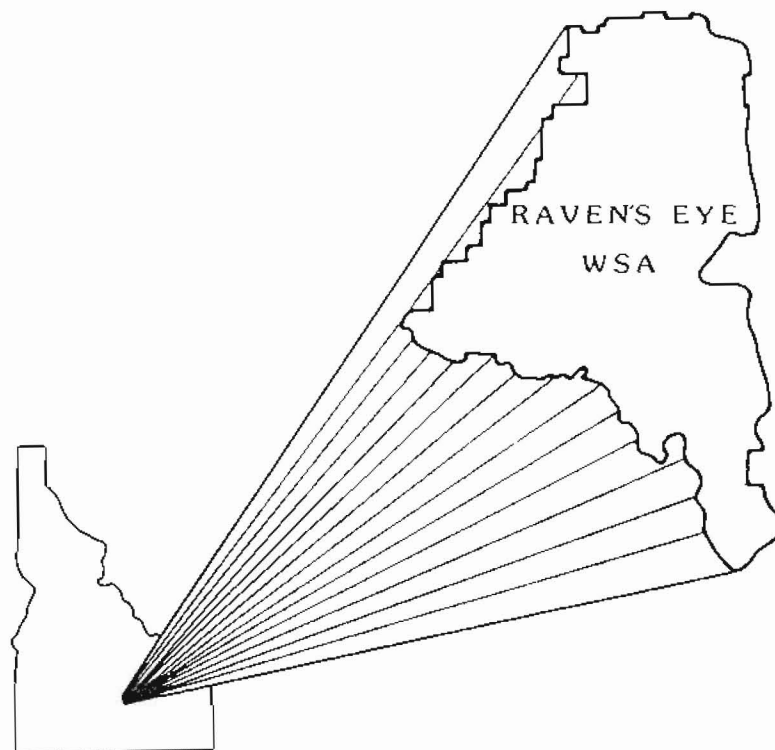




Mineral Land Assessment/1986
Open File Report

Mineral Resources of the Ravens Eye Wilderness Study Area, Blaine and Lincoln Counties, Idaho



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE RAVEN'S EYE
WILDERNESS STUDY AREA, BLAINE AND LINCOLN COUNTIES, IDAHO

By
Alan R. Buehler and Phillip R. Moyle

Western Field Operations Center
Spokane, Washington

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579, Sec. 603, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land ". . . prior to any recommendation for the designation as wilderness . . . to determine the mineral values, if any, that may be present" Results must be made available to the public and submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of the Raven's Eye Wilderness Study Area (ID-57-10), Blaine and Lincoln Counties, Idaho.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

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SUMMARY

A mineral survey of the 67,110-acre Raven's Eye WSA (Wilderness Study Area) in the north-central Snake River Plain of Idaho was conducted by the U.S. Bureau of Mines in 1985, at the request of the Bureau of Land Management. The WSA is in Blaine and Lincoln Counties; the northwest corner is about 1 mile east of Carey, ID. A search of county mining claim records indicated that no claims have been located in the WSA.

Basaltic lava is the only rock type exposed within the WSA. A platy variety of lava (slab pahoehoe) occurs that is produced from other lava fields in southern Idaho. The material is marketed as decorative stone, used for wall veneers, and retails for approximately \$125/ton. Within the WSA, approximately 18,000 tons of indicated reserves are concentrated in two areas, and a total of 12,000 tons of indicated subeconomic resources were found at six other localities. An additional 10,000 tons of inferred subeconomic resources are unevenly distributed over the remainder of the WSA.

Placer samples of sand and gravel from the Little Wood River drainage, adjacent to the northern and western boundaries of the WSA, contained an average gold value of \$0.08/yd³, which is uneconomic. Less than 1,000 yd³ of the auriferous gravel is within the WSA.

The WSA contains an occurrence of approximately 140,000 tons of volcanic cinders. While the volcanic cinders may be suitable for road metal, they cannot compete with the numerous larger occurrences which are closer to current markets.

