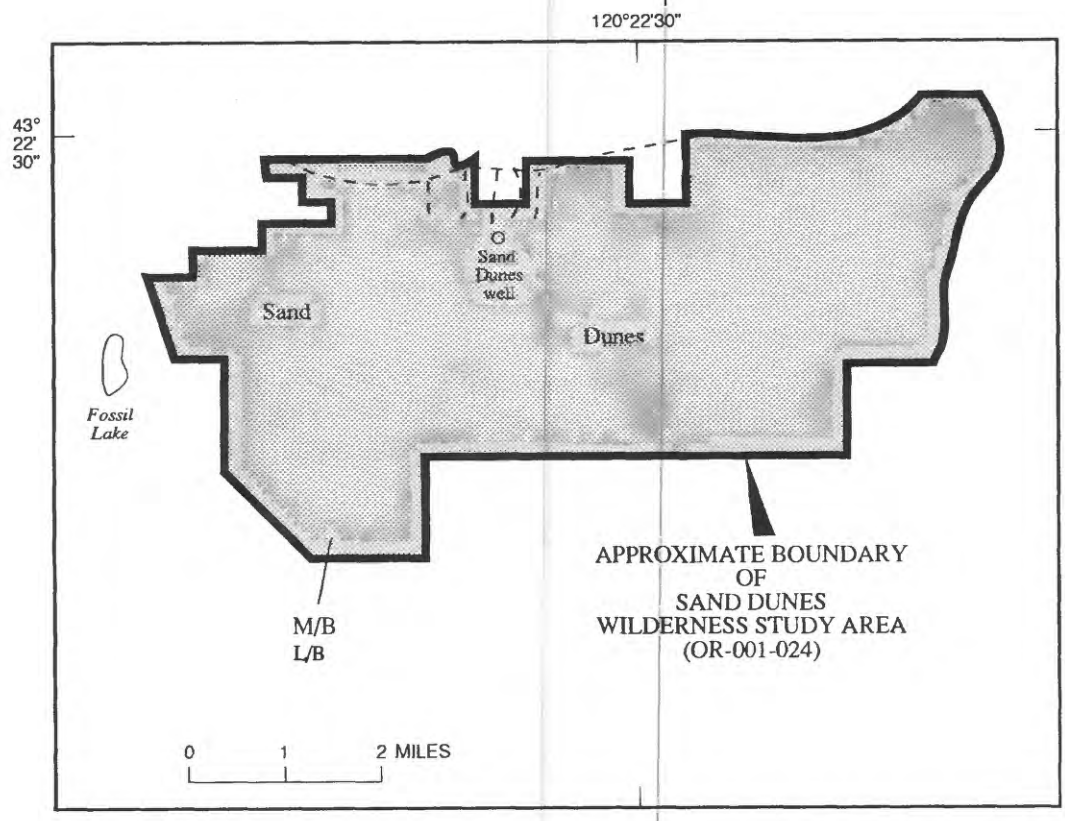
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

Fouch, T.D., 1983, Petroleum potential of wilderness lands in Oregon: U.S. Geological Survey Circular 902-J, 5 p.

Walker, G W., and McHugh, E.L., 1980, Mineral resources and mineral resource potential study of the Lost Forest Instant Wilderness Study Area, Oregon: U.S. Geological Survey Open-File Report 80-846, 19 p.



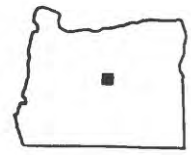
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for oil and gas with certainty level B

L/B, Geologic terrane having low mineral resource potential for geothermal energy, diatomite, mercury, copper, and silver with certainty level B

Mineral resources of the Sand Dunes Wilderness Study Area.

Name: Sand Hollow
Area number: OR-005-034
Size (acres): 8,791



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ach and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The west-central part of the Sand Hollow study area has low resource potential for epithermal deposits of mercury. The study area has low potential for oil and gas and for geothermal energy resources.

Mining Activity: No claims or other mining related activity is known within the study area. Bentonite, a clay mineral with a variety of uses, is mined on a limited basis by Central Oregon Bentonite within 1 mi southwest of the study area. As of October 1987, about 8,610 acres within the wilderness study area and the adjoining South Fork Wilderness Study Area (OR-005-033) were leased for oil and gas.

Mineral setting/ Geology: The oldest, but probably the least abundant, rocks in the study area are the Oligocene(?) and Eocene Clarno, and the Miocene to Eocene(?) John Day Formations which together occupy no more than a mi^2 in the extreme northern and northwestern parts. The Clarno consists of andesitic lava, flow-breccia, and interbedded tuffaceous sedimentary rocks. The John Day consists of sandstone, siltstone, and claystone. Successively younger rocks are: the lower Miocene Picture Gorge Basalt and interlayered and overlying fine-grained tuffaceous sedimentary rocks; late Miocene Devine Canyon and Rattle Snake Ash-flow Tuffs; and thin basalt flows. Quaternary surficial deposits consist of alluvium in canyon bottoms, talus on slopes, and local landslide deposits on canyon walls. Structure is dominated by high-angle normal faults, chiefly east-striking, but including a few of other strikes, and having offsets of tens to hundreds of feet, appear to have developed after eruption of the Picture Gorge Basalt. A later episode of faulting in the western part of the study area produced numerous small offsets in the young ash-flow tuff.

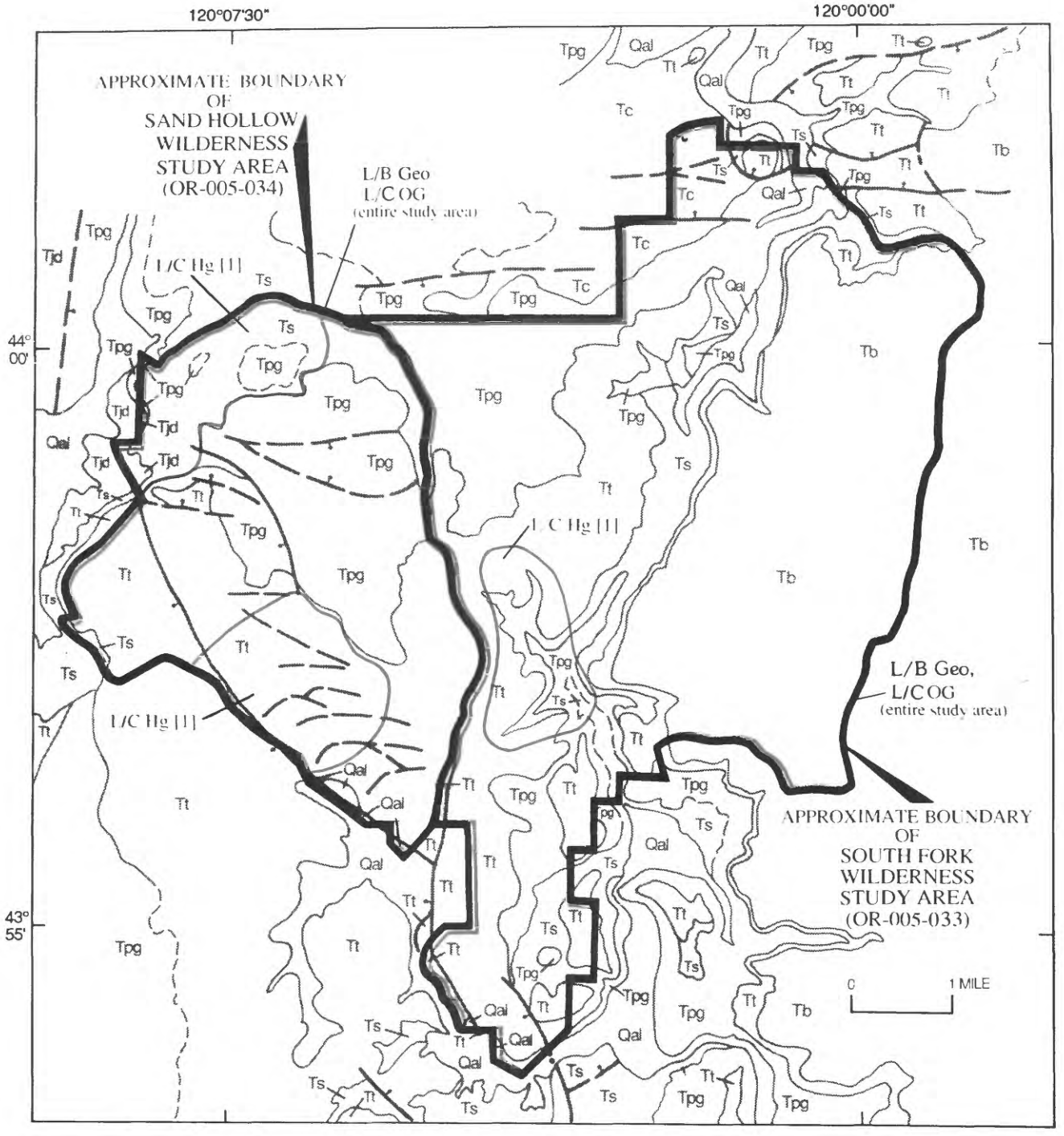
Recommendations: As all but 400 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

Gray, J.G., Geitgey, R.P., and Baxter, G.L., 1989, Bentonite in Oregon: Occurrences, analyses, and economic potential: Oregon Department of Geology and Mineral Industries Special Paper 20, 28 p.

Olson, J.E., 1987, Mineral resources of the South Fork and Sand Hollow study areas, Crook County, Oregon: U.S. Bureau of Mines Open-File Report MLA 59-87, 8 p.



Mineral resources of the Sand Hollow Wilderness Study Area.

EXPLANATION

Area having low mineral resource potential (L)

Levels of certainty of assessment

B Data suggest level of potential
C Data give good indication of level of potential

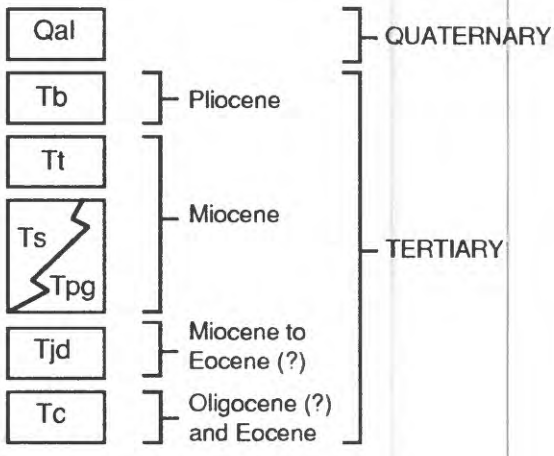
Commodities

Hg Mercury
OG Oil and natural gas
Geo Geothermal

[ ] Deposit types

1 Epithermal mercury deposits in volcanic and volcanoclastic rocks

Correlation of map units



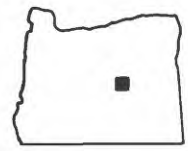
Geologic map units

Qal Alluvium (Quaternary)
Tb Basalt of Twelvemile Table (Tertiary)
Tt Ash-flow tuffs (Tertiary)
Ts Tuffaceous sedimentary rocks (Tertiary)
Tpg Picture Gorge Basalt (Tertiary)
Tjd John Day Formation (Tertiary)
Tc Clarno Formation (Tertiary)

——— – – Contact—Dashed where approximate
———•– – – Fault—Dashed where approximate; bar and ball on downthrown side

Explanation, mineral resources of the Sand Hollow Wilderness Study Area.

Name: Sheep Gulch
Area number: OR-002-098C
Size (acres): 741



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Copper-bearing quartz veins occur in the southern part of the area, but these are small and low in grade.

Mineral resource potential (undiscovered): A principal source of nearby placer deposits is thought to be Little Canyon Mountain, located about 1 mi north of the study area, where gold and silver-bearing quartz-calcite veins occur in gabbro and pyroxenite similar to rocks present in the study area. The study area is considered to have low potential for chromium, copper, gold and by-product silver.

Mining Activity: Placer gold production occurred prior to 1916 in the Canyon district located a few miles north of the study area. Four active claims, held by assessment in 1989, are located in the southern half of the wilderness study area. Five workings, located in the central part of the study area (Thayer and others, 1981, p. 42 and 65), attest to some historic exploration activity. A magnesite vein has been prospected within .25 mi of the northeast corner of the study area but is too small to be mined commercially, and does not trend into the area (Thayer and others, 1980). No other mining related activity is known. As of October 1987, no energy leases existed within the study area.

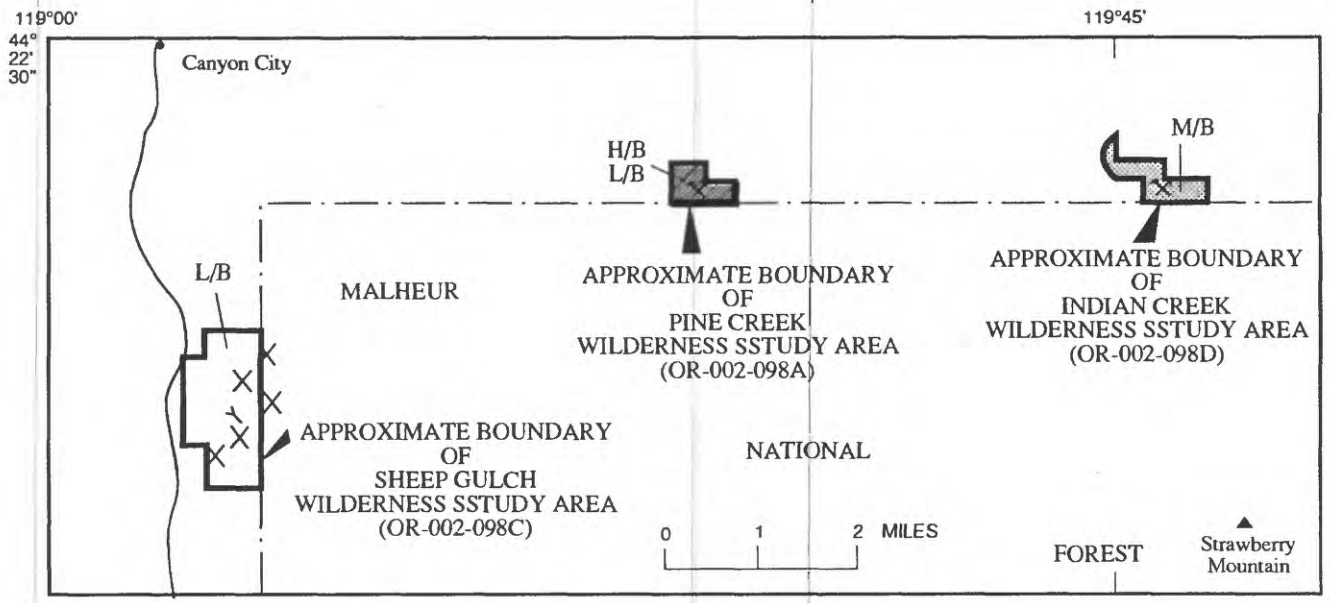
Mineral setting/ Geology: The study area is underlain mostly by gabbro and pyroxenite. These rocks are part of the Canyon Mountain complex which formed as oceanic crust in Permian time (286 to 265 m.y. ago).

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Thayer T.P., Case, J.E., and Stotelmeyer, R.B., 1981, Mineral resources of the Strawberry Mountains Wilderness and adjacent areas, Grant County, Oregon: U.S. Geological Survey Bulletin 1498, 67 p.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

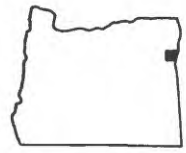


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for chromium, copper, gold and by-product silver with certainty level B

Mineral resources of the Sheep Gulch Wilderness Study Area.

Name: Sheep Mountain
Area number: OR-006-003
Size (acres): 7,040



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ashley and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Basalt, which covers most of the wilderness study area, contains common opal and agate, which are of interest to mineral collectors. Basalt could be used locally as construction material (crushed stone or fill); however, suitable stone is widespread in the region, and other areas of basalt are more accessible to possible markets. No energy resources are known in the study area.

Mineral resource potential (undiscovered): Geochemical data suggest that the exposed igneous and metamorphic complex has low potential for silver, lead, zinc, copper, and gold in polymetallic vein deposits. The study area has no potential for geothermal energy, uranium and thorium, or oil and gas.

Mining Activity: No mining claims or mining activity are known in the wilderness study area; no mine workings were found during field investigations. As of October 1987, no oil and gas, geothermal, or coal leases were located in the study area.

Mineral setting/ Geology: More than 90 percent of the study area is covered by multiple Miocene basalt flows (Columbia River Basalt Group), locally totalling about 3,000 ft in thickness, that dip westward about 5°, and a few feeder dikes. A complex of igneous and metamorphic rocks, ranging in age from Permian to Jurassic, lying unconformably beneath the basalt, is exposed in a window more than 2 mi long along the southeastern margin. The metamorphic rocks include metagranitoid and metasedimentary rocks, the latter including interbedded limestone, argillite, graywacke, and volcanic sandstone and conglomerate. Surficial deposits are mainly local unconsolidated alluvium in lower parts of drainages, and thin colluvium over and under the basalt.

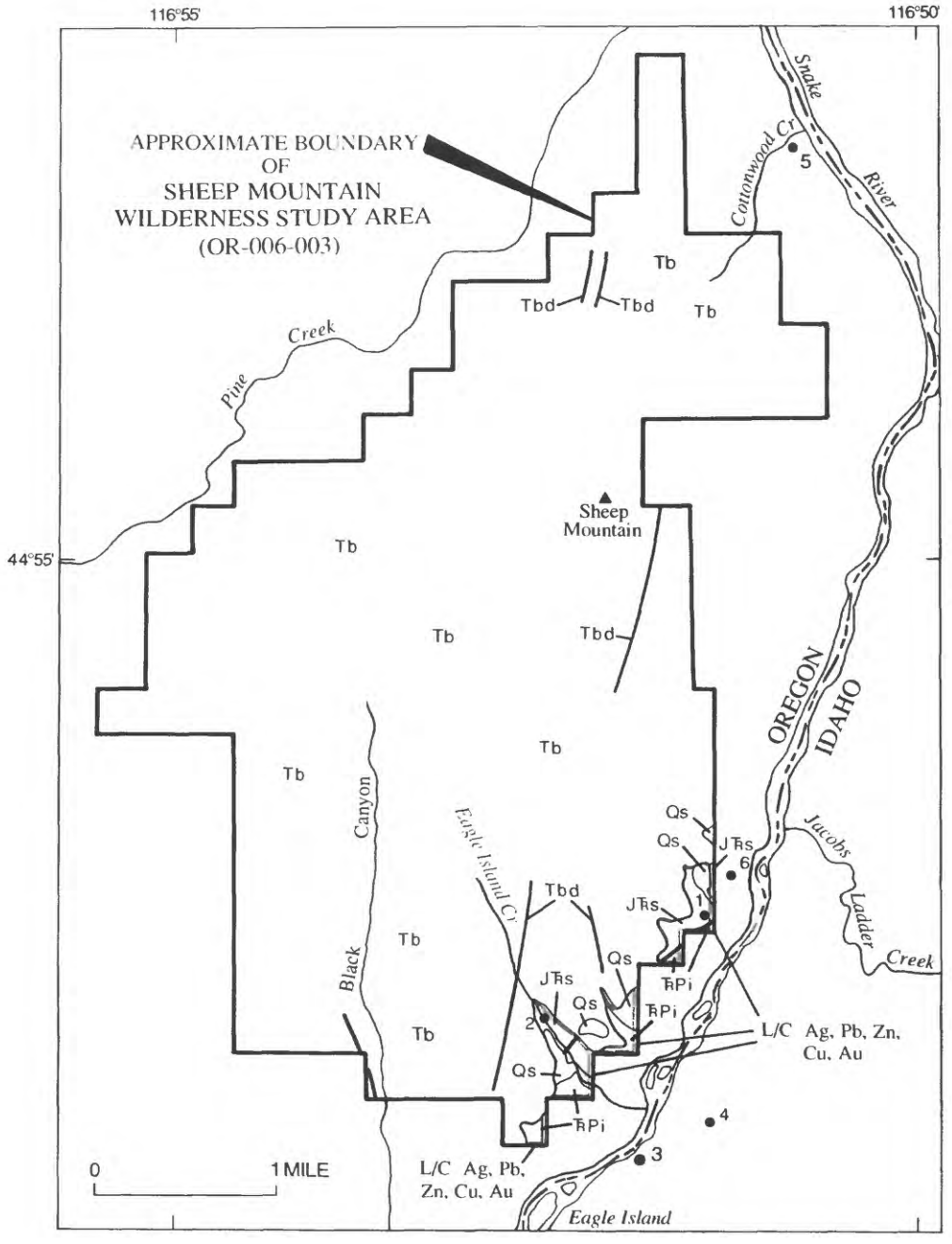
Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Ashley, R.P., Roback, R.C., Turner, R.L., Jachens, R.C., Close, T.J., and Rains, R.L., 1988, Mineral resources of the Sheep Mountain Wilderness Study Area, Baker County, Oregon: U.S. Geological Survey Bulletin 1741-B, 14 p.

