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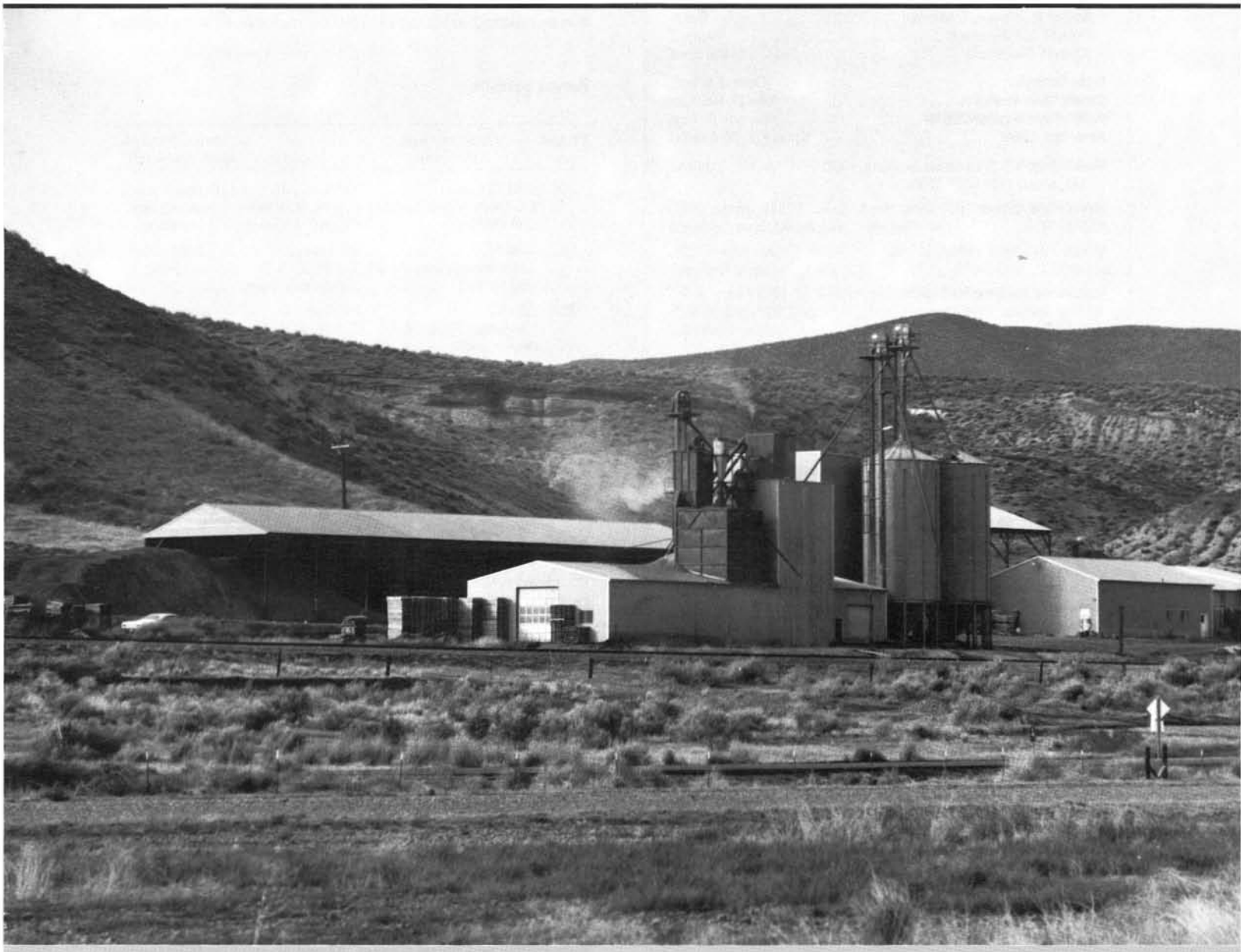

THIS MONTH:

ANNUAL SUMMARY: MINERAL INDUSTRY IN OREGON 1985

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Information for contributors

Oregon Geology is designed to reach a wide spectrum of readers interested in the geology and mineral industry of Oregon. Manuscript contributions are invited on both technical and general-interest subjects relating to Oregon geology. Two copies of the manuscript should be submitted, typed double-spaced throughout (including references) and on one side of the paper only. Graphic illustrations should be camera-ready; photographs should be black-and-white glossies. All figures should be clearly marked, and all figure captions should be typed together on a separate sheet of paper.

The style to be followed is generally that of U.S. Geological Survey publications (see the USGS manual *Suggestions to Authors,* 6th ed., 1978). The bibliography should be limited to "References Cited." Authors are responsible for the accuracy of the bibliographic references. Names of reviewers should be included in the "Acknowledgments."

Authors will receive 20 complimentary copies of the issue containing their contribution. Manuscripts, news, notices, and meeting announcements should be sent to Beverly F. Vogt, Publications Manager, at the Portland office of DOGAMI.

COVER PHOTO

Teague Mineral Products mill on banks of Snake River at Adrian, Oregon. The mill is used for storing, grinding, sizing, and bagging bentonite and zeolite mined in several areas of southeastern Oregon. Photo shows stored raw bentonite in open shed on left, silos for storage of finished product at right center. Product from this plant is shipped bagged or in bulk, by rail or truck. See annual summary of mineral industry in Oregon beginning on next page. Photo courtesy Dave Leppert, Teague Mineral Products.

OIL AND GAS NEWS

Mist Gas Field

ARCO Oil and Gas Co. is the only active operator in the state at present. In March the company drilled Longview Fibre 13-6 to a depth of 1,473 ft in sec. 6, T. 5 N., R. 4 W. It was one mile east of completed well Crown Zellerbach 12-1, but was a dry hole. It was abandoned on March 11. The contractor was Taylor Drilling.

