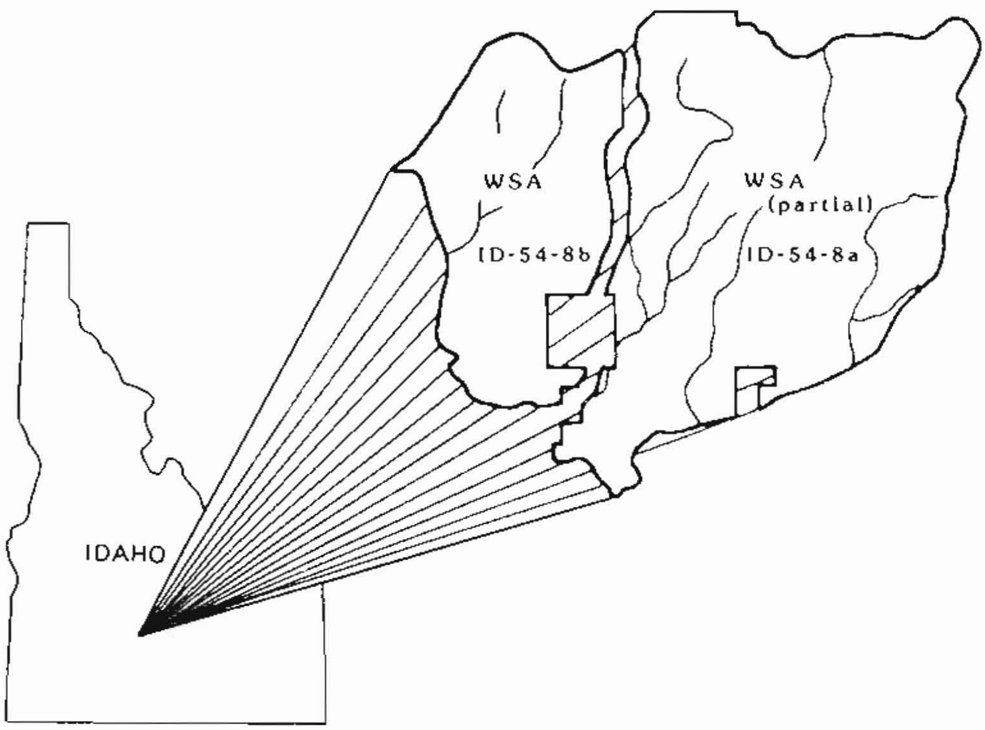
MLA 46-85

Bureau of Mines Mineral LandAssessment/1985
Open File Report

Mineral Resources of the Gooding City of Rocks Study Areas, Gooding County, Idaho



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE GOODING CITY OF ROCKS STUDY AREAS, GOODING COUNTY, IDAHO

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UNITED STATES DEPARTMENT OF THE INTERIOR
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PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, 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 designated as Wilderness Study Areas". . . 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 Gooding City of Rocks Wilderness Study Area ID-54-8a and a portion of ID-54-86b, Gooding County, ID.

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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LIST OF UNIT OF MEASURE ABBREVIATIONS

o	degree
oC	degree Celcius
oF	degree Fahrenheit
day/year	day per year
$/yd^3	dollar per cubic yard
$/ton	dollar per ton
ft	foot
in.	inch
in./year	inch per year
mg	milligram
oz/ton	ounce per ton
%	percent
lb/ft^3	pound per cubic foot
mi^2	square mile
ton/day	ton per day
ton/year	ton per year
ohm/cm	ohm per centimeter

SUMMARY

A mineral survey of 19,350 acres of the Gooding City of Rocks Wilderness Study Areas (WSAs) in the north-central Snake River Plain was conducted by the U.S. Bureau of Mines in 1984. No formal mining districts are known in or near the study area.

