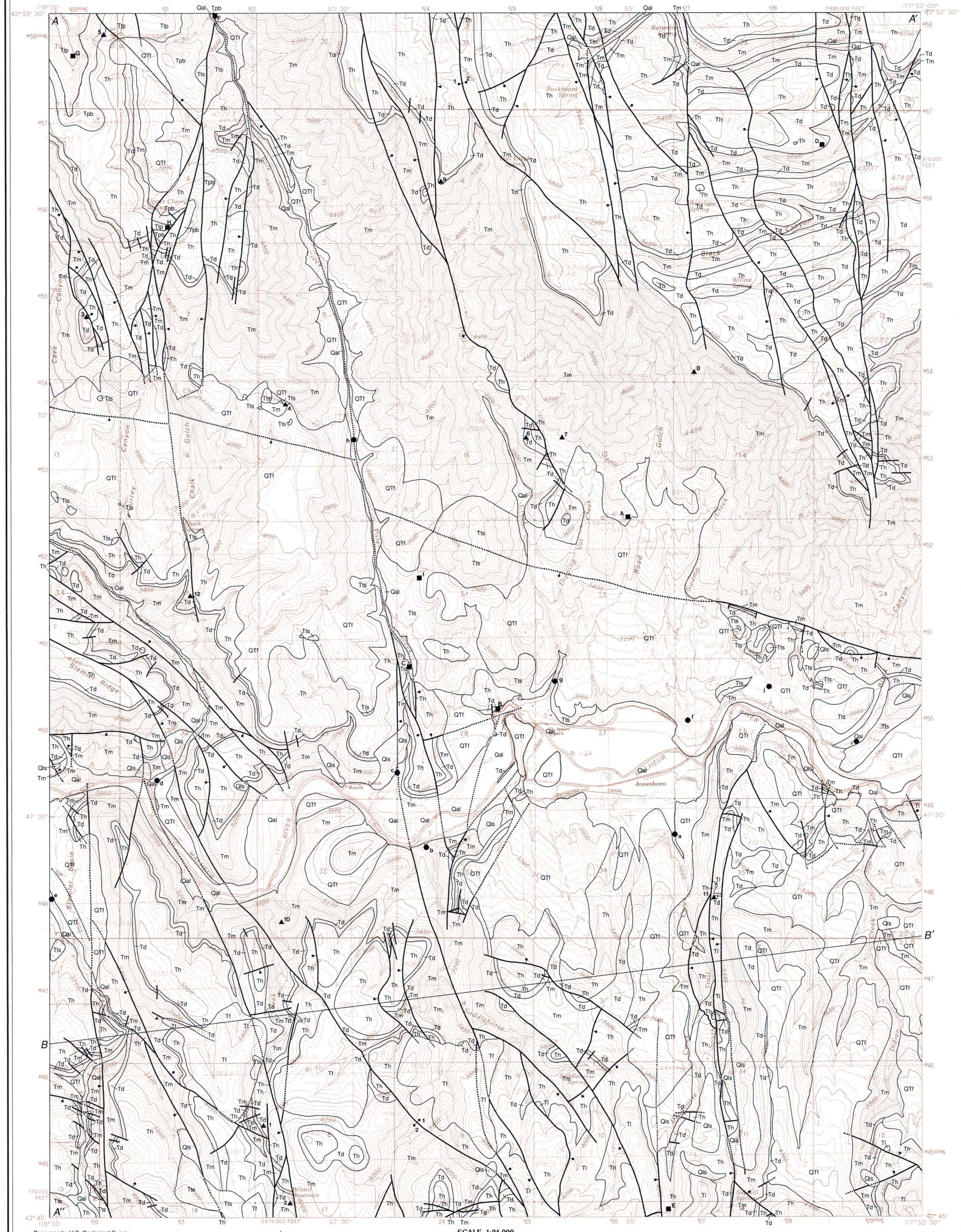
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL

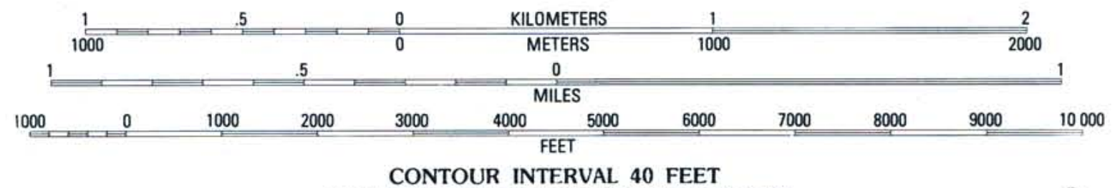
GEOLOGY AND MINERAL RESOURCES MAP OF THE JONESBORO QUADRANGLE, MALHEUR COUNTY, OREGON

1990



Base map by U.S. Geological Survey
CONTROL BY....USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN....1966
REVISED FROM AERIAL PHOTOGRAPHS TAKEN....1985
FIELD CHECKED....1987. MAP EDITED....1990
PROJECTION....LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR....ZONE 11
10,000-FOOT STATE GRID TICKS....OREGON, SOUTH ZONE
UTM GRID DECLINATION....0°39' WEST
1990 MAGNETIC NORTH DECLINATION....17°00' EAST
VERTICAL DATUM....NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM....1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (17 meters north and 81 meters east)
There may be private inholdings within the boundaries of any Federal or State reservations shown on this map