As of October 1986, there were no geothermal leases or lease applications within the WSA. The recency of volcanism and the presence of hot springs less than 1 mile northwest of the WSA indicate geothermal resources may be present; however, no surface manifestations were observed within the WSA boundary, and no geothermal or other energy resources were identified.

INTRODUCTION

A mineral survey of the Raven's Eye WSA (Wilderness Study Area) ^{1/} was conducted in June 1985 by the USBM (U.S. Bureau of Mines) and the USGS (U.S. Geological Survey) at the request of the BLM (U.S. Bureau of Land Management). The USBM researched the mining and mineral exploration history, evaluated decorative-stone resources, and searched for mining-related activities within and adjacent to the WSA. The USGS

^{1/} WSA (Wilderness Study Area): a roadless area or island that has been inventoried by the U.S. Bureau of Land Management and found to have wilderness characteristics as described in Section 603 of the Federal Land Policy and Management Act of 1976 (90 Stat. 2743) and Section 2(c) of the Wilderness Act (78 Stat. 890).

evaluated the WSA by regional geochemical and geophysical surveys and geological mapping. Results of the investigations will be used to help determine the suitability of the WSA for inclusion into the National Wilderness Preservation System. The immediate goal of this and other USBM mineral surveys is to provide data to the President, Congress, government agencies, and the public for land-use decisions. The long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at reasonable costs.

Setting

Raven's Eye WSA encompasses 67,110 acres of a basaltic lava field in the Snake River Plain section of the Columbia Intermontane geomorphic province (Thornbury, 1965, p. 459). The WSA is on public land administered by the Shoshone District of the BLM. Its center is about 3 mi (miles) south southeast of Carey, ID (fig. 1). Major access is provided by U S. Highway 93 on the north and west sides of the WSA. Secondary and unimproved roads provide access to most of the boundary, and jeep trails and unimproved roads provide access to lava flows within the WSA (fig. 2).

The lava flows have a rough and chaotic surface caused by aa ^{2/} fields, overlapping flows of pahoehoe ^{3/}, collapse features, and pressure ridges. Overall relief is about 390 ft (feet); elevations range from 4,610 ft near the Little Wood River on the western edge of the WSA to 5,003 ft atop Spud Butte on the eastern side. Most of the lava field dips gently to the southwest.

The WSA is in an arid zone; average annual precipitation is less than 10 in. (inches). Due to the scarcity of soil cover and lack of water, only sparse sagebrush, rabbit brush, and various grasses are present. No streams drain the study area. Temperatures range from about -30 to 105 °F annually and average about 53 °F.

Previous Studies

Early reconnaissance studies of the geology and water resources of the Snake River Plain, Idaho, are reported in Russell (1902) and Stearns and others (1938). Greeley and King (1977), LaPoint (1977), and Greeley (1982) described the geology of the eastern Snake River Plain, with an emphasis on volcanism. Rember and Bennett (1979) compiled a 1:250,000-scale geologic map of the Idaho Falls quadrangle which includes the study area.

^{2/} Aa: Hawaiian for rough, jagged lava flows with a clinkery surface.

^{3/} Pahoehoe: Hawaiian for basaltic lava flows with a smooth, billowy, or ropey surface.

