STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

GEOLOGY AND MINERAL RESOURCES MAP OF THE GRAVEYARD POINT QUADRANGLE, MALHEUR COUNTY, OREGON, AND OWYHEE COUNTY, IDAHO

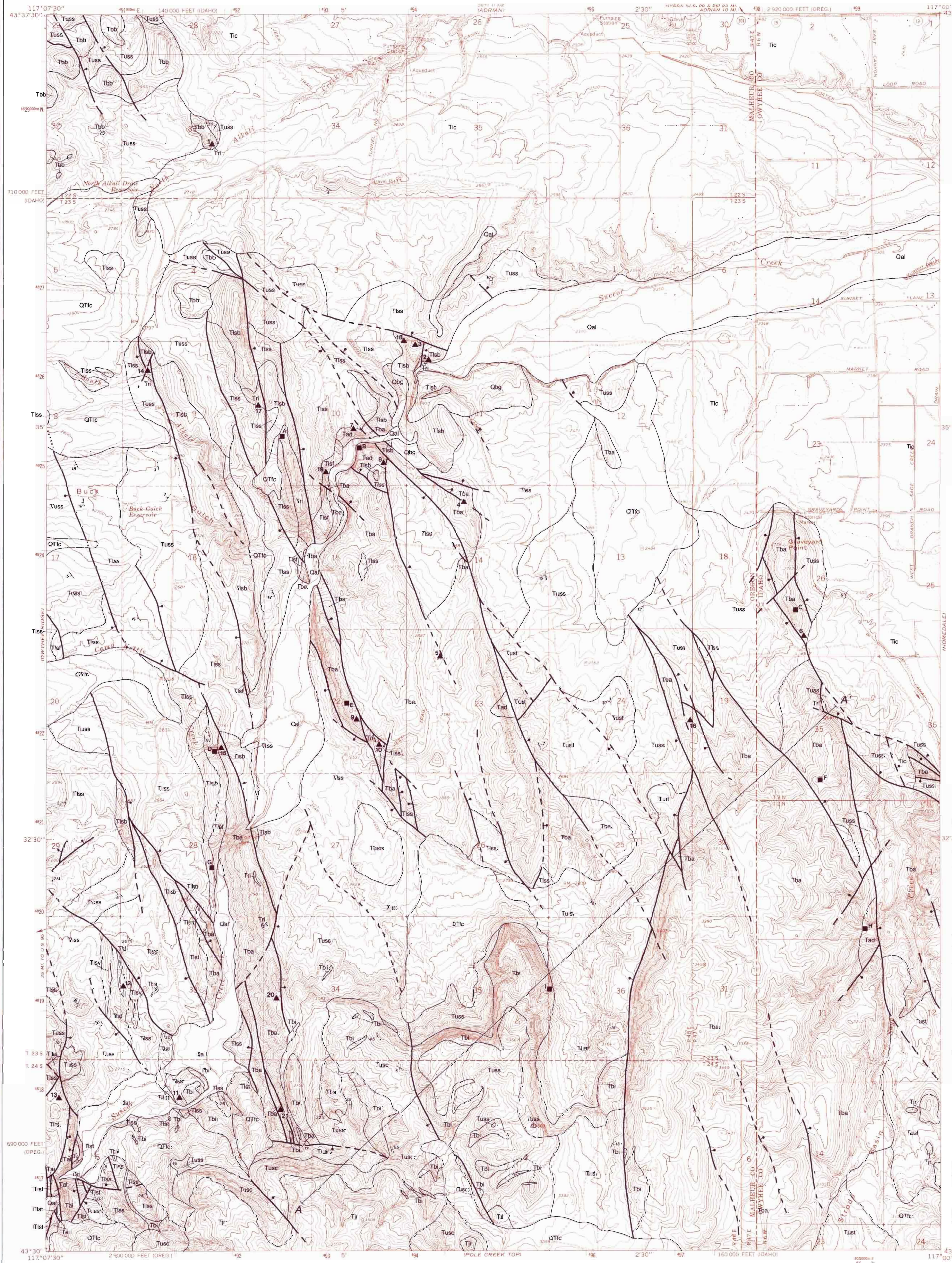
1989

GMS-54

Geology and Mineral Resources Map
of the Graveyard Point Quadrangle,
Malheur County, Oregon, and Owyhee County, Idaho

By M.L. Ferns

Funded in part by the U.S. Geological Survey (COGEOMAP)

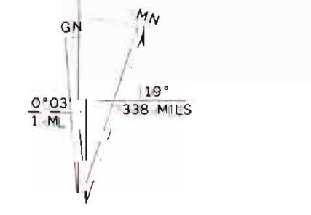


Base map by U.S. Geological Survey

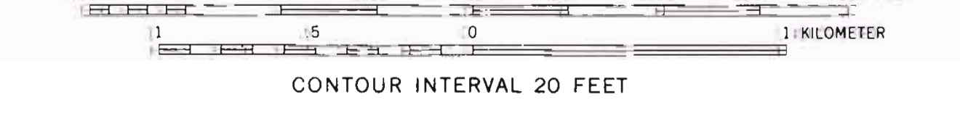
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1966 and 1967. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grids based on Oregon coordinate system, south zone, and Idaho coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11
To place on the predicted North American Datum 1983, move the projection lines 16 meters north and 79 meters east as shown by dashed corner ticks



UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



CONTOUR INTERVAL 20 FEET

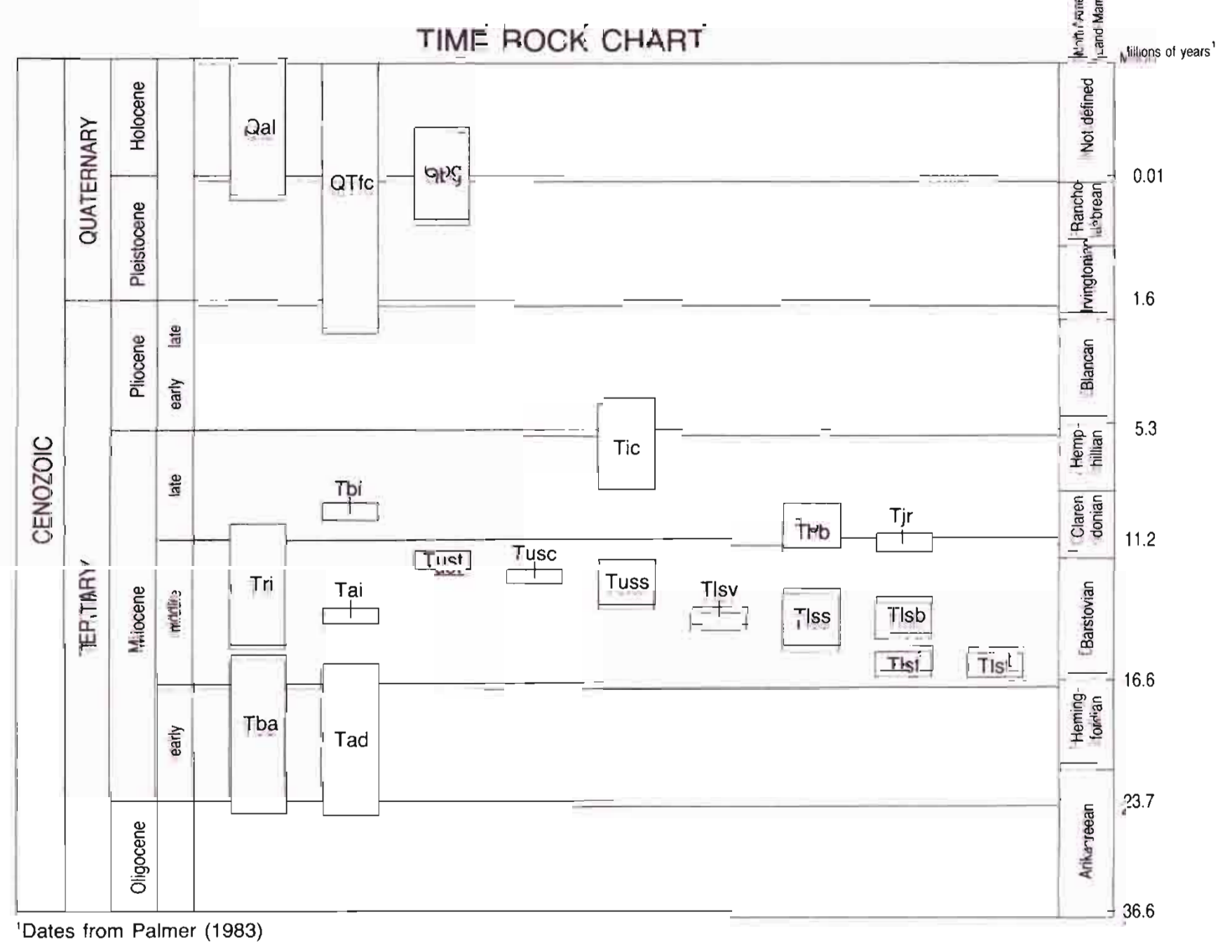
QUADRANGLE LOCATION

Geology by Mark L. Ferns,
Oregon Department of Geology and Mineral Industries

Field work conducted in 1987-88

Prepared in cooperation with the U.S. Geological Survey and the Idaho Geological Survey as part of the COGEOMAP program.

Map reviewed by Scott Minor, U.S. Geological Survey; Glen Teague, Teague Mineral Products; and Spencer Wood, Boise State University.



[1] Dates from Palmer (1983)