Recent permits

Permit no.	Operator, well, API number	Location	Status, proposed total depth (ft)
351	ARCO Longview Fibre 14-25 009-00190	SW¼ sec. 25 T. 6 N., R. 5 W. Columbia County	Permit denied; spacing unit violation.
352	ARCO Columbia County 44-27 009-00191	SE¼ sec. 27 T. 6 N., R. 5 W. Columbia County	Location; 2,360.
353	ARCO Longview Fibre 43-4 009-00192	NE¼ sec. 4 T. 5 N., R. 5 W. Columbia County	Application; 3,000.
354	ARCO Columbia County 44-6 009-00193	SE¼ sec. 6 T. 6 N., R. 5 W. Columbia County	Application; 3,000.
355	ARCO Columbia County 31-7 009-00194	NE¼ sec. 7 T. 6 N., R. 5 W. Columbia County	Application; 3,000.
356	ARCO Columbia County 13-21 009-00195	SW¼ sec. 21 T. 6 N., R. 5 W. Columbia County	Application; 3,000. □

Willamette Agate and Mineral Society displays minerals in Salem

On March 1, 1986, the Willamette Agate and Mineral Society (WAMS) of Salem installed a varied lapidary display in the Oregon Council of Rock and Mineral Clubs Case at the State Capitol building in Salem. More than 90 separate items in 36 groups include petrified wood, sagenite, carnelian, plume agate, thomsonite, pyrite, moss agate, fossils, thundereggs, nodules, limb casts, Biggs jasper, Carey plume, obsidian, opal, and jadeite.

The exhibit demonstrates several ways rocks can be enjoyed — bookends, clocks, gem trees, bracelets, necklaces, belt buckles, spheres, and mounted specimens.

Eight of the club members contributed materials from 16 Oregon counties for the display. Members arranging the exhibit were Rollin and Bettie Stearns, Al and Myrna Gardner, George Schull, and Willis Caldwell. Lyle Riggs, Agent for the Council Case; Vivian Johnson, Council Secretary; and Florence Riggs and Bernice Soules assisted.

The WAMS display will remain until May 31 and will be followed by the exhibit of Far West Lapidary and Gem Society of Coos Bay, Oregon.

On February 28, John Richardson removed the beautiful display of Richardson Recreational Ranch of Madras, which had been sponsored by Oregon Agate and Mineral Society of Portland. □

Mineral industry in Oregon, 1985

by Mark L. Ferns, Howard C. Brooks, Jerry J. Gray, and Len Ramp, Oregon Department of Geology and Mineral Industries

INTRODUCTION

The value of minerals produced in Oregon in 1985 was about $127 million, which was $10 million below the 1984 value. The decline was due in part to a six-month work stoppage at the Hanna nickel mine and smelter at Riddle during a plant modification program. Other factors involved included a drop in demand for sand, gravel, and crushed stone and a drop in prices for nearly all mineral commodities.

As in previous years, cement, sand and gravel, and stone were the main products of Oregon's mineral industry. Base-and precious-metal production from lode mines declined sharply due to the 1984 closure of the Iron Dyke and Bayhorse Mines in Baker County. Nickel from the Hanna operation remains the only metallic commodity that is currently being produced in any significant amount.

MINING ACTIVITY

Metals

A number of small gold placers were active in Baker and Grant Counties in northeastern Oregon and Josephine, Douglas, and Jackson Counties in southwestern Oregon. Most of the operations were small, and only a few produced over 50 oz of gold.

The larger productive placer mines in eastern Oregon were on Pine Creek (7)* near Hereford, on Clarks Creek (8), and on the upper Burnt River (6) in Baker County and on Boulder Creek (3) near Granite in Grant County. Numerous small operations continued in Josephine County, including a number on Josephine Creek and its tributaries (12), in the Galice area (15), and on Coffee Creek (18) in Douglas County. Proposed rules for the Wild and Scenic Illinois River Management Plan would end the use of small dredges on the Wild and Scenic stem of the Illinois River, where a number of operations have been active in past years at various sites between the U.S. National Forest boundary and the mouth of Briggs Creek.

Lode gold, silver, and base-metal production was mainly from small, intermittent operations at the Thomason Mine (5) in Baker County; the Pyx (2), Tempest (1), and Elk Heaven (4) Mines in Grant County; and the Greenback (16) and Fall Creek Gold Mine (11) in Josephine County.

The Hanna nickel smelter at Nickel Mountain (17) in Douglas County operated until mid-June, at which time it was shut down for construction of a new wet-screening plant. Renewed operations began in late November. The plant enables rapid upgrading by washing the higher grade, soft fine material off the relatively unweathered rock. The water-and-fines slurry goes through a 300-ft-diameter thickener before being transported 2½ mi down the mountain in a 10-in-diameter steel pipe to the smelter. Five centrifuges separate most of the water from the concentrate, which reportedly contains about 2.1 percent nickel.

