DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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MISCELLANEOUS FIELD STUDIES
MAP MF-1462-B
PAMPHLET ACCOMPANIES MAP

MAP A.-GEOLOGIC MAP SHOWING THE LOCATION OF RESOURCES AND SITES INVESTIGATED IN RESOURCE EVALUATION

SCALE 1:125 000
0 2 4 6 8 MILES
0 2 4 6 8 KILOMETERS

MINERAL RESOURCE POTENTIAL MAP OF THE GREAT RIFT INSTANT STUDY AREA, BLAINE, BUTTE, MINIDOKA, AND POWER COUNTIES, IDAHO

By

J. Ridenour and R. B. Stotelmeyer
U. S. Bureau of Mines
and
D. R. Mabey, M. A. Kuntz, D. E. Champion, R. H. Lefebvre, and W. D. Stanley
U. S. Geological Survey

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CORRELATION OF MAP UNITS

Qba, Qbb, Qbc, Qbd, Qbe, Qbf, Qbg, Qbh	Holocene, Pleistocene	QUATERNARY
Qs, Qbs		
pTu	Pre-Tertiary	MESOZOIC AND PALEOZOIC

DESCRIPTION OF MAP UNITS

Lava flows of the upper part of the Snake River Group--Craters of the Moon Kings Bowl, and Wapi lava fields

Qba BASALTIC PAHOEHOE, BLOCK, AND A'A LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD A (HOLOCENE-APPROXIMATE AGE 2,100-2,300 YRS B.P.)--Chiefly voluminous pahoehoe and lesser amounts of a'a lava flows erupted from fissure vents along the Great Rift in Craters of the Moon National Monument. Includes the Broken Top, Blue Dragon, North Crater, and Big Craters pahoehoe flows, and the Serrate, Devils Orchard, and Highway a'a and block flows. Includes voluminous, pahoehoe lava flows of the Wapi lava field and minor amounts of pahoehoe lava and spiny a'a flows of the Kings Bowl lava field

Qbb BASALTIC PAHOEHOE AND MINOR A'A LAVA FLOWS OF ERUPTIVE PERIOD B (HOLOCENE-APPROXIMATE AGE 3,500-4,900 YRS B.P.)--Consists of pahoehoe lava flows erupted chiefly from fissure vents at Vermillion Chasm and along the Great Rift for several miles northwest and southeast of Black Top Butte. Pahoehoe flows are typically shelly, slabby, and hummocky. Some flows appear dusty brown due to weathering of highly vesicular surfaces. Flows are particularly flows consisting largely of shelly pahoehoe. The fissures are paralled by numerous spatter and thin blankets of spatter and ash. Two vent areas at the Vermillion Chasm appear to have been lava lakes that underwent significant amounts of withdrawal of lava. The vent area for the Minidoka-Larkspur Park flow apparently shows only a small driblet spire which probably surmounts a larger, buried vent complex. The source vent for the Rangefire flows may have been Black Top Butte

Qbc BASALTIC A'A AND PAHOEHOE LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD C (HOLOCENE--APPROXIMATE AGE 5,800-6,200 YRS B.P.)--Unit consists of a later sequence of bulbous a'a lobes (Indian Wells north, Indian Wells south, and Sawtooth flows) with flow fronts as high as 80 ft (25 m), and an earlier sequence of a'a flows (Lava Creek, Lava (South Echo, Sheep Trail Butte, Pleasure Butte, and the Kimama flows). The a'a lobes are long flows, as much as 35 mi (55 km), with clinkery, jagged surfaces that contain monoliths of bedded cinders and spatter (fragments of a shattered cinder cone) as large as 300 ft (90 m) in longest dimension. Some a'a flows are covered by younger a'a and pahoehoe flows at their proximal ends, but flow directions and distribution of flows suggest that Big Cinder Butte cinder cone may be the source vent. The pahoehoe-a'a flows were erupted from fissure vents on the Great Rift that extend from Echo Crater southeast to Sheep Trail Butte. The flows are mainly pahoehoe lava near their source vents and change to a'a lava several miles along their length

Qbd BASALTIC A'A LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD D (HOLOCENE--APPROXIMATE AGE 6,600 YRS B.P.)--Unit consists of bulbous a'a lobes with flow fronts as high as 80 ft (25 m). The a'a lobes have jagged, clinkery surfaces and contain monoliths and blocks of bedded cinder and spatter (fragments of a shattered cinder cone) as large as 300 ft (90 m) in longest dimension. All a'a flows of this unit are covered by younger flows at their proximal ends, but distribution and flow directions of the flows suggest that many or all of them were erupted from Silent Cone cinder cone