EXPLANATION

Qal	**Alluvium (Holocene and Pleistocene)** — Unconsolidated and generally poorly sorted deposits of gravels, sands, and silts accumulated along modern stream flood plains. Includes small, somewhat older bench and terrace gravels along Succor Creek
Qbg	**Bench gravels (Holocene and Pleistocene)** — Unconsolidated and unsorted accumulations of gravel, sand, and silt deposited above existing flood plains
QTfc	**Colluvial and alluvial fan deposits (Pliocene? to Holocene)** — Mainly alluvial fan and slope deposits consisting of unconsolidated coarse gravels and silts deposited by periodic flash floods debouching along the broad plain west of Succor Creek. Colluvial deposits include scree and talus along slopes of ridges and scattered accumulations of windblown silt and sand on the tops of benches and ridges and in the broad valleys. Previously mapped as part of the Chalk Hills Formation (Corcoran and others, 1962) where the depositional surface has been dissected by modern streams. Includes bench and lag gravels and landslide debris
Tic	**Tuffaceous sedimentary rocks (upper Miocene and Pliocene)** — Mainly lacustrine deposits of poorly consolidated light-gray to grayish-white, fine-grained, tuffaceous sandstones, siltstones, and mudstones. Includes thin beds of diatomaceous siltstone and tuff. Also includes an areally restricted accumulation of orangish-brown palagonite breccias (maar related?) along the canal road east of Graveyard Point in sec. 26, T. 3 N., R. 6 W. The unit forms a gently eastward-dipping surface mantled by a deep silty soil. Correlative with lacustrine units in the upper part of the Idaho Group, including the Chalk Hills Formation of Malde and Powers (1962) and the Chalk Butte Formation of Corcoran and others (1962). Late Miocene age based on fish fossils collected from the Adrian quadrangle (Smith and others, 1982; Kimmel, 1982)
Tbb	**Basalt and basaltic andesite flows (middle and upper Miocene)** — Mainly gray to black, vesicular, generally aphyric holocrystalline basalt flows that fill paleocanyons eroded into underlying units **Tlss** and **Tba**. Usually gray in color on fresh surfaces due to abundant framework feldspars in groundmass. Textures range from pilotaxitic to ophitic. Characterized by plagioclase phenocrysts less than 0.1 in. in length and microphenocrysts of clinopyroxene, orthopyroxene, and olivine altered to iddingsite. Unit **Tbb** is correlative with the Blackjack Basalt of Bryan (1929) and uppermost flows of the Owyhee Basalt as mapped by Kittleman and others (1965) and Corcoran and others (1962). Radiometric K-Ar ages summarized by Fiebelkorn and others (1982) range from 13.8±0.3 to 16.1±0.9 m.y. Distinguished from underlying flows of unit **Tba** by a generally fresher appearance due to thin weathering rinds, abundance of olivine (up to 5 percent) as a phenocryst phase, and the presence of narrow, discontinuous lenses of intervening tuffaceous sedimentary rocks (e.g., in the southeast corner of sec. 4, T. 23 S., R. 46 E.)
Tjr	**Plagioclase rhyolite (Miocene)** — Light-purple to light-blue, plagioclase-phyric rhyolite and rhyolite breccia. In thin section, contains broken and partially resorbed plagioclase phenocrysts 0.08 to 0.31 in. in length in a felsic groundmass. Part of the Jump Creek Rhyolite of Kittleman and others (1965). Ekren and others (1982) report a K-Ar age of 11.1 m.y. from the Jump Creek Rhyolite in Idaho
Tust	**Tuff and tuffaceous sedimentary rocks (Miocene)** — Mainly white to pale-greenish-white, generally crystal-poor vitric tuffs and interbedded tuffaceous siltstones. Unit contains nonwelded ash-flow and airfall tuffs, including an 8-ft-thick, light-gray to grayish-blue vitric tuff that contains inflated gray pumice clasts and a 20-ft-thick greenish-white tuff with abundant inflated 0.5 to 1.5-in-long white pumice clasts. Also, unit **Tust** includes thin white bentonitic clay beds where it overlies altered andesites in SW¼ sec. 25, T. 23 S., R. 46 E. Elsewhere, the tuffs are generally unaltered. Unit appears to thicken to the southeast toward Strode Basin, where it is directly overlain by the Jump Creek Rhyolite of Kittleman and others (1965). Unit is over 200 ft thick where exposed on the jeep road in SW ¼ sec. 36, T. 23 S., R. 45 E
Tusc	**Arkosic conglomerates and sandstones (Miocene)** — Mainly indurated, orange- to light-brown-weathering, coarse granite-clast heterolithologic arkosic conglomerates occurring as well-defined planar sheets. Individual conglomerate beds are up to 50 ft thick and are poorly sorted, matrix-supported conglomerates composed of well-rounded cobbles up to 1 ft in length suspended in a silt-free matrix of coarse-grained sand. The matrix is generally white to pale yellow in color when fresh, is made up of individual quartz and feldspar grains, and contains small amounts of accessory hornblende and biotite. Conglomerate clasts are well rounded and include banded rhyolite, porphyritic andesite, massive white vein quartz, fine-grained tan and brown siliceous metamorphic rocks, coarse-grained granite, and massive pegmatite. The conglomerates also contain fragments of petrified wood, including stumps and logs as well as lenses of coarse-grained arkosic sands. Although the conglomerates are generally structureless, well-defined channels filled with arkosic sands are exposed where the unit thins to the east. Unit **Tusc**, which includes thin interbeds of tuffaceous and bentonitic siltstones, is about 400 ft thick where best exposed in SW¼ sec. 4, T. 24 S., R. 46 E., and thins to the east
Tuss	**Tuffaceous siltstones (middle Miocene)** — Mainly pale-yellowish-white and pale-greenish-brown, fine-grained tuffaceous siltstones. Includes poorly indurated granite-clast arkosic conglomerates overlain by and interbedded with white and yellowish-white tuff near the top of the section. The unit contains interbedded bentonite claystone beds that locally attain composite thicknesses of 40 ft. Individual bentonite seams are gray to grayish-white and green in color and range from 2 to 8 in. in thickness where exposed in mine cuts. The bentonites weather to a characteristic popcorn texture on unexcavated slopes. Unconformably overlies unit **Tlss**. Delineation of extent of unit mantled by unit **QTfc** near Buck Gulch west of the Succor Creek Road is based in part on drilling by Teague Mineral Products
Tlss	**Tuffaceous sandstones and siltstones (Miocene)** — Mainly light-orangish-brown, fine-grained tuffaceous sandstones and pale-yellowish-white tuffaceous siltstones. Locally includes fine-grained, white zeolitic tuffs and pale-brown palagonitic tuffs and tuff breccias. Includes pale-yellow, fine-grained porcellanite reportedly comprised of silicified diatoms (Teague, oral communication, 1987). Also includes sandy pale-brown bentonitic claystone beds. Separated from overlying unit **Tuss** by an angular unconformity