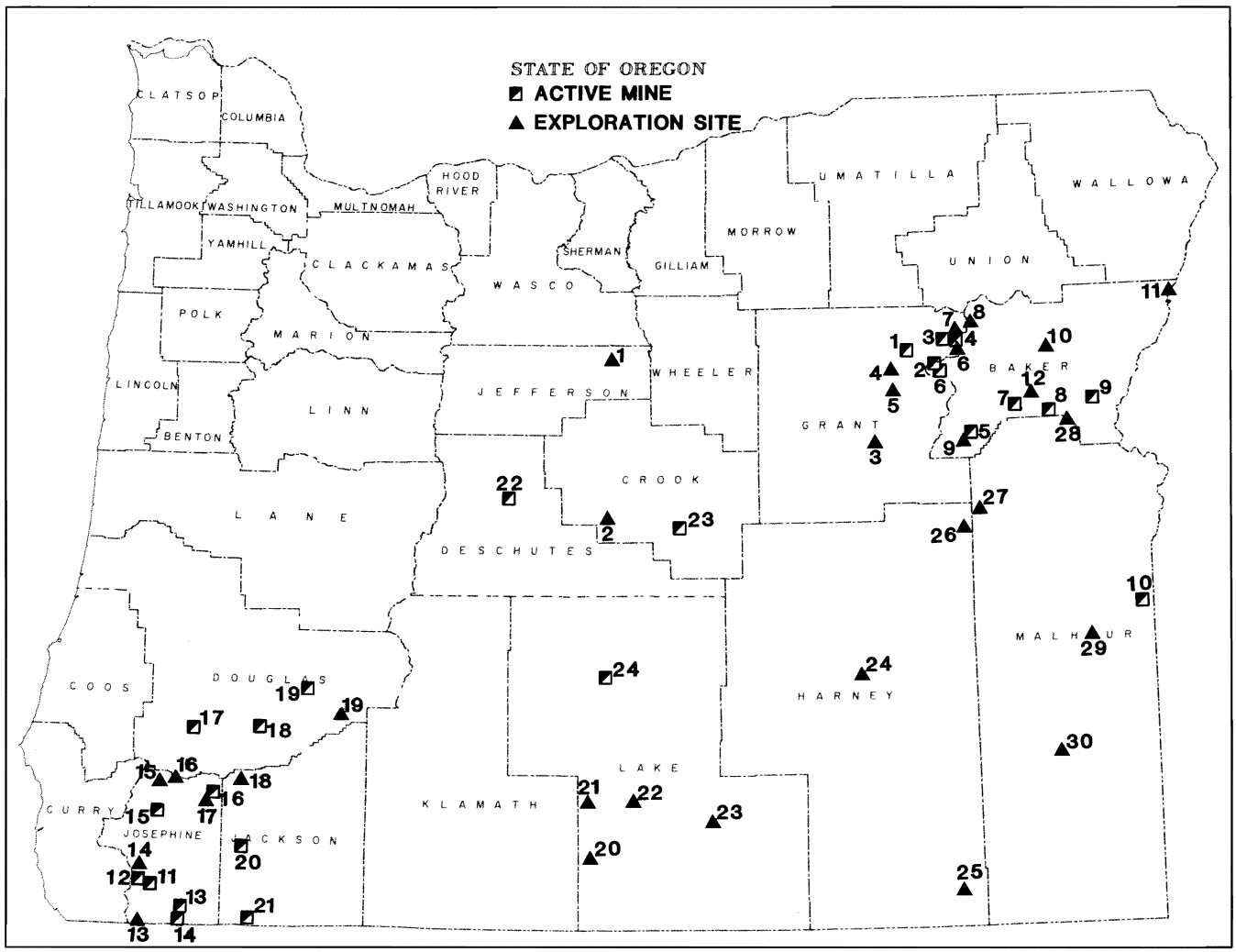
A conveyer belt is being constructed to transport ore from the lower ore body up the mountain to the wet-screening plant. A 12.2-yd^3 Marion 191 electric shovel will be used for mining about 7 million tons per year. Only about 10 percent of the material mined will be smelted. The new equipment is expected to enable Hanna to produce nickel for about $1.90 per pound.

Nonmetals

Ash Grove Cement West (9) continued to produce cement and limestone from its limestone quarry and cement plant facili-

*All mine numbers in this section refer to "Active Mines" on the location map and in Table 1.

Bristol Silica and Limestone Company's mine in Jackson County. Open-pit quarry in background, crusher and screening plant in foreground. Here, silica rock used for decorative granules and silicon metal is produced.



EXPLANATION

ACTIVE MINES (half-filled square)

1. Tempest (Ag)
2. Pyx (Au)
3. Boulder Creek (Au)
4. Elk Heaven (Au, Ag)
5. Thomason (Au)
6. Burnt River (Au)
7. Pine Creek (Au)
8. Clarks Creek (Au)
9. Ash Grove Cement West (cement, limestone)
10. Teague Mineral Products (bentonite, zeolite)
11. Fall Creek Gold (Au)
12. Josephine Creek and tributaries (Au)
13. Sucker Creek (Au)
14. Althouse Creek (Au)
15. Galice area placers (Au)
16. Greenback (Au)
17. Nickel Mountain (Ni)
18. Coffee Creek (Au)
19. Quartz Mountain Silica (silica)
20. Bristol Silica (silica)
21. Steatite of Southern Oregon (soapstone)
22. Cascade Pumice, Central Oregon Pumice (pumice)
23. Camp Creek (clay)
24. Oil-Dri West (diatomite)

EXPLORATION SITES AND AREAS (solid triangle)

1. Rejax (Au, Ag)
2. Bear Creek Buttes (Au)
3. Miller Mountain (Au)
4. Susanville (Au, Ag)
5. Dixie Meadows (Au, Ag)
6. Bald Mountain-Ibex (Au, Ag)
7. Cable Cove (Au, Ag)
8. Meadow Lake (Au, Ag)
9. Grouse Spring (Cu, Mo)
10. Flagstaff (Au)
11. Iron Dyke (Au, Ag, Cu)
12. Dooley Mountain (perlite)
13. Turner-Albright (Au, Ag, Zn, Cu, Co)
14. Fall Creek Copper (Au, Ag, Cu, Co)
15. Gold Bug (Au)
16. Goff (Au, Ag, Cu, Pb, Zn)
17. John Hall (Au)
18. Gold Note (Au, Ag, Cu)
19. Foster Creek (clay)
20. Quartz Mountain (Au)
21. Little Baldy (Au)
22. Tucker Hill (perlite)
23. Coyote Hills (Au)
24. Harney prospect (zeolite)
25. Flagstaff Butte (Au)
26. Celatom (diatomite)
27. Castle Rock (Au)
28. Sunday Hill (Au)
29. Red Butte (Au)
30. Rome prospect (zeolite)

Mining and mineral exploration in Oregon in 1985 (excluding sand and gravel and stone). Active mines are keyed to Table 1; exploration sites are keyed to Table 2.

ties near Durkee in southern Baker County. The plant at Durkee was built in 1980 and has an annual production capacity of 500,000 tons of cement. Additional amounts of crushed limestone from the quarry are supplied to sugar manufacturing plants in Idaho.

The new management at Bristol Silica and Limestone Company (20) continued to produce metallurgical-grade silica rock for Dow Corning at its mine in Jackson County. Other products included poultry grit and fine-grained silica used for filtration. Silica production was down from the previous year, and no limestone or dolomite was shipped from the property in 1985.

Hanna Mining Company continued to utilize silica rock from the Quartz Mountain Silica Mine (19) in eastern Douglas County in its nickel smelter. Production was lower than in 1984 due to the smelter shutdown during construction of the new wet-screening plant.