Close, T.J., and Rains, R.L., 1987, Mineral resources of the Sheep Mountain study area, Baker County, Oregon: U.S. Bureau of Mines Open-File Report MLA 57-87, 11 p.

Fredrickson, R.S., and Fernette, Greg, 1983, Geology, energy, and mineral (GEM) resource evaluation of the Homestead GRA, Oregon-Idaho, including the McGraw Creek (6-1), Homestead (6-2), and Sheep Mountain (6-3) Wilderness Study Areas: prepared by WGM Inc., Mining and Geological Consultants, contract YA-553-CT2-1039 for the U.S. Bureau of Land Management, 54 p.



Mineral resources of the Sheep Mountain Wilderness Study Area.

EXPLANATION

Area having low mineral resource potential, (L); data give good indication of level of potential (C)

Commodities

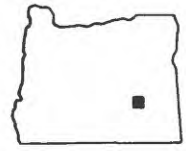
Ag	Silver
Pb	Lead
Zn	Zinc
Cu	Copper
Au	Gold

Geologic map units

Qs	Surficial deposits (Quaternary)—Consists of alluvium and landslide deposits
Tbd	Basaltic dikes (Tertiary)—Feeder dikes in the Columbia River Basalt Group
Tb	Basalt flows (Tertiary)—Olivine-bearing lavas of the Columbia River Basalt Group
JTRs	Sedimentary rocks (Jurassic and Late Triassic)—Metamorphosed limestone, graywacke, argillite, and andesitic sandstone and conglomerate; in part correlative with the Martin Bridge Limestone and Hurwal Formation
TRPi	Intrusive rocks (Early Triassic and Permian)—Metamorphosed plagiogranite, leucodiorite, leucogabbro, leucotonalite, and diabase; correlative with the (informal) Oxbow complex
———	Contact
———	Fault
●3	Geochemical sampling site—See text for discussion

Explanation, mineral resources of the Sheep Mountain Wilderness Study Area.

Name: Sheepshead Mountains
Area number: OR-002-072C
Size (acres): 54,390



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Sherrod and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area during the field studies or other phases of the studies conducted.

Mineral resource potential (undiscovered): The wilderness study area is considered to have low potential for occurrence of deposits of gold and silver along faults, low potential for occurrences of oil and gas, and moderate potential for occurrence of geothermal energy resources, especially along range-bounding faults.

Mining Activity: There has been no known mineral production in or near the wilderness study area, nor are there any mining claims in or near it (July 1990). There are no known mineral localities in or near the area. As of October 1987, no energy leases existed within the study area.

Mineral setting/ Geology: Apart from relatively thin deposits of Pleistocene and Holocene alluvium and colluvium, rocks exposed in the study area are entirely volcanic extending from middle Miocene Steens Basalt through late Miocene Devine Canyon Ash-Flow Tuff and into unnamed Pleistocene high-alumina basalt. Minor interlayered tuffaceous sedimentary rocks occur in a basaltic to dacitic unit overlying the Steens. The rocks are mainly horizontal, but an episode of uplift and tilting of as much as 18°, prior to deposition of the Devine Canyon, can be documented. A group of north-northwest to north-northeast-striking high-angle normal faults defines the regional grain, with measurable offsets of as much as 1,000 ft. Faults of a second group strike northwest to west-northwest, generally have offsets of less than 100 ft, and transect the more northwardly-trending blocks. Several of the basins created by faulting are closed depressions that contained large pluvial lakes in the Pleistocene, and which locally include diatomite among the associated sedimentary deposits.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 5,415 acres that constitute the balance.

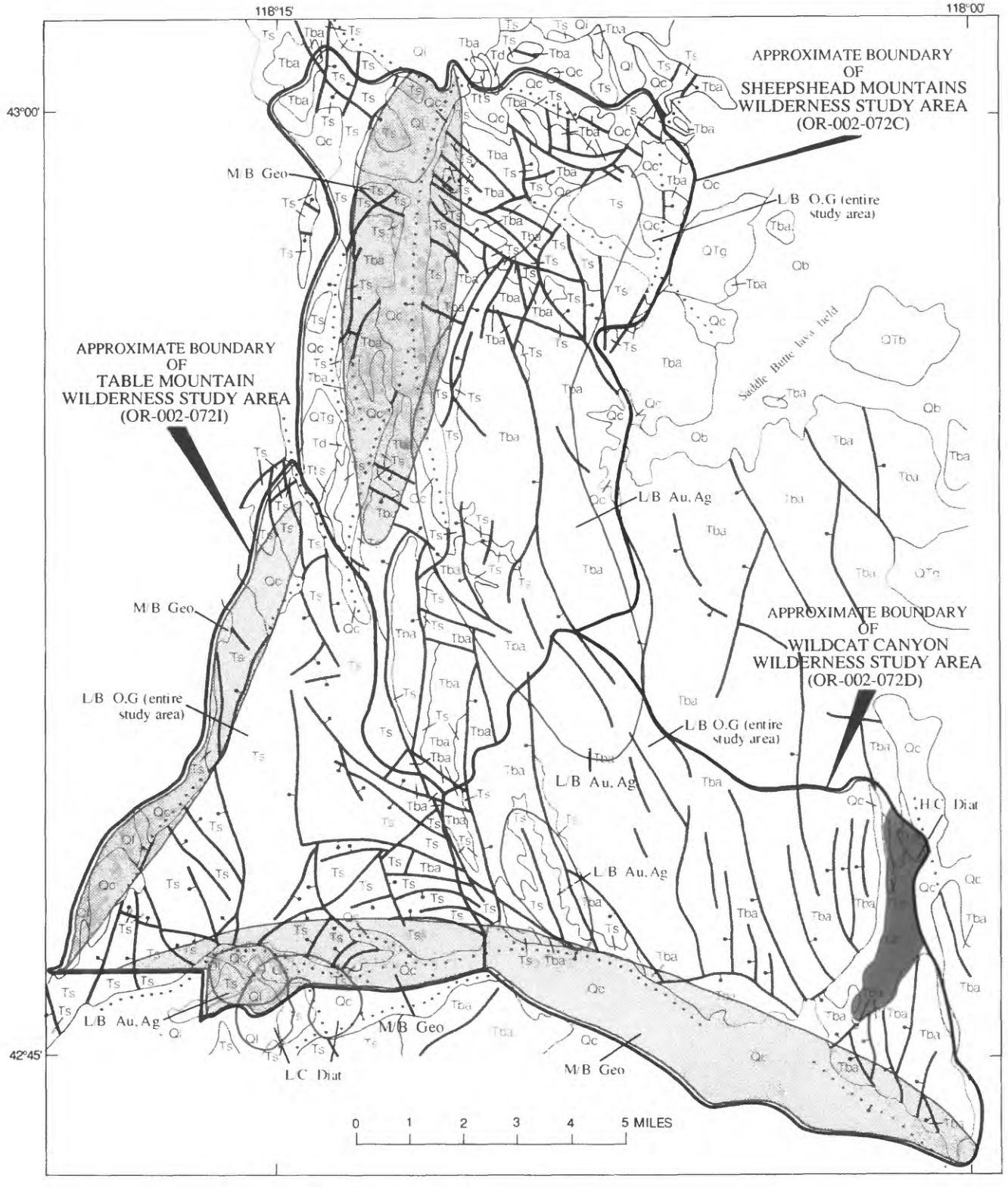
References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale Districts, Southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Graham, D.E., and Buehler A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas, and Wildcat Canyon Wilderness Study Area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 62-87, 20 p.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale Districts, Southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.



Mineral resources of the Sheepshead Mountains Wilderness Study Area.

EXPLANATION

Area with high mineral resource potential (H)

Area with moderate mineral resource potential (M)

Area with low mineral resource potential (L)

Levels of certainty of assessment

B	Data suggest level of potential
C	Data give good indication of level of potential

Commodities

Au	Gold
Ag	Silver
Diat	Diatomite
Geo	Geothermal
O,G	Oil, Gas

Geologic map units

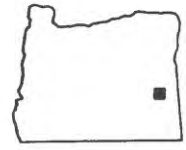
Ql	Lacustrine and playa deposits (Quaternary)
Qc	Colluvium (Quaternary)
Qb	Younger basalt (Quaternary)
QTb	Older basalt (Quaternary or Tertiary)
QTg	Gravel and conglomerate (Quaternary and Tertiary)
Tts	Tuff and tuffaceous sedimentary rocks (Tertiary)
Tdc	Devine Canyon Ash-flow Tuff (Tertiary)
Tba	Basalt, basaltic andesite, andesite, and dacite (Tertiary)
Ts	Steens Basalt (Tertiary)

——— Contact—Approximately located

—•—··· Fault—Dotted where concealed. Ball and bar on downthrown side

Explanation, mineral resources of the Sheepshead Mountains Wilderness Study Area.

Name: Slocum Creek
Area number: OR-003-075
Size (acres): 7,600



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1989).

Identified mineral resources (known): There are no identified mineral or energy resources within or adjacent to the study area. Sand and gravel deposits along drainages within the study area do not constitute resources because similar deposits are more accessible and closer to existing markets. Welded parts of the caldera-forming tuff exposed within the study area are suitable for construction purposes; however, because similar tuff elsewhere is more accessible and closer to existing markets, this tuff does not constitute a resource.

Mineral resource potential (undiscovered): Large parts of the study area have moderate resource potential for volcanogenic deposits of uranium and thorium, and low potential for volcanogenic zinc. Anomalous concentrations of lithium in samples of tuff and intrusive rhyolite, results in assigning the entire area low potential for occurrence of stratiform lithium deposits. Brecciated, veined, and silicified intrusions of rhyolite have moderate resource potential for gold, silver, mercury, and zinc. Thermal springs along north-trending faults in the region form the basis for assigning moderate potential for geothermal energy in similar settings in the study area. The study area is considered to have no potential for oil and gas.

Mining Activity: No mines, claims, or prospects were found in the study area. According to the July 17, 1990 U.S. Bureau of Land Management mining claim recordation files, there are no lode or placer claims located within the study area. Search of the U.S. Bureau of Mines Mineral Industry Location System (MILS) revealed no MILS entries within the study area boundaries. U.S. Bureau of Land Management township plats showed no geothermal or other energy leases.

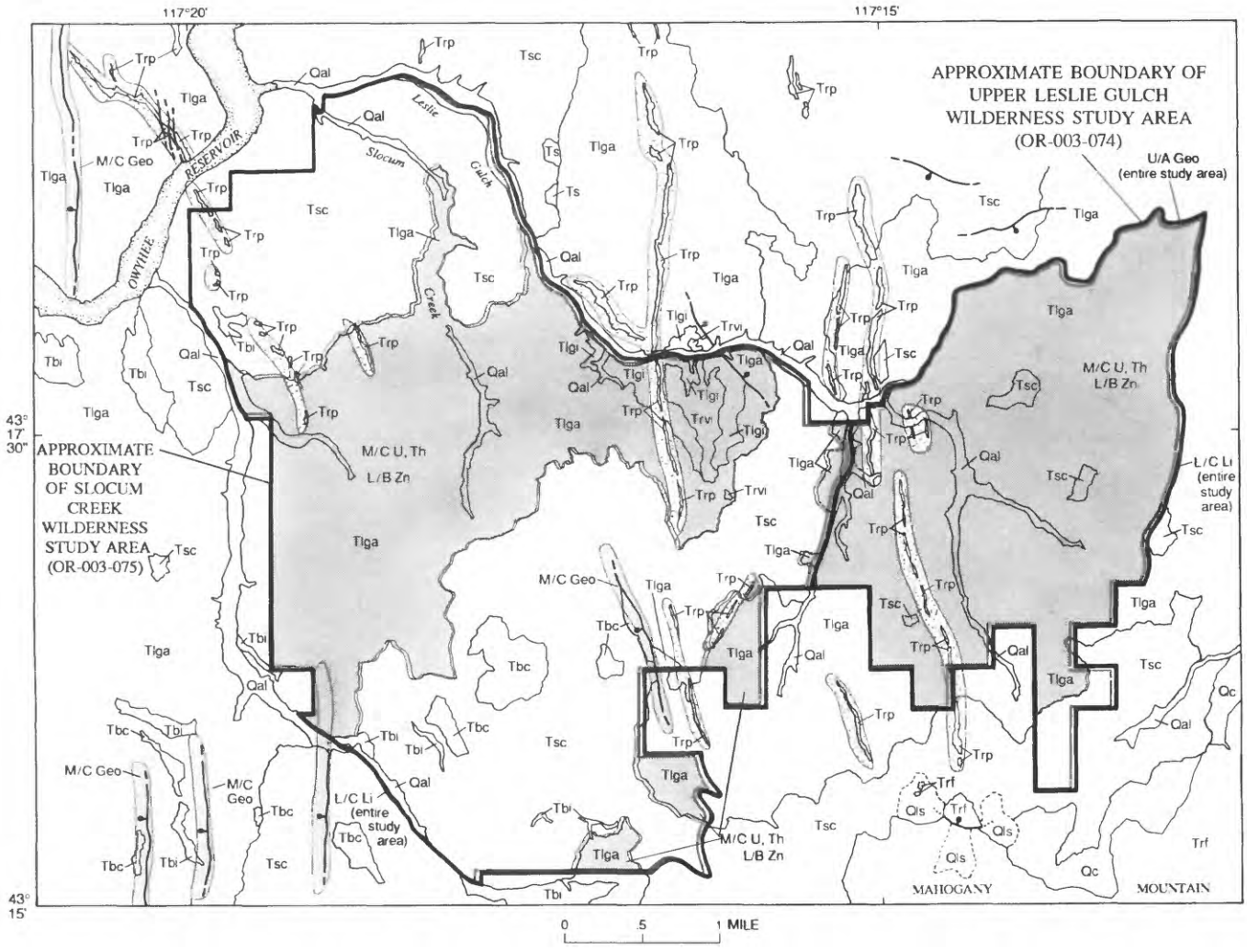
Mineral setting/ Geology: The study area is within the Mahogany Mountain caldera, an 8- by 12-mi elliptical collapse structure that resulted from eruption, during the middle Miocene, of huge volumes of rhyolitic ash-flow and air-fall tuff, 1,150 ft of which comprises the stratigraphically lowermost rocks exposed. Overlying these rocks are two units of ash-flow tuff which, in contrast, were erupted from a vent outside the caldera. Many northwest-trending rhyolite dikes, some showing horizontal columnar structure, and several basalt dikes, intrude the tuff. Several contemporary rhyolite domes and plugs intrude along the north and east caldera margins; some are brecciated, silicified, and cut by quartz veins. Alluvial deposits are restricted to the main drainage canyons. Although it lies within the northern part of the basin and range province, only two northwest-trending high-angle faults are mapped in the study area. Others of pre-middle Miocene age are doubtless buried beneath the thick tuffs in the caldera.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Benham, J.R., 1988, Mineral resources of the Slocum Creek and Upper Leslie Gulch Wilderness Study Areas, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 22-88, 16 p.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., and Benham, J.R., 1989, Mineral Resources of the Upper Leslie Gulch and Slocum Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-D, 20 p.



Mineral resources of the Slocum Creek Wilderness Study Area.

EXPLANATION

Area having moderate resource potential (M)

Area having moderate mineral resource potential (M), certainty level B, for Au, Ag, Hg, and Zn

Area having low (L) mineral resource potential

Levels of certainty of assessment

A	Data not adequate for determination of potential
B	Data only suggest level of potential
C	Data give good indication of level of potential

Commodities

Ag	Silver	Li	Lithium
Au	Gold	Th	Thorium
Geo	Geothermal energy	U	Uranium
Hg	Mercury		

Geologic map units

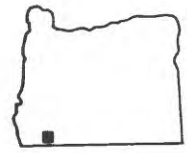
Qal	Alluvium (Quaternary)
Qc	Colluvium deposits (Quaternary)
Qls	Landslide deposits (Quaternary)
Ts	Sedimentary rocks (Tertiary)
Trp	Rhyolite porphyry (Tertiary)
Tbi	Basalt intrusions (Tertiary)
Tbc	Tuff of Birch Creek (Tertiary)
Tsc	Tuff of Spring Creek (Tertiary)
Trvi	Rhyolite vent intrusion (Tertiary)
Tlga	Leslie Gulch Tuff; air-fall facies (Tertiary)
Tlgi	Leslie Gulch Tuff; intracaldera facies (Tertiary)
Trf	Rhyolite flows (Tertiary)

Contact—Dashed where approximately located

Fault—Dashed where inferred; dotted where concealed; ball and bar on downthrown side

Explanation, mineral resources of the Slocum Creek Wilderness Study Area.

Name: Soda Mountain
Area number: OR-011-017
Size (acres): 5,640



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Pickthorn and others, 1990).

Identified mineral resources (known): The Soda Mountain Wilderness Study Area has no identified mineral resources or recorded mining activity. However, a small prospect, the Soda Mountain Prospect, consisting of a seven-ft-deep shaft and a nearby shallow pit was located in an area of hydrothermally altered silicic tuff and andesite breccia on a ridge to the northeast of Camp Creek. Gold values for the altered rocks at the prospect are as high as 0.06 oz per ton.

Mineral resource potential (undiscovered): Geologic, geochemical, and geophysical investigations suggest potential for epithermal precious metal mineralization in the Soda Mountain Wilderness Study Area. One area of epithermal vein mineralization, based on rock samples with anomalous boron, mercury, and tellurium values, occurs approximately 1 mi north of the study area boundary. Also, the Barron mine, a past producer of gold and silver, is located within the Tertiary volcanic rocks about 10 miles northwest of the study area. The area of the Soda Mountain prospect has moderate resource potential for gold and silver. Areas along the eastern edge of the study area and within the Dutch Oven Creek watershed, have a moderate resource potential for gold and silver. The potential for geothermal resources in the study area is low. Areas of active geothermal energy and exploration are associated with silicic volcanism less than 2 Ma or areas of high heat flow, neither of which is present here. The potential for oil and gas resources is the study area is low. This evaluation is based on the absence of suitable source or reservoir rocks. The potential for placer gold and building stone are also low.

Mining Activity: Shallow workings just outside the boundary explore the gold occurrence in the northern part of the wilderness study area. Two borrow pits in basaltic andesite are just outside the north and west boundaries. No current (July 1990) mining claims are located within the study area; one claim was located in 1983 in the west part of the area, but lapsed in 1985. As of October 1987, no oil/gas, geothermal, or coal leases existed within the study area.

Mineral setting/ Geology: Bedrock in the Soda Mountain Wilderness Study Area is made up of volcanic rocks, principally andesite.

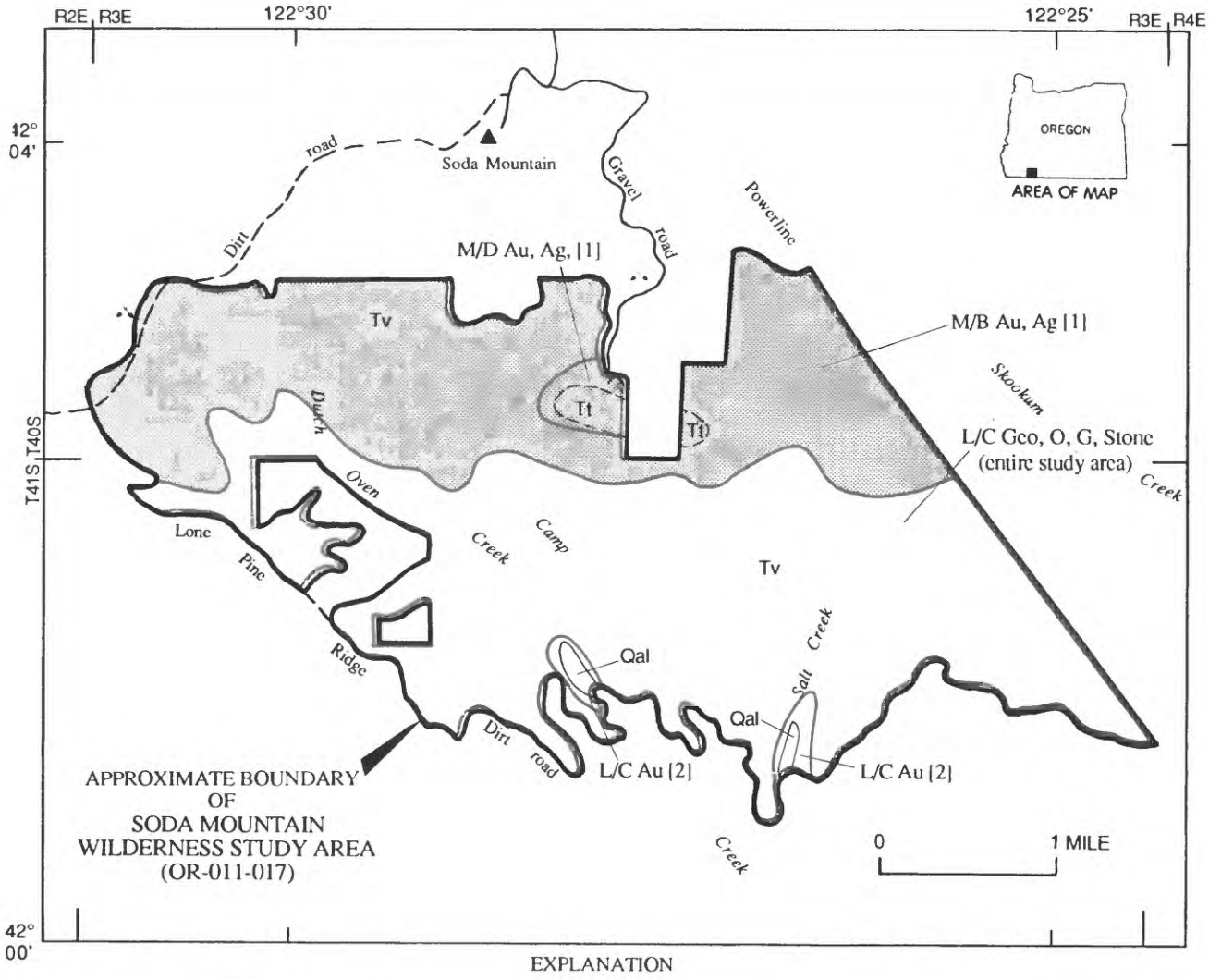
Recommendations: The possible southern extension of the identified gold anomaly should be further explored by additional surface sampling. If a well defined target emerges, drilling might be justified to establish resources.