Qbe BASALTIC PAHOEHOE AND A'A LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD E (HOLOCENE--APPROXIMATE AGE 7,300-7900 YRS B.P.)--Pahoehoe lava erupted from Grassy Cone cinder cone forms a long, narrow, composite flow (Grassy Cone and Laidlaw Lake flows) located between the main and western lobes of the Craters of the Moon lava field. Parts of the Grassy Cone and Laidlaw Lake flows consist of a'a lava, particularly where pahoehoe lava flowed over steep slopes. A thin blanket of volcanic ash covers the proximal parts of the Grassy Cone flow within several miles (kilometers) of Grassy Cone. The Lava Point a'a flow is a bulbous lobe with flow fronts as high as 80 ft (25 m)

Qbf BASALTIC PAHOEHOE LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD F (HOLOCENE-UPPER PLEISTOCENE, APPROXIMATE AGE 10,000-11,000 YRS B.P.)--Pahoehoe lava flows located along the southwest margin and in the central part (Pronghorn, and Bottleneck Lake flows) of the main lobe of the Craters of the Moon lava field; source vents(s) are unknown but are located on the Great Rift probably near the present site of Sheep Trail Butte. Pahoehoe flows located at the east margin of the Craters of the Moon lava field (Heifer Reservoir flows) are assigned to eruptive period F based on their radiocarbon age of about 10,600 yrs. The source vent for the Heifer Reservoir flows is on the Great Rift, probably near the present site of Crescent Butte

Qbg BASALTIC PAHOEHOE AND A'A LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD G (UPPER PLEISTOCENE, APPROXIMATE AGE 12,000-13,900 YRS B.P.)--Pahoehoe flows moved as much as 22 mi (35 km) east (Sunset) and as much as 35 mi (55 km) southwest (Carey) from a source vent at Sunset Cone cinder cone. The Sunset flow is covered by a thin sheet, <5 ft (2 m), of volcanic ash within 3 mi (5 km) east (downwind) of Sunset Cone. Before the eruption of the flows from Sunset Cone, a'a flows with jagged, blocky, clinkery surfaces erupted from 4 or more vents near Lava Creek in the southern Pioneer Mountains. The flows from the Lava Creek vents moved as much as 22 mi (35 km) east onto the Snake River Plain and about 2 mi (3 km) north in a tributary of Dry York Creek. Pyroclastic deposits of unknown thickness mantle vent areas

Qbh BASALTIC PAHOEHOE LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS OF ERUPTIVE PERIOD H (UPPER PLEISTOCENE--APPROXIMATE AGE ABOUT 15,000 YRS B.P.)--Pahoehoe lava flows are located along the southwestern (Kimama flows) and western margins (Bear Den Lake flows) of main lobe of the Craters of the Moon lava field; their source vents are unknown. Unit also includes isolated exposures of pahoehoe lava east of the Great Rift near The Watchman and Two Point Butte cinder cones; isolated exposures of pahoehoe lava with no known source vents are located on the south margin (Bruon flows) and on the east margin (baseline flows) of the main lobe of the Craters of the Moon lava field

Surficial deposits

Qs SURFICIAL DEPOSITS (LATE PLEISTOCENE)--Chiefly alluvial deposits along streams and colluvial deposits at the base of steep slopes. Thin deposits of eolian sand and silt are not mapped

Basalt flows of the lower part of the Snake River Group

Qbs BASALT LAVA FLOWS AND ASSOCIATED PYROCLASTIC DEPOSITS (PLEISTOCENE)--Chiefly pahoehoe lava flows, cinders, and ash, with minor amounts of a'a lava. Older units are covered by eolian deposits as much as 5 ft (2-3 m) thick. Younger flows have fresh, glassy surfaces and thin, <3 ft (1 m), localized mantles of eolian sediment. Pyroclastic deposits occur mainly near vents

pTu PRE-TERTIARY ROCKS OF THE PIONEER MOUNTAINS, MESOZOIC AND PALEOZOIC SEDIMENTARY AND IGNEOUS ROCKS, UNDIVIDED

Field mapping by D.E.Champion (1971-75, 1977-79), H.R.Covington (1976-77), M.A.Kuntz (1977-79), R.H.Lefebvre (1974-79) and L.A.McBroome (1978-79)

CONTACT--Dashed where approximately located, particularly between lava flows that are veneered by thin deposits of windblown sand and loess. Letters Y and O used to denote younger and older flows along contact. Dash-dot contact between flows of same map unit and between units erupted from the same vent