Forty-two placer claims within and adjacent to the study areas cover the Clover Creek diatomite deposit. Minor production from four pits was reported by the owners. The diatomaceous sediments are underlain by dacitic welded tuff and capped with basalt. Five exposures or blocks totaling 416 million tons of the diatomaceous material comprise the Clover Creek deposit; four of the blocks are in the study areas, but are predominantly covered by basalt. The North Clover block, just west of the areas, is only partially capped, and could be mined by open pit methods on the western flank of the exposure. The minable wedge contains an inferred marginal reserve of 35 million tons of diatomite possibly suitable for filter aid, filler, insulation, and other applications. At a production rate of 150,000 tons/year, total mining and milling costs for high-grade filter aid diatomite would be about $100/ton. The deposit is classed as marginal because products from this deposit may be inferior to currently marketed diatomite products. The market is well supplied by developed sources.

Several occurrences of platy welded tuff, possibly suitable as decorative stone, are in the areas; however, abundant deposits to the east could be more easily developed. Deposits of sand and gravel are too distant from markets.

Minor gold was detected in a small prospect to the northeast of the study areas. The prospect area may be associated with an ancient hot springs system as suggested by the occurrence of gold, reed molds in opalized volcanic breccia, and scattered silicification.

Existing hot springs and wells north and south of the areas indicate favorable environments for low-temperature geothermal resources; however, no surface manifestations are present within the study areas. No geologic structures favorable for oil and gas are known in the vicinity.

INTRODUCTION

A mineral survey of the major portions of the Gooding City of Rocks Wilderness Study Areas (WSAs) was conducted by the U.S. Bureau of Mines (USBM) and the U.S. Geological Survey (USGS) at the request of the U.S. Bureau of Land Management (BLM). The USBM researched the mining and mineral exploration history and evaluated mines, prospects, and mineralized areas within or adjacent to the study areas. The USGS evaluated the gross mineral potential of the areas by regional geochemical and geophysical surveys and geological mapping. Results of the investigations will be summarized in a joint report used to help determine the suitability of the areas for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective of the USBM surveys is to insure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The Gooding City of Rocks study areas cover 19,350 acres in the southeast portion of Mount Bennett Hills, in Gooding County, ID (fig. 1). The two areas are separated by a several-mile-long, north-trending, 4-wheel-drive bulldozer road that connects Hole-in-the-Wall on the south with Bowman Flat on the north. The eastern study area consists of 13,063 acres of the 14,743-acre WSA (ID-54-8a), and the western area (WSA ID-54-8b) consists of 6,287 acres. (Hereafter, the study areas are referred to as WSAs.) The nearest town is Gooding, the county seat, approximately 15 miles by road to the south. Unimproved roads lie near or along three sides of the WSAs. These roads are best reached from State Route 46, five miles to the east.

The highest elevation is 5,615 ft in the northwest portion of the western WSA (fig. 2), and the low point is 4,000 ft on Clover Creek. The study area is dissected by deeply incised, south-flowing streams creating near-vertical canyon walls. The Gooding City of Rocks, an area of extensive erosion in the southeast portion of the eastern WSA, is a popular tourist attraction (Goar, 1978).

The climate is semiarid. Precipitation averages about 10 in./year; more than half occurs as winter snowfall. Access into the general area is limited to those times when roads are dry or frozen. Flora consist predominantly of sagebrush and various grasses; trees sparsely populate some drainages.

