STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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GEOLOGY AND MINERAL RESOURCES OF THE SHADY COVE QUADRANGLE, JACKSON COUNTY, OREGON

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Geology and Mineral Resources Map of the Shady Cove Quadrangle, Jackson County, Oregon
By Frank R. Hladky
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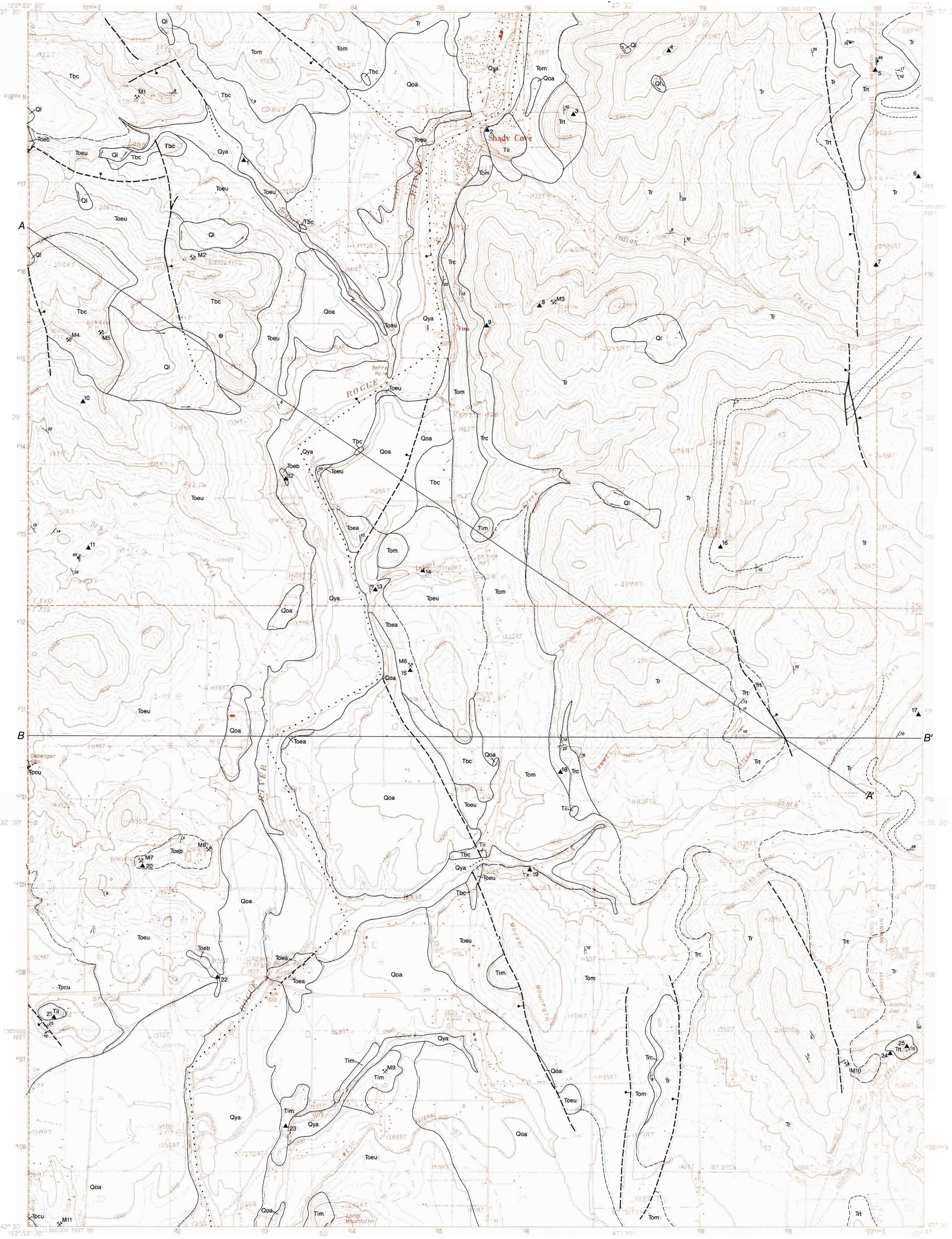
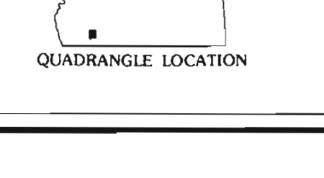
Plate 1