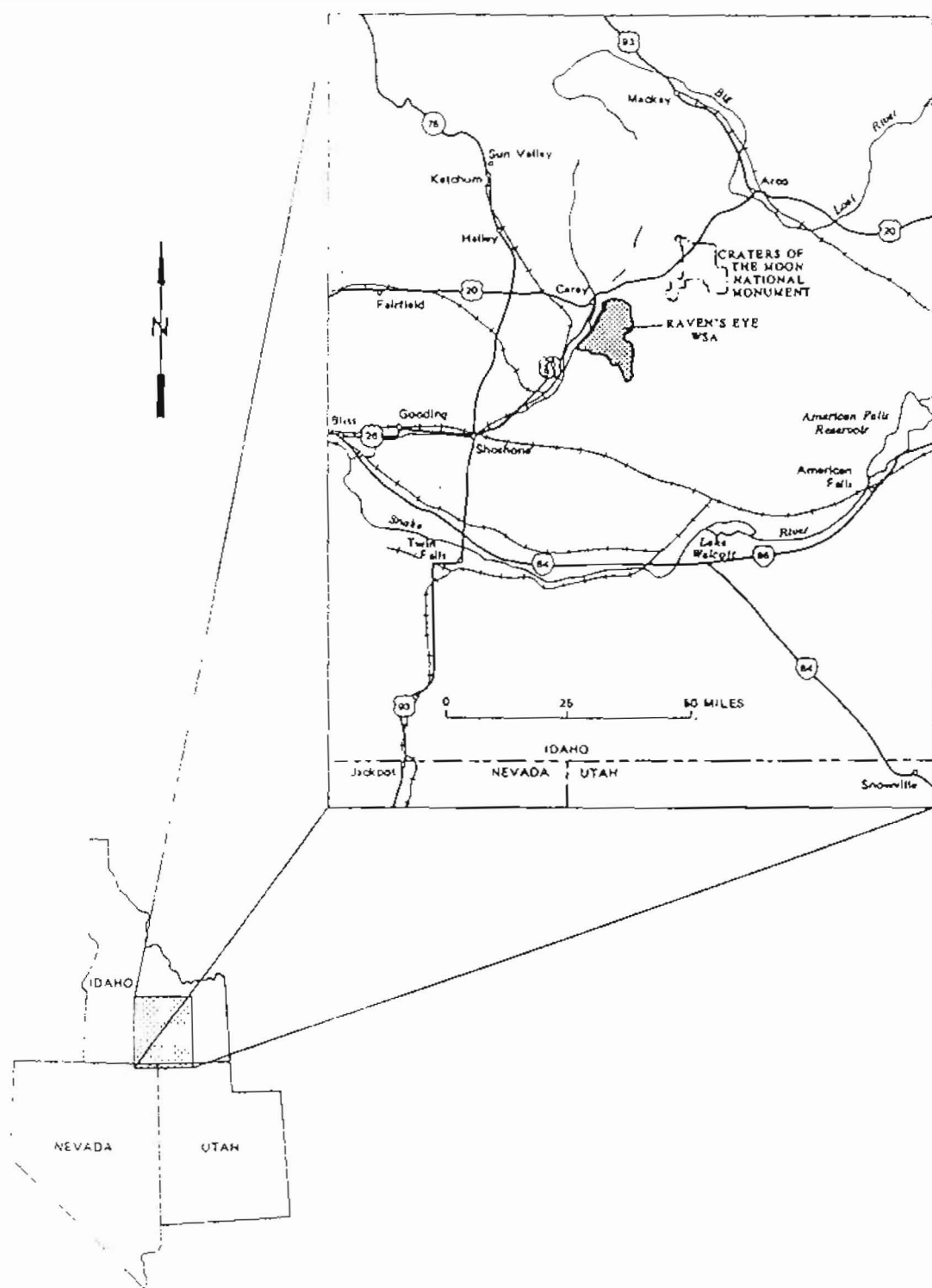


FIGURE 1.— Location of the Raven's Eye Wilderness Study Area (ID-57-10), ID

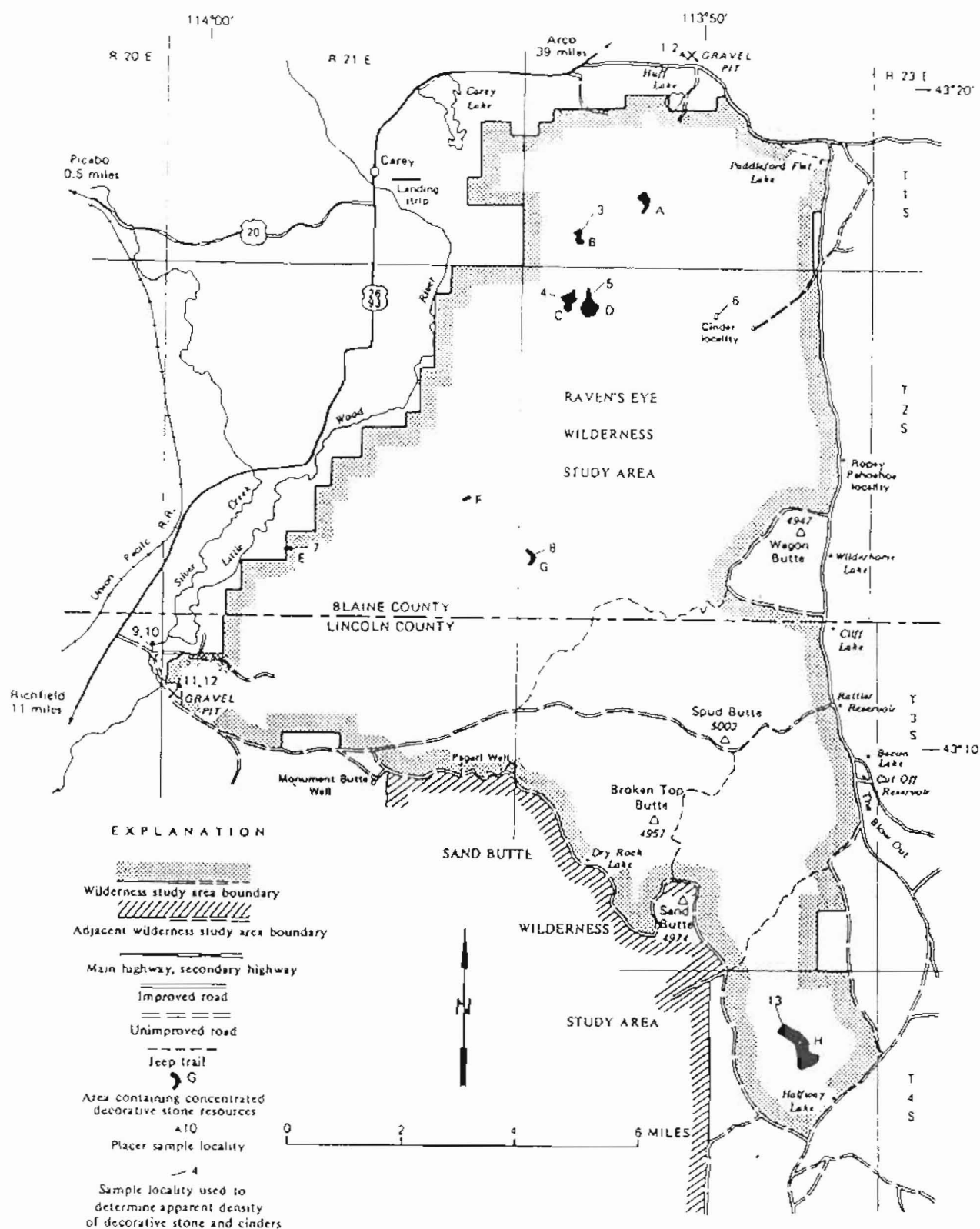


FIGURE 2.— Mineral resource localities in the Raven's Eye Wilderness Study Area (ID-57-10), ID

Results of a reconnaissance study of the GEM (geology, energy, and mineral) resources of the WSA and surrounding areas are reported in a BLM contract report by Fredericksen and Fernette (1983). Investigations of the Wapi Flow (Ridenour, 1980) and the Hell's Half Acre lava field (Moyle and Winters, 1985) identified decorative stone resources similar to those in the Raven's Eye WSA, and the latter contained a brief study of the decorative stone market in Idaho Falls and Boise, ID, and Spokane, WA.

Present Study

Work by USBM personnel entailed prefield, field, and report preparation phases during 1985 and 1986. Prefield studies included library research and perusal of BLM mining and mineral lease records. Bureau of Mines and other production records were searched. Field studies in 1985 involved air and ground searches for deposits of decorative stone in localities which appeared to be promising on aerial photographs. Areas within and adjacent to the WSA, which were found to contain high concentrations of decorative stone were examined and, where warranted, mapped and sampled. A total of 13 samples were taken (6 decorative stone, 1 cinder, and 6 placer).