SCALE 1:24 000



CONTOUR INTERVAL 40 FEET
SUPPLEMENTARY CONTOUR INTERVAL 20 FEET

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by .3048

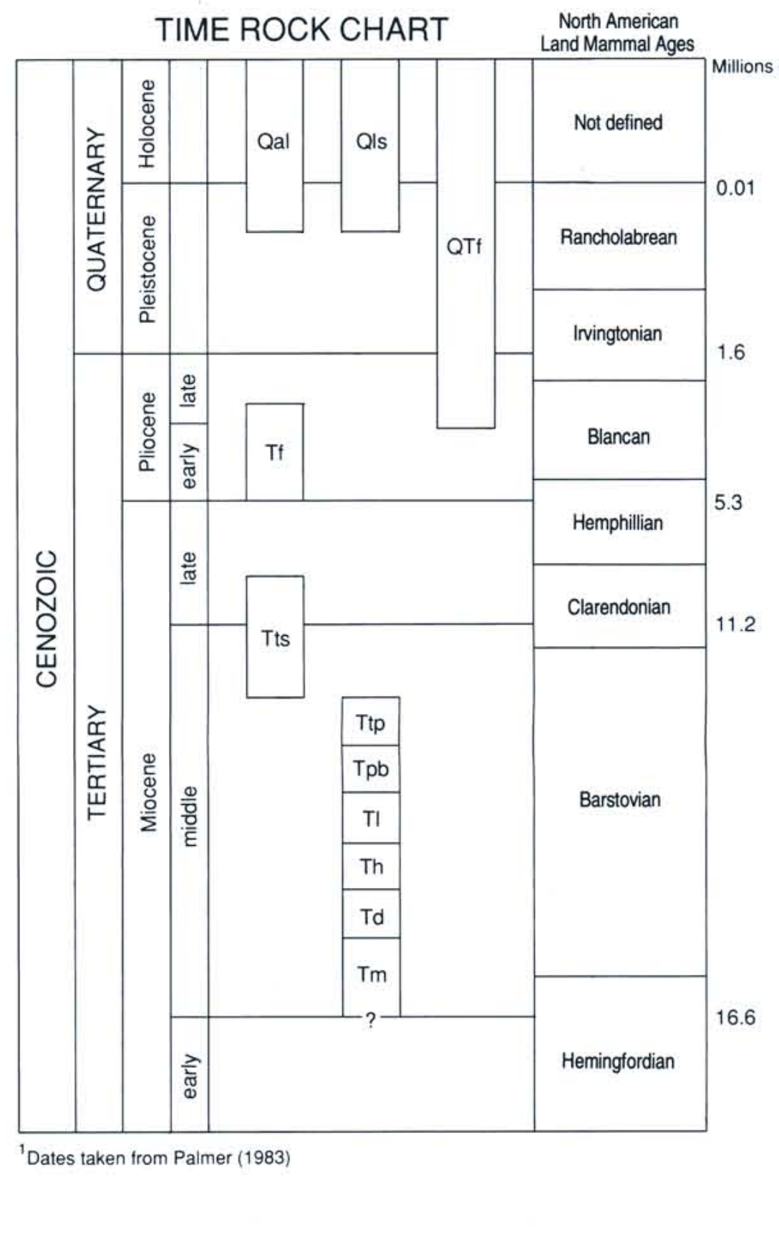
QUADRANGLE LOCATION

Geology by James G. Evans, U.S. Geological Survey.

Mapping was conducted in 1988 and 1989 as part of the Survey's Wilderness Study (Evans and others, 1990a,b) and COGEOMAP programs.

Cartography by Mark E. Neuhaus

TIME ROCK CHART



[1] Dates taken from Palmer (1983)