Base map by U.S. Geological Survey
Control by USGS and NOS/NOAA
Topography compiled from aerial photographs taken 1976, field checked 1977, edited 1983.
Lambert Conformal Conic Projection. 1927 North American datum 10,000-foot grids based on Oregon coordinate system, south zone.
1000-meter Universal Transverse Mercator grid ticks, zone 10

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
SUPPLEMENTARY CONTOUR INTERVAL 20 FEET



QUADRANGLE LOCATION

Geology by Frank R. Hladky,
Oregon Department of Geology and Mineral Industries

Field work conducted from March, 1991 to February, 1992

Reviewed by Thomas J. Wiley, Oregon Department of Geology and Mineral Industries

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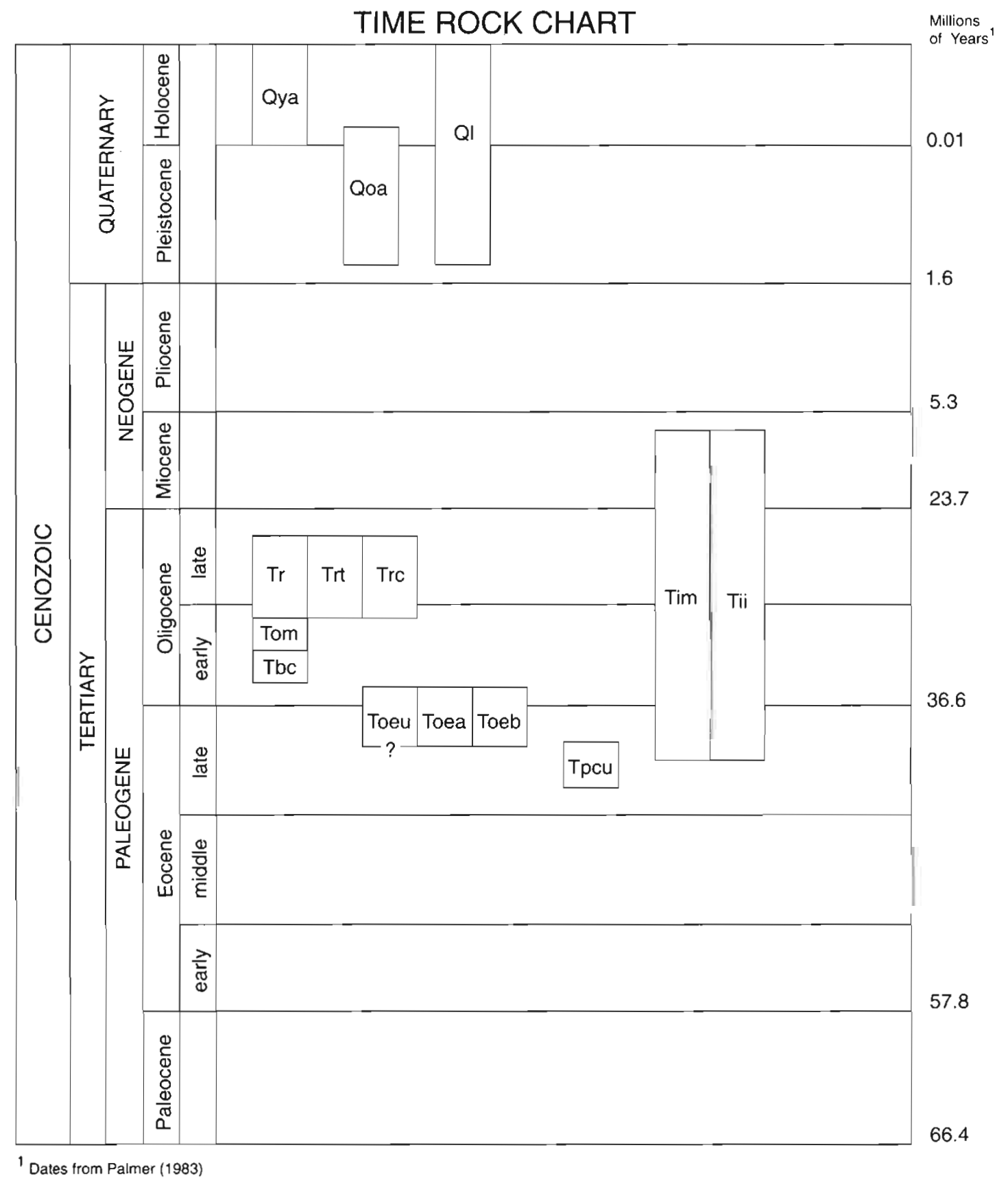
Cartography by Allan Cartography