References:

Peters, T.J., and Willett, S.L., 1989, Mineral resources of the Soda Mountain Wilderness Study Area, Jackson County, Oregon: U.S. Bureau of Mines Open-File Report MLA 32-89, 24 p.

Pickthorn, W.J., Goldfarb, R.J., Plouff, Donald, Sutley, S.J., Wilcox, M.D., Peters, T.J., and Willett, Spencee, 1990, Mineral resources of the Soda Mountain Wilderness Study Area, Jackson County, Oregon: U.S. Geological Survey Bulletin 1744-C.

Sutley, S.J., Goldfarb, R.J., and Pickthorn, W.J., 1990, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Soda Mountain Wilderness Study Area, Jackson County, Oregon: U.S. Geological Survey Open-File Report 90-450, 13 p.



EXPLANATION

Area having moderate mineral resource potential (M)

Area having low mineral resource potential (L)

Levels of certainty of assessment

- B — Data only suggest level of potential
- C — Data give good indication of level of potential
- D — Data clearly define level of potential

Commodities

- Ag — Silver
- Au — Gold
- Geo — Geothermal
- O, G — Oil and gas
- Stone — Building stone

Deposit types

- [1] — Epithermal vein
- [2] — Placer

Description of map units

- Qal — Alluvium (Quaternary)—Mostly unconsolidated stream sand and gravel
- Tv — Volcanic rocks (Tertiary)—Basalt, basaltic andesite, and andesite flows and breccia; age is Oligocene
- Tt — Tuff (Tertiary)—Silicic ashflow tuff; may be aquagene, in part

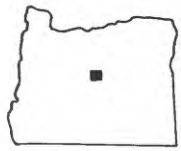
Contact—Dashed where approximately located

Soda Mountain prospect

Borrow pit

Mineral resources of the Soda Mountain Wilderness Study Area.

Name: South Fork
Area number: OR-005-033
Size (acres): 19,631



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ach and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The west-central part of the South Fork study area has low resource potential for epithermal deposits of mercury. The study area has low potential for oil and gas and for geothermal energy resources.

Mining Activity: A small block of active claims, held by assessment in 1989, probably for semi-precious stone, is located near the north boundary of the wilderness study area along Sulfur Creek. No other claim or mining activity is known. As of October 1987, about 8,610 acres within the study area and the adjoining Sand Hollow Wilderness Study Area were leased for oil and gas.

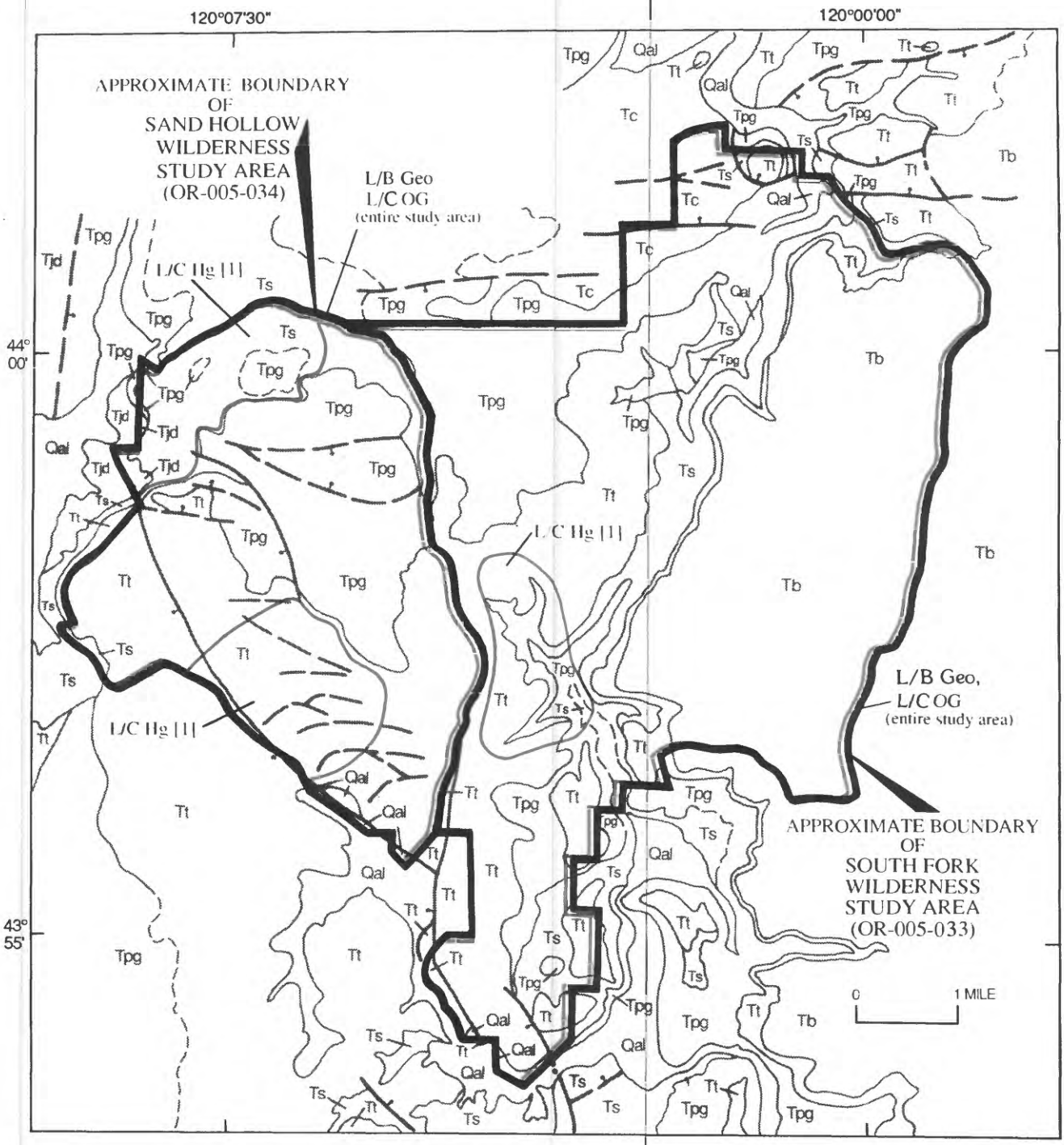
Mineral setting/ Geology: The oldest, but probably the least abundant, rocks in the study area are the Oligocene(?) and Eocene Clarno, and the Miocene to Eocene(?) John Day Formations which together occupy no more than a mi^2 in the extreme northern and northwestern parts. The Clarno consists of andesitic lava, flow-breccia, and interbedded tuffaceous sedimentary rocks. The John Day consists of sandstone, siltstone, and claystone. Successively younger rocks are: the lower Miocene Picture Gorge Basalt and interlayered and overlying fine-grained tuffaceous sedimentary rocks; late Miocene Devine Canyon and Rattle Snake Ash-flow Tuffs; and thin basalt flows. Quaternary surficial deposits consist of alluvium in canyon bottoms, talus on slopes, and local landslide deposits on canyon walls. Structure is dominated by high-angle normal faults, chiefly east-striking, but including a few of other strikes, and having offsets of tens to hundreds of feet, appear to have developed after eruption of the Picture Gorge Basalt. A later episode of faulting in the western part of the study area produced numerous small offsets in the young ash-flow tuff.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 2,390 acres that constitute the balance.

References:

Ach, J.A., Bateson, J.T., Blakely, R.J., King, H.D., and Olson, J.E., 1988, Mineral resources of the South Fork and Sand Hollow Wilderness Study Areas, Crook County, Oregon: U.S. Geological Survey Bulletin 1744-A, 17 p.

Olson, J.E., 1987, Mineral resources of the South Fork and Sand Hollow study areas, Crook County, Oregon: U.S. Bureau of Mines Open-File Report MLA 59-87, 8 p.



Mineral resources of the South Fork Wilderness Study Area.

EXPLANATION

Area having low mineral resource potential (L)

Levels of certainty of assessment

B Data suggest level of potential
C Data give good indication of level of potential

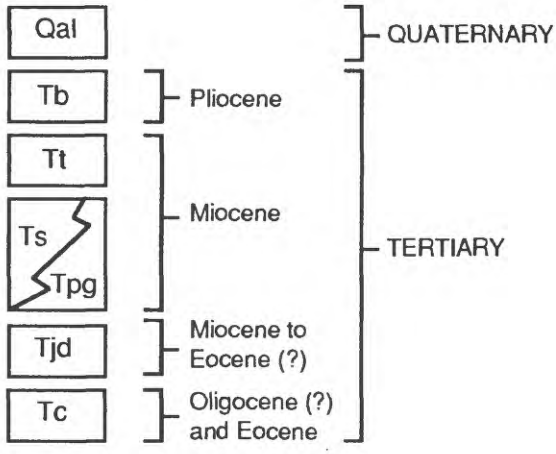
Commodities

Hg Mercury
OG Oil and natural gas
Geo Geothermal

[ ] Deposit types

1 Epithermal mercury deposits in volcanic and volcanoclastic rocks

Correlation of map units



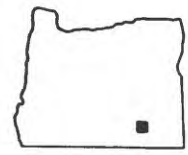
Geologic map units

Qal Alluvium (Quaternary)
Tb Basalt of Twelvemile Table (Tertiary)
Tt Ash-flow tuffs (Tertiary)
Ts Tuffaceous sedimentary rocks (Tertiary)
Tpg Picture Gorge Basalt (Tertiary)
Tjd John Day Formation (Tertiary)
Tc Clarno Formation (Tertiary)

Contact—Dashed where approximate
Fault—Dashed where approximate; bar and ball on downthrown side

Explanation, mineral resources of the South Fork Wilderness Study Area.

Name: South Fork Donner Und Blitzen River
Area number: OR-002-085G
Size (acres): 37,555



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Bukofski and others (1984), report silver and copper anomalies in the area.

Mineral resource potential (undiscovered): The areas of sediments, particularly those underlain by diatomaceous material have low potential for diatomite. All areas underlain by basalt may be favorable for construction material; however, field examination of the material is needed to assess its suitability for specific applications. The area has low potential for geothermal energy. The area has low potential for gold, mercury, uranium, and silver, moderate potential for geothermal energy, and low potential for oil and gas.

Mining Activity: No current mining claims are located within the wilderness study area (July 1990); no mines or prospects are known. As of October 1987, five oil and gas leases within the study area covered 17,525 acres.

Mineral setting/ Geology: The South Fork of Donner Und Blitzen River (OR-002-085G) Wilderness Study Area lies on the west slope of Steens Mountain in the very northern part of the Basin and Range physiographic province; in this part of the province pre-Tertiary basement rocks are not exposed. The structural gain of the region consists of north trending horst and graben, dominated west of the study area by Catlow Rim.

The area encloses 17-14 million-year-old lava flows of Steens Basalt that are locally capped by the 9.2 million-year-old Devine Canyon Ash-Flow Tuff. In widely scattered outcrops overlying the Steens Mountain Basalt is tuffaceous sedimentary rocks including lacustrine sandstones and siltstones, diatomaceous material, conglomerates, and fanglomerates.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

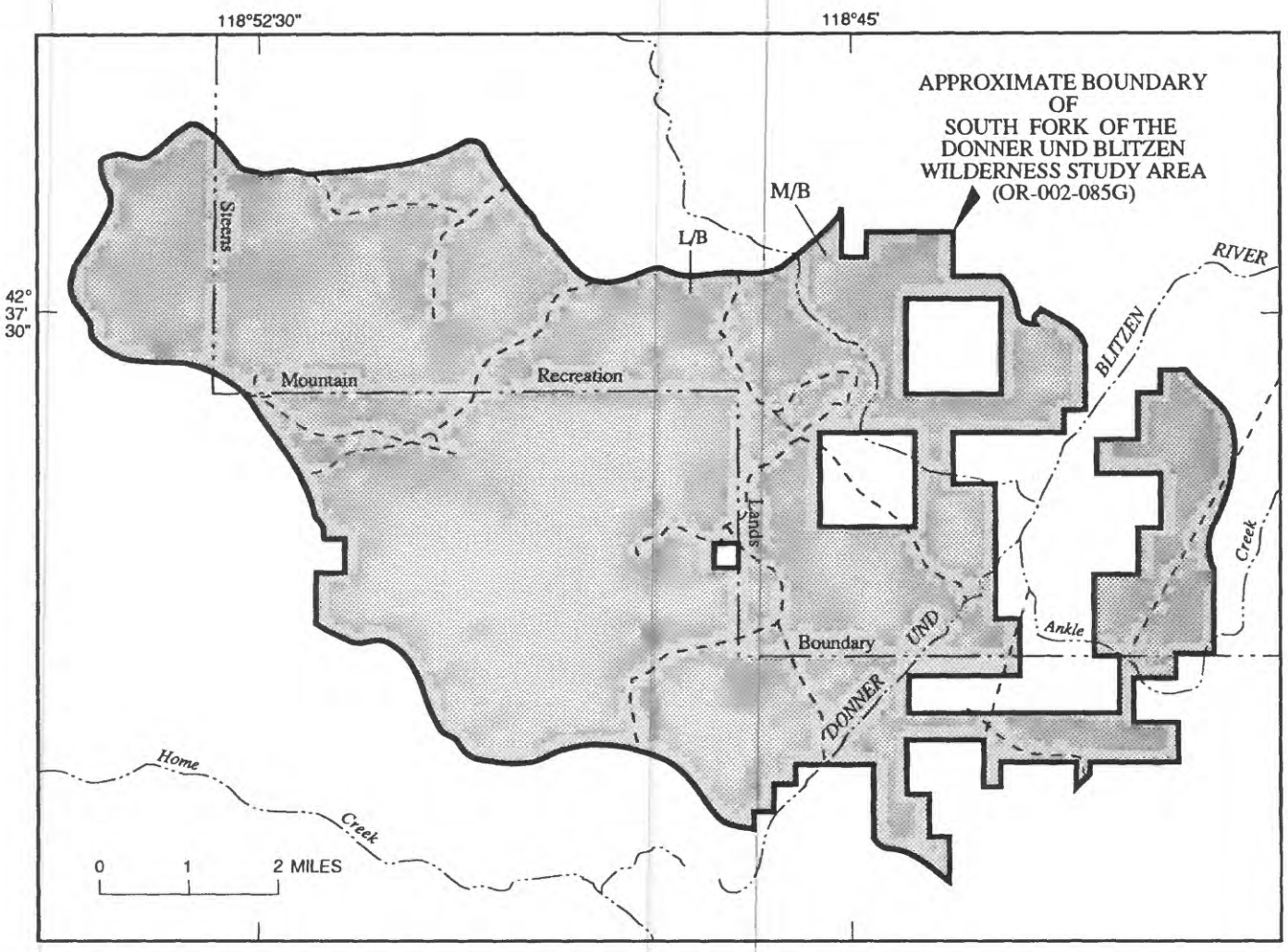
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Mathews, G.W., and Blackburn, W.H., 1983, Assessment of geology, energy, and minerals (GEM) resources - Catlow Rim GRA (OR-020-020), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, 32 p.

Moyle, P.R., 1987, Mineral resources of the Blitzen River study area, Harney County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 56-87, 14 p.

_____1987, Mineral resources of the Home Creek study area, Harney County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 58-87, 13 p.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., and Moyle, P.R., 1988, Mineral resources of the Blitzen River Wilderness Study Area, Harney County, Oregon: U.S. Geological Survey Bulletin 1740-D, 14 p.



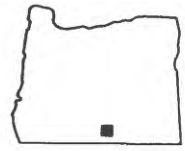
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for geothermal energy with certainty level B

L/B, Geologic terrane having low mineral resource potential for diatomite, geothermal energy, gold, mercury, uranium, silver, and oil and gas with certainty level B

Mineral resources of the South Fork Donner Und Blitzen River Wilderness Study Area.

Name: Spaulding
Area number: OR-001-139
Size (acres): 69,530



Status of mineral surveys: Only part of this wilderness study area has been studied for known resources (Miller, 1988) and as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (M.G. Sawlan, H.D. King, Donald Plouff, and M.S. Miller, unpub. data, 1990).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. This area contains a variety of known mineral occurrences including: large subeconomic resources of pozzolan in the northern part and stone throughout the area; large occurrences of sand and gravel; and occurrences of perlite, gold, and silver.

Mineral resource potential (undiscovered): The study area has low potential for gold. Trace amounts of gold have been found in stream sediment samples from the northwest and southeast parts of the area, but no rock alteration indicative of gold deposits was found during geologic mapping. Two small areas located in tuff show manganese mineralization but these occurrences are volumetrically insignificant.

Mining Activity: Although there is no recorded mineral production, at least one small pit and two claim groups are located within the wilderness study area; however, there are no currently active claims in the study area (as of June 1990). No energy leases existed within the area as of October 1987.

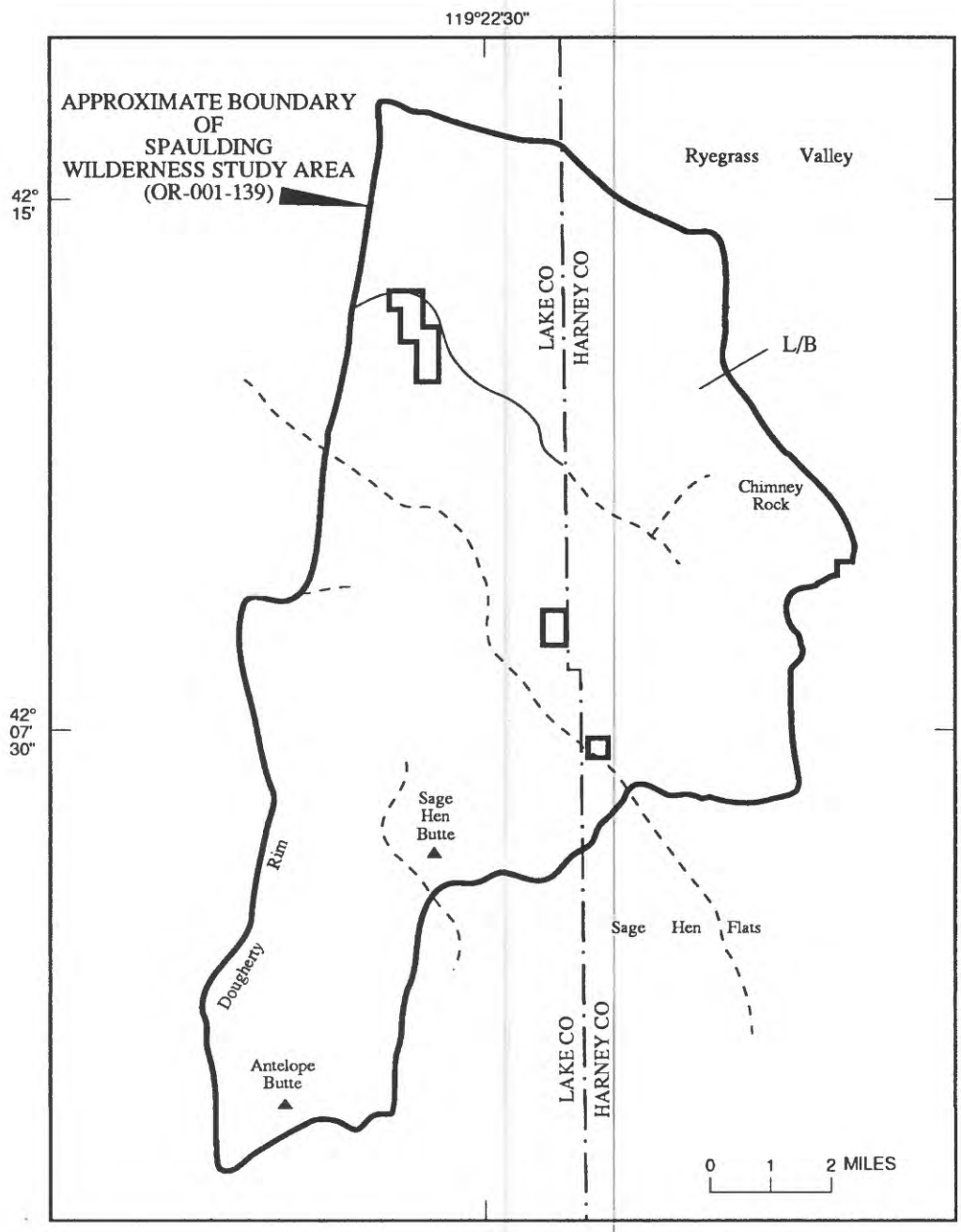
Mineral setting/ Geology: The study area is underlain by mesa-forming basalt that mostly overlies andesite lavas in the northwest part of the study area, and ash-flow tuff and associated tuffaceous sedimentary rocks in the southeast part of the study area. Numerous northwest-trending faults cut these Miocene volcanic rocks.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 30,920 acres that constitute the balance.