FLOW LINE--Linear flow features and lava tubes; arrow shows flow direction. Open circles on flow lines are locations of skylights in lava tubes

LAVA CHANNEL--Arrow shows direction of flow within lava channel

CRATER--Outline of crater rim on volcanic vent, hachures point toward central depression. Barbs not shown on smaller craters

CINDER CONE--Vent for small lava cones, cinder cones, and spatter cones

ERUPTIVE FISSURE--Fracture in rock through which lava erupted, generally bordered by spatter ramparts

ROOTLESS VENTS--Secondary source of lava not directly related to conduits that brought magma to the surface from deep magma reservoir; chiefly openings in lava tubes

LAVA POND--Lavaes surrounding lava pond shown by hachured line

NONERUPTIVE FISSURES--Fractures in rock through which lava has not erupted. Width generally less than 3 ft (1 m)

FAULT--Ball and bar on downthrown side; dashed where inferred or concealed

DECORATIVE BUILDING STONE SITE

GEOTHERMAL SITE

VOLCANIC CINDER SITE

SAND AND GRAVEL PIT

CINDER PIT

STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey to conduct mineral surveys on certain areas to determine the mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geologic and geophysical survey of the Great Rift Instant Study Area (33-1), Blaine, Butte, Minidoka, and Power Counties, Idaho.

SUMMARY STATEMENT

Aeromagnetic, gravity, and magnetotelluric investigations of the young lava fields provide basic data on the nature of the crust beneath the young lava flows, and provided aid for an assessment of potential resources. Magnetic anomalies in the area are complex and result from both strongly magnetized surface and near-surface lava flows and magnetic rocks underlying the flows. The magnetic data suggest that a deeply buried intrusive body underlies the study area. Gravity anomalies are related to variations in the thickness of Cenozoic volcanic rocks and possibly to the inferred intrusive body. Magnetotelluric studies have provided data for interpreting the structure and possible rock types in the upper 6 mi (10 km) of the crust.

No mining districts exist in either the northern or southern parts of the Great Rift Instant Study Area. No mining claims have been filed in the northern part of the study area, but a group of eight claims, presumably for building stone, was located at Pillar Butte in 1980.

Identified resources in the study area are confined mainly to decorative building stone and volcanic cinders (figs. 2 and 3). Decorative building stone consists chiefly of slabs of pahoehoe lava, 1-4 in. (2.5-10 cm) thick, that occur at the margins of flows and flow units, near vent rims, and in squeeze-ups. Resources of building stone in the northern part of the study area are about 5,500 tons (5400 t), and 10,000 tons (9100 t) are inferred. Inferred surface resources of useable building stone in the southern part of the study area may approach a half million tons. Volcanic cinders for use as road metal, fill, and so on, are found in cinder cones along the Great Rift, mainly in the northern part of the study area.

Speculative resources of geothermal water, surficeous gravel, uranciferous silt, and hypothetical reservoirs of oil and gas that may lie within and beneath the basaltic lava flows of the study area may be inferred on the basis of occurrences largely outside the study area. Locating such resources would require extensive geophysical exploration and drilling.

INTRODUCTION

The Great Rift Instant Study Area is located in the Snake River Plain of south-central Idaho. The Snake River Plain is an area of geologically young (Pliocene, Pleistocene, Holocene) basaltic volcanism. The Great Rift Instant Study Area consists of two parts. The northern part comprises 287,800 acres (1,163 km²) partly surrounding the Craters of the Moon National Monument and encompassing a large part of the Craters of the Moon lava field (fig. 1). The southern part of the study area comprises 66,600 acres (150 km²) encompassing most of the Wapi lava field (fig. 1).

Lava flows in both parts of the study area are mostly fresh, glassy-surfaced pahoehoe, but a'a flows and cinders at and near vents are present locally. The flows are so young that they are nearly free of soil and vegetation. The flows were derived from eruptive fissures and fissure-controlled cinder cones along the Great Rift. The Great Rift is a 55-mi-long (83 km), 1-5-mi-wide (2-8 km) belt of cinder cones and eruptive and noneruptive fissures that extends from the southern Pioneer Mountains on the northern margin of the Snake River Plain, southeastward through the Craters of the Moon National Monument, to Pillar Butte near the southern margin of the Snake River Plain. The younger flows of the study area lie on older flows that are more weathered and typically covered with a variable thickness of eollan sand and alluvial sediments (Kuntz and others, 1983).