EXPLANATION

Qal	**Alluvium (Holocene and Pleistocene)**—Stream gravels, stream terraces, flood plain deposits along Malheur River and fanglomerate along sides of valleys
Qls	**Landslide deposits (Holocene and Pleistocene)**—Occur near steep faults and contact of the Littlefield Rhyolite of Kittleman and others (1965) and the Hunter Creek Basalt. Surface of landslides is hummocky. Deposits contain large randomly oriented angular blocks. Rotated blocks tilt toward headwalls, and closed depressions, some containing thin playa deposits, occur below some headwalls
QTf	**Younger fanglomerate (Holocene, Pleistocene, and Pliocene)**—Mostly coarse, unconsolidated, poorly sorted sediments that contain angular boulders. Boulders, mostly basalt, are as much as 4 ft across. Alluvial fan morphology is well preserved. Fanglomerate may be as much as 400 ft thick north of Malheur River
Tf	**Older fanglomerate (Pliocene)**—Poorly sorted, unconsolidated sediments containing angular boulders as much as 2 ft across of basalt and rhyolite. Fanglomerate may be as much as 200 ft thick near the southwest corner of the quadrangle. Age of unit is estimated to be predominantly older than unit **QTf** because unit is faulted and has poorly preserved alluvial fan morphology
Tts	**Tuff, welded tuff, and tuffaceous sedimentary rocks (upper and middle Miocene)**—White, light-gray, and brown pyroclastic and sedimentary rocks that include air-fall tuff, lapilli tuff, strongly to partly welded tuff of several cooling units, and beds of silt and clay. Welded tuff contains less than 5 percent phenocrysts of quartz, plagioclase, olivine, and hornblende as much as 0.08 in. long. Generally angular lithic fragments in lapilli tuff comprise 5 to 75 percent of some beds and are locally as much as 1 ft long. Lapilli include basalt, basaltic glass, rhyolitic welded tuff, and rhyolite. Bedding is 0.5 to 6 in. and well defined in some places and 3 to 6 ft and poorly defined in other places. Unit is as much as 700 ft thick north of Malheur River. Age of unit is based on tentative correlation with the Juntura Formation of Bowen and others (1963)
Ttp	**Tims Peak Basalt (middle Miocene)**—Dark-gray to black basalt flows in northwest corner where they underlie the highest ridge of the quadrangle. Basalt flows are vesicular and diktytaxitic (5 to 15 percent cavities). Chemically these rocks are high-alumina olivine tholeiites (Table 1, Plate 2) (Evans, 1990), although olivine is not common modally and is absent in some samples. Plagioclase laths are as long as 0.08 in., but the mineral grains are not clearly divided into phenocryst and groundmass phases. Most of the rock consists of plagioclase (45 to 60 percent), clinopyroxene (25 to 40 percent), and olivine (as much as 10 percent). Minor ilmenite is present. Clinopyroxene is interstitial or forms oikocrysts as much as 0.16 in. long. Haddock (1967) determined a modal composition for his samples: laboradorite, 55 percent; subcalcic augite, 20 percent; olivine, 10 percent; opaque minerals, 5 percent; glass, 5 percent; voids, 5 percent; and traces of apatite and alteration products. Olivine is partly altered to bowlingite. Locally, unit has white-clay interbeds as much as 10 ft thick. The basalt unit is 240 ft thick in quadrangle. Age of the basalt (12.4 Ma) is based on its correlation with radiometrically dated Shumuray Ranch Basalt of Kittleman and others (1965, 1967)
Tpb	**Pillow-basalt breccia (middle Miocene)**—Basaltic breccia and hyaloclastite deposits in northwest corner of quadrangle. Contains broken basalt pillows as much as 4 ft long in a matrix of smaller basalt fragments, basaltic glass, and pale-brown and gray silt. Locally, unit contains beds of lapilli tuff that consist of pale-yellow angular lapilli as much as 1 in. across in a matrix of pale-gray tuff containing basalt and basaltic glass. Locally, contains white tuffaceous siltstone and claystone. Uppermost part of unit in places is yellow-gray pebble conglomerate containing 15 to 20 percent rounded basalt pebbles as much as 1 in. long. Basalt contains as much as 30 percent phenocrysts, mostly plagioclase laths, as much as 0.12 in. long and minor olivine as much as 0.04 in. long. Phenocrysts tend to be glomeroporphyritic. Groundmass consists of glass that is opaque owing to disseminated ilmenite and/or magnetite and contains plagioclase laths, minor olivine, and an unidentified yellow-brown cryptocrystalline material. Unit thickens from 120 to 300 ft from west to east. Age of unit is based on its stratigraphic position between two units (unit **Ttp**, 12.4 Ma, and unit **Td**, 15 Ma), which have been assigned middle Miocene ages
Tl	**Littlefield Rhyolite of Kittleman and others (1965) (middle Miocene)**—Mostly massive gray porphyritic rhyolite flows that contain 5 to 15 percent white phenocrysts. Weathers brown. Commonly has closely spaced cleavage that does not appear to be related to flow layering. A detailed petrographic description of the Littlefield Rhyolite is in Evans (1990). Base of unit is marked by minor black vitrophyre. As much as 430 ft of rhyolite unit is exposed in southeast corner of east-central part of quadrangle south of Malheur River. Rhyolite flows underlie the pillow-basalt breccia unit in the adjacent South Mountain quadrangle but are absent below the pillow-basalt breccia unit in the northwest corner of Jonesboro quadrangle. Age of rhyolite unit is based on its stratigraphic position between two rock units (units **Ttp** and **Td**) that have been assigned middle Miocene ages
Th	**Hunter Creek Basalt (middle Miocene)**—Mostly aphyric black massive basalt flows that typically weather into irregular, angular, equant fragments as much as 8 in. across. In places, basalt flows have as much as 15 percent phenocrysts of plagioclase as much as 0.12 in. long. Rarely vesicular. Locally flows contain flow layering, flow breccia, and sedimentary interbeds. Plagioclase phenocrysts are euhedral and glomeroporphyritic in a groundmass of plagioclase laths as long as 0.01 in. Some of the rock contains as much as 50 percent glass that contains trichites or is opaque owing to disseminated ilmenite and/or magnetite. Olivine, a minor constituent, is locally altered to bowlingite. Locally basalt groundmass does not contain glass and consists largely of magnetite partly altered to hematite. Haddock (1967) determined modal compositions of three samples that were coarser than average: labradorite, 46 to 55 percent; clinopyroxene, 27 to 33 percent; opaque minerals, 5 to 8 percent; and glass, 13 to 15 percent. Unit ranges in thickness west to east from 160 to 280 ft. Age of basalt flows is based on their stratigraphic position between two units (units **Ttp** and **Td**), which are assigned middle Miocene ages
Td	**Dinner Creek Welded Tuff (middle Miocene)**—Mostly rhyolitic welded ash-flow and air fall tuff. Densely welded part of unit is typically exposed and forms brown and gray cliffs 20 to 80 ft high. The poorly welded parts of the unit above and below the cliffs are usually covered by talus deposits. The strongly welded part has undergone enough crystallization to obliterate most of the primary pyroclastic structures and textures. The strongly welded part commonly contains lithophysae as much as 1 in. across and is cut by numerous white, yellow, and black quartz veins, especially in SE¼ sec. 22, T. 20 S., R. 40 E. In places, parts of the ash-flow unit above and below the cliffs are exposed: the unit is generally 20 to 80 ft thick above the cliffs and 40 to 60 ft thick below the cliffs. In places, only the strongly welded tuff is present. These poorly exposed rocks are light- to dark-gray, black, and yellow lapilli tuff, welded to varying degrees, locally thinly bedded (0.5 to 6 in.), and in places a black vitrophyre. Lapilli include mostly pumice but also black glass, welded tuff, basalt, and vitrophyre. Locally, black glass comprises as much as 50 percent of the rock. Pumice fragments as much as 5 in. across are locally discoid and flattened along a compaction foliation. Sparse phenocrysts as much as 0.12 in. long consist of angular anhedral plagioclase, quartz, and rare olivine. Haddock (1967) identified phenocrysts of anorthoclase, minor plagioclase (An_{30}), and clinopyroxene in his samples. The unit contains at least two cooling units and thickens from 60 to 200 ft toward northwest. A bed of basaltic welded tuff occurs above the cliff-forming part of the unit. The basaltic tuff is chemically like the samples analyzed for the Hunter Creek Basalt (Table 1, Plate 2) (Evans, 1990). Age of the unit is middle Miocene, based on radiometric data (15 Ma, average)
Tm	**Basalt of Malheur Gorge (middle Miocene or older)**—These rocks were previously called the "unnamed igneous complex" by Kittleman and others (1965). Mostly dark-gray to black tholeiitic basalt flows, weathering brown and greenish brown, that form discontinuous ledges 10 to 40 ft thick that represent individual flows. Basalt flows locally have columnar jointing. Lithologies include massive basalt, platy basalt, and black glassy vesicular basalt breccia. Basalt flows contain as much as 50 percent phenocrysts that are mostly plagioclase as much as 0.08 in. long and locally as long as 1 in. Minor olivine and ilmenite phenocrysts are also present in some flows. Groundmass is generally holocrystalline, consisting of plagioclase, olivine, and clinopyroxene (ophitic and intersertal). Proportions of major constituents are plagioclase, 60 to 75 percent; clinopyroxene, 0 to 35 percent; olivine, 0 to 20 percent; and ilmenite, as much as 5 percent. Haddock (1967) determined modal composition of 11 samples of the basalt to be labradorite, 41 to 52 percent; subcalcic augite, 22 to 35 percent; olivine, as much as 4 percent; opaque minerals, 3 to 9 percent; glass, 3 to 17 percent; and alteration products, as much as 19 percent. Olivine is locally altered to serpentine, magnetite, hematite, and bowlingite. Unit contains as much as 10 percent beds of pyroclastic and sedimentary rocks 6 to 40 ft thick. Interbeds include white to pale-gray and light-brown welded tuff; tuffaceous and arkosic sandstone, siltstone, and claystone; hyaloclastite; and red basaltic welded tuff. Hyaloclastite contains as much as 30 percent pale-brown, poorly indurated silt and angular glassy basalt fragments as much as 1 ft across. A few rounded basalt fragments may be bombs or small pillows. Basaltic glass contains as much as 10 percent plagioclase laths as long as 0.04 in. and minor olivine. Basaltic welded tuff contains abundant angular lithic fragments of basalt and basaltic welded tuff and minor rhyolitic glass, rhyolitic welded tuff, and diatomite. A few basalt dikes as much as 20 ft thick were recognized cutting the lower part of the unit in SW¼ sec. 7, T. 20 S., R. 39 E., and two possible vents having oval cross sections about 0.2 and 0.1 mi in SW¼ sec. 32, T. 19 S., R. 39 E., and SE¼ sec. 5, T. 20 S., R. 39 E., intrude the basalt flows. The lower part of the unit is generally porphyritic, commonly has large (1 in.) plagioclase phenocrysts, and contains sedimentary and pyroclastic interbeds. Upper part of unit is commonly aphyric, platy basalt lacking interbeds of other lithologies. Unit is at least 2,000 ft thick north of Malheur River. Age of unit is considered to be middle Miocene or older, as it underlies the middle Miocene Dinner Creek Welded Tuff