Steatite of Southern Oregon (21) produced block soapstone suitable for carving from its mine on Elliot Creek Ridge in southern Jackson County. Shipments of block soapstone reportedly declined slightly in 1985.

The Oregon Sun Ranch and Central Oregon Bentonite clay pits on Camp Creek (23) in central Oregon were active producers in 1985. Both properties produce low-grade clays that are used primarily in the cat-litter industry.

Teague Minerals Products (10) continued to produce bentonitic clay and zeolite from its pits near Adrian in eastern Malheur County.

Table 1. *Active mines in Oregon, 1985*

Map no.	Name	Location	Commodity	Comments
1.	Tempest	Sec. 10 T. 9 S., R. 34 E. Grant County	Ag	Newly erected small mill produced small amount of concentrates.
2.	Pyx	Sec. 1 T. 10 S., R. 35 E. Grant County	Au	Continued small, seasonal production.
3.	Boulder Creek	Sec. 34 T. 8 S., R. 35½ E. Grant County	Au	Small placer operation.
4.	Elk Haven	Sec. 16 T. 8 S., R. 36 E. Grant County	Au, Ag	Produced small amount of concentrates.
5.	Thomason	Sec. 6 T. 14 S., R. 37 E. Baker County	Au	Continued small, seasonal operation.
6.	Burnt River	T. 10 S., Rs. 35, 35½ E. Baker County	Au	Several small placer operators.
7.	Pine Creek	T. 12 S., R. 39 E. Baker County	Au	Several small placer operators.
8.	Clarks Creek	Tps. 12, 13 S., R. 41 E. Baker County	Au	Several small placer operators.
9.	Ash Grove Cement West	Sec. 11 T. 12 S., R. 43 E. Baker County	Cement, limestone	Continued production.
10.	Teague Mineral Products	Sec. 29 T. 23 S., R. 46 E. Malheur County	Bentonite, zeolite	Continued production.
11.	Fall Creek Gold	T. 38 S., R. 9 W. Josephine County	Au	Small production from placer and lode by owner Tim Von Pinnon.
12.	Josephine Creek & tributaries	Secs. 30, 36 T. 38 S., Rs. 8, 9 W. Secs, 2, 11 T. 39 S., R. 8 W. Josephine County	Au	Several small placer operators.

Table 1. *Active mines in Oregon, 1985 — continued*

Map no.	Name	Location	Commodity	Comments
13.	Sucker Creek	Sec. 1 T. 40 S., R. 7 W. Josephine County	Au	Several small placer operators.
14.	Althouse Creek	Secs. 11, 12 T. 41 S., R. 7 W. Josephine County	Au	Several small placer operators.
15.	Galice area (Galice Creek, Taylor Creek, Rocky Gulch)	Secs. 25, 36 T. 34 S., R. 8 W. Secs. 2, 10, 16 T. 35 S., R. 8 W. Josephine County	Au	Several small placer operators.
16.	Greenback	Secs. 32, 33 T. 33 S., R. 5 W. Sec. 5 T. 34 S., R. 5 W. Josephine County	Au	Property returned to owners, Sunny Valley Mining & Development Co., who are currently mining on the Irish Girl vein.
17.	Nickel Mountain	Sec. 17 T. 30 S., R. 6 W. Douglas County	Ni	Mine and smelter reopened in November after installing new wet-screening plant.
18.	Coffe Creek	Sec. 7 T. 30 S., R. 2 W. Douglas County	Au	Small placer operation.
19.	Quartz Mountain Silica	Sec. 2 T. 28 S., R. 1 E. Douglas County	Silica	Reduced production due to smelter shutdown.
20.	Bristol Silica	Sec. 30 T. 36 S., R. 3 W. Jackson County	Silica	Silica production reduced from 1984 level.
21.	Steatite of Southern Oregon	Secs. 10, 11 T. 36 S., R. 3 W. Jackson County	Soapstone	Production of carving-grade soapstone declined from 1984 level.
22.	Cascade Pumice, Central Oregon Pumice	Bend area Deschutes County	Pumice	Continued production.
23.	Camp Creek	T. 19 S., R. 21 E. Crook County	Clay	Oregon Sun Ranch, Inc., and Central Oregon Bentonite Co. producing clays.
24.	Oil-Dri West	T. 27 S., R. 17 E. Lake County	Diatomite	Continued production of diatomite used mainly in pet litter.

OREGON'S MINERAL PRODUCTION

MILLIONS OF DOLLARS

	ROCK MATERIALS Sand & Gravel, Stone	METALS & INDUSTRIAL MINERALS Cement, Nickel, Pumice, etc.	NATURAL GAS	TOTAL
1972	54	22	0	76
1973	55	26	0	81
1974	75	29	0	104
1975	73	33	0	106
1976	77	35	0	112
1977	74	35	0	109
1978	84	44	0	128
1979	111	54	+	165
1980	95	65	12	172
1981	85	65	13	163
1982	73	37	10	120
1983	82	41	10	133
1984	75	46	8	129
1985	78	39	10	127

Summary of mineral production in Oregon for the last 16 years. Data for 1985 derived from U.S. Bureau of Mines annual preliminary Mineral Industry Survey and Oregon Department of Geology and Mineral Industries natural gas production statistics.

EXPLORATION AND DEVELOPMENT ACTIVITY

The level of mineral exploration and development activity in 1985 generally declined from 1984 levels. Industry interests continued an ongoing shift in emphasis from metallic to nonmetallic commodities.

Metals

State and Federal research teams continued their search for submarine polymetallic sulfide deposits along the Juan de Fuca and Gorda Ridges off the Oregon coast. The Oregon Department of Geology and Mineral Industries released a comprehensive map (GMS-37) showing known offshore mineral resources.

Similar onshore polymetallic sulfide deposits continued to be evaluated in southwest Oregon. The Turner Albright Mine (13)** in extreme southwest Josephine County is one of the best known sulfide deposits in Oregon. The property is now owned by Baretta and is currently being evaluated by Ray Rock Mines, Inc. Ray Rock did a pulse-electromagnetic geophysical survey to determine the downdip extension of the ore zone.