GEOLOGY

Three latest Pleistocene and Holocene lava fields are silled along the Great Rift. The Craters of the Moon lava field is a composite of more than 40 flows that were erupted from more than 25 cinder cones and eight eruptive fissures. Most of the vents for the Craters of the Moon lava field are located in the Craters of the Moon National Monument. But some of the vents extend into the northern part of the study area. The Kings Bowl lava field is a part of the Craters of the Moon lava field cover about 385,000 acres (about 1,560 km²). The Craters of the Moon flows were emplaced during eight eruptive periods. The first period began about 15,000 years ago, and the last eruptive period took place about 2,100 years ago. The northern part of the study area includes most of the area covered by lava flows of the Craters of the Moon lava field that extend west, south, and east of Craters of the Moon National Monument (Kuntz and others, 1983).

The Wapi lava field is a broad shield volcano with a vent complex at Pillar Butte. It covers an area of about 86,800 acres (350 km²). Radiocarbon and paleomagnetic data suggest that the entire lava field was emplaced in a single eruptive period that lasted several months to several years and occurred about 2,200 years ago. The southern part of the study area encompasses nearly all of the Wapi lava field (Kuntz and others, 1983).

The Kings Bowl lava field is a small (815 acres, 3.37 km²) accumulation of pahoehoe lava flows that lie along the Great Rift several miles north of the northern part of the Wapi lava field. The Kings Bowl lava field was probably formed simultaneously with the Wapi lava field about 2,200 years ago. The Kings Bowl lava field is the site of a commercial public attraction, Crystal Ice Cave, and it is not included in the study area (Kuntz and others, 1983).

GEOPHYSICS

Gravity, magnetic, and magnetotelluric methods have been employed to infer the structure and type of rocks that underlie the lava flows at the surface in the study area. An aeromagnetic investigation shows that magnetic anomalies are very complex in the study area and reflect 3 main factors: (1) local surface relief, (2) direction of magnetization, and (3) thickness and depth of sequence of flows with normal and reverse magnetization. A prominent magnetic anomaly that reflects a deeply buried source is a magnetic high in the area of the Craters of the Moon National Monument. Analysis of the anomaly by multibody inversion analysis (Bhattacharyya, 1980) indicates that the primary source of the anomaly is a highly magnetized body of rock with a top 0.6-2.2 mi (1-3.5 km) below sea level and a base 6.5-7.1 mi (10.5-11.5 km) below sea level. The magnetic data suggest that the anomaly-producing body is a deep-seated intrusive. Inversion of the magnetic data show that the base of the magnetized crust lies about 6 mi (9 km) below sea level north of the study area and about 13 mi (21 km) below sea level a few miles south of the study area. The base of the magnetized crust may coincide with the Curie-point isotherm. Thus the magnetized crust may reflect anomalously high crustal temperatures in the northern part of the study area.

A low gravity trend extends across the Snake River Plain from Craters of the Moon National Monument to American Falls Reservoir. The axis of the gravity low is roughly coincident with the magnetic high and the Great Rift in the northern part of the study area.

Streams draining the lava Creek mining district, adjoining the north end of the Craters of the Moon National Monument, have been worked for placer gold. During the Pleistocene and prior to the eruption of the flows of the Craters of the Moon lava field, these streams may have been competent to transport significant amounts of auriferous gravel into the northern part of the study area, about 1 mi (1.6 km) from the foothills.

Lenses of radioactive silt and sand have been intersected by wells drilled at the Idaho National Engineering laboratory (Walker, 1964). However, radioactive monitoring of these wells failed to disclose uranium.

Wapi lava field

The southern part of the study area contains no known mining districts. Bonanza Bar, with gold placers, lies approximately 6 mi (10 km) southeast of the southern tip of the Wapi lava field. In 1980, after the field work was completed, a group of eight claims was located on Pillar Butte, presumably for building stone. Decorative building stone has been removed from several sites within and adjacent to the study area. Four areas (fig. 3, map A), representing approximately 16 percent of the Wapi lava field, were investigated by aerial reconnaissance, aerial color photographs, and on foot. Those areas contain approximately 91,000 tons (83,000 t) of indicated and classified as identified (measured, indicated, and inferred), and undiscovered (speculative and hypothetical), reflecting decreasing degrees of geological assurance (U.S. Geological Survey, 1980).