The blackened areas on figure 2 were traced from aerial photographs, and represent surface areas containing 5 percent or more of decorative slab pahoehoe. Six representative samples of stone (fig. 2, nos. 3-5, 7, 8, 9, and 13), suitable as decorative veneer, were taken to determine the apparent density for resource calculation. Each sample was cut into a cube with a rock saw, and volume was determined. Apparent density was calculated by dividing the weight of the sample by the volume.

The tonnage of a small spatter cone cinder occurrence was calculated (fig. 2, no. 6). Volume was determined by digitizing 4/ 10-ft contours of the cinder cone and applying Simpson's Approximation 5/. Apparent density was determined by the same methods used to calculate the density of decorative stone resources.

Placer samples (fig. 2, nos. 1, 2, and 9-12) comprised of a level-full 14 in. pan of material from the Little Wood River drainage were panned to a rough concentrate, screened, and processed on a Wilfley table. The resulting heavy mineral fractions were scanned with a binocular microscope to determine gold and other heavy mineral content and then examined for radioactivity and fluorescence.

Resource classifications in this report are based on principles developed by the U.S. Bureau of Mines and U.S. Geological Survey (1980) and appear as the appendix.

4/ Digitizing: a computerized method of calculating area.

5/ Simpson's Approximation: an integral used to calculate the volume of an irregular shape.

ACKNOWLEDGMENTS

Larry Dee, geologist, BLM, Shoshone District, provided aerial photographs and historical mining data. Terry Maley and Tim Carroll, geologists, BLM, Idaho State Office, shared decorative stone market data gathered by BLM staff geologists since 1980.

GEOLOGIC SETTING

The style of volcanism exhibited in the eastern Snake River Plain is identified by Greely (1982, p. 407) as ". . . gradational between flood basalt volcanism (fissures, rift zone, flat surface) and Hawaiian volcanism (central vents, lava tubes, tube flows)." The only rock type exposed within the WSA is Pleistocene basaltic lava of the Snake River Group (LaPoint, 1977; Rember and Bennett, 1979). Most of the study area consists of a network of pressure ridges, collapse depressions, and plateaus which have clinkery (aa) surfaces or smooth (pahoehoe) surfaces. Other typical basaltic features include ropey structures, squeeze-ups, fractures, lava tubes and tunnels, blisters, spatter cones and ramparts, and minor cinder cones.

Most decorative stone resources within the WSA are concentrated as pahoehoe slabs within aa areas of the Sunset-Carey lava flow. The Sunset-Carey flow is the youngest in the WSA. It originated in Craters of the Moon National Monument 20 mi to the northeast, and covers the northwest half of the WSA, north and west of the jeep trail near Wagon Butte. The remaining decorative stone resources are in an aa flow which erupted from Sand Butte, in the southeast corner of the WSA.

MINING HISTORY AND PRODUCTION

As of October 1986, no mining claims were within or adjacent to the WSA; however, the Lava Creek mining district is 10 mi northeast (Kuntz and others, 1980, p. 31). Host rocks of the Lava Creek district are exposed north of the WSA, and a small number of lode claims were filed 3 to 5 mi north of the WSA boundary.

Basaltic lava rock from the eastern Snake River Plain has been used as dimension stone in the Idaho Falls area since the 1880s (Mansfield, 1927, p. 338) and more recently as decorative stone. The blocky building stone variety is no longer in vogue. Slabs of pahoehoe lava, found as float ^{6/} near the Raven's Eye WSA, have been mined and marketed as decorative stone for more than 15 years as a result of strong demand for earth-tone veneers. Mining of float consists of selecting suitable flat material, generally 1 to 3 in. thick and 8 or more inches in diameter, and loading it on trucks.

^{6/} Float: general term which, in this report, indicates slablike pieces of basaltic rock lying on the surface and separated from the parent rock, generally along flow surfaces.