Tlsb	**Olivine basalt flows (Miocene)** — Generally black to dark-gray, vesicular, aphyric olivine basalt flows found near the base of the tuffaceous sandstones and siltstones of unit **Tlss**. Includes interbedded orange palagonitic sandstones. Basal flows form bulbous outcrops projecting through the sandstones, suggesting that the flows have locally burrowed down into the underlying sediments (Lawrence, 1988). In thin section, the basalts are generally holocrystalline and lack phenocrysts. Textures range from pilotaxitic to ophitic with conspicuous groundmass olivine. Phenocrysts when present include both plagioclase and olivine. Includes both alkalic basalts and tholeiites (sample G, Table 1). Flows depositionally overlie the tuff of Spring Creek (Vander Meulen and others, 1987) and are in turn unconformably overlain by Barstovian fossiliferous strata of unit **Tuss**
Tlsv	**Cinders and scoria (Miocene)** — Red scoria and agglutinate with bombs of black plagioclase phyric basalt or basaltic andesite. Overlies unit **Tlsf**. May represent a local mafic vent complex related either to unit **Tlsb** or **Tai**
Tlst	**Ash-flow tuff and tuffaceous sediments (Miocene)** — Mainly green to white, quartz-sanidine lithic tuff with discontinuous, detached zones of black vitrophyre. Includes overlying tuffaceous silt and sandstones. Ash flow is partly welded and contains flattened pink pumice clasts, mafic lithic fragments, and nearly completely resorbed quartz phenocrysts. Best exposed west of Succor Creek in SW¼ sec. 33, T. 23 S., R. 46 E., where two separate cooling units each 30 ft thick are exposed. Ash flows may be outflow facies of the tuff of Spring Creek of Vander Meulen and others (1987)
Tlsf	**Rhyolite (ash-flow tuff?) (Miocene)** — Mainly pinkish-gray to pinkish-white, flow-foliated, lithic rhyolite. Unit locally includes overlying fine-grained white zeolitic airfall tuff. Lithic clasts include angular pieces of pink banded rhyolite and flattened pumice. Phenocrysts comprise about 5 percent of the rhyolite and include subequal amounts of sanidine crystals up to 0.3 in. in length and prismatic opaques. The groundmass in densely welded zones is granophyric in texture and contains secondary quartz. Overlying white tuff has been converted to clinoptilolite and locally contains lenses of green jasper. Miocene age is based on the stratigraphic position at the base of the Succor Creek Formation of Kittleman and others (1965)
Tba	**Mafic and intermediate flows and breccias (upper Oligocene and Miocene)** — Mainly dark-gray to black, fine-grained platy plagioclase-phyric lava flows and autoclastic breccias that weather to various shades of red and brown. Includes generally thin, lenticular deposits of subaerial tuff and scoria. Includes individual basaltic andesite, andesite, and dacite flows as much as 100 ft thick that are hyalocrystalline and contain plagioclase phenocrysts as much as 0.2 in. in length as well as occasional phenocrysts of clinopyroxene and orthopyroxene. Also includes pilotaxitic basalt flows near Graveyard Point that contain both phenocryst and groundmass olivine. Includes thick sheets of iron-stained pyroxene andesite autoclastic breccias south of Graveyard Point. Previously mapped in part as the basalt at Bishops Ranch by Kittleman and others (1965) and as the unnamed basalts and latites of Ekren and others (1981) in the Graveyard Point quadrangle. May be correlative with the lower part of the Owyhee Basalt of Bryan (1929) and mafic flows of the "unnamed igneous complex" of Kittleman and others (1965) that are exposed in the Malheur River gorge. Represents part of the partially dissected calc-alkaline basement upon which the younger Miocene rhyolitic caldera systems were formed. Radiometric K-Ar ages for the Owyhee Basalts mapped by Bryan (1929) range from 14.1 to 25.3±1.5 m.y. (Fiebelkorn and others, 1982; Brown and Petros, 1985). Ekren and others (1982) report a 17-m.y. K-Ar age from the unnamed basalt-latite sequence
Tad	**Dacite, andesite, and basaltic andesite intrusives (upper Oligocene ? and Miocene)** — Thick, platy, gray to bluish-gray, porphyritic basaltic andesite, andesite, and dacite masses associated with unit **Tba**. Includes a red-weathering porphyritic intrusion west of Sage Creek in Idaho that contains plagioclase, oxide-rimmed oxyhornblende, and titanaugite phenocrysts. Unit also includes a mafic aphanitic intrusion on Succor Creek that contains 0.08-in.-long plagioclase and orthopyroxene phenocrysts. Individual intrusions form massive outcrops over 200 ft thick
Tri	**Rhyolite intrusives (Miocene)** — Larger intrusives are flow-foliated, pinkish-gray, sanidine-bearing rhyolites such as those exposed in the rock quarry east of Succor Creek in sec. 22, T. 23 S., R. 46 E., and on the long ridge north of Succor Creek in sec. 15, T. 23 S., R. 46 E. Also includes stony, commonly hydrothermally altered, purple-gray sanidine rhyolite dikes such as those exposed below the mercury mine south of Graveyard Point in sec. 35, T. 3 N., R. 6 W., and on the north bank of North Alkali Creek in sec. 33, T. 22 S., R. 46 E. The smaller dikes occasionally have black vitrophyre margins. A geochemical analysis of the dike in sec. 15, T. 23 S., R. 46 E., is nearly identical to the unit **Tlsf** ash flow and suggests the dike may be a feeder to the ash flow
Tai	**Intermediate and mafic intrusions (Miocene)** — Mainly platy plagioclase phyric basalts and basaltic andesites emplaced as irregularly shaped dikes and sills
Tbi	**Mafic intrusions (upper Miocene)** — Mainly coarse-grained holocrystalline basaltic intrusions. Includes an over 200-ft-thick, dark grayish-black, coarse-grained diabase sill exposed in the highlands between Succor Creek and Sage Creek. The sill is made up of lath-shaped plagioclase crystals up to 0.3 in. in length which, together with anhedral magnetite and anhedral olivine crystals, are set in a groundmass of ophitic clinopyroxenes that are up to 0.5 in. in diameter. The sill has chilled margins and locally contains zones of coarser grained pyroxene and plagioclase. A dark-bluish-gray, flinty-textured hornfels that is locally preserved above the sill contains tridymite and cordierite (identified by X-ray diffraction, Ron Geitgey, Oregon Department of Geology and Mineral Industries, oral communication, 1987). Coarse-grained basaltic dikes believed to be related to the sill that intrudes unit **Tjr** (Jump Creek Rhyolite) in SE¼ sec. 3, T. 24 S., R. 46 E., indicate a late Miocene age or younger for the intrusions. A K-Ar age of 6.7±0.4 m.y. was obtained by a U.S. Geological Survey analytical laboratory, Menlo Park, California, from sample I (Table 1)