References:

Miller, M.S., 1988, Mineral resources of the Spaulding study area, Harney and Lake Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 23-88, 30 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

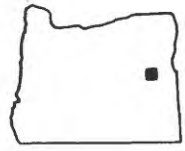


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold with certainty level B

Mineral resources of the Spaulding Wilderness Study Area.

Name: Sperry Creek
Area number: OR-003-035
Size (acres): 5,600



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Evans and others, 1990).

Identified mineral resources (known): This area contains a marginal economic inferred resource of 40,000 tons of marginally economic resources of stone (building and decorative). The area has occurrences of basalt (crushing and fiber) which are large but market dependent, low-grade gold, low-grade zeolites, and widespread optical calcite.

Mineral resource potential (undiscovered): The geologic environment, which includes at least one large rhyolite intrusion, silicified tuff and volcanic breccias, suggests that mineralization may have occurred. By analogy with the nearby region, part of the study area has moderate resource potential for gold, silver, and mercury. The entire study area has low potential for oil and gas energy resources.

Mining Activity: Although the area has no recorded production, there are at least six historic mining claims within the wilderness study area, and a group of 34 active lode claims. Currently there are no active oil and gas, or geothermal energy leases or applications. In 1989 Manville conducted sampling, mapping and proposed a drill program in search of precious metals, primarily gold.

Mineral setting/ Geology: The contiguous Gold Creek and Sperry Creek Wilderness Study Areas are underlain by 3,000 ft of Miocene to Pliocene basalt, welded tuff, rhyolite, and volcaniclastic rocks.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

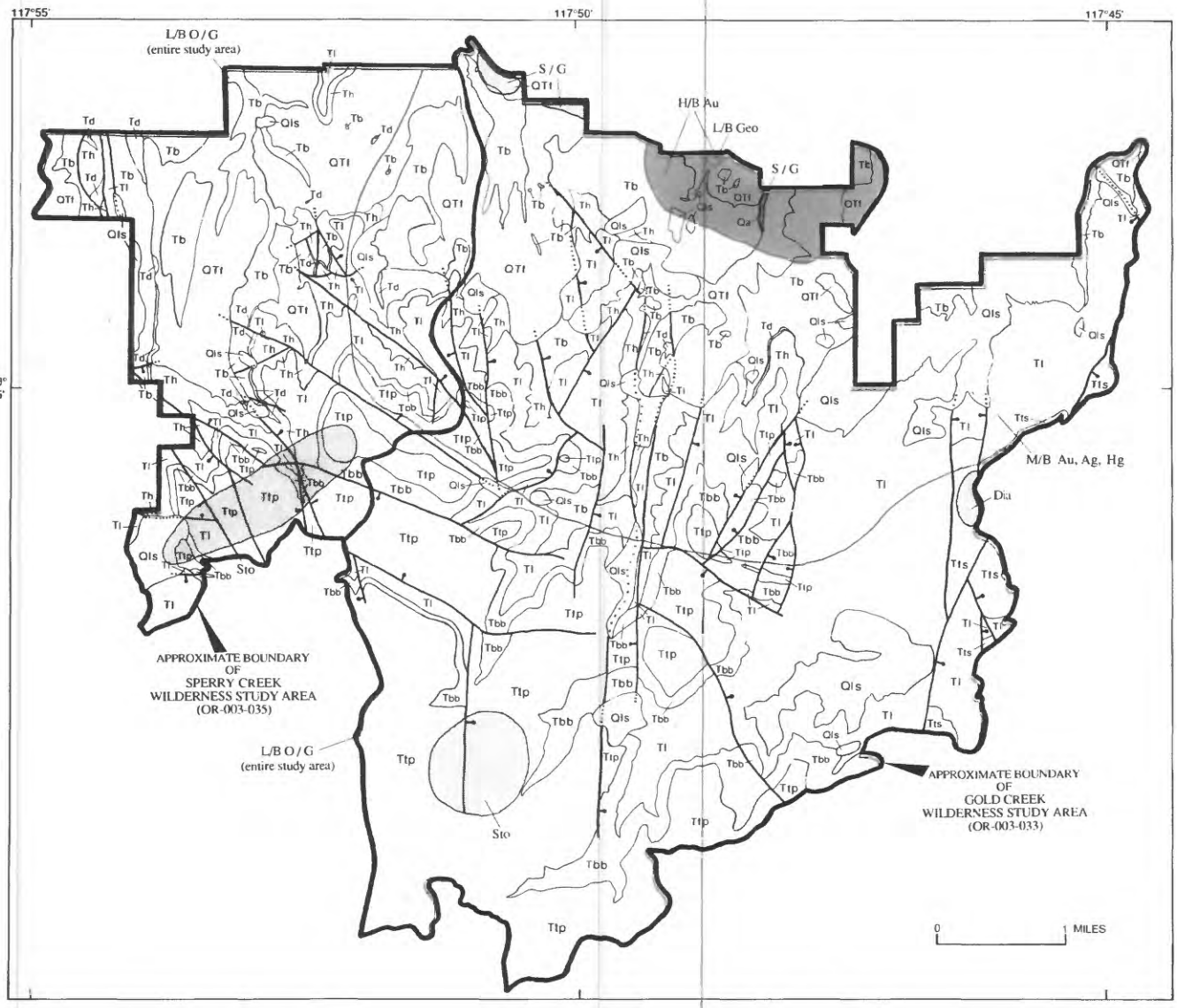
References:

Evans, J.G., Frisken, J.G., Griscom, Andrew, Sawatzky, D.L., and Miller, M.S., 1990, Mineral resources of the Gold Creek and Sperry Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-E.

Miller, M.S., 1989, Mineral resources of the Sperry Creek Wilderness Study Area and Gold Creek Wilderness Study Area and addition, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 22-89, 71 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.



Mineral resources of the Sperry Creek Wilderness Study Area.

EXPLANATION

Area having high mineral resource potential (H)

Area having moderate mineral resource potential (M)

Area having low mineral resource potential (L)

Level of certainty of assessment

B Data only suggest level of potential

Area having identified mineral resources for commodities as labeled

Commodities

Au	Gold
Ag	Silver
Dia	Diatomite
Geo	Geothermal resources
Hg	Mercury
O / G	Oil and gas
Sto	Building and decorative stone
S / G	Sand and Gravel

Geologic map units

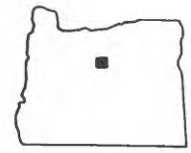
Qa	Alluvium (Quaternary)
Qls	Landslide deposits (Quaternary)
QTf	Fanglomerate (Quaternary and Pliocene)
Tts	Tuff and tuffaceous siltstone (Pliocene or Miocene)
Ttp	Tims Peak Basalt of Kittleman and others (1965) (Miocene)
Tbb	Pillow-basalt breccia (Miocene)
Tl	Littlefield Rhyolite of Kittleman and others (1965) (Miocene)
Th	Hunter Creek Basalt of Kittleman and others (1965) (Miocene)
Td	Dinner Creek Welded Ash-Flow Tuff of Kittleman and others (1965) (Miocene)
Tb	Basaltic complex (Miocene or older)—Equivalent to unnamed igneous complex of Kittleman and others (1965)

Contact

Fault—Dotted where concealed. Bar and ball on downthrown side

Explanation, mineral resources of the Sperry Creek Wilderness Study Area.

Name: Spring Basin
Area number: OR-005-009
Size (acres): 5,982



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ach and others, 1989).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): Two areas of less than a square-mile each in the eastern part of the study area have, respectively, low potential for epithermal deposits of gold, silver, and mercury, and low potential for epithermal deposits of mercury, alone. Part of the study area is under lease for oil and gas, hence, the entire study area is assigned low potential for oil and gas resources. The study area is considered to have no potential for uranium or geothermal energy resources.

Mining Activity: One lode mining claim is recorded in the July 1990 U.S. Bureau of Land Management claim records. No energy leases existed within the wilderness study area as of October 1987.

Mineral setting/ Geology: Lithified rocks of the study area comprise (ascending) the Clarno and the John Day Formations of Eocene to early Miocene age. The Clarno consists of as much as 1,700 ft of gently northwestward-dipping, intertonguing flows, breccia, and shallow intrusions, which are andesite in average composition, and volcaniclastic and tuffaceous rocks. Slightly unconformable over the Clarno is the John Day Formation which, in the study area, consists of welded and non-welded rhyolitic ash-flow tuff about 75 ft thick. Besides the northwestward tilt, a few northeast-striking high-angle normal faults, with apparent displacements of as much as 400 ft, account for the local structure.

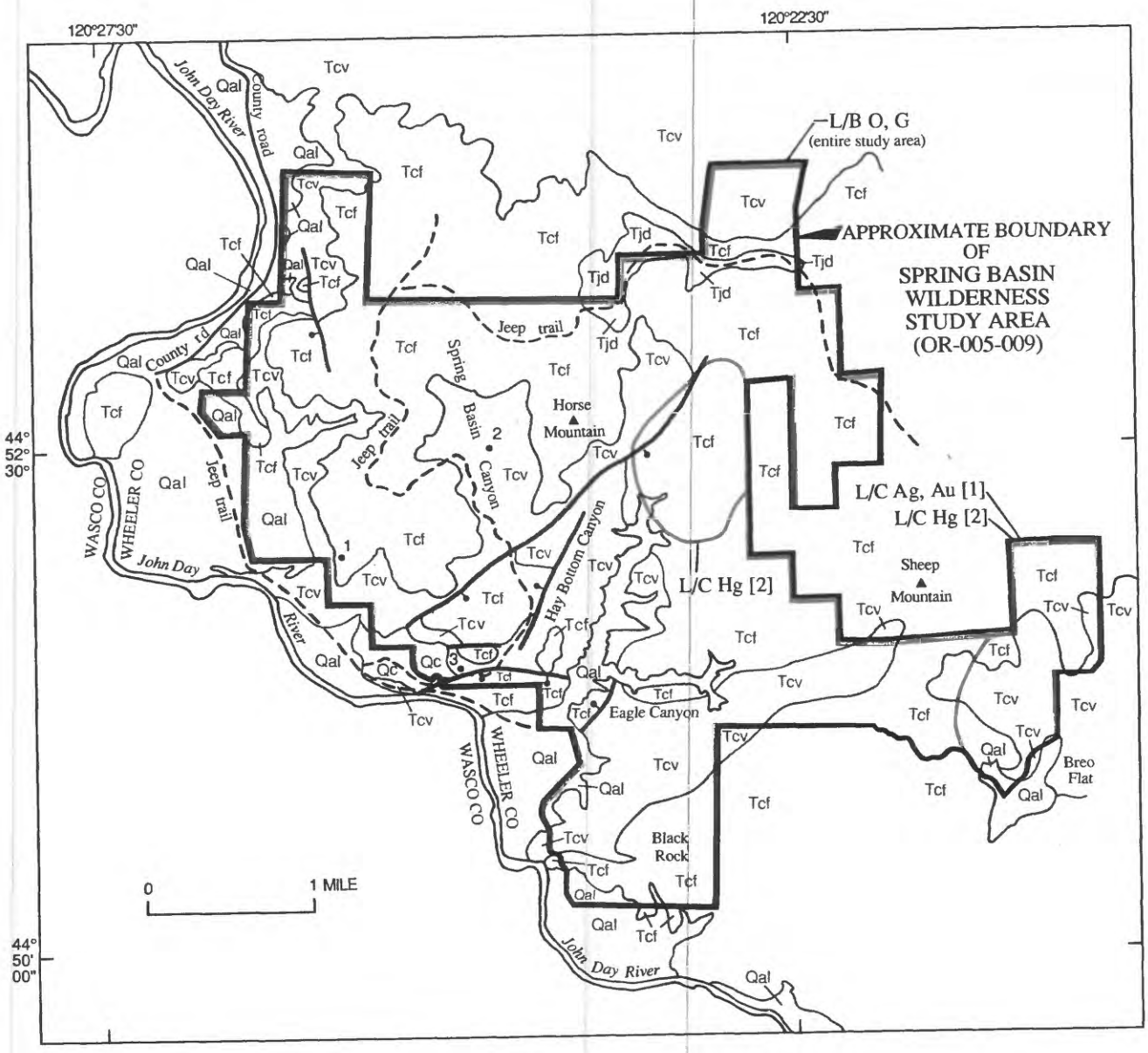
Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Ach, J.A., Minor, S.A., Frisken, J.G., Blakely, R.J., Winters, R.A., and Peters, T.J., 1989, Mineral resources of the Spring Basin Wilderness Study Area, Wheeler County, Oregon: U.S. Geological Survey Bulletin 1743-C, 16 p.

Malcolm, M.J., Frisken, J.G., Briggs, P.H., and Welsch, E.P., 1989, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Spring Basin Wilderness Study Area (OR-005-009), Wheeler County, Oregon: U.S. Geological Survey Open-File Report 89-0539, 21 p.

Winters, R.A., and Peters, T.J., 1988, Mineral resources of the Spring Basin Wilderness Study Area, Wheeler County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 4-88, 13 p.



Mineral resources of the Spring Basin Wilderness Study Area.

EXPLANATION

Area of low mineral resource potential (L)

Levels of certainty of assessment

- B — Data only suggest level of potential
- C — Data give good indication of level of potential

Commodities

- Ag — Silver
- Au — Gold
- Hg — Mercury
- O,G — Oil, Gas

[ ] Deposit types

- 1 — Epithermal precious- and base-metal deposits
- 2 — Epithermal mercury deposits

Geologic map units

- Qal — Alluvium (Quaternary)
- Qc — Colluvium (Quaternary)
- Tjd — John Day Formation (Tertiary)—Ash-flow tuffs
- Tcf — Clarno Formation (Tertiary)—Volcanic flows, plugs, and domes
- Tcv — Clarno Formation (Tertiary)—Volcaniclastic rocks

Contact

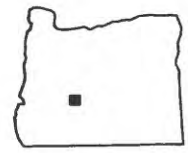
Normal fault—Bar and ball on downthrown side

• Claims

- 1 — Crystal Peak claim
- 2 — MEM-CAF claim
- 3 — Unnamed claim

Explanation, mineral resources of the Spring Basin Wilderness Study Area.

Name: Squaw Ridge Lava Bed
Area number: OR-001-003
Size (acres): 28,340



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Keith and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Widespread occurrences of slab lava (building stone), cinders, and sand and gravel are present the wilderness study area but are not considered economic at 1988 prices.

Mineral resource potential (undiscovered): Potential for oil and gas and for low-temperature geothermal resources is low for the study area. The north half of Squaw Ridge study area has low potential for the occurrence of slab lava (building stone) resources.

Mining Activity: Slab lava has been removed from numerous areas along the margins of lava flows. Six claims were located during the early 1970's, probably for slab lava; as of 1987, there were no active mining claims within the wilderness study area. As of July 1990, U.S. Bureau of Land Management mining records showed no active mining claims within the study area. No energy leases existed within the study area in October 1987.

Mineral setting/ Geology: Pliocene, Pleistocene, and Holocene basaltic lavas, including lesser andesite, dacite, and rhyolite, associated with the older basalt, underlie the study areas and aggregate more than 1,200 ft in thickness. Dacite and rhyolite locally form domes as well as flows. Structure consists of a few northwest-trending high-angle normal faults and associated tension fractures.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 7,330 acres that constitute the balance. Additional studies are recommended to determine if the cinders present within the wilderness study area are of marketable character.

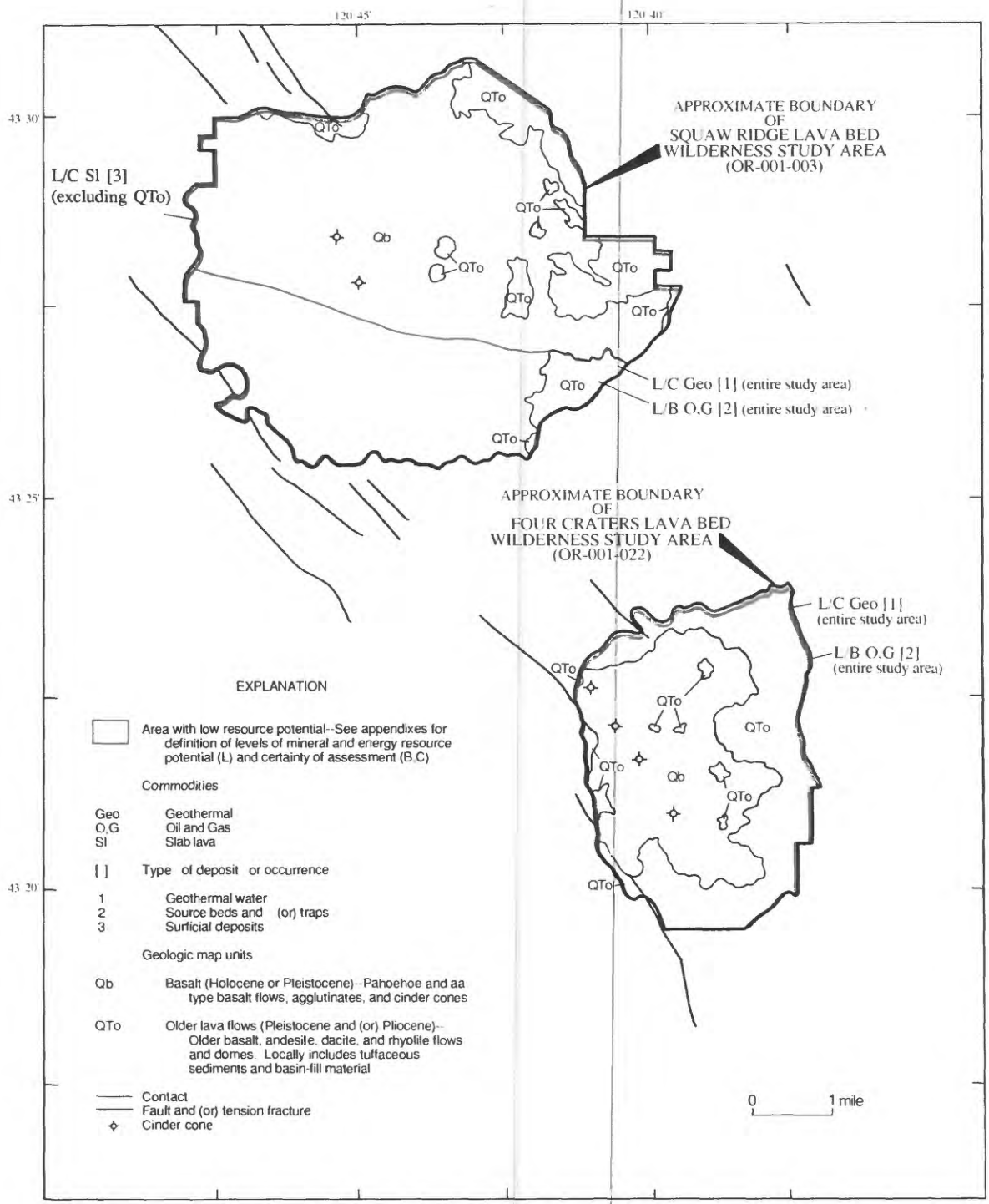
References:

Erickson, M.S., Hopkins, R.T., Fey, D.L., and King, H.D., 1989, Analytical results and sample locality map of rock samples from the Devil's Garden Lava Bed (OR-001-002), Squaw Ridge Lava Bed (OR-001-003), and Four Craters Lava Bed (OR-001-022) Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Open-File Report 89-0307, 10 p.