Previous drilling programs by Baretta and Noranda reportedly outlined 3.3 million tons of reserves averaging 0.114 oz per ton of gold, 0.443 oz per ton of silver, 1.46 percent copper, 3.32 percent zinc, and 0.055 percent cobalt.

Ore-dressing research on the complex sulfide ore is being conducted by the U.S. Bureau of Mines (USBM) research center in Salt Lake City, Utah.

The U.S. Geological Survey (USGS) is also conducting a study of the deposit as an onshore example of a submarine black-smoker deposit.

Seneca Exploration of Vancouver, B.C., and Litho-Logic Resources of Grants Pass, Oregon, are conducting a geologic mapping and sampling program on the Fall Creek Copper (14) massive sulfide deposit in Josephine County. The deposit is situated about 10 mi west of Selma along Fall Creek, a tributary of the Illinois River. The massive sulfide deposit is associated with pillow basalts and ultramafic rocks and may be another example of a black-smoker deposit.

Other massive sulfide deposits currently being evaluated in Oregon are hosted by island-arc volcanic rocks. Amselco is conducting a drilling project on one of these deposits, the Goff Mine (16), located in Josephine County about 2 mi north of Grave Creek between Rock Creek and Reuben Creek. The deposit is in siliceous tuffs and contains massive sulfides capped by barite. Amselco is drilling on lands leased for exploration from Josephine County.

**All site numbers in this section refer to "Exploration Sites and Areas" on the location map and in Table 2.

Boise Cascade drilled the Gold Note (18) stratabound sulfide deposit on the Josephine-Jackson County line in the upper Grave Creek area.

Activity on similar deposits in northeastern Oregon has been steadily decreasing in recent years. The Iron Dyke Mine (11) on the Snake River in eastern Baker County was inactive through most of 1985. The owner and operator, Silver King Mines, Inc., placed a crew on the property in late fall of 1985 with the expressed intent of mining out a 20,000-ton ore body left from earlier operations. The ore body is reported to run about 0.3 oz per ton of gold and 3 percent copper.

Most of the recent activity in northeast Oregon has focused on vein gold deposits about the margins of the Late Jurassic-Early Cretaceous intrusions. During spring, Rio Algom put down some drill holes on the Sunday Hill Mine (28) located in the old Mormon Basin district in southern Baker County. The property is held by Capri Resources Ltd. of Vancouver, B.C.

Sunshine Mining and Minerals was active in the Virtue Flat district east of Baker. The company sampled some of the accessible underground workings on the old Flagstaff Mine (10). This property explored quartz veins and sheared gouge zones in a metamorphosed intrusive complex of gabbro and quartz diorite.

Inspiration drilled 12 holes at the Dixie Meadows Mine (5) north of Prairie City. Drill results were discouraging, and Inspiration dropped its option on the property which is held by Big Turtle Mines, Inc., of Boise, Idaho.

American Copper and Nickel Company, Inc., a subsidiary of INCO Ltd., continued exploration at its Susanville property (4) in northern Grant County. The property is located adjacent to the southwest margin of the Sunrise Butte stock and contains several sulfide-rich precious metal veins that are hosted in schist and serpentine. In 1985, American Copper and Nickel continued evaluation of one of those, the Bull of the Woods vein, in a 6,000-ft surface-drilling program.

American Copper and Nickel was also active in and along the margins of the Bald Mountain Batholith. This area has historically been one of the most productive lode gold regions in Oregon. American Copper and Nickel continued its evaluation of the Bald Mountain Mine (6) under the terms of a joint venture agreement with the owners of the property, Ibex Mining Company. The 1985 program consisted of a 9,500-ft surface drilling program on the Bald Mountain-Ibex and Grand Trunk vein systems. The drill program was completed in late November. Other lode properties along the southern margins of the batholith, including the North Pole-Columbia, Cougar-Independence, Buffalo, and Argonaut Mines, were idle in 1985.

Table 2. *Exploration sites and areas in Oregon, 1985*

Map no.	Name	Location	Commodity	Comments
1.	Rejax	SE part of T. 9 S., R. 17 E. Jefferson County	Au, Ag	Continued exploration by Ocelot Industries Ltd.
2.	Bear Creek Buttes	T. 18 S., R. 17 E. Crook County	Au	Exploration program by Shell Mining Company.
3.	Miller Mountain	Sec. 22 T. 14 S., R. 32 E. Grant County	Au	Sampling of underground workings by CBM.
4.	Susanville	T. 10 S., R. 33 E. Grant County	Au, Ag	Continued diamond drill program by American Copper and Nickel.
5.	Dixie MeadowsSec. 23 T. 11 S., R. 33 E. Grant County	Au, Ag	Drill program by Inspiration.	
6.	Bald Mountain-Ibex	Sec. 4 T. 9 S., R. 36 E. Baker, Grant Counties	Au, Ag	Continued diamond drill program by American Copper and Nickel.