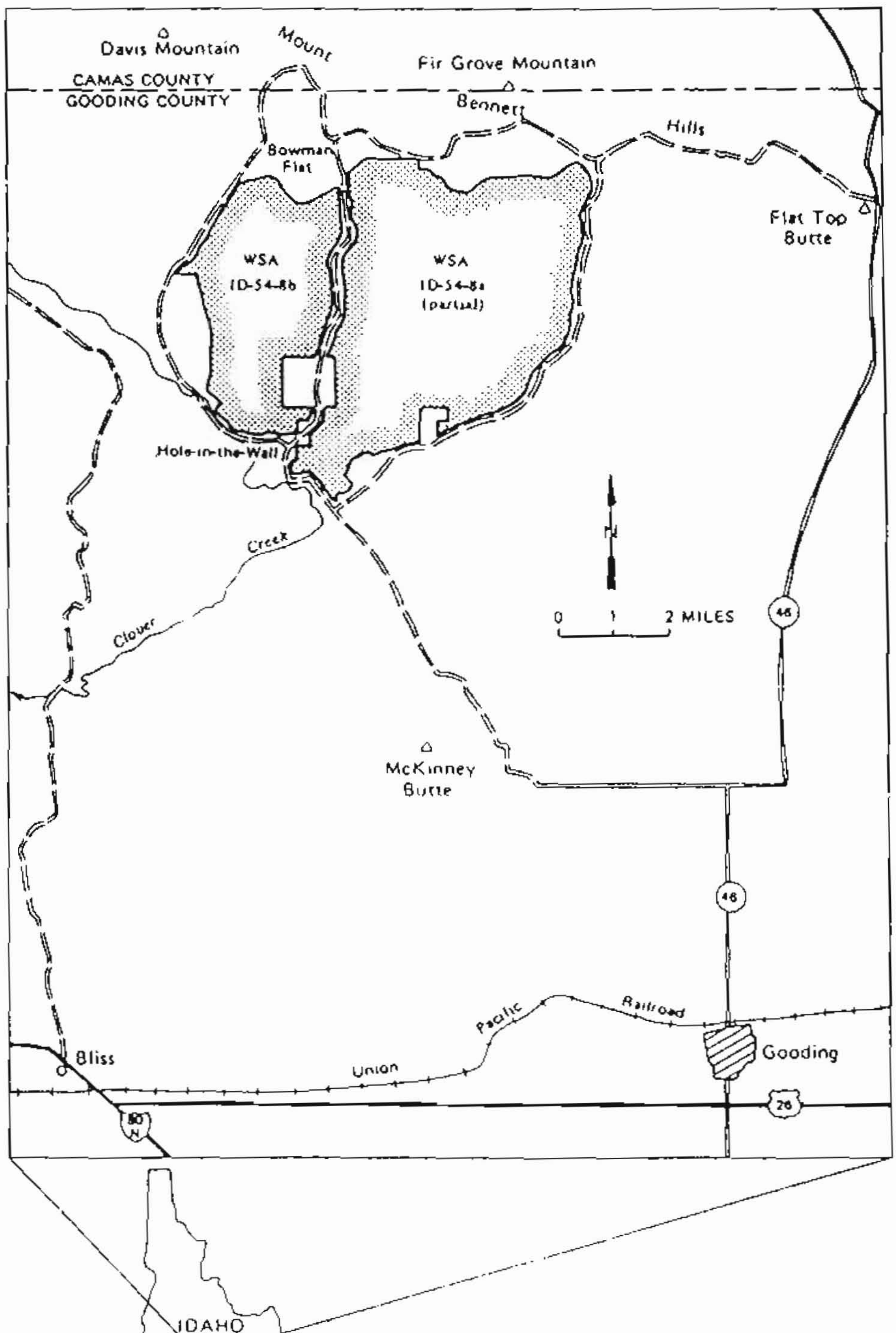

FIGURE 1. – Location map of the Gooding City of Rocks study areas, ID

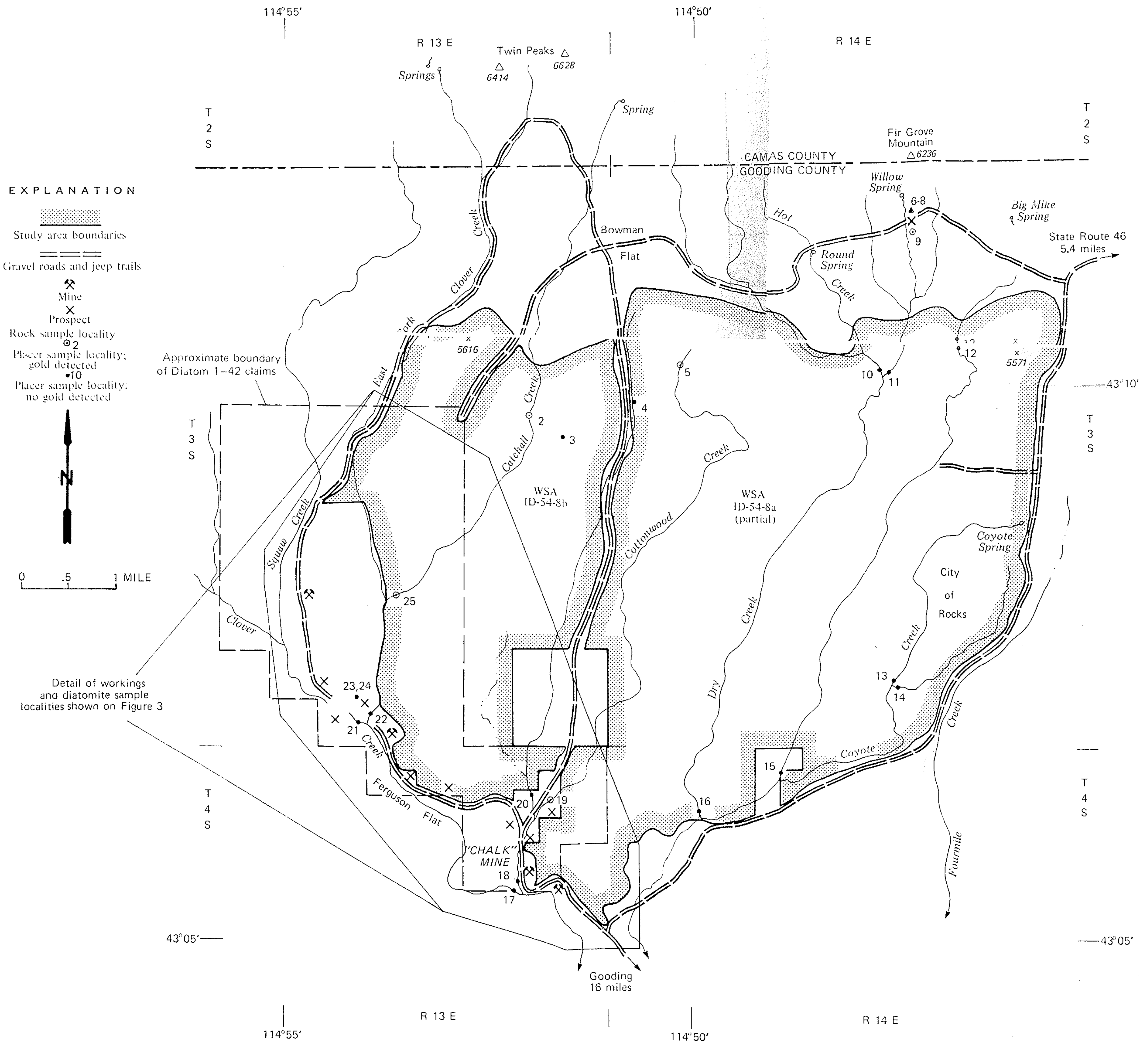

FIGURE 2. – Mines, prospects, and sample localities in the Gooding City of Rocks study areas

Previous Studies

Stearns and others (1938) conducted the first major study of the geology and mineral resources of the Snake River Plain. Malde and Powers (1962) described the Upper Cenozoic stratigraphy, and Malde and others (1963) published a reconnaissance geologic map of the west central Snake River Plain. Smith's (1966) thesis describes the geology of eastern Mount Bennett Hills. Rember and Bennett (1979) published a geologic map of the Hailey 2° quadrangle. Fernette (1983) reported on the geology, energy, and mineral (GEM) resources of the Mt. Bennett Hills area, and Rishel and Dee (1984) studied the Clover Creek diatomite deposit.

Present Study

Work by the USBM, Western Field Operations Center (WFOC), Spokane, WA, entailed pre-field, field, and report preparation phases during the years 1984 and 1985. Pre-field studies included library research and perusal of Gooding County and BLM mining and mineral lease records. Bureau of Mines, State, and other production records were searched and pertinent data compiled. Claim owners were contacted for permission to examine properties and publish the results. On two occassions they accompanied the author to the property.