GEOLOGY

The formations of the study area were described by Bowen and others (1963) and Kittleman and others (1965). A reconnaissance geologic map (scale of 1:63,360) that included the quadrangle was made by Haddock (1967) as part of a study of the Dinner Creek Welded Tuff of the Malheur Gorge area. Haddock's mapping was incorporated into a geologic map of the Owyhee region at the scale of 1:125,000 by Kittleman and others (1967) and a map of eastern Oregon at the scale of 1:500,000 by Walker (1977). The part of the quadrangle south of the Malheur River was mapped as part of the Gold Creek and Sperry Creek Wilderness Study Areas (Evans and others, 1990a,b) at the scale of 1:24,000. During that study, rock, stream-sediment, and panned concentrate samples were collected by the U.S. Geological Survey and the U.S. Bureau of Mines.

The rocks exposed in the quadrangle mostly comprise a flat-lying to gently-dipping section of volcanic, pyroclastic, and sedimentary rocks of late Tertiary age. The oldest unit is the basalt of Malheur Gorge, a sequence of basalt flows containing minor sedimentary, pyroclastic, and hyaloclastite beds that is at least 2,000 ft thick north of the Malheur River. The name "basalt of Malheur Gorge," as used here, is equivalent to the "unnamed igneous complex" of Kittleman and others (1965). The unit is common in the Malheur Gorge area and may extend as much as 30 mi south of the quadrangle (Kittleman and others, 1967). The few thin dikes and small vents cutting the lower part of the unit are not abundant or large enough to comprise the principal sources of the flows, nor is it clear whether these dikes fed upper flows of this unit or basalt flows in the overlying units. The basalt of Malheur Gorge is assigned a middle Miocene or older age, as it underlies the radiometrically dated Dinner Creek Welded Tuff.