Total annual trespass removal of decorative stone from the vicinity is unknown, but known illegal removal sites are rare (Larry Dee, personal communication, 1985). In 1985, there were two common use areas ^{7/} located near the WSA, which meet persistent local demand for decorative stone. One is located at Black Butte, 18 mi west of the WSA, and another is between Shoshone and Gooding.

MINERAL COMMODITIES

Industrial Minerals

Decorative Stone

Marketing

Slab pahoehoe, similar in most respects to that which occurs in the WSA, is mined in the Idaho Falls-Blackfoot area, from the Hell's Half Acre lava field, from Black Butte, near the WSA, and other areas near Shoshone and Gooding. It is marketed as decorative veneer in Idaho and throughout the Pacific Northwest and competes with other varieties of decorative rock as well as brick and cultured (synthetic) stone.

A 1984 market survey (Moyle and Winters, 1985, p. 11) of stone dealers in Spokane, WA, and Boise and Idaho Falls, ID, showed retail prices for decorative stone ranging from \$50 to \$70/ton (per ton) for field rubble (field basalt) to about \$250/ton for travertine mined in Montana and a variety of slab pahoehoe mined from Black Butte. Slab pahoehoe from the Hell's Half Acre lava field, 70 mi east of the WSA, retailed for \$125/ton and competes well with other stone varieties. Two dealers stated that slab pahoehoe, sold under the name Idaho Moss, is the most popular wall and fireplace veneer in the Spokane area. Consumption of decorative stone varies considerably in the short-term (seasonally, annually) depending on the amount of new construction. Annual sales in Spokane were about 500 to 1,000 tons per year.

Observed on pallets in stoneyards, the stone is slab-like, ranges in thickness from 1 to 3 in., is generally 8 to 12 in. or more in diameter, and often has lichen or moss growth on the weathered surface. The tops of the slabs have a frothy or ropey appearance, whereas the undersides have some drip features and casts of older flows. The unweathered underside of slab pahoehoe is used by some masons for a different

^{7/} Common use area: an administrative area open to the public for non-commercial mining of decorative stone. A royalty plus a reclamation fee is charged by the BLM.

decorative appearance. Masons prefer the blunted or squared edges of slab pahoehoe over the feather-edged varieties of stone. The relatively light weight (low apparent density due to numerous vesicles--gas cavities) eases handling and gives large coverage per ton of stone. According to dealers, one ton of slab pahoehoe will generally cover 70 to 120 ft² (square feet), depending on thickness, whereas one ton of non-vesicular varieties of decorative stone covers only 35 to 50 ft².

Production Costs

Slab pahoehoe from the Raven's Eye WSA is similar to material in the Hell's Half Acre WSA, so detailed studies of the latter by Moyle and Winters (1985), and economic data from historic mining operations, were used to determine the minability and production costs of slab pahoehoe in the Raven's Eye WSA. Mining typically includes removal of float or rock which can easily be pried loose with a steel bar, and transportation to a central point. The BLM assesses a royalty of \$15/ton and \$5/ton in the two common use areas near the WSA.

An inventory conducted by BLM staff geologist Tim Carroll (personal communication, 1984) in 1980 determined that marketable slab pahoehoe on the Hell's Half Acre lava field, 70 mi east of the WSA, typically ranges from 0 to more than 5 tons/acre, and averages 1 ton/acre. Data from a 1979 competitive stone sale, the last available information, indicated mining costs of \$10 to \$20/ton, a shipping cost to Spokane, WA, of about \$20/ton, and a profit of about \$20/ton.

By comparison, the 1979-1980 mining cost for slab pahoehoe mined at Black Butte ranged from \$32 to \$35/ton with shipping costs of \$4/ton to Boise, ID, and \$20/ton to Bend, OR (Maley and Holland, 1981 p.38). The marketable Black Butte variety of slab pahoehoe ranges from 0 to 90 tons/acre (tons per acre). Parcels considered depleted by commercial operators still contain from 6 to 16 tons/acre in accessible areas; this is an indication of the lower economic limit for commercial operations.