Table 2. *Exploration sites and areas in Oregon, 1985 —continued*

Map no.	Name	Location	Commodity	Comments
7.	Cable Cove	T. 8 S., R. 36 E. Baker County	Au, Ag	Small drill program by American Copper and Nickel.
8.	Meadow Lake	T. 8 S., R. 37 E. Baker, Grant Counties	Au, Ag	Shell Mining Company joined in joint venture program with Manville Corp.
9.	Grouse Spring	Secs. 24, 25 T. 14 S., R. 36 E. Baker County	Cu, Mo	Small drill program by Manville Corp.
10.	Flagstaff	Sec. 5 T. 9 S., R. 41 E. Baker County	Au	Underground workings sampled by Sunshine.
11.	Iron Dyke	Sec. 21 T. 13 S., R. 45 E. Baker County	Au, Ag, Cu	Reopened by Silver King.
12.	Dooley Mountain	Tps. 11, 12 S., R. 40 E. Baker County	Perlite	Evaluation program by Supreme Perlite.
13.	Turner-Albright	Secs. 3, 15, 16 T. 41 S., R. 9 W. Josephine County	Au, Ag, Zn, Cu, Co	Continued evaluation by Ray Rock.
14.	Fall Creek Copper	Tps. 37, 38 S., R. 9 W. Josephine County	Au, Ag, Cu, Co	Mapping and sampling program by Seneca Exploration and Litho-Logic Resources.
15.	Gold Bug	Sec. 26 T. 33 S., R. 8 W. Josephine County	Au	Old workings reopened by GeoMining Company of Salt Lake City.
16.	Goff	Secs. 20, 29 T. 33 S., R. 7 W. Josephine County	Au, Ag, Cu, Pb, Zn	Drill program by Amselco.
17.	John Hall	Sec. 18 T. 34 S., R. 5 W. Josephine County	Au	David Gaunt and Gene Lattimer of Sunny Valley reopened old workings and set up small mill.
18.	Gold Note	Sec. 30 T. 33 S., R. 3 W. Jackson, Josephine Counties	Au, Ag, Cu	Drill program by Boise Cascade.
19.	Foster Creek	T. 29 S., R. 3 E. Douglas County	Clay	Evaluation of soil amendment material by Cascade Sulfur Company.
20.	Quartz Mountain	T. 37 S., R. 11 E. Lake County	Au	Continued evaluation of large-tonnage epithermal gold deposit.
21.	Little Baldy	T. 34 S., R. 16 E. Lake County	Au	Exploration program by Long Lac.
22.	Tucker Hill	Sec. 35 T. 34 S., R. 19 E. Lake County	Perlite	Continued evaluation by Tenneco.
23.	Coyote Hills	T. 35 S., R. 23 E. Lake County	Au	Drilled and later dropped by Cominco American.
24.	Harney prospect	T. 27 S., R. 31 E. Harney County	Zeolite	Continued drilling by Anaconda.
25.	Flagstaff Butte	T. 39 S., R. 37 E. Harney County	Au	Exploration program by Utah International.
26.	Celatom	Tps. 19, 25 S., Rs. 35, 36, 37 E. Harney, Malheur Counties	Diatomite	Plant construction by Eagle Picher.
27.	Castle Rock	T. 18 S., R. 37 E. Malheur County	Au	Exploration program by Manville Corp.
28.	Sunday Hill	Sec. 17 T. 13 S., R. 42 E. Malheur County	Au	Drilled by Rio Algom.
29.	Red Butte	Secs. 26, 27, 34, 35 T. 25 S., R. 43 E. Malheur County	Au	Tenneco joint-ventured with Manville Corp. on a sampling and mapping program.
30.	Rome prospect	Tps. 31, 32 S., R. 41 E. Malheur County	Zeolite	Continued drilling by Anaconda.

New wet-screening plant at Hanna Nickel Company high on the flanks of Nickel Mountain. Here, nickel-bearing, fine, weathered material is separated from unweathered rock and transported down the mountain as a slurry.

American Copper and Nickel completed a 1,600-ft surface-drilling program in the heart of the Cable Cove (7) district within the batholith. The veins here consist of brecciated granodiorite that has been locally altered to clay minerals and sericite and impregnated with lenses and streaks of quartz, calcite, and sulfide minerals. The sulfide lenses, which may contain appreciable amounts of gold and silver, consist primarily of pyrite and arsenopyrite, with accessory galena, sphalerite, chalcopyrite, and occasional molybdenite and stibnite.

Shell Mining Company became a joint venture partner on the Meadow Lake property (8) owned by Manville. The property, which is located along strike to the northeast of the Cable Cove veins, had been previously evaluated by Manville for copper-molybdenum mineralization. Last summer's joint venture project consisted of mapping and sampling of associated precious metal mineralization.

Other porphyry deposits of consequence include the Cedar Creek prospect in the Quartzville district in the Western Cascades, which is held by Amoco, and the Grouse Springs prospect in southern Baker County, which is held by Manville. Manville continued its small-scale surface-drilling program on the property this past summer.

Zones of precious-metal mineralization hosted in Tertiary volcanic and sedimentary rocks continued to be popular exploration targets in 1985. A number of companies conducted exploration and evaluation programs in the Western Cascade, Ochoco, Quartz Mountain, McDermitt, and Vale-Weiser areas.

Tenneco began an extensive surface sampling and mapping program at Manville's Red Butte (29) property in central Malheur County. This is a presumably caldera-associated deposit of the hot-springs type, hosted in tuffaceous sedimentary rocks of Miocene age.

Manville continued its surface sampling and mapping program on its Castle Rock property (27) in northern Malheur County. Precious metal mineralization there is reported to occur in the Miocene rhyolite flow-dome complex.

Cominco-American drilled nine reverse-circulation holes at Coyote Hills (23) in central Lake County. Stockworks of quartz-pyrite mineralization are reported to occur along northwest-trending fracture zones at and near intersecting northeast-trending fractures. In fall of 1985, the property, which is presumably located in a late Tertiary volcanic complex, was dropped by Cominco-American due to discouraging drill results.

Evaluation of the Quartz Mountain (20) property northwest of Lakeview in Lake County continued through 1985. The property was held in a joint venture agreement between Anaconda and Exploration Ventures of Spokane, Washington. Gold mineralization on the 3,200-acre property is reportedly associated with late Tertiary rhyolite porphyry intrusions that cut the Miocene tuffaceous sedimentary rocks. The main defined mineralized zone at Krone Hill is centered on an alteration zone adjacent to one of four intrusions on the property. Better grade gold mineralization is said to be present in a stratabound replacement zone located along the margins of the rhyolite porphyry. The zone locally contains high-grade veins, stockworks, and hydrothermal breccias. Gold mineralization is also known to occur in a contact breccia and in a hot springs sinter deposit. Based on 11,525 ft of drilling done earlier on 32 holes by Anaconda, a potential resource of 25 million tons of rock grading better than 0.04 oz per ton of gold has been identified on the property. Anaconda's interest in the property was transferred to a Vancouver, B.C., company in 1985 as part of the Anaconda breakup.