The location of the Dinner Creek Welded Tuff (Greene and others, 1972; formerly the Dinner Creek Welded Ash-Flow Tuff of Kittleman and others, 1965) is clearly marked in the field by cliffs 20 to 80 ft high formed by the central strongly welded part of the formation. The less strongly welded parts of the formation above and below the cliffs are usually buried by debris from the overlying Hunter Creek Basalt. Average composition of the Dinner Creek is alkali rhyolite (Haddock, 1967; Table 1, Plate 2). The formation ranges in thickness from 60 to 200 ft. Source of the welded tuff, according to Haddock (1967), is a vent at Castle Rock, 14 mi northwest of the quadrangle, because isopachs of the formation show thickening toward that vent. The formation contains at least two cooling units that can be identified in places where the part of the formation above the cliffs is well exposed. The basaltic welded tuff in the upper part of the Dinner Creek is similar in composition to the Hunter Creek Basalt (Table 1, Plate 2) and probably marks the beginning of eruption of the Hunter Creek magma. The basaltic welded tuff is placed in the Dinner Creek because the tuff occurs below the break in slope that marks the more resistant Hunter Creek Basalt flows. Some of the formation contains basalt fragments that could have been derived from the basalt of Malheur Gorge or other basalt at depth. Fiebelkorn and others (1983) summarized radiometric ages of samples of the Dinner Creek at 15.3 ± 0.4 Ma and 14.7 ± 0.4 Ma in Malheur County and 14.9 ± 0.4 Ma in Baker County. The oldest age is from the Dinner Creek on the south side of Malheur Gorge near the river on the east side of the quadrangle. The other dated sample from Malheur County was taken from the Dinner Creek west of the quadrangle. Based on these radiometric ages, the age of the Dinner Creek is about 15 Ma (middle Miocene).

The Hunter Creek Basalt (Kittleman and others, 1965; Greene and others, 1972) overlies the Dinner Creek Welded Tuff. The Hunter Creek lithologically resembles the uppermost part of the basalt of Malheur Gorge in being black, being generally aphyric, and containing rare sedimentary interbeds. Chemical differences between the upper part of the basalt of Malheur Gorge and the Hunter Creek may be indicated by the platy character of the upper part of the basalt of Malheur Gorge and the angular fracturing of the Hunter Creek. Whole-rock analyses indicate that the Hunter Creek Basalt has about 5 percent more SiO_2, 1 percent more K_2O, and 2 percent more Fe_2O_3 than the basalt of Malheur Gorge (Table 1, Plate 2) (Evans, 1990).

The Littlefield Rhyolite of Kittleman and others (1965) occurs in the southeast corner of the quadrangle and along the south bank of the Malheur River along the east boundary. As much as 430 ft of the rhyolite is present in the study area. Hagood (1963) suggested that the Littlefield Rhyolite was extruded from vents located about 14 mi south of the quadrangle at the Rooster Comb and Star Mountain (Kittleman and others, 1967). Other silicic vents have been mapped by Walker (1977) in that area. Evans and others (1990a) interpreted the vent for the Littlefield Rhyolite in the Jonesboro quadrangle to lie in the northeastern part of the Tims Peak quadrangle below a circular aeromagnetic high. A K-Ar age of 17.9 ± 0.6 Ma was reported for the Littlefield Rhyolite south of the quadrangle (Fiebelkorn and others, 1983). This age is here considered to be in error because it is inconsistent with the three radiometric ages reported for the underlying Dinner Creek Welded Tuff.

A unit predominantly of pillow-basalt breccia overlies the Littlefield Rhyolite in the northwest corner of the quadrangle and contains tuff and tuffaceous sedimentary interbeds. Although some of the lithologies are different here than in the pillow-basalt breccia unit in the southern part of the adjacent South Mountain quadrangle (Evans, 1990), the pillow-basalt breccia unit here, like the pillow-basalt breccia in the South Mountain quadrangle, appears to reflect basalt extrusion along a lake margin. In sec. 31, T. 19 S., R. 39 E., basalt dikes as thick as 15 ft cut the pyroclastic and sedimentary rocks and suggest local sources for the pillow-basalt basalt breccia unit. Recent mapping in the eastern Tims Peak quadrangle (Evans and Keith, unpublished mapping, 1989) indicates that the pillow-basalt breccia unit there overlies a volcanic conglomerate that may correlate with Butte Creek Volcanic Sandstone of Kittleman and others (1965, 1967). Gazin (1932) described a mammalian fauna from part of the Butte Creek and estimated the age as middle Miocene or later. Evernden and others (1964) dated glass shards from the beds containing these mammalian fossils at 15.5 Ma (middle Miocene, K-Ar method, recalculated according to Dalrymple, 1979). Therefore, the pillow-basalt breccia unit is younger than 15.5 Ma but may still be middle Miocene in age.

The Tims Peak Basalt overlies the pillow-basalt breccia unit in the northwest corner of the quadrangle. Although separated from the main body of the Tims Peak Basalt on the plateau east of Tims Peak 3 mi south of the quadrangle, the unit in the study area is correlated with the Tims Peak because it is in the same stratigraphic position as the Tims Peak of the type locality and is a diktytaxitic ophitic clinopyroxene basalt like the Tims Peak of the type locality. Tims Peak itself is adjacent to, but not underlain by, the basalt bearing its name. Chemically, Tims Peak Basalt is similar to the pillow-basalt breccia (Table 1, Plate 2) (Evans, 1990), suggesting that these two map units are related. Recent geologic mapping in the eastern part of the Tims Peak quadrangle (Evans and Keith, unpublished mapping, 1989) southwest of the study area, suggests that the Tims Peak Basalt is laterally continuous with the Shumuray Ranch Basalt of Kittleman and others (1965, 1967). The Shumuray Ranch Basalt was dated at 12.4 ± 0.5 Ma (middle Miocene; Fiebelkorn and others, 1983). Fiebelkorn and others (1983) also report a radiometric age of the Tims Peak Basalt at 21.6 ± 2.3 Ma, which is not consistent with the ages of the other rock units and is here judged to be in error.