Frederic L. Kadey, Jr., an acknowledged expert in the evaluation of diatomite deposits, was consulted about the Clover Creek deposit and accompanied the author on a one day visit to the field. Field studies involved searches for all mines, prospects, and claims indicated by pre-field studies to be within the study area. Those found were mapped and sampled. Claims outside, but near the WSAs, also were studied to determine whether mineralized zones might extend into the areas. Both ground and air reconnaissance were used to identify significant geologic structures and zones of alteration related to mineral deposits.

Samples collected by USBM personnel at mines and prospects included 83 of diatomite, 2 of rock, and 1 of alluvium from a dump. In addition, 8 other samples were taken of country rock for chemical analysis, 21 were taken of sand and gravel to examine for placer gold, 7 samples were taken for petrographic analysis, and 5 samples were taken for density determination. Rock samples were of five types : 1) chip - a regular series of rock chips taken in a continuous line across a mineralized zone or other exposure; 2) random chip - an unsystematic series of chips taken from an exposure of apparently homogeneous rock; 3) grab - rock pieces taken unsystematically from a dump, or of float (loose rock lying on the ground); 4) select - pieces of rock chosen, generally, from the apparently best mineralized parts of an exposure or of any particular fraction (e.g. quartz, host rock); and 5) point - a representative volume taken from an exposure of apparently homogeneous material. Diatomite samples were of two types - chip and point. Placer samples were reconnaissance samples from stream-laid sand and gravel. Ten-quart volumes were collected at each site.

Most diatomite samples were microscopically examined by USBM staff at WFOC for diatom presence and condition. Suitable samples were submitted to the Manville Service Corporation Research and Development Center (Manville) in Denver, CO, for microscopic examination and determination of crude and ignited color and condition, moisture content, and ignition loss. More detailed characterization studies were conducted by Manville on four of the best diatomite samples. Chemical analysis for 9 major oxides 1/ were conducted by the USBM Reno Research Center on 55 of the diatomite samples.

Non-diatomite rock samples, except those collected for petrographic and density testing, were crushed, pulverized, thoroughly mixed, split, and then checked for fluoresence and radioactivity at WFOC. Gold and silver for 13 samples were determined by fire assay followed by inductively coupled plasma analysis (ICP). Other requested metals were determined by ICP. Some rock samples were analyzed for 40 2/ elements by the semi-quantitative spectrographic method to detect unsuspected elements of possible significance. Placer samples, partially concentrated in the field, were further concentrated on a laboratory-sized Wilfley table at WFOC. Resulting heavy mineral fractions were scanned with a binocular microscope to determine heavy mineral content. When gold was detected, larger particles were hand-picked, fine gold was recovered by amalgamation, and then both fractions were weighed. Concentrates were also checked for radioactivity and fluorescence.

ACKNOWLEDGEMENTS

The author was ably assisted in the field by Richard Winters, Steven Robinson, and David Brink. Larry Dee, BLM geologist, Shoshone District, provided aerial photographs, historical information, and logistical support. Edward and Leroy Strout accompanied the author to the diatomite deposit and provided important production data. The author is indebted to Frederic L. Kadey, Jr., who visited the deposit and instructed several USBM employees in the identification and evaluation of diatomite.

1/ Silica (SiO_2), alumina (Al_2O_3), ferric oxide (Fe_2O_3), titania (TiO_2), phosphorus pentoxide (P_2O_5), lime (CaO), magnesia (MgO), sodium oxide (Na_2O), potassium oxide (K_2O).

2/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lathanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.