Johnson, F.L., 1987, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed study areas, Lake County, Oregon: U.S. Bureau of Mines Open-File Report MLA 37-87, 10 p.

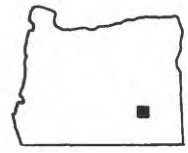
Keith, W.J., King, H.D., Gettings, M.E., and Johnson, F.L., 1988, Mineral resources of the Devil's Garden Lava Bed, Squaw Ridge Lava Bed, and Four Craters Lava Bed Wilderness Study Areas, Lake County, Oregon: U.S. Geological Survey Bulletin 1738-A, 14 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000



Mineral resources of the Squaw Ridge Lava Bed Wilderness Study Area.

Name: Stonehouse
Area number: OR-002-023L
Size (acres): 21,325



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The study area has low resource potential for gold, silver, diatomite, and oil and gas. It also has low geothermal energy potential along range-bounding faults.

Mining Activity: No current mining claims are located within the wilderness study area (July 1990); no mines or prospects are known. No oil and gas leases existed within the study area as of October 1987.

Mineral setting/ Geology: The contiguous Stonehouse and Lower Stonehouse Wilderness Study Areas, which lie at the north end of the Steens Mountain south of State Highway 78, are underlain almost entirely by 17-14 million-year-old lava flows of Steens Basalt. Probably no areas have significant mineralization, although geothermal fluids moving upward along the range-front fault system may have deposited trace amounts of gold and silver. Diatomite potential is nil, even in those parts of the Alvord Valley that are enclosed by the study area, because any lake environment would have been too small to allow the accumulation of sufficiently pure diatomite. Geothermal energy resource potential is high along the major range-front escarpment. Oil and gas potential is low or none; small reservoirs containing chiefly gas may be buried several thousand feet in lower Tertiary basin deposits.

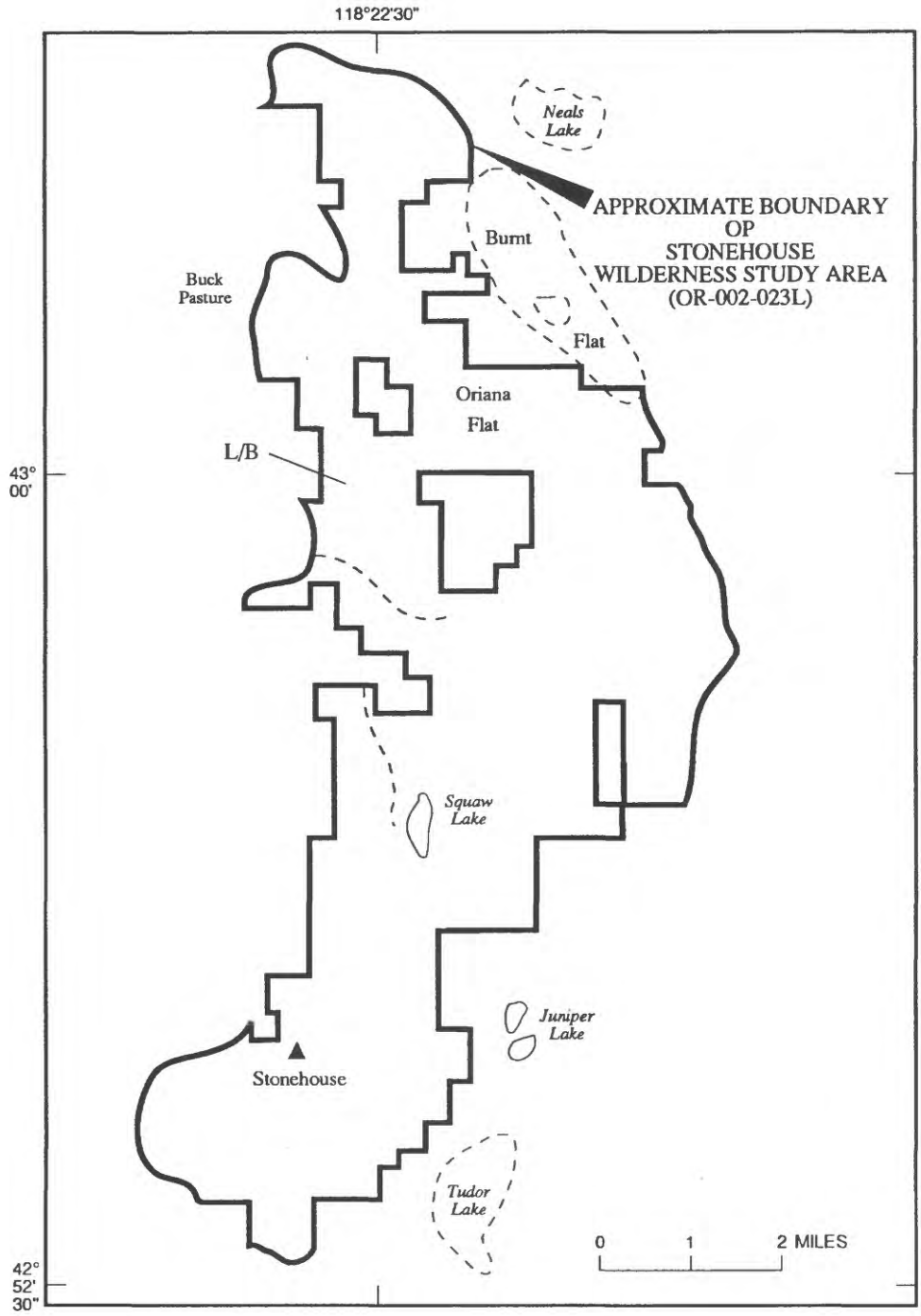
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey.

References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Pineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Graham, D.E., and Buehler, A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas, and the Wildcat Canyon Wilderness Study Area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 62-87, 20 p.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

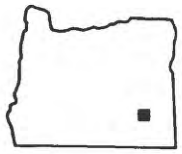


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, silver, diatomite, oil and gas, and (or) geothermal energy with certainty level B

Mineral resources of the Stonehouse Wilderness Study Area.

Name: Table Mountain
Area number: OR-002-072I
Size (acres): 40,592



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Sherrod and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Occurrences of placer gold and diatomite are too low in grade to be considered resources; indications of zeolites and fluorite are also present (Graham and Buehler, 1987). The south end of this area is in the Alvord Known Geothermal Resource Area (Riccio, 1978). Additionally, the area is covered by a known low-temperature geothermal resource area (Riccio, 1978).

Mineral resource potential (undiscovered): The wilderness study area is considered to have low potential for occurrence of deposits of gold and silver along faults, low potential for occurrences of oil and gas, and moderate potential for occurrence of geothermal energy resources, especially along range-bounding faults. Potential for the occurrence of diatomite deposits is low in the wilderness study area.

Mining Activity: There is no recorded mineral production from the area, no recorded mining claims, and limited industry exploration of the general area. Geothermal leases covered 7,376 acres within the area in 1984. Two geothermal leases covered 2,340 acres within the wilderness study area as of October 1987; no geothermal exploration is reported. Nine oil and gas leases covered 18,000 acres of the study area in 1984. Currently, (October 1987) these leases are inactive, and no oil or gas exploration has been recorded.

Mineral setting/ Geology: Apart from relatively thin deposits of Pleistocene and Holocene alluvium and colluvium, rocks exposed in the study area are entirely volcanic extending from middle Miocene Steens Basalt through late Miocene Devine Canyon Ash-Flow Tuff and into unnamed Pleistocene high-alumina basalt. Minor interlayered tuffaceous sedimentary rocks occur in a basaltic to dacitic unit overlying the Steens. The rocks are mainly horizontal, but an episode of uplift and tilting of as much as 18°, prior to deposition of the Devine Canyon, can be documented. A group of north-northwest to north-northeast-striking high-angle normal faults defines the regional grain, with measurable offsets of as much as 1,000 ft. Faults of a second group strike northwest to west-northwest, generally have offsets of less than 100 ft, and transect the more northwardly-trending blocks. Several of the basins created by faulting are closed depressions that contained large pluvial lakes in the Pleistocene, and which locally include diatomite among the associated sedimentary deposits.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 13,415 acres that constitute the balance.

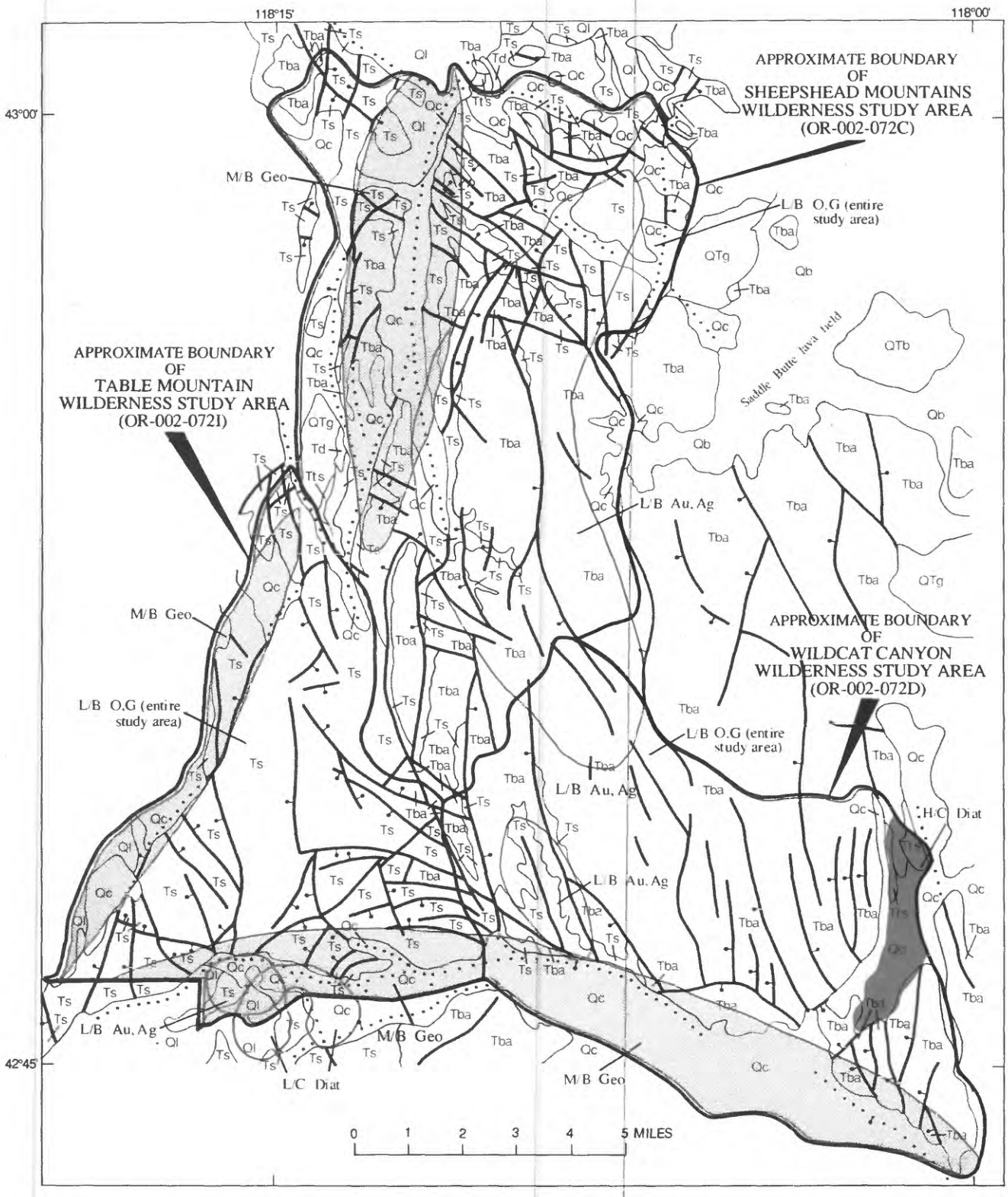
References:

Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Pineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for the U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Graham, D.E., and Buehler A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas, and Wildcat Canyon Wilderness Study Area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 62-87, 20 p.

Riccio, J.F., 1978, Preliminary Geothermal Resource Map of Oregon: Oregon Department of Geology and Mineral Industries, Geologic Map Series (GMS) 11, 1 sheet, scale 1:500,000

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.



Mineral resources of the Table Mountain Wilderness Study Area.

EXPLANATION

Area with high mineral resource potential (H)

Area with moderate mineral resource potential (M)

Area with low mineral resource potential (L)

Levels of certainty of assessment

B	Data suggest level of potential
C	Data give good indication of level of potential

Commodities

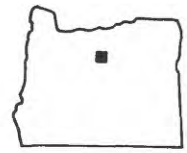
Au	Gold
Ag	Silver
Diat	Diatomite
Geo	Geothermal
O,G	Oil, Gas

Geologic map units

Ql	Lacustrine and playa deposits (Quaternary)
Qc	Colluvium (Quaternary)
Qb	Younger basalt (Quaternary)
QTb	Older basalt (Quaternary or Tertiary)
QTg	Gravel and conglomerate (Quaternary and Tertiary)
Tts	Tuff and tuffaceous sedimentary rocks (Tertiary)
Tdc	Devine Canyon Ash-flow Tuff (Tertiary)
Tba	Basalt, basaltic andesite, andesite, and dacite (Tertiary)
Ts	Steens Basalt (Tertiary)
———	Contact—Approximately located
—t—···	Fault—Dotted where concealed. Ball and bar on downthrown side

Explanation, mineral resources of the Table Mountain Wilderness Study Area.

Name: Thirtymile
Area number: OR-005-001
Size (acres): 7,538



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Ach and others, 1988).

Identified mineral resources (known): The Thirtymile Wilderness Study Area has 790,000 yd^3 of subeconomic gold resources averaging 0.03 oz/yd^3 gold in two river bars along the John Day River. Stone, sand, and gravel from the wilderness study area could be quarried and used for construction purposes; however, supplies of construction material outside the study area are more accessible to potential use sites and are ample to supply regional demand.

Mineral resource potential (undiscovered): The study area is under lease for oil and gas and are therefore, despite any intrinsic evidence, assigned low potential for oil and gas resources. The area also has low potential for placer gold resources along the canyon of the John Day River; it has no potential for geothermal energy resources. Part of the Thirtymile study area has low potential for gold and (or) mercury resources in hydrothermal deposits.

Mining Activity: No mines, prospects, or current mining claims are known. No evidence of mining activity was found in or near the Thirtymile Wilderness Study Area. One mining claim was located in the wilderness study area in 1983, but is now abandoned. None of the Thirtymile Wilderness Study Area was leased for oil and gas exploration as of October 1987. Current U.S. Bureau of Land Management practice preserves the natural character of the area viewed from the John Day River (5,686 acres) from oil and gas development by use of "no surface occupancy" lease stipulations where mineral estate is owned by the Federal Government. Three wells were drilled near Clarno between 1929 and 1957; one had a gas show, but none contained oil or commercial quantities of gas. An additional dry hole was drilled near Condon in 1957 to depth of 8,726 ft. No geothermal leases exist in the study area. Sand, gravel, and stone have been quarried from at least 13 sites along State and Federal highways between 6 and 30 mi from the study area. Most was used as fill or a base topping for roads. Sites are reopened or new sites are developed as needs arise.

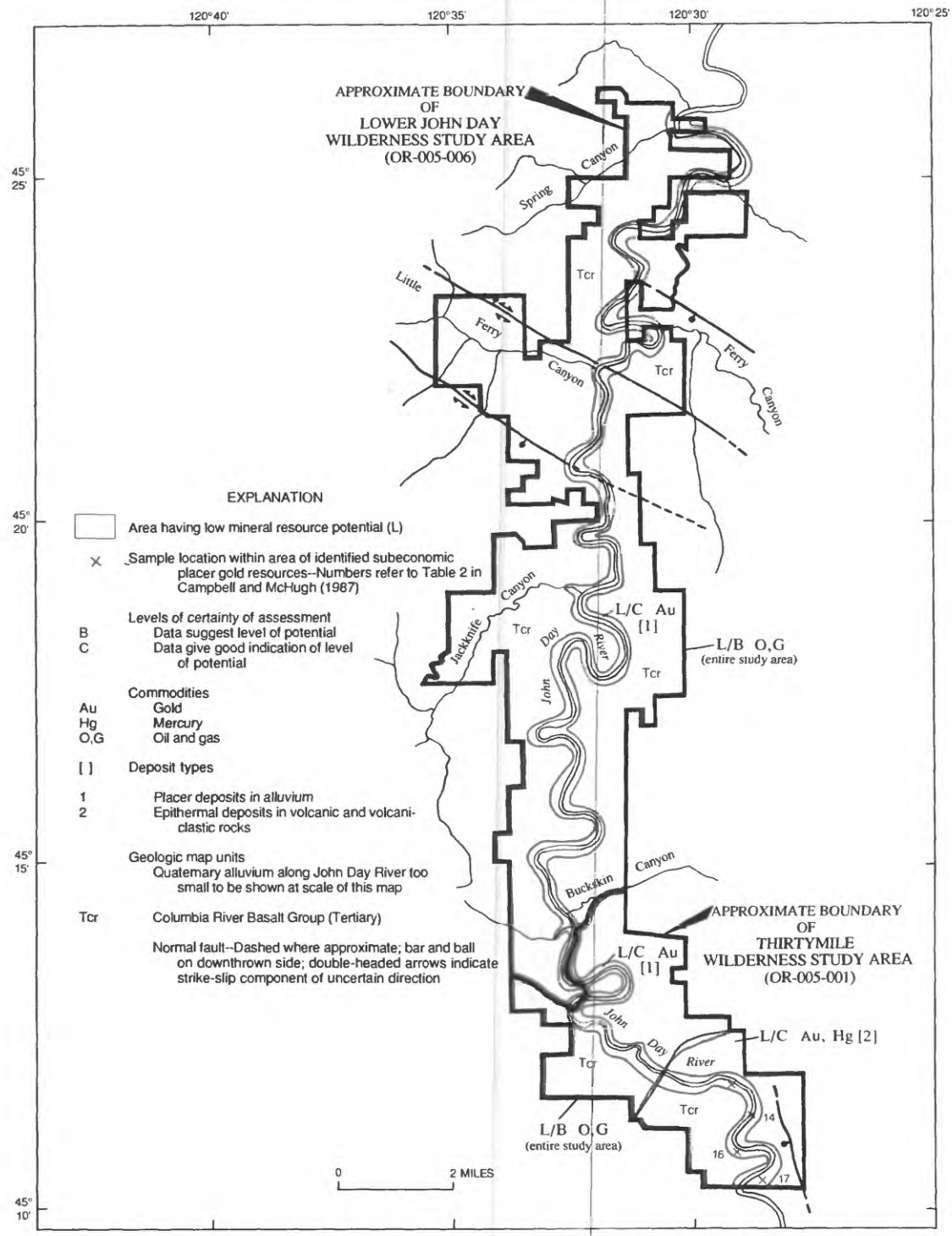
Mineral setting/ Geology: Basalt of the Miocene Columbia River Basalt Group, consisting of a thick accumulation of lava in flows 50 to 100 ft thick, 1,800 ft of which is locally exposed, is the only bedrock unit exposed in the study area. Flows are typically columnar jointed and have vesicular, readily eroded tops. Lying unconformably beneath the basalt are interlayered tuff, tuffaceous sedimentary rocks, and mafic lava flows of the latest Eocene to early Miocene John Day Formation. Nearest exposures of the John Day are 7 mi south of the study area in the canyon of the John Day River. Documenting the existence of the John Day and Clarno beneath the Columbia River Basalt in this region, are the results of Standard Oil Company's test hole drilled 14 mi east of the study area. The hole penetrated 2,440 ft of basalt, below which it penetrated 4,255 ft of John Day and possibly Clarno rocks. The Columbia River Basalt dips northward about 5° and is cut by high-angle, normal and oblique-slip, northwest-striking faults in the northern part of the study area and by a north-northwest-striking high-angle normal fault near the southern boundary. Quaternary alluvial deposits of sand and gravel occur chiefly along the inner banks of the present channel of the John Day River, but include patchy remnants in old, higher-level, abandoned meander scars.

Recommendations: As all but 206 acres of this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

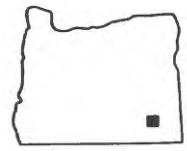
Ach, J.A., Minor, S.A., Frisken, J.G., Blakely, R.J., Campbell, H.W., and McHugh, E.L., 1988, Mineral resources of the Lower John Day and Thirtymile Wilderness Study Areas, Sherman and Gilliam Counties, Oregon: U.S. Geological Survey Bulletin 1743-A, 18 p.

Campbell, H.W., and McHugh, E.L., 1987, Mineral resources of the Lower John Day and Thirtymile study areas, Gilliam and Sherman Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 52-87, 17 p.