Identified resources in the study area are confined mainly to decorative building stone and volcanic cinders. The following criteria used to evaluate decorative stone potential were developed by examining a site near Black Butte, near Shoshone, Idaho, where similar material is currently being extracted. Usable pieces of decorative stone must be a minimum of 1 in. (2.5 cm) thick and can be as thick as 4 in. (10 cm), although a desirable thickness would probably be 2 to 3 in. (5 to 7.5 cm). These pieces should be at least 1 ft² (0.09 m²) in surface area and be flat to gently curved. Preferably four sides would form pahoehoe flows. The degree of surface roughness ranges from low-relief-filamented (<1/4 in., <0.5 cm) to medium-relief-filamented (<1/2 in., <1.5 cm) (Champion, 1973). Desirability criteria, such as type of texture, color, and presence or absence of lichens, which would lead to selection of one place over others, are more difficult to evaluate without a detailed market study and are not considered in the overall resource estimates. However, some of the observed decorative stone sites contain material whose surficial features are unique, possibly enhancing desirability and marketability. Resources are based on surface material only, although this does not rule out the eventual use of material from underlying layers (where present) or fragments smaller or thinner than the dimensions stated above.

Because of the wide range in observed bulk densities of the pahoehoe (18.4-18 lb/ft³ to 217.4 lb/ft³, 1.9 g/cm³ to 3.5 g/cm³), tonnages represent an average of observed and inferred material in place. Slab pahoehoe, suitable for use as decorative building stone, was observed: (1) at the margins of flows and flow units, (2) in the vicinity of vent rims, and (3) in squeeze ups. This material is more prevalent in the Wapi lava field.

Volcanic cinders, prevalent in the Craters of the Moon lava field, occur on low cinder cones within the lava field but especially along the Great Rift. This material has a variety of uses so that the various

Craters of the Moon Lava Field

No known mining claims occur within the Craters of the Moon lava field, but sand and gravel and volcanic cinders have been removed from two sites adjacent to the eastern boundary of the lava field (fig. 2, map A). A pit, about 200 ft (60 m) in diameter and 50 ft (15 m) deep, was excavated in a small cinder cone near Huddles Hole Road (NE1/4 SE1/4 sec. 27, T. 2 N., R. 26 E., map A); the material was used locally as road metal. Sand and gravel have been removed from a small pit near Pratt Lake (NE1/4 NE1/4 sec. 24, T. 1 S., R. 27 E., fig. 2, map A).

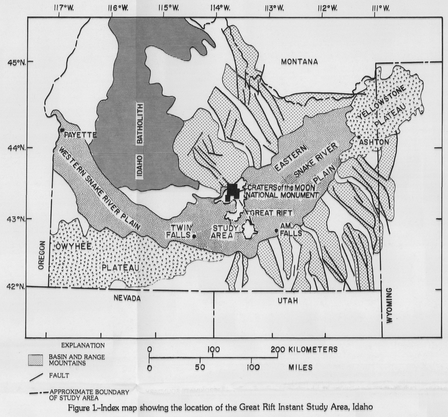

Figure 1.-Index map showing the location of the Great Rift Instant Study Area, Idaho

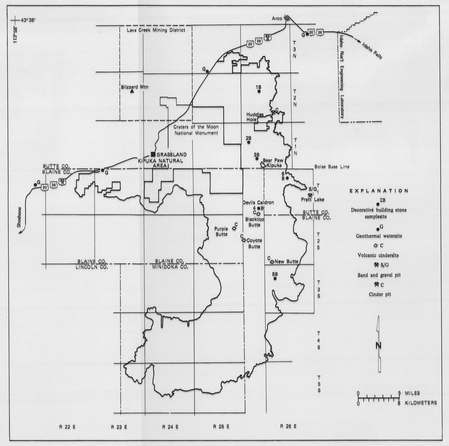

Figure 2.-Mineral resource potential map showing the location of resources in the northern part of the Great Rift Instant Study Area, Idaho

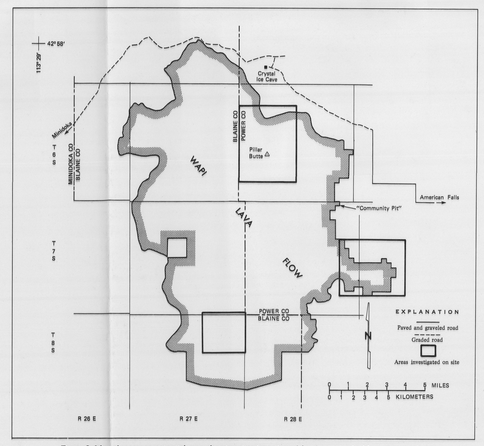

Figure 3.-Mineral resource potential map showing sites investigated for decorative building stone in the southern part of the Great Rift Instant Study Area, Idaho

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