Mining costs of material within the Raven's Eye WSA may be slightly higher than those at the Hell's Half Acre and Black Butte lava fields because the Raven's Eye slab pahoehoe reserves and resources are located with aa flows rather than pahoehoe flows. The large clinkerlike, scoriaceous masses of aa would make access into the flow, and slab removal, more difficult and time consuming.

Decorative Stone Resources

The USBM mineral survey of the Raven's Eye WSA identified slab pahoehoe suitable for decorative wall veneer in 8 parcels (A through H, fig. 2). Table 1 lists stone resources and contains other data pertinent to evaluation of those resources in the WSA. The WSA contains a total of about 40,000 tons of 1.5- to 4-in.-thick slab pahoehoe resources suitable for wall veneer. Two localities (fig. 2, C and D) contain a total of 13,000 tons of indicated reserves; the marketable stone in these areas

TABLE 1.-- Decorative stone resources in the Raven's Eye Wilderness
Study Area (10-57-10), 10
(see figure 2.)

Site No.	Area (acres)	Usability factor 1/ (%)	Average thickness (in.)	Apparent density (lb/ft ³)	Resource size 2/ (tons)	Frequency factor 3/ (tons/acre)	Coverage factor 4/ (ft ² /ton)
INDICATED RESERVES							
C	42	40-50	1.5-2	120	7,200	170	110
D	69	20	3-4	127	11,000	160	54
INDICATED SUBECONOMIC RESOURCES							
A	29	10	2-3	126 ^{5/}	1,700	57	76
B	19	10	2	130	900	47	92
E	10	10	2-3	129	590	59	74
F	12	10	2-3	126 ^{5/}	690	57	76
G	18	5	2	128	420	23	94
H	137	10-20	1.5-2	123	8,000	59	110
INFERRED SUBECONOMIC RESOURCES							
WSA	10,000	(estimate 1 ton/acre average)			10,000		
Total indicated reserves					18,000 tons		
Total indicated subeconomic resources					12,000 tons		
Inferred subeconomic resources					10,000 tons		
Total resources					40,000 tons		

1/ Estimated percentage of area containing slab pahoehoe suitable as a decorative stone veneer.

2/ Data may not add to totals because of independent rounding.

3/ Tons/acre of slab pahoehoe suitable as a decorative veneer.

4/ Area in square feet that a mason can cover with 1 ton of decorative veneer.

5/ Estimated.

ranges from 160 to 170 and averages 164 tons/acre. Approximately 12,000 tons of indicated, subeconomic slab pahoehoe resources occur in the remaining 6 parcels (fig. 2); the marketable stone in these areas ranges from 23 to 59 and averages 55 tons/acre, and the pahoehoe slabs range from 1.5 to 3 in. thick.

Field studies indicate that portions of the WSA containing slab pahoehoe, but not included in the parcels shown on figure 2, total approximately 10,000 acres with an average of 1 ton of slab pahoehoe per acre. A total of 10,000 tons of subeconomic resources are inferred within these areas.

Other Rock Commodities

One volcanic cinder occurrence, which contains approximately 140,000 tons of cinder, was identified within the WSA (fig. 2, no. 6). The cinder may be suitable for road metal, but it could not compete with the numerous larger deposits which are closer to current markets, and it has no apparent unique properties which would make it attractive for special uses.

Sand and gravel occurrences are common along the Little Wood River drainage; two common-borrow or sand-and-gravel pits are shown on figure 2, and numerous others are within a few miles of the WSA (Stroud and others, 1981). The sand and gravel excavated from the pits has been used locally for road metal. Most of the Little Wood River and its flood plain are north and west of the WSA, and the area studied contains less than 1,000 yd³ of sand and gravel, all of it along the Little Wood River drainage. While the included sand and gravel could be used in local road construction, it could not compete with the numerous larger deposits which are closer to current markets, and it has no apparent unique properties which would make it attractive for special uses.