MINERAL RESOURCES

Introduction

A variety of valuable and potentially valuable mineral resources are found or indicated in the quadrangle, including bentonite clay, clinoptilolite zeolite, gold, mercury, semiprecious gemstones, building stone, and geothermal resources. Zeolite, bentonite, and semiprecious gemstones in the form of plume agate are currently being mined in the quadrangle, and mercury and possibly gold have been produced in the past.

Nonmetallic resources

One of the main nonmetallic resources now being mined in the quadrangle is zeolite from the Teague Mineral Products pit west of Succor Creek. The zeolite is found in a nearly monomineralic white airfall tuff that overlies the top of a rhyolite flow near the base of the Succor Creek Formation. The zeolite is overlain by olivine-basalt flows and together with the underlying rhyolite flow comprises unit **Tlsf**. At the quarry, the mined zeolite bed is about 30 ft thick and contains dark-green silicified lenses that have been previously mined as picture jasper. The zeolite consists mainly of clinoptilolite and is used in detoxification of hazardous wastes and as pet litter.

Another major nonmetallic mineral product from the quadrangle is bentonite clay, also mined by Teague Mineral Products. The main clay beds lie immediately to the west of the Succor Creek road, near the base of unit **Tuss**. The nature of the bentonite deposits is well illustrated in the mine pits in sec. 29, T. 23 S., R. 46 E., where a clay zone over 24 ft thick is exposed. The gray, grayish-white, and green bentonite clay beds range from 2 to 8 in. in individual thickness and form a composite bentonitic zone whose base is not exposed. Teague Mineral Products indicates that the economic bentonite zone is as much as 40 ft thick. The clay is reportedly a sodium bentonite used mainly as a sealant.

Other nonmetallic minerals that were produced in the past in the quadrangle include flow-foliated rhyolite from the quarry east of Succor Creek, which was used as decorative stone, and weathered arkosic sands and gravels, which have been used as road metal. Potential resources include the diabase sill (unit **Tbi**) in sec. 35, T. 23 S., R. 46 E., which could be used as decorative stone.

Semiprecious gemstones

Several varieties of chalcedonic quartz are important mineral products from the quadrangle and are eagerly sought by the rock-hounding fraternity — professional and hobbyist alike. Major collecting areas include Graveyard Point and sec. 25, T. 23 S., R. 46 E., where a mottled, multicolored blue chalcedony known as plume agate is mined on located claims from fissure veins and cavity fillings in basalt and andesite. Similar-looking material can be found as float where hydrothermal zones cut the mafic rocks at the Boggs gold prospect and along the ridges in the central part of the quadrangle.