Mineral resources of the Thirtymile Wilderness Study Area.

Name: Twelve Mile Creek
Area number: OR-003-162
Size (acres): 28,600



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Peterson and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the Twelve Mile Creek Wilderness Study Area. Moonstone (an opalescent-blue variety of orthoclase feldspar) is present in the upper parts of Antelope, Little Antelope, and Twelve Mile Creeks. The occurrence may be of interest to rock collectors, but does not constitute a mineral resource.

Mineral resource potential (undiscovered): The area has low potential for zeolite resources because of its volcanic terrane. The northernmost part of the Twelve Mile Creek area has low potential for pumice as scattered fragments in tuff. The study area has a low potential for geothermal energy resources because of its proximity to warm-water wells and springs nearby. There are no oil and gas leases in the area and it has low potential for resources of oil and gas. The tuff of Trout Creek Mountains, exposed in the study area, has a low potential for resources of light rare-earth elements and zirconium in local accumulations of aenigmatite, a sodium-iron-titanium mineral. This same rock unit is locally attractive enough to be used as decorative building stone; therefore, this unit has low potential for decorative stone resources. Sand and gravel accumulations are present locally in the study area, but material of similar quality is available elsewhere, closer to potential markets.

Mining Activity: No mining claims or mining activity is known. As of October 1987, no oil and gas, geothermal, or other mineral leases existed in the wilderness study area.

Mineral setting/ Geology: The study area is comprised of four contiguous wilderness study areas in the northern part of the Basin and Range physiographic province, and additionally, is in a region where Tertiary volcanic calderas are numerous, and are the sources for most of the underlying rocks. The oldest rocks, and the only ones unrelated to nearby calderas, are multiple flows of porphyritic basalt that average about 20 ft thick and may correlate with the middle Miocene Steens Basalt. Progressively overlying the basalt is a zoned ash-flow tuff and a flow sequence of basalt, andesite, and rhyolite, interbedded with tuff and flow breccia; all the foregoing units dip northwestward 3° to 5°. Nearly 600 ft of rhyolitic ash-flow tuff overlie the flow sequence and, in the southeasternmost part of the study area, also overlie a small cluster of rhyolite domes and dikes which cut the older rocks. Most of the Tertiary units in the local stratigraphic section have been radiometrically dated at 15 to 16 Ma, hence, all are middle Miocene in age. Quaternary alluvial deposits consist of poorly sorted, locally derived material in canyons and along margins of mountains. Structure in the southern part of the study area is dominated by intersecting northern rims of Washburn and Long Ridge calderas--part of the McDermitt caldera complex--and their associated sub-parallel fault systems.

Displacements along these ring-fault systems, which are typically stepped downward toward the caldera center, are generally less than 1,000 ft, but are locally as much as 1,500 ft. Structure in the central and northern parts consists of scattered, north- to northwest-striking, high-angle, typical basin and range faults.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 1,620 acres that constitute the balance.

References:

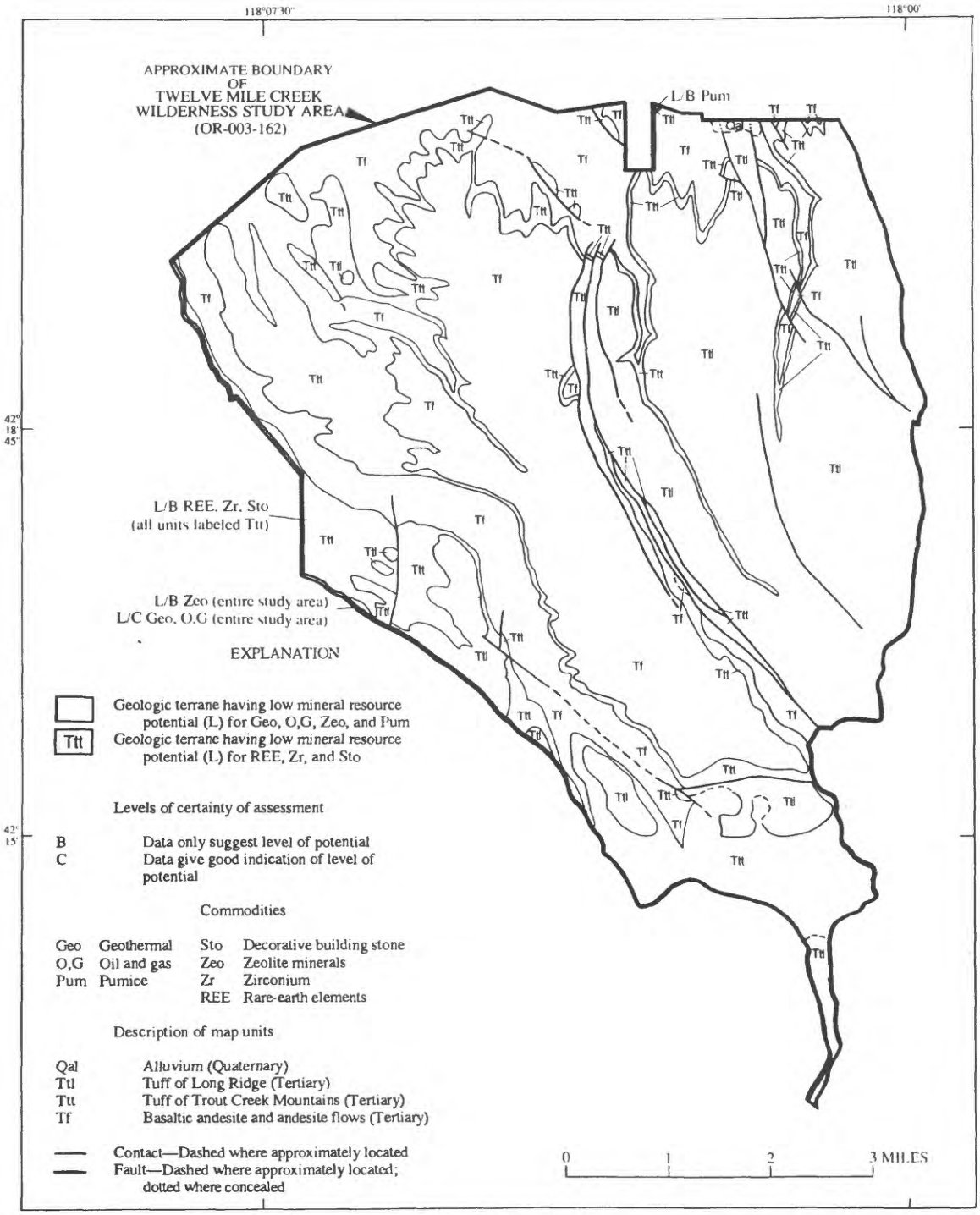
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Gray, J.J., Peterson, N.N., Clayton, J., and Baxter, G., 1983, Geology and mineral resources of the 18 wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-2, 106 p.

Jones, J.L., Erickson, M.S., and Fey, D.L., 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Fifteen Mile Creek, Twelve Mile Creek, Oregon Canyon, and Willow Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0696, 48 p.

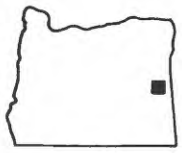
Peterson, J.A., Rytuba, J.J., Plouff, Donald, Vercoutere, T.L., Turner, R.L., Sawatzky, D.L., Leszcykowski, A.M., Peters, T.J., Schmauch, S.W., and Winters, R.A., 1988, Mineral resources of the Fifteen Mile Creek, Oregon Canyon, Twelve Mile Creek, and Willow Creek Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1742-B, 24 p.

Schmauch, S.W., 1987, Mineral resources of the Twelve Mile Creek study area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 39-87, 10 p.



Mineral resources of the Twelve Mile Creek Wilderness Study Area.

Name: Upper Leslie Gulch
Area number: OR-003-074
Size (acres): 3,000



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Vander Meulen and others, 1989).

Identified mineral resources (known): No mineral resources have been identified in or adjacent to the wilderness study area. Sand and gravel deposits along drainages within the study area do not constitute resources because similar deposits are more accessible and closer to existing markets. Welded parts of the caldera-forming tuff exposed within the study area are suitable for construction purposes; however, because similar tuff elsewhere is more accessible and closer to existing markets, this tuff does not constitute a resource.

Mineral resource potential (undiscovered): Large parts of the study area have moderate resource potential for volcanogenic deposits of uranium and thorium, and low potential for volcanogenic zinc. Anomalously high content of lithium in samples of tuff and intrusive rhyolite, results in assigning the entire area low potential for occurrence of stratiform lithium deposits. Brecciated, veined, and silicified intrusions of rhyolite have moderate resource potential for gold, silver, mercury, and zinc. Thermal springs along north-trending faults in the region form the basis for assigning moderate potential for geothermal energy in similar settings in the study area. The study area is considered to have no potential for oil and gas.

Mining Activity: No mines, claims, or prospects were found in the study area during field studies. According to the July 17, 1990 U.S. Bureau of Land Management mining claim recordation files, there are no lode or placer claims located within the study area. Search of the U.S. Bureau of Mines Mineral Industry Location System (MILS) revealed no MILS entries within the study area boundaries. U.S. Bureau of Land Management township plats showed no geothermal or other energy leases.

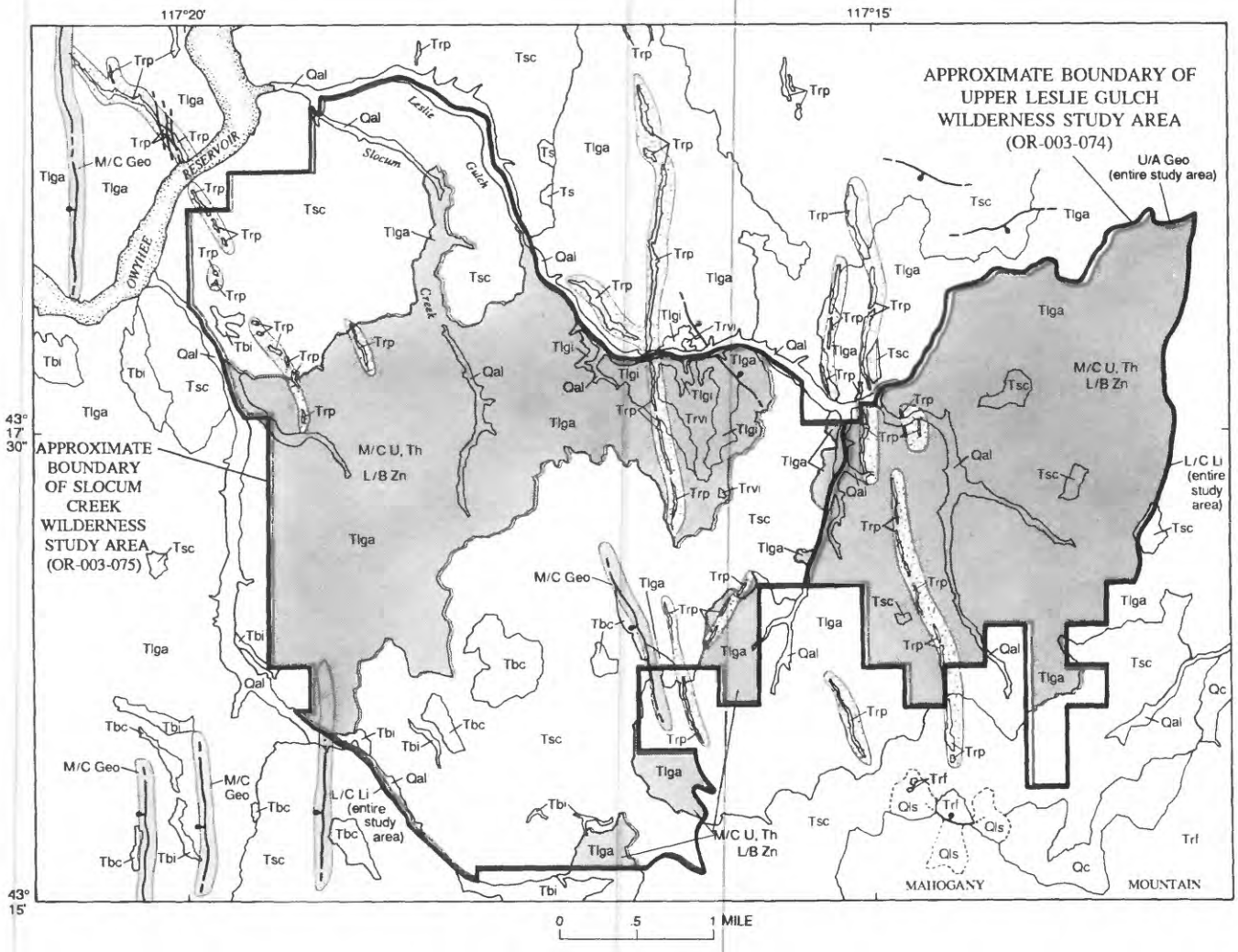
Mineral setting/ Geology: The study area is within the Mahogany Mountain caldera, an 8- by 12-mi elliptical collapse structure that resulted from eruption, during the middle Miocene, of huge volumes of rhyolitic ash-flow and air-fall tuff, 1,150 ft of which comprises the stratigraphically lowermost rocks exposed. Overlying these rocks are two units of ash-flow tuff which, in contrast, were erupted from a vent outside the caldera. Many northwest-trending rhyolite dikes, some showing horizontal columnar structure, and several basalt dikes, intrude the tuff. Several contemporary rhyolite domes and plugs intrude along the north and east caldera margins; some are brecciated, silicified, and cut by quartz veins. Alluvial deposits are restricted to the main drainage canyons. Although it lies within the northern part of the basin and range province, only two northwest-trending high-angle faults are mapped in the study area. Others of pre-middle Miocene age are doubtless buried beneath the thick tuffs in the caldera.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Benham, J.R., 1988, Mineral resources of the Slocum Creek and Upper Leslie Gulch Wilderness Study Areas, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 22-88, 16 p.

Vander Meulen, D.B., Griscom, Andrew, King, H.D., and Benham, J.R., 1989, Mineral Resources of the Upper Leslie Gulch and Slocum Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-D, 20 p.



Mineral resources of the Upper Leslie Gulch Wilderness Study Area.

EXPLANATION

Area having moderate resource potential (M)

Area having moderate mineral resource potential (M), certainty level B, for Au, Ag, Hg, and Zn

Area having low (L) mineral resource potential

Levels of certainty of assessment

A	Data not adequate for determination of potential
B	Data only suggest level of potential
C	Data give good indication of level of potential

Commodities

Ag	Silver	Li	Lithium
Au	Gold	Th	Thorium
Geo	Geothermal energy	U	Uranium
Hg	Mercury		

Geologic map units

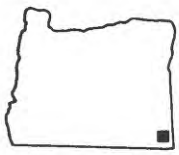
Qal	Alluvium (Quaternary)
Qc	Colluvium deposits (Quaternary)
Qls	Landslide deposits (Quaternary)
Ts	Sedimentary rocks (Tertiary)
Trp	Rhyolite porphyry (Tertiary)
Tbi	Basalt intrusions (Tertiary)
Tbc	Tuff of Birch Creek (Tertiary)
Tsc	Tuff of Spring Creek (Tertiary)
Trvi	Rhyolite vent intrusion (Tertiary)
Tlga	Leslie Gulch Tuff; air-fall facies (Tertiary)
Tlgi	Leslie Gulch Tuff; intracaldera facies (Tertiary)
Trf	Rhyolite flows (Tertiary)

Contact—Dashed where approximately located

Fault—Dashed where inferred; dotted where concealed; ball and bar on downthrown side

Explanation, mineral resources of the Upper Leslie Gulch Wilderness Study Area.

Name: Upper West Little Owyhee
Area number: OR-003-173
Size (acres): 62,500



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Evans and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The study area is considered to have low resource potential for deposits containing silver and mercury. Potential for the occurrence of oil and gas resources is also low.

Mining Activity: No mines, prospects, or current mining claims (July 1990) are located within the wilderness study area; no energy leases existed within the study area as of October 1987.

Mineral setting/ Geology: The oldest and dominant rock unit in the study area is the Swisher Mountain Tuff, a dark, massive to laminated, rhyolitic vitrophyre breccia that is continuous with a welded ash-flow tuff mapped as Swisher Mountain Tuff in the adjoining Owyhee Canyon Wilderness Study Area (Evans and others, 1987). At least 400 ft thick(as much as 1000 ft north of the study area), geophysical evidence suggests that the rock originated from caldera eruptions in southwest Idaho that occurred 12.5 to 14.6 Ma (million years before present) - middle Miocene - based on isotopic age determinations. Generally massive Pliocene or Miocene basalt flows, as thick as 100 ft, overlie the Swisher Mountain, and are overlain by conglomeratic siltstone, and locally by conglomeratic tuffaceous sandstone. Holocene alluvium and playa deposits are the youngest materials. A fault separates basalt from Swisher Mountain at the north end of the study area, and elsewhere, another fault is covered by the post-basalt clastic and pyroclastic rocks.

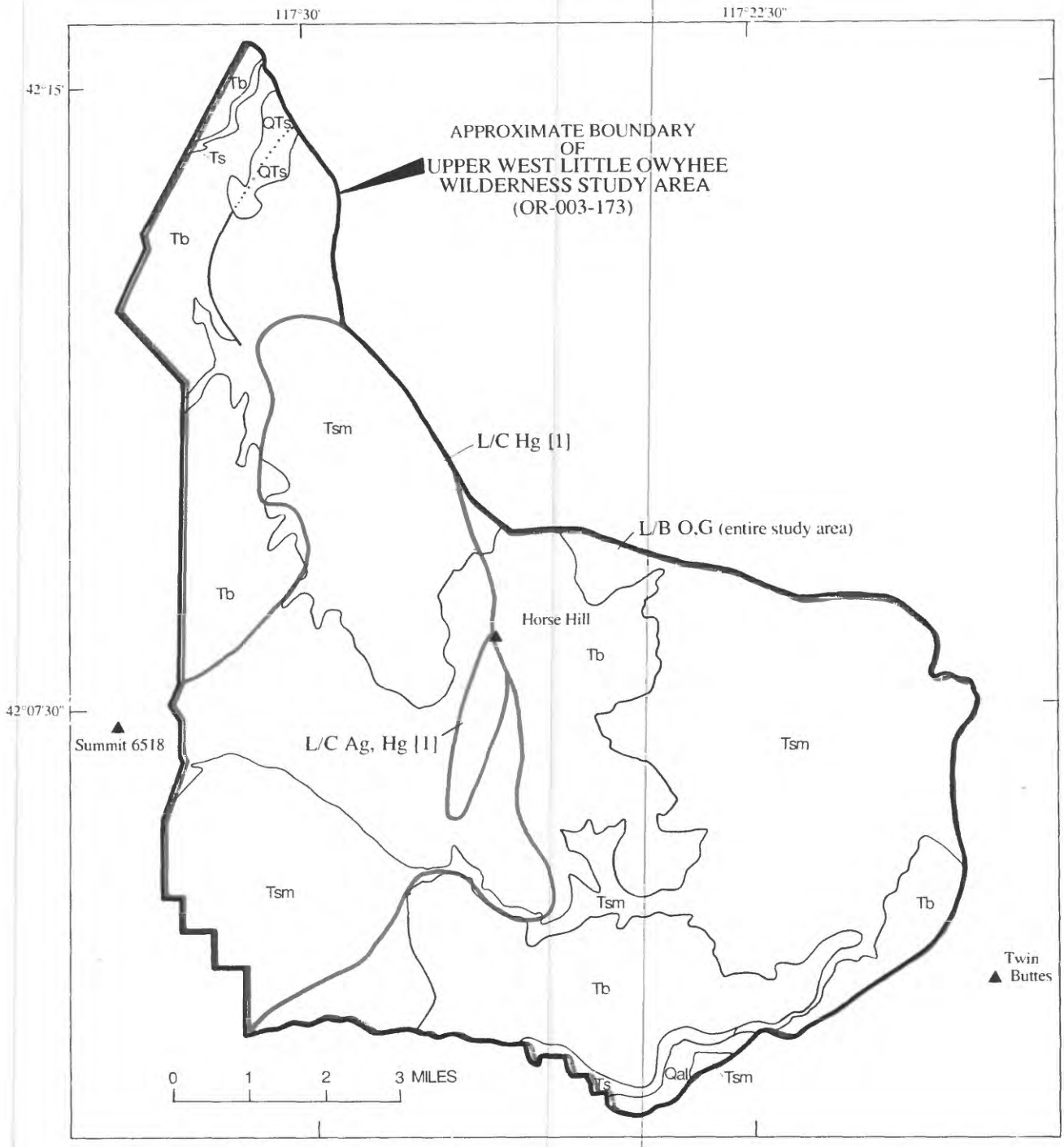
Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Evans, J.G., Turner, R L., Plouff, Donald, Sawatzky, D.L., and Linne, J.M., 1988, Mineral resources of the Upper West Little Owyhee Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1719-H, 14 p.