Tuff, lapilli tuff, welded tuff, and tuffaceous sedimentary rocks (unit Tts) overlie the middle Miocene or older volcanic rocks in a zone across the middle of the quadrangle north of the Malheur River. The unit on the north side of the river and in the southwest corner may be related to the Juntura Formation of Bowen and others (1963). The unit in the northwest corner may be related to the Bully Creek Formation of Kittleman and others (1965, 1967). The unit in the northwest corner may also be a lacustrine facies equivalent of the pillow-basalt breccia unit discussed above. If the unit in the northwest corner is a lateral equivalent of the pillow-basalt breccia unit, this part of the unit would be older than the rest of the unit in the quadrangle. The unit to the south was deposited over a surface eroded on middle Miocene volcanic rocks and is largely preserved in a graben. Kittleman and others (1965) suggested that the Juntura and Bully Creek are related. The uppermost member of the Juntura contains Clarendonian mammalian fossils (Shotwell and Russell, 1963) that are in the age range middle to late Miocene (Berggren and others, 1985). In the northeastern part of the Tims Peak quadrangle, lithic lapilli of brecciated basalt lithologically identical to the brecciated basalt around the rhyolite intrusions north of Monument Peak were found in the pyroclastic and sedimentary rock unit that Kittleman and others (1967) mapped as the Bully Creek Formation. This evidence suggests that the Bully Creek is younger than 12.4 Ma, as the rhyolite intruded structures that formed after deposition of the Tims Peak Basalt. These relations also suggest that the tuff and welded tuff of unit Tts of the Jonesboro quadrangle may have come from the rhyolite vents in the Monument Peak area. Some of the tuff may also have come from late Miocene calderas to the southeast, such as the one inferred at Iron Point along the Owyhee River, 40 mi southeast of the quadrangle (Evans and others, 1990c). In this report, the tuff, lapilli tuff, welded tuff, and tuffaceous sedimentary rocks unit is tentatively assigned a middle and late Miocene age.

The Miocene rocks are covered locally by fanglomerate of at least two periods. The older fanglomerate of presumed Pliocene age occurs in the southwest corner of the quadrangle and represents remnants of a more widespread fanglomerate unit deposited over a paleosurface of as much as 400 ft of relief. The relative age of the unit is suggested by its poorly preserved alluvial fan morphology and by the northwest-striking fault that appears to truncate the fanglomerate. Younger fanglomerate of late Pliocene and Pleistocene age is common within 2 mi of the Malheur River, especially north of the river. The generally well-preserved alluvial fan morphology and lack of faulting in the unit suggest that this fanglomerate was post-tectonic. The younger fanglomerate unit was clearly much more extensive, covering large areas from river level at 2,800 to 2,900 ft in elevation to 4,400 ft. One occurrence of the younger fanglomerate unit is in an abandoned meander channel on the south side of the Malheur River. Locally, the younger fanglomerate unit grades into alluvium along the Malheur River.

Holocene deposits include landslide deposits and alluvium. Landslide deposits occur along steep faults and locally along the contact of the Littlefield Rhyolite and Hunter Creek Basalt. The largest landslide deposit on the east side of South Trail Creek is fault related. Alluvium occurs largely in the flood plain along the Malheur River and was mapped along Pole, Calf, and Hunter Creeks. The alluvium in Pole Creek and the small deposits in Trail Creek and Black Canyon do not connect with the alluvium along the Malheur River and reflect latest Holocene downcutting.

MAP SYMBOLS

──	**Contact**--Approximately located
──•── ······	**Fault**—Dotted where concealed; ball and bar on downthrown side; where two directions of movement are indicated, older movement is labeled "1"
■ H	**Location of whole-rock sample analyzed in Table 1, Plate 2**
▲ 12	**Location of altered-rock sample analyzed in Table 2, Plate 2**
● j	**Location of stream-sediment sample analyzed in Table 3, Plate 2**
∽	**Hot spring**

Cross sections are on accompanying sheet (Plate 2)

ISSN 0270-952X

GMS-66

Geology and Mineral Resources Map of the Jonesboro Quadrangle, Malheur County, Oregon
By James G. Evans

Funded jointly by the Oregon Department of Geology and Mineral Industries, Oregon State Lottery, and the U.S. Geological Survey COGEOMAP Program as part of a cooperative effort to map the west half of the 1° by 2° Boise sheet, eastern Oregon.

Plate 1

STRUCTURE

The Miocene volcanic and sedimentary rocks are mostly flat lying to gently dipping in several directions but generally eastward. Locally, in a small area north of the Malheur River along the east boundary of the quadrangle, the rocks dip moderately to steeply to the south.

The rocks are cut by numerous, mostly vertical and steeply dipping faults that strike largely north, north-northwest, and west-northwest. In general, the west-northwest-striking faults appear to be older than the others, because they are offset along faults of the other two groups.

The general structure of the rock units of the quadrangle consists of a gentle eastward-dipping homocline (cross sections A-A′, B-B′, Plate 2). Superimposed on the homocline is a large west-northwest-trending graben along the north side of the Malheur Gorge (cross section A-A′, Plate 2), into which the volcanic section was dropped about 2,000 ft. The graben may appear to control the course of the Malheur River in the eastern part of the quadrangle, but the river diverges southward from the graben in the western part. The graben may have been important in the accumulation of middle and upper Miocene pyroclastic and sedimentary rocks (unit Tts) and provided a basin for deposition of upper Pliocene and Pleistocene fanglomerate (unit QTf).

A narrow north-trending graben occurs along South Trail Creek where a block containing the Littlefield Rhyolite was dropped between blocks that expose the basalt of Malheur Gorge (cross section B-B′, Plate 2).