Nonmetals

The year 1985 saw increased activity in exploration and development of nonmetallic mineral resources. The Celatom diatomite project (26), owned and operated by Eagle Picher Industries, Inc., continued toward production. Four mine sites on the 3,700-acre property, located along the Malheur-Harney County line near Drewsey, are expected to provide 140,000 yd^3 of diatomite ore per year. The ore will be shipped to a processing plant now being constructed 7 mi west of Vale in Malheur County. The $13-million project is partially funded by an Industrial Revenue Bond and an Urban Development Action Grant. The processing plant is expected to be completed in the summer of 1986, at which time diatomite ore mined this past summer will be processed.

Geologists for Tenneco Minerals Company reported in 1985 that the Tucker Hill perlite deposit (22) in Lake County contained resources of at least 20 to 40 million tons of vesicular to granular perlite and perlite breccias amenable to open-pit mining. Bulk sample tests made by Tenneco suggest that the perlite is suitable for a number of industrial applications including horticultural and loose-fill insulation products as well as the production of insulation board and acoustical tile. Feasibility studies continued in 1985.

Supreme Perlite, a Portland-based company, continued its evaluation of the perlite deposits at Dooley Mountain (12) in southern Baker County. The Miocene rhyolite center at Dooley Mountain is currently being mapped in detail by the U.S. Geological Survey.

Several companies continued to evaluate zeolite prospects. Anaconda conducted an assessment drilling program on its Harney property (24) south of Burns in Lake County. This is reportedly one of the largest clinoptilolite deposits in the world, partially replacing a 215-ft-thick ash flow tuff. Anaconda indicates that the deposit may contain around 1 billion tons of 90 percent clinoptilolite rock.

Anaconda also continued its drilling program at Rome (30) in Malheur County. The zeolite resource here has been reported as 30 million tons of 60 percent mordenite.

Cascade Sulfur Company has been conducting an exploration of soil amendment material mined from an area of hydrothermal alteration of dacitic volcanic rocks in the Foster Creek (19) drainage of southeastern Douglas County. The material reportedly contains in large part bentonitic clays (montmorillonite) with some pyrophyllite, fine disseminated pyrite, and secondary sulfates. Test results on application to both alkaline and acid soils appear to be very encouraging. More than 1,000 tons of material have been mined and applied to various sites including Klamath and Lake County alfalfa fields and the U.S. Bureau of Land Management tree plantation near Provolt. The company plans further testing and development of its deposit. □

A reinterpretation of the Gray Butte limestone and arenite exposure as a hydrothermally-derived calcite vein and pebble dike

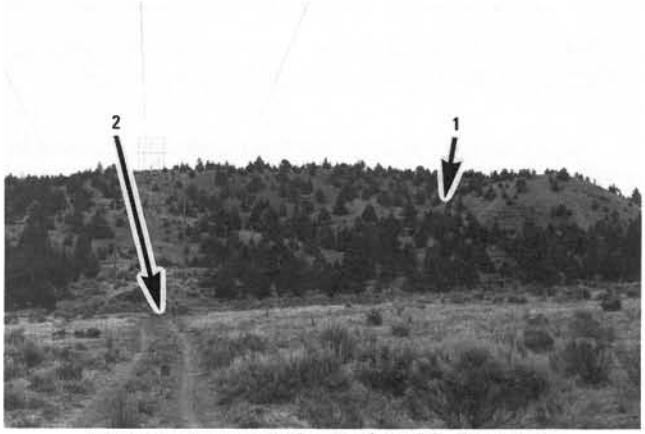
by Jerry J. Gray and Gary Baxter, Oregon Department of Geology and Mineral Industries

In the July 1979 issue of *Oregon Geology*, Ashwill, in a reconnaissance study, locates and describes "limestone" occuring on the western flank of Gray Butte, Jefferson County. The main outcrop is located approximately 15 mi south of Madras in the SE¼ SE¼ sec. 22, T. 13 S., R. 13 E., and a second exposure lies about 100 yd west of the first (Ashwill, 1979). Other rocks cropping out nearby are described as "arenite." Both the "limestone" and "arenite" are assumed to be sedimentary in origin. The "arenites" and other clastic rocks are described as older than the surrounding rocks because of their "anomalously steep dips, indications of metamorphism in the recrystallization of the limestone, and the quartzic arenites."

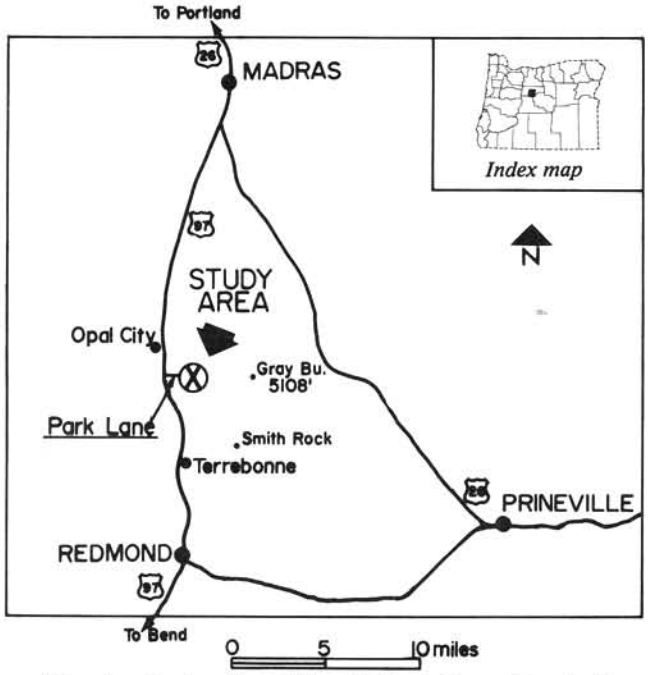
The authors suggest that the "limestone" and "arenite" are not sedimentary in origin. The "limestone" instead appears to be a calcite vein and the "arenite" a pebble dike (breccia formed by hydrofracturing occurring during hydrothermal activity) that are both part of a hot-spring system. While conducting Oregon Department of Geology and Mineral Industries (DOGAMI) geochemical studies of hydrothermal systems, the first author visited the Gray Butte "limestone/arenite" area during the 1984 field season and collected several samples for assaying and petrographic study. All the samples that were assayed had detectable gold, two showed anomalous values for arsenic, one had anomalous silver values, and one had anomalous mercury values (Table 1). Thin sections were cut from three of the samples that had been collected for petrographic study. Two of these three samples were also examined by X-ray diffraction. The assay, X-ray, and petrographic data and the authors' interpretation are given in Table 1.