GEOLOGIC SETTING

The Gooding City of Rocks WSAs are in the southeast portion of an east-trending, uplifted, extensively faulted and eroded core of a southeasterly-tilted horst (Smith, 1966, p. 98). The study area lies in the Columbia-Snake River Plateau geomorphic province (Hunt, 1974, p. 538) and is underlain by the Lower Pliocene Idavada Volcanics and the Middle Pliocene Banbury Basalt. Malde and Powers (1962, p. 1200) define the Idavada Formation as many layers of nonmineralized, silicic, volcanic rocks, predominantly welded ash flows, that include some bedded vitric tuffs and lava flows which uncomformably overlie granite and older rhyolite. Smith (1966, p. 10) reports an average collective thickness of about 1,500 ft in ten mappable units. Within the WSAs, the dominant unit is the Gooding City of Rocks Tuff, a flow-structured ignimbrite of dacitic welded tuff with an average thickness of 175 ft (Smith, 1966, p. 55 and 122). It is the erosion of this unit into rounded vertical columns that produces the spectacular City of Rocks. Hyalite opal encrustations and chalcedony fracture-fillings are commonly observed in the Idavada rocks.

The Idavada Volcanics are unconformably overlain, in part, by the Banbury Basalt. The upper section is composed mainly of olivine basalt in columnar lava flows (Malde and Powers, 1962, p. 1204) found to range from 15 to 100 ft in thickness. The middle section of the Banbury is composed of sedimentary deposits; locally these are characterized by thick beds of diatomacous sediments, discussed in detail in this report. The basal or lower section was not identified in the study area.

Active drainages in the WSAs contain thin deposits of sand and gravel. Several slump blocks in and near the WSAs are associated with zones of weakness in over-steepened slopes of diatomaceous sediments.

MINES, PROSPECTS, AND MINERAL RESOURCES

Mining History

Thomas Conaway and family settled the north end of Ferguson Flat in 1910 and, with George Chaffin and others, located the Bank Bar Nos. 1-3, the first recorded placer claims, on diatomite in sec. 34, T. 3 S., R. 13 E. Numerous subsequent placer claims, including the Crown Point Placer Group in 1918 by Rockhills, Chaffin, and others, the Zeolite Group in 1926 by Chaffin and others, the Snowdrift Group in the mid-1930's by Becker, Chaffin, and others, and many real estate exchanges were made by various parties through the 1970's.

Production

From 1973 through 1984, total domestic production of diatomite ranged from a low of 573,000 tons in 1975 to a high of 717,000 tons in 1979. Four states - California, Nevada, Washington, and Oregon (in order of production) - account for all output. More than half is from the marine deposits in southern California. Since 1978, 23% to 25% of domestically produced diatomite has been exported, while imports, mostly from Mexico, have been negligible. U.S. production from 1978 through 1981 ranged from 40% to 43% of world output, and in 1982 and 1983 it was 37% of world output (Meisinger, 1982, p. 309-310; 1984, p. 321-322; Kadey, 1983, p. 697).

Applications

Uses for diatomite are extremely varied. The widest use for processed diatomite is as a filter aid for the separation of suspended solids from fluids. Filtration applications include beer and wine, sugar, dry cleaning, swimming pool waters, fruit juices, and organic and inorganic chemicals (Robertson, 1960, p. 15; Benton, 1983, p. 1). Of 1983 domestic production, 66% was sold as a filter aid and 21% was sold as a filler or extender, the second largest use (Meisinger, 1984, p. 322). Fillers may be used as bulk mineral fillers or as functional fillers. Benton (1983, p. 1) notes:

> "Paint, plastics and paper are some of the major markets. Diatomite is used in paint as a low cost pigment extender and as a flatting agent. In plastics, it is used as an anti-blocking agent for film. In paper, diatomite is used as a lightweight bulking agent, a drainage aid and as a low cost opacity builder."

Manville Corp. at Lompoc, CA, produces 12 different diatomite filter-aid products, each designed to meet a specific filtration requirement. In addition, 11 natural, 6 calcined, and 17 flux-calcined diatomite filler products are sold. Diatomite applications requiring minimal processing are varied, but limited by amount of demand. Three percent of the 1983 domestic production went for use as insulation, while the remaining 10% went for such diverse uses as absorbants, silica additives to cement, abrasives (polishing compounds), catalysts, lightweight aggregates for soil conditioners, and as chemical carriers. Although there are a great number of product types and a variety of applications, Kadey (1983, p. 697) notes that the probability of economic success for a potential deposit is seriously reduced if it cannot be processed into one or more filter-aid products.