Gray, J.J., Peterson, N.N., Clayton, Janine, and Baxter, Gary, 1983, Geology and mineral resources of 18 BLM Wilderness Study Areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-83-2, 103 p., 2 appendices.

Linne, J.M., 1987, Mineral resources of the Upper West Little Owyhee Wilderness Study Area, Malheur County, Oregon: U.S. Bureau of Mines Open-File Report MLA 40-87, 10 p.



Mineral resources of the Upper West Little Owyhee Wilderness Study Area.

EXPLANATION

Area of low mineral resource potential--See appendix for definition of levels of mineral resource potential (L) and certainty of assessment (B,C)

Commodities

Ag	Silver
Hg	Mercury
O,G	Oil and gas

[1] Epithermal alteration

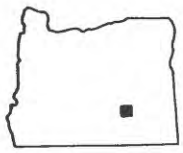
Geologic map units

Qal	Alluvium (Quaternary)
QTs	Tuffaceous sandstone (Quaternary or Tertiary)
Ts	Siltstone (Pliocene or Miocene)
Tb	Basalt (Pliocene or Miocene)
Tsm	Swisher Mountain Tuff (middle Miocene)

——— Contact
——— Fault--Dotted where concealed

Explanation, mineral resources of the Upper West Little Owyhee Wilderness Study Area.

Name: West Peak
Area number: OR-002-072J
Size (acres): 8,535



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area.

Mineral resource potential (undiscovered): The area has low potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas resources. The diatomite would be present most likely as impure, low-tonnage deposits. The geothermal energy would be present along range-bounding faults.

Mining Activity: No current mining claims are located within the wilderness study area (July 1990); no mines and prospects are known. As of October 1987, one geothermal lease covered 360 acres within the study area; there were no oil and gas leases.

Mineral setting/ Geology: The contiguous Heath Lake and West Peak Wilderness Study Areas enclose several fault blocks of 17-14 million-year-old basalt lava flows, with intervening graben (basins) that contain shallow fill of upper Miocene to Quaternary sedimentary rocks. Some basins are sufficiently large to possess mineral resource potential for diatomite and zeolite, although the deposits would likely be relatively impure and of low tonnage. Otherwise, the mineral and energy resource potential, summarized above, follows the same reasoning explained for Stonehouse Wilderness Study Area.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Bukofski and others (1983), report gold, silver, and copper anomalies in or near the study area. Mathews and others (1983), recommend additional study to upgrade the confidence levels of previous work with emphasis on industrial minerals. Exposures of basin-filling sediment are limited, and interested parties would have to drill shallow holes to delineate the occurrence of diatomite or zeolite. Geophysical surveys, mainly seismic and gravity, might aid in predicting the thickness of sedimentary deposits.

References:

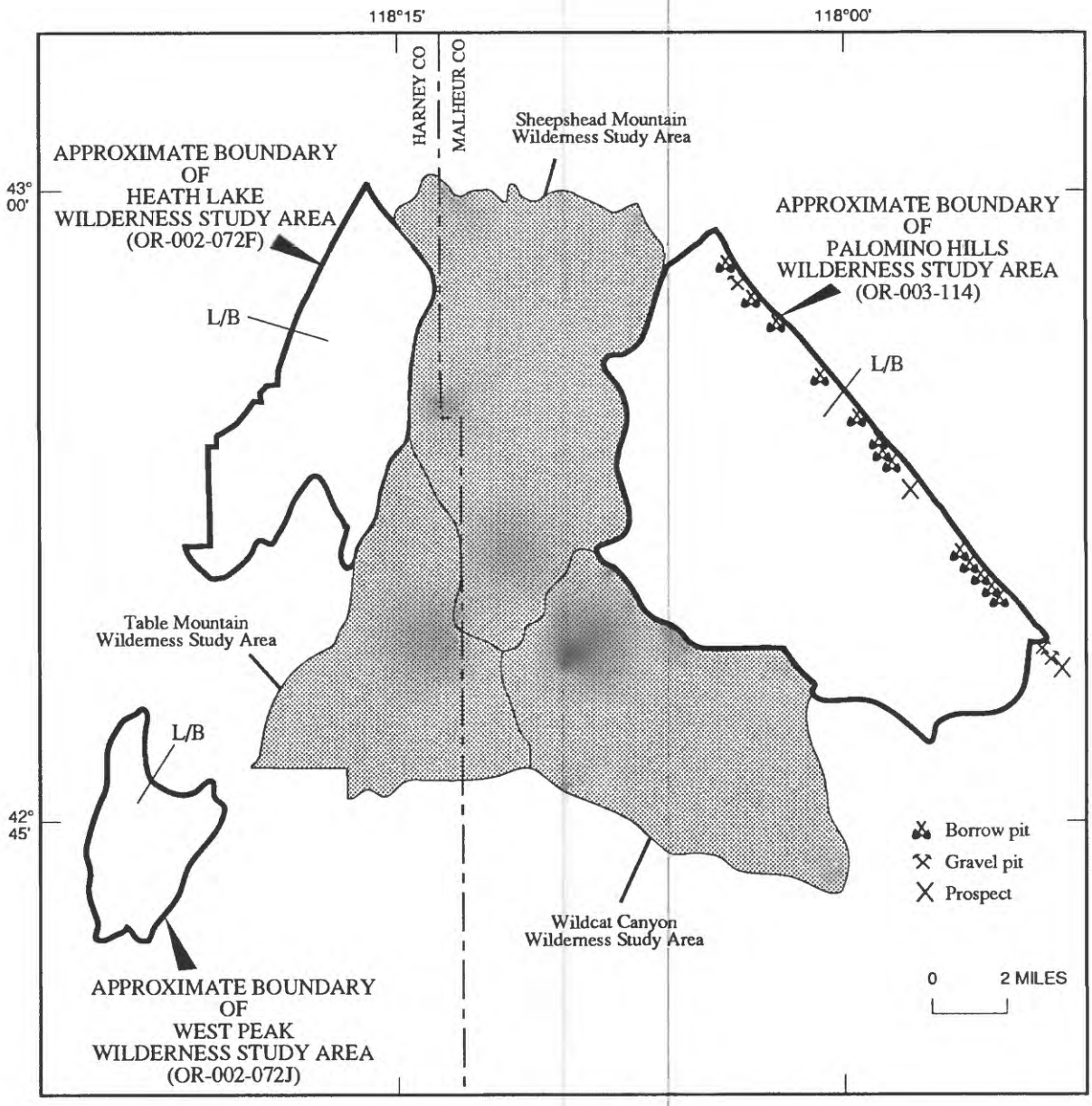
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for the Bureau of Land Management contact YA-551-CT3-440045, 94 p.

Graham, D.E., and Buehler, A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas and the Wildcat Canyon Wilderness Study Area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 62-87, 20 p.

Mathews, G.W., Blackburn, W.H., and Chappell, D.L., 1983, Assessment of geology, energy, and minerals (GEM) resources, Sheepshead Mountain GRA (OR-023-018), Harney and Malheur Counties, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management contract YA-553-CT2-1042.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

Turrin, B.D., Griscom, Andrew, Turner, R.L., Lawson, W.A., Buehler, A.R., and Graham, D.E., 1989, Mineral resources of the Alvord Desert and East Alvord Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Bulletin 1739-B, 16 p.

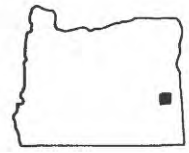


EXPLANATION

L/B, Geologic terrane having low mineral resource potential for gold, silver, copper, mercury, diatomite, geothermal energy, and oil and gas with certainty level B

Mineral resources of the West Peak Wilderness Study Area.

Name: Wild Horse Basin
Area number: OR-003-077B
Size (acres): 12,100



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Optical calcite is present at three locations and a geothermal well is situated in the NW 1/4 of section 10, T. 23 S., R. 44 E.

Mineral resource potential (undiscovered): The southwestern part of the study area has low potential for optical grade calcite. Sedimentary rocks along the southern and eastern parts of the study area have low potential for zeolite, bentonite, diatomite, and feldspathic sands. The study area has low potential for gold. The study area has high resource potential for geothermal energy and moderate potential for oil and gas.

Mining Activity: None known, however, the south-southwest part of the study area is covered by more than 160 claims and an additional five claims in the northeast as of July 1990. No energy leases existed within the wilderness study area as of October 1987. Three calcite claims are located along fracture zones in the basalt flows.

Mineral setting/ Geology: The study area is underlain by middle Miocene? to Pliocene basalt flows and sedimentary rocks.

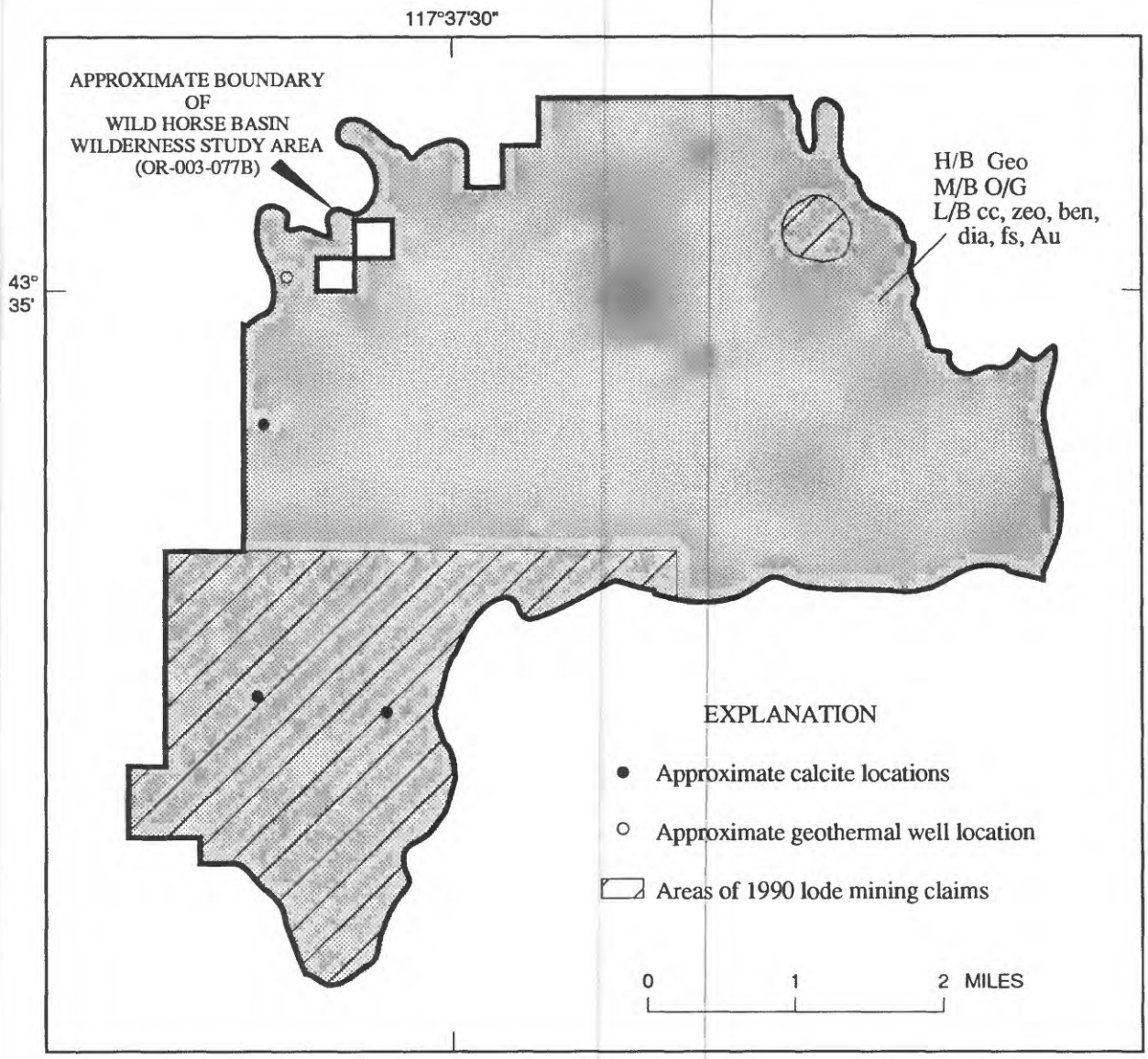
Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. The study area is surrounded by nearby gold exploration activity that has resulted in one major gold discovery. The area immediately north of the study area has been identified as containing a major epithermal gold resource with potential for feldspathic sands, bentonite, and diatomaceous silica. Approximately one-third of the study area itself is covered by lode mining claims.

References:

Ferns, M.L. and Ramp, Len, 1989, Geology and mineral resources map of the Grassy Mountain quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-57, scale 1:24,000.

Ferns, M.L., 1989, Mining activity and exploration in Oregon, 1988: Oregon Geology, v. 51, no. 2, p. 27-32.

Vander Meulen, D.B., Rytuba, J.J., King, H.D., Plouff, Donald, and Scott, D.F., 1987, Mineral resources of the Honeycombs Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-A, 15 p.



EXPLANATION

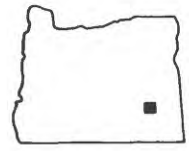
H/B, Geologic terrane having high mineral resource potential for geothermal energy with certainty level B

M/B, Geologic terrane having moderate mineral resource potential for oil and gas with certainty level B

L/B, Geologic terrane having low mineral resource potential for calcite, zeolite, bentonite, diatomite, feldspathic sands, and gold with certainty level B

Mineral resources of the Wild Horse Basin Wilderness Study Area.

Name: Wildcat Canyon
Area number: OR-002-072D
Size (acres): 34,830



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Sherrod and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area during the field studies or other phases of the studies conducted.

Mineral resource potential (undiscovered): The wilderness study area is considered to have low potential for occurrence of deposits of gold and silver along faults, low potential for occurrences of oil and gas, and moderate potential for occurrence of geothermal energy resources, especially along range-bounding faults. Potential for the occurrence of diatomite deposits is high in the wilderness study area.

Mining Activity: There has been no known mineral production in or near the wilderness study area, nor are there any mining claims in or near it (July 1990). There are no known mineral localities in or near the area. As of October 1987, no energy leases existed in the study area.

Mineral setting/ Geology: Apart from relatively thin deposits of Pleistocene and Holocene alluvium and colluvium, rocks exposed in the study area are entirely volcanic extending from middle Miocene Steens Basalt through late Miocene Devine Canyon Ash-Flow Tuff and into unnamed Pleistocene high-alumina basalt. Minor interlayered tuffaceous sedimentary rocks occur in a basaltic to dacitic unit overlying the Steens. The rocks are mainly horizontal, but an episode of uplift and tilting of as much as 18°, prior to deposition of the Devine Canyon, can be documented. A group of north-northwest to north-northeast-striking high-angle normal faults defines the regional grain, with measurable offsets of as much as 1,000 ft. Faults of a second group strike northwest to west-northwest, generally have offsets of less than 100 ft, and transect the more northwardly-trending blocks. Several of the basins created by faulting are closed depressions that contained large pluvial lakes in the Pleistocene, and which locally include diatomite among the associated sedimentary deposits.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

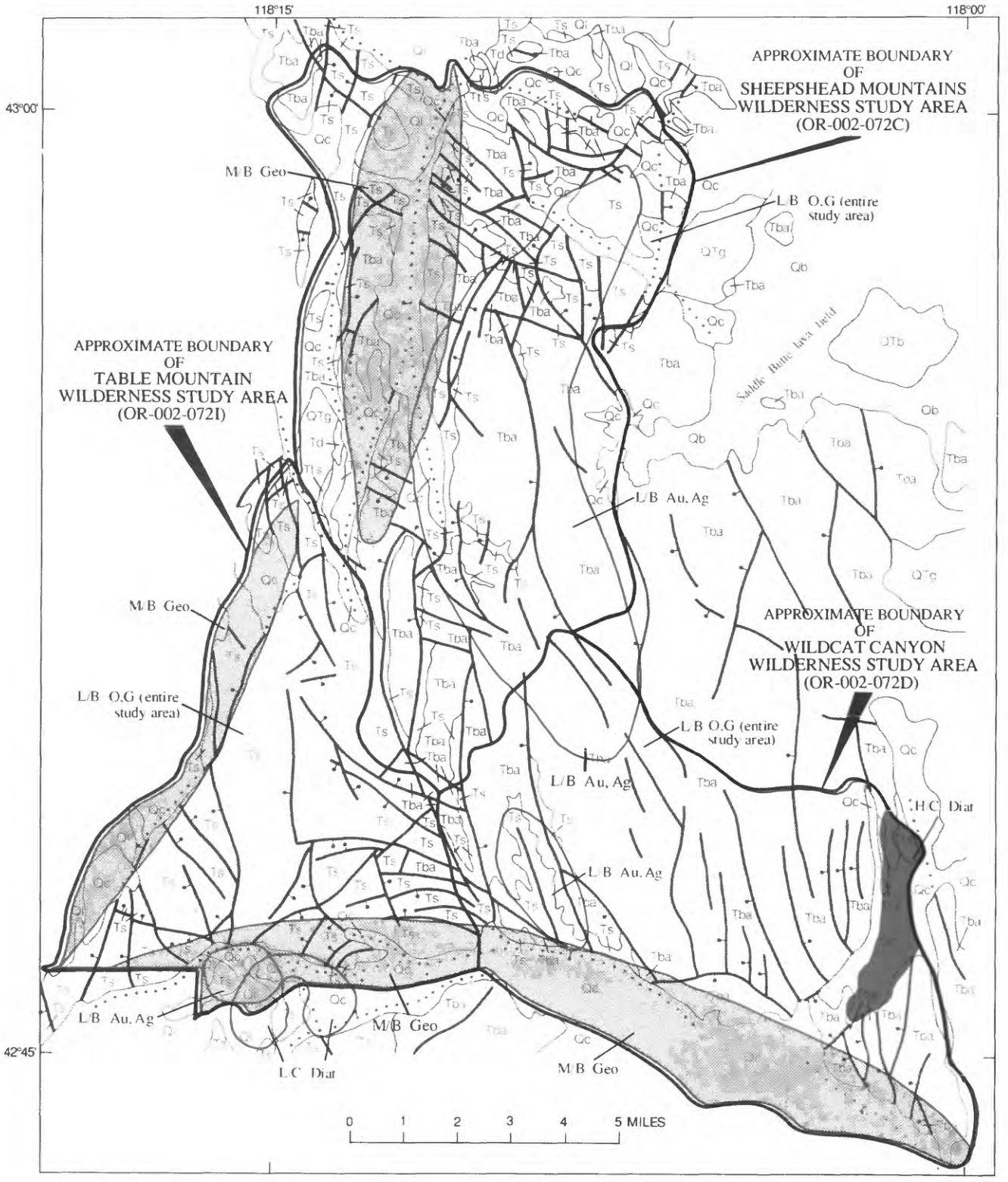
References:

Bukofski, J.F., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale Districts, Southeastern Oregon: Golden, CO, Barringer Resources Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Graham, D.E., and Buehler A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas, and Wildcat Canyon Wilderness Study Area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 62-87, 20 p.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

U.S. Bureau of Land Management, 1989, Oregon Wilderness Environmental Impact Statement (Final), Volume III: Bureau of Land Management Oregon State Office, Portland, OR, 670 p.



Mineral resources of the Wildcat Canyon Wilderness Study Area.

EXPLANATION

Area with high mineral resource potential (H)

Area with moderate mineral resource potential (M)

Area with low mineral resource potential (L)

Levels of certainty of assessment

B	Data suggest level of potential
C	Data give good indication of level of potential

Commodities

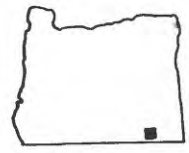
Au	Gold
Ag	Silver
Diat	Diatomite
Geo	Geothermal
O,G	Oil, Gas

Geologic map units

Ql	Lacustrine and playa deposits (Quaternary)
Qc	Colluvium (Quaternary)
Qb	Younger basalt (Quaternary)
QTb	Older basalt (Quaternary or Tertiary)
QTg	Gravel and conglomerate (Quaternary and Tertiary)
Tts	Tuff and tuffaceous sedimentary rocks (Tertiary)
Tdc	Devine Canyon Ash-flow Tuff (Tertiary)
Tba	Basalt, basaltic andesite, andesite, and dacite (Tertiary)
Ts	Steens Basalt (Tertiary)
———	Contact—Approximately located
—•···	Fault—Dotted where concealed. Ball and bar on downthrown side

Explanation, mineral resources of the Wildcat Canyon Wilderness Study Area.

Name: Willow Creek
Area number: OR-003-152
Size (acres): 30,565



Status of mineral surveys: Only part of this wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Peterson and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the Willow Creek Wilderness Study Area.