Multihued silicified tuffs known as picture rock occur in a few localities, including the Teague Mineral Products zeolite pit and the tuffs overlying the mafic rocks in sec. 10, T. 23 S., R. 46 E.

Metallic mineral resources

Much of the eastern half of the quadrangle shows evidence of hydrothermal alteration in the form of chalcedonic quartz and calcite veins and areas of argillic alteration. Limited numbers of rock-chip samples contain anomalous values of metals such as arsenic, mercury, and antimony that may be pathfinders for epithermal precious-metal deposits. Gypsiferous clays occur along the canal west of Graveyard Point. Mercury in the form of cinnabar has been mined from the small prospect south of Graveyard Point in NE¼ sec. 35, T. 3 N., R. 6 W. The cinnabar occurs as a fine paint on argillically altered andesites and in northeast-striking, weakly silicified breccia zones. The andesite breccias to the south are heavily iron stained and contain vesicle fillings of chalcedonic quartz with disseminated marcasite.

According to local lore (Glenn Teague, personal communication, 1987), a small amount of gold was produced from the Boggs prospect near the common corner of secs. 2, 3, 10, and 11, T. 23 S., R. 46 E. The mineralization is apparently confined to the mafic rocks of units **Tba** and **Tlsb** and includes northeast- and east-west-striking shear zones that contain gouge, stringers and strands of iron-stained, locally pyritic chalcedonic quartz, and isolated discrete lenses of chalcedonic quartz that fill joint sets and voids within the mafic rocks. Vein matter from this area (nos. 2, 3, and 18, Table 2) indicates a high arsenic-molybdenum hydrothermal system (75-793 ppm As and 6-212 ppm Mo) that shows signs of being slightly anomalous for gold (8-15 ppb Au).

Other areas prospected in the past for gold include a north-trending fault zone on the flanks of what is locally referred to as Million Dollar Hill in secs. 4, 9, and 10, T. 23 S., R. 46 E. Several caved adits and prospect pits are located along the fault, which is marked by a zone of argillic alteration. One of the prospect cuts is on a N. 55° W.-striking shear zone about 6 ft wide that contains strands of calcite-cemented breccia. A sample of this material (no. 17, Table 2) contains anomalous amounts of arsenic (74 ppm).

Two quartz veins in NE¼NW¼ sec. 14, T. 23 S., R. 46 E., are the largest and best exposed mineralized shears in the quadrangle. A 3-ft-thick rib of iron-stained, densely silicified quartz breccia forms a resistant rib on the north side of an 8-ft-wide zone of brecciated red andesite that is cut by numerous iron-oxide-stained, blue chalcedony stringers. The vein attitude is N. 50° W., 90° E. A second vertical N. 70° W.-striking zone of breccia veins with chalcedony is exposed a few hundred feet to the north. Massive nodules of limonitic chalcedony are scattered about the top of the hill, filling joints and fractures in the andesite. Finely disseminated dark sulfides occur in the massive chalcedony nodules, while scattered weathered pyrite casts together with fibrous iron-oxides (jarosite?) occur in the veins. Trace-element analyses in a sample of vein material (no. 4, Table 2) show high abundances of arsenic and molybdenum (476 ppm As and 16.7 ppm Mo).

GEOCHEMISTRY

Sample preparation

Samples for whole-rock analysis (WRA) (Table 1) were crushed to minus ¼-in. in a steel-jawed Braun chipmunk crusher and split in a Jones-type splitter in the Oregon Department of Geology and Mineral Industries (DOGAMI) laboratory. A split of about 100 g of each sample was ground to minus 200 mesh in agate grinding media by X-ray Assay Laboratories (XRAL) of Don Mills, Ontario.

Samples for trace-element analysis (Table 2) were crushed to minus ¼-in. and split as indicated above. Each sample split was ground to about minus 200 mesh in chrome-steel grinding media in an Angstrom disc mill in the DOGAMI laboratory. Each minus-200-mesh split was split again to produce two subsamples: one for gold and one for the other trace elements to be determined.

Chemical analysis

Whole-rock analysis: X-ray fluorescence (XRF) analyses were performed by XRAL. XRAL used a fused button for its analyses (1.3 g of sample roasted at 950 °C for one hour, fused with 5 g of lithium tetraborate, and melt cast into a button). Loss on ignition (LOI) was determined by the roasting.

Trace-element analysis:

1. Gold—Bondar-Clegg, Ltd., of North Vancouver, British Columbia, performed the analyses for gold. The method employed was fire assay preconcentration of the gold in a 20-g sample (gold was collected in added silver), acid dissolution of the resulting bead, and a directly coupled plasma (DCP) emission spectrometer finish. The detection limit was 1 ppb.

2. Other trace elements—Geochemical Services, Inc., (GSI) of Torrance, California, performed the analyses for 15 other trace elements. The method employed a proprietary acid dissolution/organic extraction of a 5-g sample. The finish was by induction coupled plasma (ICP) emission spectrometry. GSI considers the digestion to provide total metal contents except for gallium and thallium. The detection limit for a given element varies slightly as a result of GSI's monitoring process.