Three other factors should be noted. The first is that 2 mi northwest of the "limestone/arenite," the Gray Butte mercury prospect occurs. Brooks (1963) describes the geology and mineralization of this prospect as follows:

"Cinnabar is sparsely distributed along an east-trending zone of faulting which can be traced for about 1,000 ft. At the west end of the area, the fault zone is expressed by a rib of silicified tuff from 2 to 6 ft wide protruding in places as much as 8 ft above the surface. The rib is bordered on the north by a 2-ft-wide zone of mildly silicified gouge and brecciated tuffs. Cinnabar is visible as fracture coatings along the north edge of the silicified rib."

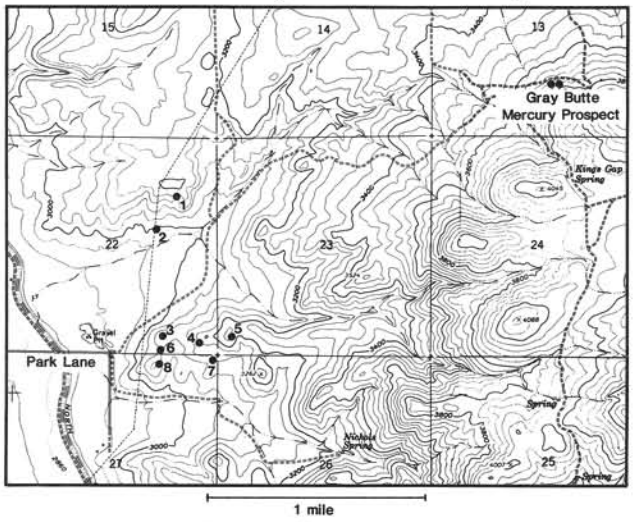


Arrows point to sample sites 1 and 2, Gray Butte.



Map showing location of Gray Butte, Jefferson County, Oregon. Park Lane leads to study area that is shown in greater detail on map below.

The second factor is inferred from the topographic map of the area. Two topographic lows almost surround the "limestone/arenite" area. During the formation of the hydrothermal



Partial topographic map of T. 13 S., R. 13 E. showing locations from which samples were collected for this study.

Table 1. *Assay data and petrology, Gray Butte, Jefferson County, Oregon*

Assays (ppm)									Mineralogical analysis technique		Rock name
Sample no.	Au	Ag	As	Cu	Hg	Mo	Pb	Zn	Thin section (?)	Clay fraction X-ray (?)	
1	0.003	*0.93	4	10	0.08	4.8	9	68	Yes	No	Jasperoid
2	0.002	0.16	3	9	0.04	3.3	15	83	No	No	Jasperoid
3	0.007	0.10	*15	51	*1.30	2.2	4	50	No	No	Breccia
4	——	——	——	——	——	——	——	——	No	No	Calcite
5	0.003	0.11	*14	48	0.24	4.1	4	71	No	No	Breccia
6	——	——	——	——	——	——	——	——	Yes	Yes	Breccia
7	0.003	0.12	4	52	0.07	0.7	5	79	Yes	Yes	Breccia
8	0.003	0.06	3	90	0.08	0.6	2	71	No	No	Andesite (?)

*Anomalous value.

Comments on samples in Table 1:

1. Sample taken from an outcrop 200 ft long and several feet thick. The rock, which has yellow, brown, and green patterns, is being mined by rockhounds as picture rock. Thin-section examination indicates that this rock is a silicified ash-fall tuff that formed from air fall of ash into a quiet body of water.
2. Lake-bed sediments that have been silicified. Some secondary fracturing and silicification have occurred. The rock is tan, and the secondary silicification is green. The outcrop is 100 ft by 50 ft by 20 ft and is being used as the footing for a power-line tower.
3. Silicified, brecciated, and mineralized sample. The rock has slickensides, indicating movement has occurred after silicification.
4. Coarse crystalline calcite that is white on a fresh surface. No assays were performed.
5. Silicified, brecciated, mineralized rock that is impregnated with calcite. The outcrop is at least a couple of hundred of feet square.
6. "Arenite," as mapped by Ashweill. Outcrop was extended farther to the west by 1984 DOGAMI field work. Sample 6 was taken from the west end of the "arenite," and sample 7 was taken from the east of the center of the outcrop. The sample-6 thin section shows that the "arenite" sand grains are rounded breccia fragments of mostly jasperoids after tuffs. The spaces between the fragments are filled with quartz, calcite, and clay minerals. X-ray diffraction indicates that the clay minerals are chlorite and kaolinite. The outcrop is probably a pebble dike caused by steam explosions.
7. "Arenite" sample similar to sample 6, except that X-ray shows that the clay mineral illite (a higher temperature clay) is also present.
8. Sample field identified by the authors as andesite. It is calcite bearing and carries detectable gold. No thin sections were prepared from this sample.

Closeup of sample site 1, showing pit where silicified lake-bed sediments have been mined by rockhounds for picture rock.

Sample site 7, a pebble dike probably caused by hydrofracturing of rock by steam explosions during hot-spring activity.

(hot spring), silica-rich systems, a clay alteration zone may form around the area of silicification. This may be the reason for the two topographic lows.

The third factor is that nearby lakebed sediments from which fossils have been reported (Ashwill, 1983) have been silicified —a sign of hot springs activity.

In summary, the rock types, silicification, brecciation, calcite veining, gold and other metal mineralization, topography, and the nearby mercury prospect all suggest a hydrothermal system in the Gray Butte area. Detailed geologic mapping, geochemical surveying, and drilling will be needed to determine if this and nearby areas have potential for being a commercial gold deposit.

The petrographic samples and thin sections are available for study at the Portland office of the Oregon Department of Geology and Mineral Industries.

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