Mineral resource potential (undiscovered): The southern part of the Willow Creek study area has low potential for antimony, bismuth, mercury, silver, molybdenum, and zinc resources in epithermal deposits. Tin geochemical anomalies in the southeast corner of the Willow Creek study area suggest a terrane having low potential for tin resources of unknown origin, possibly related to the basaltic rocks in that part of the study area. The area has low potential for zeolite resources because of its volcanic terrane. The study area has a low potential for geothermal energy resources because of its proximity to warm-water wells and springs nearby. There are no oil and gas leases in the area and it has low potential for resources of oil and gas. The tuff of Trout Creek Mountains, exposed in the study area, has a low potential for resources of light rare-earth elements and zirconium in local accumulations of aenigmatite, a sodium-iron-titanium mineral. This same rock unit is locally attractive enough to be used as decorative building stone; therefore, this unit has low potential for decorative stone resources. Sand and gravel accumulations are present locally in the study area, but material of similar quality is available elsewhere, closer to potential markets.

Mining Activity: No mining claims are known within the wilderness study area. No indication of mining activity was found during the joint mineral survey. As of October 1987, no oil and gas, geothermal, or other mineral leases existed in the study area.

Mineral setting/ Geology: The study area is comprised of four contiguous wilderness study areas in the northern part of the Basin and Range physiographic province, and additionally, is in a region where Tertiary volcanic calderas are numerous, and are the sources for most of the underlying rocks. The oldest rocks, and the only ones unrelated to nearby calderas, are multiple flows of porphyritic basalt that average about 20 ft thick and may correlate with the middle Miocene Steens Basalt. Progressively overlying the basalt is a zoned ash-flow tuff and a flow sequence of basalt, andesite, and rhyolite, interbedded with tuff and flow breccia; all the foregoing units dip northwestward 3° to 5°. Nearly 600 ft of rhyolitic ash-flow tuff overlie the flow sequence and, in the southeasternmost part of the study area, also overlie a small cluster of rhyolite domes and dikes which cut the older rocks. Most of the Tertiary units in the local stratigraphic section have been radiometrically dated at 15 to 16 Ma, hence, all are middle Miocene in age. Quaternary alluvial deposits consist of poorly sorted, locally derived material in canyons and along margins of mountains. Structure in the southern part of the study area is dominated by intersecting northern rims of Washburn and Long Ridge calderas--part of the McDermitt caldera complex--and their associated sub-parallel fault systems. Displacements along these ring-fault systems, which are typically stepped downward toward the caldera center, are generally less than 1,000 ft, but are locally as much as 1,500 ft. Structure in the central and northern parts consists of scattered, north- to northwest-striking, high-angle, typical basin and range faults.

Recommendations: As only part of this area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, further work is needed to assess the 2,680 acres that constitute the balance.

References:

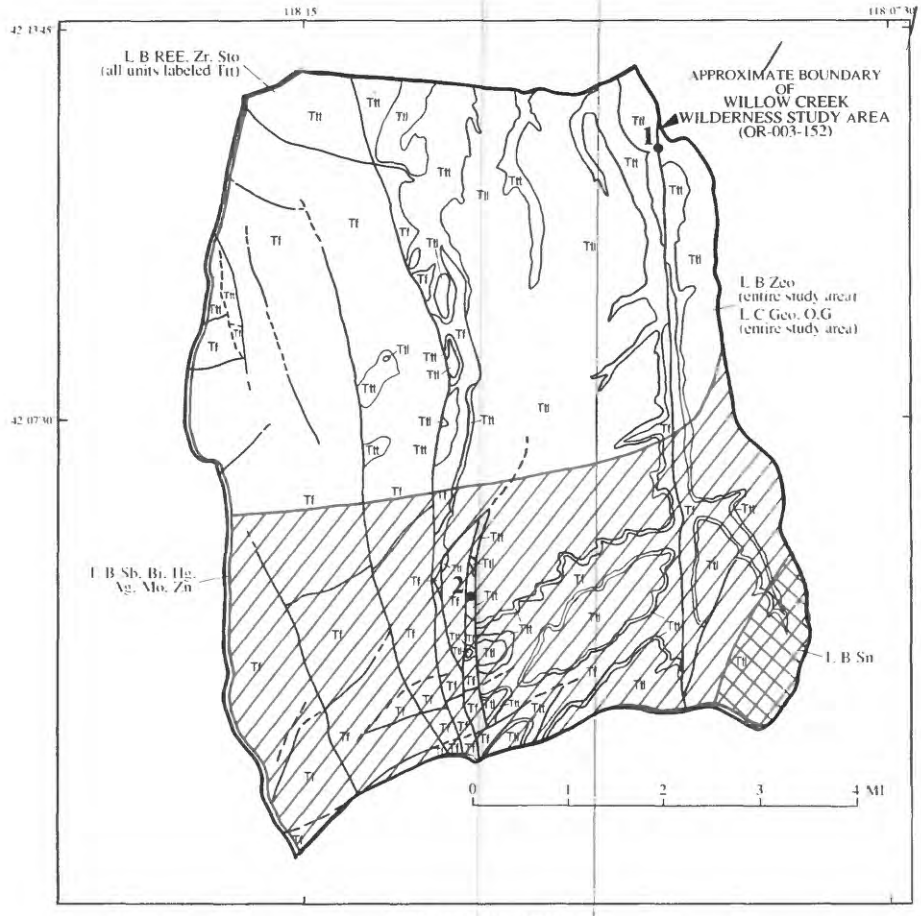
Bukofski, J.F., Lovell, J.S., and Meyer, W.T., 1984, Mineral resource assessment through geochemical studies of heavy mineral concentrates from wilderness study areas in the Burns, Prineville, and Vale districts, southeastern Oregon: Golden, CO, Barringer Resources, Inc., prepared for U.S. Bureau of Land Management, contract YA-551-CT3-440045, 94 p.

Gray, J.J., Peterson, N.N., Clayton, J., and Baxter, G., 1983, Geology and mineral resources of the 18 wilderness study areas, Harney and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-2, 106 p.

Jones, J.L., Erickson, M.S., and Fey, D.L., 1988, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Fifteen Mile Creek, Twelve Mile Creek, Oregon Canyon, and Willow Creek Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Open-File Report 88-0696, 48 p.

Peters, T.J, and Winters, R.A., 1989, Mineral Resources of the Willow Creek study area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Open-File Report MLA 37-89, 19 p.

Peterson, J.A., Rytuba, J.J., Plouff, Donald, Vercoutere, T.L., Turner, R.L., Sawatzky, D.L., Leszcykowski, A.M., Peters, T.J., Schmauch, S.W., and Winters, R.A., 1988, Mineral resources of the Fifteen Mile Creek, Oregon Canyon, Twelve Mile Creek, and Willow Creek Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1742-B, 24 p.



EXPLANATION

Geologic terrane having low mineral resource potential (L) for Sb, Bi, Hg, Ag, Mo, and Zn

Geologic terrane having low mineral resource potential (L) for Sn

Geologic terrane having low mineral resource potential (L) for Zeo, Geo, and O,G

Ttl — Geologic terrane having low mineral resource potential (L) for REE, Zr, and Sto

Levels of certainty of assessment

B — Data only suggest level of potential
C — Data give good indication of level of potential

Commodities

Ag	Silver	Sb	Antimony
Bi	Bismuth	Sn	Tin
Geo	Geothermal	Sto	Decorative building stone
Hg	Mercury	Zeo	Zeolite minerals
Mo	Molybdenum	Zn	Zinc
O,G	Oil and gas	Zr	Zirconium
REE	Rare-earth elements		

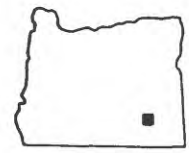
Description of map units

Ttl — Tuff of Long Ridge (Tertiary)
Ttt — Tuff of Trout Creek Mountains (Tertiary)
Tf — Basaltic andesite, andesite, and rhyolitic flows (Tertiary)

Contact
Fault—Dashed where approximately located
1 • Sample locality noted in text

Mineral resources of the Willow Creek Wilderness Study Area.

Name: Winter Range
Area number: OR-002-073H
Size (acres): 15,440



Status of mineral surveys: This area was not studied by the U.S. Geological Survey or the U.S. Bureau of Mines.

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. The western part of the wilderness study area is within the Alvord Known Geothermal Resource Area.

Mineral resource potential (undiscovered): Gravity data, from south of the area, indicate that northeast trending faults are the major conduits for the hydrothermal systems. The entire study area has a low potential for epithermal-type gold, boron, silver deposits, and uranium resources. The area is part of the Alvord Valley Known Geothermal Resource Area (KGRA). As of December, 1986, no land in the study area was under lease for geothermal exploration. However, there were several leases in the recent past, and exploratory drilling for low-temperature geothermal resources was done outside the northern border of the East Alvord study area. The Winter Range (OR-002-073H) has a moderate potential of low to medium temperature geothermal resources. Parts of the area were rated as having high favorability for the occurrence of geothermal resources by Brown and Peterson, (1980). However, exploration drilling for low-temperature geothermal resources there in the recent past have not lead to the development of any low-temperature geothermal resources. Because of the extensive Miocene volcanic activity, the area is too thermally mature to have formed any hydrocarbon reserves (Sandberg, 1983). Moreover, the area lacks suitable source rocks for hydrocarbon generation and therefore has only low resource potential for oil and gas.

Mining Activity: No current mining claims are located within the wilderness study area (July 1990); no mines or prospects are known. As of October 1987, One geothermal lease covered 640 acres in the wilderness study area, and there were no oil and gas leases.

Mineral setting/ Geology: The Winter Range Wilderness Study Area is east of Steens Mountain and 70 miles southeast of Burns, Oregon. It is situated in the transition zone between the Basin and Range and Columbia Plateau physiographic provinces. The Basin and Range Province is an extensive semi-arid to arid tract of subparallel, north-trending en echelon mountain ranges and intervening valleys. The Columbia Plateau physiographic province is a high dissected plateau comprising mostly Tertiary volcanic rocks that are locally hydrothermally altered and silicified. The area is underlain mainly by 17-11 million-year-old lava, chiefly Steens Basalt. The area lies within the Alvord Valley Known Geothermal Resource Area.

Recommendations: The wilderness study area should be studied as part of a comprehensive mineral survey by the Bureau of Mines and Geological Survey. Further studies are needed to confirm the presence and determine the extent of a possible shallow geothermal resource.

References:

Brown, D.E., and Peterson, N.V., 1980, Preliminary geology and geothermal resource potential of the Alvord Desert area: Oregon Department of Geology and Mineral Industries Open-File Report O-80-10, 57 p.

Buehler, A.R., and Graham, D.E., 1987, Mineral resources of the Alvord Desert and East Alvord study areas, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines, Mineral Land Assessment Open-File Report 53-87, 18 p.

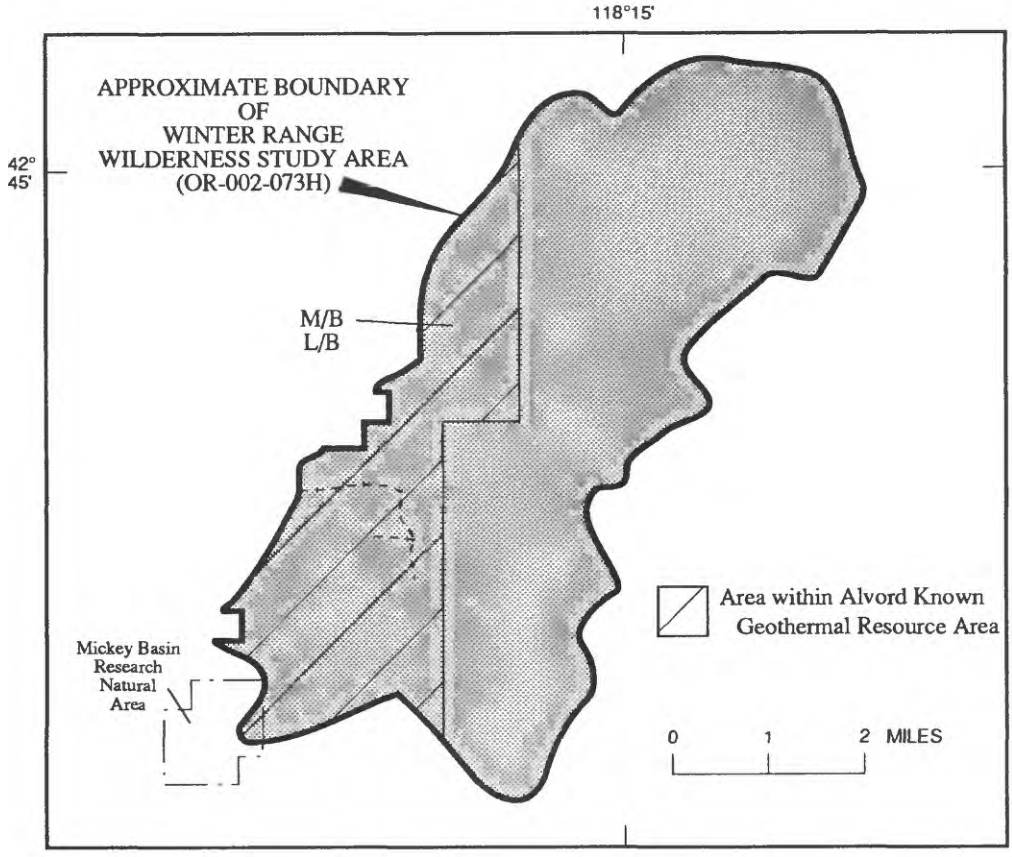
Graham, D.E., and Buehler, A.R., 1987, Mineral resources of the Sheepshead Mountains and Table Mountain study areas and the Wildcat Canyon Wilderness study area, Harney and Malheur Counties, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report 62-87, 20 p.

Mathews, G.W., and Blackburn, W.H., Assessment of geology, energy, and minerals (GEM) resources, Alvord Desert GRA (OR-023-019), Harney County, Oregon: Lakewood, CO, Terradata, prepared for U.S. Bureau of Land Management, contract YA-553-CT2-1042, p. I1-B5.

Sandberg, C.A., 1983, Petroleum potential of wilderness lands in Nevada: U.S. Geological Survey Circular 902-H, p. H1-H11.

Sherrod, D.R., Griscom, Andrew, Turner, R.L., Minor, S.A., Graham, D.E., and Buehler, A.R., 1988, Mineral resources of the Sheepshead Mountains, Wildcat Canyon, and Table Mountain Wilderness Study Areas, Malheur and Harney Counties, Oregon: U.S. Geological Survey Bulletin 1739-A, 16 p.

Turrin, B.D., Griscom, Andrew, Turner, R.L., Lawson, W.A., Buehler, A.R., and Graham, D.E., 1989, Mineral resources of the Alvord Desert and East Alvord Wilderness Study Areas, Harney and Malheur Counties, Oregon: U.S. Geological Survey Bulletin 1739-B, 16 p.



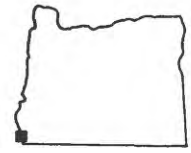
EXPLANATION

M/B, Geologic terrane having moderate mineral resource potential for geothermal energy with certainty level B

L/B, Geologic terrane having low mineral resource potential for gold, boron, silver, uranium, and oil and gas with certainty level B

Mineral resources of the Winter Range Wilderness Study Area.

Name: Zwagg Island
Area number: OR-012-014
Size (acres): 5



Status of mineral surveys: This wilderness study area has been studied as part of a mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines (Bergquist and others, 1988).

Identified mineral resources (known): No mineral resources have been identified in the wilderness study area. Stone in the wilderness study area is not suitable for construction of jetties; ample stone suitable for construction purposes is available outside the wilderness study area.

Mineral resource potential (undiscovered): Rocks of the island have low resource potential for riprap.

Mining Activity: No mining claims or mining activity are known on or near Zwagg Island. Heavy mineral or black sand deposits have been mined and explored intermittently since 1852 along the beaches and terraces of the southern Oregon coast. Although concentrations of black sands have been reported in the vicinity of Zwagg Island, none were found in terrace or beach deposits on or near Zwagg Island. Construction materials mined near the wilderness study area include sand, gravel, and stone. At least 16 quarries within 7 mi of Zwagg Island have supplied material used for fill, road aggregate, and riprap.

Mineral setting/ Geology: The dominant rock composing the island is thin- to thick-bedded, poorly sorted, fine- to coarse-grained sandstone, associated with minor amounts of siltstone and greenstone (metamorphosed basalt), all of the Dothan Formation of Upper Jurassic and Lower Cretaceous age. The rocks are jointed, fractured, and faulted, and occur as a complex aggregation of large, disordered blocks.

Recommendations: As this area has already been studied as part of a comprehensive mineral survey by the U.S. Geological Survey and the U.S. Bureau of Mines, no further work is needed.

References:

Bergquist, J.R., King, H.D., and McHugh, E.L., 1988, Mineral resources of the Zwagg Island Wilderness Study Area, Curry County, Oregon: U.S. Geological Survey Open-File Report 88-0257, 15 p.

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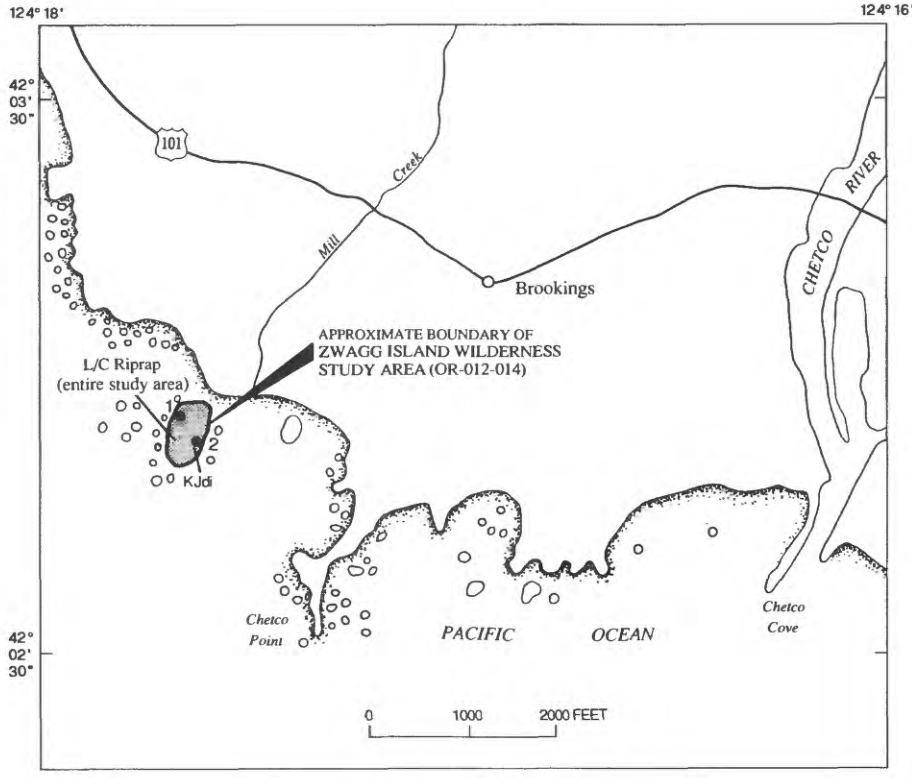

EXPLANATION

Area having low mineral resource potential (L)

Description of map units

KJd Dothan Formation (Lower Cretaceous and Upper Jurassic)—Thin - to thick-bedded, poorly sorted, fine- to coarse-grained sandstone with lesser amounts of grit and pebble conglomerate; interbeds of black siltstone as thick as 6 ft; minor amounts of greenstone

— Contact

• Sample location—See table 1

Mineral resources of the Zwagg Island Wilderness Study Area.

GEOLOGIC TIME CHART

Terms and boundary ages used by the U.S. Geological Survey in this report

EON	ERA	PERIOD		EPOCH	AGE ESTIMATES OF BOUNDARIES IN MILLION YEARS (Ma)
Phanerozoic	Cenozoic	Quaternary		Holocene	0.010
				Pleistocene	1.7
		Tertiary	Neogene Subperiod	Pliocene	5
				Miocene	24
			Paleogene Subperiod	Oligocene	38
				Eocene	55
				Paleocene	66
	Mesozoic	Cretaceous		Late Early	96 138
		Jurassic		Late Middle Early	205
		Triassic		Late Middle Early	~240
	Paleozoic	Permian		Late Early	290
		Carboniferous Periods	Pennsylvanian	Late Middle Early	~330
			Mississippian	Late Early	360
		Devonian		Late Middle Early	410
		Silurian		Late Middle Early	435
		Ordovician		Late Middle Early	500
		Cambrian		Late Middle Early	[1]~570
Proterozoic	Late Proterozoic				900
	Middle Proterozoic				1600
	Early Proterozoic				2500
Archean	Late Archean				3000
	Middle Archean				3400
	Early Archean				
pre-Archean[2]		(3800?)			4550

[1]Rocks older than 570 Ma also called Precambrian, a time term without specific rank.
[2]Informal time term without specific rank.

Figure 4.--Geologic time chart.