The structure of the quadrangle may, in part, be a response to emplacement of small plutons nearby. Aeromagnetic data (Boler, 1978) show a high over rhyolite intrusions at Westfall Butte (Haddock, 1967; Kittleman and others, 1967; Walker, 1977) 4 mi north of the study area and a low in the Monument Peak area (Hagood, 1963; Kittleman and others, 1967; Walker, 1977) 4 mi south of the study area. These rhyolite intrusions are younger than the Tims Peak Basalt because they intrude structures that cut the basalt. A possible concealed intrusion (Evans and others, 1990a) 5 mi southwest of the study area is interpreted to be the vent through which the Littlefield Rhyolite south of the Malheur River was extruded.

Gravity potential data indicate a low about 3 mi across near the east boundary of the quadrangle (Lillie, 1977) in the vicinity of the graben that occurs there.

Uplift and erosion of the study area since Miocene rocks were deposited have occurred in stages that are preserved in units Tts, Tf, and QTf. In addition, large scattered blocks (3 ft across maximum) of the Dinner Creek Welded Tuff occur on top of the Hunter Creek Basalt on the ridge top in the northeast part of the quadrangle. These blocks may be relics of fanglomerates that are older than unit Tf and have been eroded away. Unlike the circumstances described for the South Mountain area (Evans, 1990), none of these blocks of the Dinner Creek can be reasonably supposed to have been transported by human activity. Possible sources of the blocks are parts of the same ridge that are a few hundred feet higher than the sites of the blocks. It is not clear how much movements along vertical faults influenced the development and removal of the fanglomerates, or whether, lacking major recent uplift, the 3,000 ft of relief north of the Malheur River represents downcutting and erosion of older fanglomerates since approximately early Pliocene time.

GEOLOGIC HISTORY

The rocks exposed in the quadrangle reflect a history covering a period of at least middle Miocene to Holocene time. The Miocene and possibly older rocks comprise a sequence of mostly basalt, lesser amounts of rhyolite, and minor sedimentary and pyroclastic rock that was deposited on an unknown substrate. The source vents of the basalt are not known. Rhyolite was extruded from a vent 5 mi southeast of the quadrangle. The Dinner Creek Welded Tuff, the major pyroclastic unit in the quadrangle, may have come from Castle Rock, about 12 mi northwest of the quadrangle. Some of the basalt in the pillow-basalt breccia unit and possibly in the Tims Peak Basalt came from minor dikes in the northwest corner of the quadrangle, but these dikes are probably too small to have been the major basalt conduits for the pillow-basalt breccia and basalt flows. Unconformities in most of the middle Miocene section are minor in the study area, in contrast to the ones described in the adjacent South Mountain quadrangle. Locally, gentle topography of less than 100 ft was noted on the top of the Dinner Creek. Tectonism, uplift, and erosion resulted in the formation of a network of irregular basins occupied at times by lakes by middle and late Miocene time. Some of the faulting and uplift may have resulted from emplacement of intrusions south and north of the quadrangle. During this period, rhyolitic pyroclastic volcanism occurred in the region, as indicated by the pyroclastic rocks deposited in the basins. The source of much of the tuff was probably the rhyolite vent at Monument Peak, but some of it may have come from as far away as 40 mi southeast of the quadrangle. The Pliocene into the Holocene has been a period of erosion of the Miocene rocks, including stages during which alluvial fans were formed and destroyed. Faults were active in the area up to some time in the Pliocene.

MINERAL RESOURCES

The southeastern corner of the Jonesboro quadrangle is included in the western part of the Sperry Creek Wilderness Study Area (Miller, 1989; Malcolm and others, 1990; Evans and others, 1990a,b). The mineral-resource and geochemical studies of the Sperry Creek Wilderness Study Area cited above indicated that the area contains basalt suitable for crushed aggregate or production of basalt fiber and resources of sand and gravel. No mineral potential for gold or other commodities was indicated by these earlier studies.

The Jonesboro quadrangle outside the Sperry Creek Wilderness Area also contains large amounts of basalt and sand and gravel resources. A hot spring (125 to 13 °F) used for domestic heating (M. Miller, unpublished data, 1989) occurs in the SW¼SE¼ sec. 29, T. 20 S., R. 39 E., along the north side of the Malheur River.

Twelve rock and 10 stream sediment samples were collected from the Jonesboro quadrangle by J.G. Evans and H.C. Brooks. Three of the rock samples contain detectable amounts of gold (lower limit of detection of 1 part per billion [ppb]). The maximum amount of gold found in these samples is 4 ppb. Four of the rock samples contain silver detectable at the 15-ppb level. The maximum concentration of silver is 43 ppb. Arsenic was found in 10 of the samples (lower limit of detection of 1 part per million [ppm]). The maximum concentration of arsenic found is 128 ppm.

Most of the stream-sediment fractions contain detectable amounts of gold at the 0.2-ppb level. The maximum concentration of gold detected is 15 ppb in the minus 30 plus 80 mesh fraction collected from South Trail Creek. The highest concentrations of gold in the other stream-sediment samples range from 3 to 6 ppb and occur in the minus 30 plus 80 mesh fractions. One sample has its highest gold concentration in the heavy-mineral fraction (7.53 ppb).

Silver occurs in highest concentration in the heavy-mineral fractions (11.8 to 84.4 ppm) in the stream-sediment samples. The highest concentration occurs in the sample from South Trail Creek. The silver concentrations in the minus 80 mesh fractions range from 11.6 to 30.8 ppm and may be more representative of average silver concentrations of the drainages.