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MAP SYMBOLS

Contact — Approximately located

Fault — Dashed where inferred; dotted where concealed; queried where doubtful; ball and bar on downthrown side

Strike and dip of beds

■ **Location of whole-rock sample analyzed in Table 1**

▲21 **Location of mineralized sample analyzed in Table 2**

Table 1. Whole-rock analyses, Graveyard Point quadrangle, Oregon and Idaho[1]

Map letter	Field and laboratory no.	¼	¼	Sec.	T.	R.	UTM coordinates	Elev. (ft)	Lithology	Map unit	Oxides (wt percent)												Trace elements (ppm)						
											SiO_2	Al_2O_3	TiO_2	Fe_2O_3T	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	LOI	Total	Cr	Rb	Sr	Y	Zr	Nb	Ba
A	87-B0-24A	NW	SW	10	23 S.	46 E.	482527N 49254E	2,820	Sanidine rhyolite	Tri	77.1	11.4	0.26	1.19	0.02	0.15	0.01	4.49	3.90	0.04	0.70	99.26	16	138	<10	116	644	47	1,310
B	87-B0-20	NW	SE	10	23 S.	46 E.	482518N 49343E	2,460	Basaltic andesite	Tad	55.9	16.1	1.15	8.36	0.17	5.16	2.08	2.69	4.14	0.62	1.85	98.22	<10	49	489	34	144	28	1,080
C	87-B0-26	SE	SW	35	3 N.	6 W. (ID)	482332N 49[illegible]38E	2,780	Basaltic andesite	Tba	55.1	15.1	1.87	10.6	0.24	6.24	2.31	1.63	3.89	1.03	2.01	100.02	<10	63	447	34	201	20	978
D	87-B0-52	SE	SE	21	23 S.	46 E.	482176N 49184E	2,600	Sanidine rhyolite	Tlsf	76.0	11.3	0.26	1.36	0.02	0.07	<0.01	3.52	4.68	0.03	0.77	98.01	14	154	<10	84	644	59	1,070
E	87-B0-35	NW	SE	22	23 S.	46 E.	482220N 49332E	2,500	Aphyric basalt	Tba	53.3	15.6	1.42	11.7	0.20	6.92	3.47	1.73	3.63	0.57	0.93	99.47	11	41	515	12	93	24	771
F	87-B0-29	SE	SW	35	3 N.	6 W. (ID)	48[illegible]2140N 49[illegible]68E	3,020	Hornblende dacite	Tba	65.0	13.2	1.19	9.31	0.09	4.19	0.43	1.73	2.98	0.50	1.85	100.47	18	41	452	22	90	14	788
G	87-B0-54	NW	SE	28	23 S.	46 E.	482045N 49178E	2,600	Alkalic basalt	Tlsb	49.1	14.6	1.87	14.2	0.23	7.10	3.74	1.63	3.42	0.66	1.62	98.17	<10	28	397	46	149	23	696
H	87-B0-56	SE	SE	2	2 N.	6 W. (ID)	481972N 49915E	2,900	Altered andesite	Tad	65.4	14.5	1.00	5.27	0.07	3.80	0.50	2.58	4.03	0.60	1.08	98.83	<10	39	451	52	124	14	1,180
I	87-B0-38	SW	NW	36	23 S.	46 E.	481908N 49359E	3,100	Olivine gabbro	Tbi	48.1	14.5	2.24	13.1	0.20	11.4	5.15	0.60	2.27	0.35	0.54	98.45	260	13	200	29	123	13	303

[1] XRF analyses by XRAL.

Table 2. Trace-element analyses, Graveyard Point quadrangle, Oregon and Idaho[1]