Metallic Minerals

No metallic mineral resources were identified within the WSA. No placer claims have been filed for gold near the WSA; however, gold was seen in samples from the Little Wood River drainage. Six placer samples, taken adjacent to the western and northern boundaries (fig. 2), contained a subeconomic average of \$0.08/yd³ (per cubic yard), with values ranging from \$0.05 to \$0.18/yd³ (gold at \$300.00 per troy ounce). Placer operations require a grade of several dollars per cubic yard. No anomalous amounts of other heavy minerals were found. Stream channels containing placer gold may extend south from the Lava Creek mining district into the WSA, but would be buried by lava flows.

Geothermal Resources

There are two hot springs near Carey Lake, less than 1 mi north of the WSA. One of the springs is reported to produce 346 gal/min. of 124 °F water (Frederickson and Fernette, 1983, p. 23). The geochemical aquifer temperature may be as high as 176 °F (Mitchell and others, 1980).

APPRAISAL OF MINERAL RESOURCES

The WSA contains 18,000 tons of indicated reserves, and 12,000 tons of indicated and 10,000 tons of inferred, subeconomic resources of slab pahoehoe suitable for use as a decorative wall veneer. From evidence of hand-constructed jeep trails over portions of the WSA (fig. 2), it appears that much of the area is accessible. Development of individual parcels containing suitable stone would require jeep-trail construction.

Slab pahoehoe from the WSA would have a 1985 retail price of about \$125/ton. Estimated production and selling costs would be: \$35/ton mining cost; \$10 to \$25/ton shipping cost, depending on distance to market; and \$35/ton retail handling and markup. This would leave \$30 to \$35/ton for the mine operator. The mining cost and profit margin are primarily dependent upon the amount of marketable stone per area (table 1, usability factor). The surface areas of those parcels considered to be economic generally contain 20 percent or more marketable stone (greater than 100 tons/acre).

Decorative stone resources within the WSA will probably not attract commercial interest due to the difficult access and small size relative to other reserves elsewhere. Scattered throughout the remainder of the WSA are areas which contain a relatively low number of tons of suitable slab pahoehoe per acre and are considered subeconomic for large volume, commercial operations. The reserves and resources may be of interest to consumers who gather their own decorative stone to avoid wholesale and retail markup. The economic classifications given for slab pahoehoe, discussed previously, assume a continuing market of adequate volume.

The WSA contains an occurrence of 140,000 tons of volcanic cinders which may be suitable as a surfacing for local roads, but they cannot compete commercially with large deposits.

Six placer samples taken adjacent to the western and northern boundaries contained subeconomic amounts of gold; no anomalous concentrations of other heavy minerals were found in those samples. Additional work would be required to determine if lava-covered stream channels extend into the WSA and if they contain economic concentrations of gold.

The recency of volcanism and the presence of hot springs less than 1 mi northwest of the WSA indicate low temperature geothermal resources may be present; however, no surface manifestations were observed within the boundary of the WSA, and no geothermal or other energy resources were identified.

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APPENDIX--RESOURCE/RESERVE DEFINITIONS

(From U.S. Geological Survey Circular 931, 1980)

RESOURCE.--A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

MEASURED.--The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

INDICATED.--Quantity and grade and (or) quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough for continuity between points of observation to be assumed.

INFERRED.--Estimates are based on an assumed continuity beyond measured and (or) indicated resources for which there is geologic evidence. There may be no samples or measurements.

RESERVES.--That part of the reserve base which could be economically 1/ extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative. Reserves include only recoverable materials; thus, terms such as "extractable reserves" and "recoverable reserves" are redundant and are not a part of this classification system.

MARGINAL RESERVES.--That part of the reserve base which, at the time of determination, borders on being economically producible.

SUBECONOMIC RESOURCES.--The part of identified resources that does not meet the economic criteria 2/ of reserves and marginal reserves.

1/ In this report, reserves are expected to yield at least a 20 percent rate of return.

2/ In this report, subeconomic resources are expected to return at least 20 percent, but less than all production expenditures.