The rock and steam-sediment samples collected in the Jonesboro quadrangle suggest widespread weak epithermal alteration and gold and silver mineralization. The stream-sediment sample from South Trail Creek contains the highest gold and silver concentrations, suggesting that the South Trail Creek drainage may be the most promising area for prospecting in the quadrangle. No other prospective areas are clearly delineated.

There is no specific information available on ground water in this quadrangle. There are no records of wells drilled (Marshall Gannett, written communication, 1990). In places, springs roughly coincide with the contact between the Hunter Creek Basalt and the Dinner Creek Welded Tuff; some springs occur just above the cliff-forming, strongly welded Dinner Creek Welded Tuff.

REFERENCES

Berggren, W.A., Kent, D.V., and van Couvering, J.A., 1985, The Neogene: Part 2, Neogene geochronology and chronostratigraphy, *in* Snelling, N.J., ed., The chronology of the geologic record: The Geological Society Memoir 10, p. 211-242.

Boler, F.M., 1978, Aeromagnetic measurements, magnetic source depths, and the Curie point isotherm in the Vale-Owyhee, Oregon, geothermal area: Corvallis, Oreg., Oregon State University master's thesis, 104 p.

Bowen, R.G., Gray, W.L., and Gregory, C.D., 1963, General geology of the northern Juntura basin, *in* Shotwell, J.A., ed., The Juntura basin: Studies in earth history and paleoecology: American Philosophical Society Transactions, v. 53, p. 22-34.

Dalrymple, G.B., 1979, Critical tables for conversion of K-Ar ages from old to new constants: Geology, v. 7, no. 11, p. 558-560.

Evans, J.G., 1990, Geologic map of the South Mountain quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-67, scale 1:24,000.

Evans, J.G., Frisken, J.G., Griscom, A., Sawatkzy, D.L., and Miller, M.S., 1990a, Mineral resources of the Gold Creek and Sperry Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-E, 42 p.

------1990b, Mineral resources of the Gold Creek and Sperry Creek Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Open-File Report 90-0517, 21 p.

Evans, J.G., Turner, R.L., Griscom, A., Sawatzky, D.L., and Causey, J.D., 1990c, Mineral resources of the Lower Owyhee Canyon Wilderness Study Area, Malheur County, Oregon: U.S. Geological Survey Bulletin 1741-F, 43 p.

Evernden, J.F., Savage, D.E., Curtis, G.H., and James, G.T., 1964, Potassium-argon dates and the Cenozoic mammalian chronology of North America: American Journal of Science, v. 262, no. 2, p. 145-198.

Fiebelkorn, R.B., Walker, G.W., MacLeod, N.S., McKee, E.H., Smith, J.G., 1983, Index to K-Ar determinations for the State of Oregon: Isochron/West, no. 37, p. 3-60.

Gazin, C.L., 1932, A Miocene mammalian fauna from southeastern Oregon: Contributions to Paleontology, Carnegie Institute of Washington Publication 418, p. 37-86.

Greene, R.C., Walker, G.W., and Corcoran, R.E., 1972, Geologic map of the Burns quadrangle, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-680, scale 1:250,000.

Haddock, G.H., 1967, The Dinner Creek Ash-Flow Tuff of the Malheur Gorge area, Malheur County, Oregon: Eugene, Oreg., University of Oregon doctoral dissertation, 110 p.

Hagood, A.R., 1963, Geology of the Monument Peak area, Malheur County, Oregon: Eugene, Oreg., University of Oregon master's thesis, 165 p.

Kittleman, L.R., Green, A.R., Haddock, G.H., Hagood, A.R., Johnson, A.M., McMurray, J.M., Russell, R.G., and Weeden, D.A., 1967, Geologic map of the Owyhee region, Malheur County, Oregon: University of Oregon Museum of Natural History Bulletin 8, scale 1:125,000.

Kittleman, L.R., Green, A.R., Hagood, A.R., Johnson, A.M., McMurray, J.M., Russell, R.G., and Weeden, D.A., 1965, Cenozoic stratigraphy of the Owyhee Region, southeastern Oregon: University of Oregon Museum of Natural History Bulletin no. 1, 45 p.

Lillie, R.J., 1977, Subsurface geologic structure of the Vale, Oregon, Known Geothermal Resource Area from the interpretation of seismic reflection and potential field data: Corvallis, Oreg., Oregon State University master's thesis, 52 p.

Malcolm, M.J., Frisken, J.G., and Motooka, J.M., 1990, Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Gold Creek (OR-003-033) and the Sperry Creek (OR-003-035) Wilderness Study Areas, Malheur County, Oregon: U.S. Geological Survey Open-File Report 90-29, 29 p.

Miller, M.S., 1989, Mineral resources of the Sperry Creek Wilderness Study Area and Gold Creek Study Area and addition, Malheur County, Oregon: U.S. Bureau of Mines Mineral Land Assessment Open-File Report MLA 22-89, 70 p.

Palmer, A.R., 1983, The decade of North American geology 1983 geologic time scale: Geology, v. 11, no. 9, p. 503-504.

Shotwell, J.A., and Russell, D.E., 1963, Mammalian fauna of the upper Juntura Formation, the Black Butte local fauna, *in* Shotwell, J.A., ed., The Juntura basin: Studies in earth history and paleoecology: American Philosophical Society Transactions, v. 53, p. 43-69.

Walker, G.W., 1977, Geologic map of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-902, scale 1:500,000.

Acknowledgments: The section on analytical methods was prepared by G.L. Baxter, Geochemist, Oregon Department of Geology and Mineral Industries. This map was reviewed by James J. Rytuba and Dean Vander Meulen, U.S. Geological Survey, and Mark L. Ferns and Howard C. Brooks, Oregon Department of Geology and Mineral Industries.