Map no.	Laboratory no.	¼	¼	Sec.	T.	R.	UTM coordinates	Elev. (ft)	Lithology	Map unit	Ag (ppm)	As (ppm)	Au (ppb)	Cu (ppm)	Hg (ppm)	Mo (ppm)	Pb (ppm)	Sb (ppm)	Tl (ppm)	Zn (ppm)	Bi (ppm)	Cd (ppm)	Ga (ppm)	Pd (ppm)	Se (ppm)	Te (ppm)
1	AVB-201	NW	SE	33	22 S.	46 E.	482854N 49178E	2,740	Jasper	Tbb	<0.014	1,580	5	40.2	3.42	54.1	1.62	4.04	<0.456	30.5	0.783	<0.091	4.00	<0.456	6.92	<0.456
2	AVB-202	NW	NW	11	23 S.	46 E.	482614N 49428E	2,420	Jasper	Tlsb	0.058	793	15	7.37	3.45	212	3.00	13.4	1.39	26.7	3.27	<0.095	4.06	<0.475	<0.951	<0.475
3	AVB-203	NW	NW	11	23 S.	46 E.	482632N 49400E	2,600	Jasper	Tlsb	<0.014	253	8	6.32	0.305	23.5	1.09	6.14	<0.476	2.38	0.309	<0.095	1.96	<0.476	<0.952	<0.476
4	AVB-204	NE	NW	14	23 S.	46 E.	482458N 49462E	2,700	Quartz and chalcedony	Tba	0.015	476	6	7.64	0.975	16.5	2.10	16.7	1.01	19.0	0.244	<0.093	1.54	<0.463	<0.926	<0.463
5	AVB-205	NW	NW	23	23 S.	46 E.	482286N 494[illegible]E	2,720	Chalcedony	Tba	<0.015	227	<1	7.34	0.502	105	1.11	7.39	0.956	3.89	1.61	<0.097	<0.484	<0.484	<0.967	<0.484
6	AVB-206	SE	SW	26	3 N.	6 W. (ID)	482302N 49844E	2,640	Clay and chalcedony	Tba	<0.014	17.9	<1	5.57	0.614	0.553	7.19	0.766	<0.478	24.4	<0.239	<0.096	2.83	<0.478	<0.956	<0.478
7	AVB-207	NW	SE	10	23 S.	46 E.	482538N 49336E	2,660	Picture rock	Tlss	0.015	68.5	1	8.60	0.163	5.81	3.08	6.55	<0.479	7.25	<0.239	<0.096	0.787	<0.479	<0.958	<0.479
8	AVB-208	SE	SE	10	23 S.	46 E.	482496N 49372E	2,760	Chalcedony	Tba	0.017	20.3	<1	6.90	<0.095	3.73	2.69	0.614	<0.474	33.0	<0.237	<0.095	1.97	<0.474	<0.949	<0.474
9	AVB-209	NW	SE	22	23 S.	46 E.	482226N 49342E	2,[illegible]0	Chalcedony	Tba	0.03	907	1	7.90	4.03	306	2.69	60.9	2.20	9.71	4.63	<0.097	2.97	<0.485	1.40	<0.485
10	AVB-210	SE	SE	22	23 S.	46 E.	482176N 49184E	2,700	Chalcedony	Tri	<0.015	94.6	<1	9.65	0.143	2.74	2.20	0.798	<0.486	98.2	<0.243	0.110	2.15	<0.486	<0.973	<0.486
11	AVB-211	NW	NW	4	24 S.	46 E.	481792N 49140E	2,620	Opaline quartz	Tai	0.026	4.21	1	54.1	<0.097	2.22	2.36	<0.241	<0.483	74.7	<0.241	<0.097	4.81	<0.483	<0.965	<0.483
12	AVB-212	SE	NE	32	23 S.	46 E.	4819[illegible]N 49074E	2,[illegible]0	Opaline quartz	Tlss	0.019	103	<1	5.23	<0.092	5.72	13.7	2.18	<0.461	30.5	<0.231	0.201	5.22	<0.461	<0.923	<0.461
13	AVB-213	NW	NW	5	24 S.	46 E.	481790N 49002E	2,900	Opaline quartz	Tlst	0.024	9.05	3	6.37	<0.099	3.46	8.91	<0.248	0.544	76.3	<0.248	<0.099	5.10	<0.496	<0.992	<0.496
14	AVB-214	NW	NW	9	23 S.	46 E.	482604N 49104E	2,760	Opaline quartz	Tri	0.022	27.3	<1	8.76	<0.095	3.78	49.8	0.626	<0.473	48.2	2.55	0.253	1.16	<0.473	<0.945	<0.473
15	AVB-215	SE	SE	21	23 S.	46 E.	482178N 49202E	2,520	Weakly silicified breccia	Tlsb	0.038	39.5	1	9.60	0.404	4.79	11.9	0.522	1.30	79.3	<0.237	0.108	4.33	<0.473	<0.947	<0.473
16	AVB-218	NE	SE	24	23 S.	46 E.	482216N 49714E	2,780	Chalcedony	Tba	0.016	75.1	<1	37.7	1.09	6.19	1.62	2.51	<0.478	40.4	<0.239	<0.096	3.40	<0.478	<0.956	<0.478
17	AVB-219	SE	NE	9	23 S.	46 E.	482562N 49228E	2,860	Quartz calcite	Tlss, Tri	0.037	73.9	1	5.24	1.35	2.78	6.49	1.16	<0.49	71.4	<0.245	0.105	9.71	<0.49	<0.98	<0.49
18	AVB-225	SE	SE	3	23 S.	46 E.	482640N 49398E	2,460	Quartz	Tlsb	0.08	961	11	6.46	3.53	325	5.48	17.8	1.15	18.6	4.90	<0.094	4.18	<0.47	0.957	0.497
19	AVB-235	SE	SW	10	23 S.	46 E.	481900N 49252E	2,460	Rhyolite	Tba	<0.014	2.61	4	45.9	<0.092	3.40	2.04	<0.23	<0.46	48.6	<0.23	<0.092	3.18	<0.46	<0.919	<0.46
20	AVB-236	NW	SW	34	23 S.	46 E.	481776N 49254E	3,000	Chalcedony	Tba	0.015	13.4	4	10.3	<0.095	4.65	2.37	0.382	<0.474	8.11	<0.237	<0.095	0.838	<0.474	<0.949	<0.474
21	AVB-237	NE	NE	4	24 S.	46 E.	482498N 49298E	2,780	Chalcedony	Tlsf	0.044	13.4	17	6.17	0.354	3.04	8.94	0.886	<0.484	60.4	<0.242	<0.097	5.62	<0.484	<0.967	<0.484

[1] Gold analyses by Bondar-Clegg; other trace-element analyses by GSI.

GEOLOGIC CROSS SECTION