TIME ROCK CHART



[1] Dates from Palmer (1983)

EXPLANATION

QUATERNARY DEPOSITS

Qya **Young alluvium (Holocene)**—Gravel, sand, and silt deposited along modern stream channels

Qoa **Old alluvium (Pleistocene and Holocene)**—Gravel, sand, and silt; primarily terraces above modern stream channels; locally dissected; depositional surfaces preserved in places. Thickness less than 8 m (25 ft)

Ql **Landslide deposits (Pleistocene and Holocene)**—Fragments of bedrock mixed with gravel, sand, silt, or clay and displaced downslope by gravity sliding. Arrows indicate direction of movement

ANGULAR UNCONFORMITY

TERTIARY (PALEOGENE) SEDIMENTARY AND VOLCANIC ROCKS

Tr **Roxy Formation (lower to upper Oligocene)**—Mostly brown-, tan-, and gray-weathering andesite flows, often platy; also undivided andesitic and latitic tuff, latite, and very local conglomerate. Andesite composed of euhedral, zoned andesine laths (up to 4 mm), subhedral augite and pigeonite (up to 1 mm), and, rarely, orthoclase in a fine-grained pilotaxitic to hyalopilitic groundmass of oligoclase to andesine microlites, clear crypto-felsic minerals, pyroxene, magnetite, and also variously containing brown glass, chlorite, and hematite. Crypto-felsic minerals interpreted to be devitrified glass. Dark-gray latitic flow or dike comprised of euhedral andesine laths (up to 3 mm), perthitic orthoclase, and sparse augite in a pilotaxitic groundmass of crypto-felsic minerals, andesine microlites, chlorite, and magnetite exposed in NW¼ NW¼ sec. 19, T. 35 S., R. 1 E., south of Nichols Gap in an overflow draw for the Medford aqueduct. Thickness in quadrangle greater than 900 m (3,000 ft)

Trt **Tuff**—Tan, buff, light-olive, crystal vitric andesitic to latitic tuff. Laterally discontinuous, often discordant. Includes several deposits probably erupted from different sources. Includes welded, latitic, orthoclase-phyric ash-flow tuff in NE¼ SE¼ sec. 15, T. 34 S., R. 1 W.; similar exposures on the southeast flank of Vestal Butte contain carbonized wood. A devitrified, fine-ash, andesitic, crystal vitric tuff intruded by andesitic dikes in the NE¼ NE¼ sec. 13, T. 34 S., R. 1 W. In NW¼ NW¼ sec. 19, T. 35 S., R. 1 E., unit **Trt** includes planar-stratified, thin- to medium-bedded, moderately to poorly sorted, partially argillized, unwelded, pumice lithic crystal, lapilli-ash air-fall tuff containing randomly emplaced latitic blocks displaying poorly preserved impact structures; this deposit is underlain by poorly sorted, chaotic, welded, latitic block- and ash-flow tuff, which, in turn, is underlain by latitic flows or dikes. Maximum thickness about 120 m (400 ft)

Trc **Conglomerate**—Tan, poorly sorted, mud-supported, polymodal, polylithic volcanogenic cobble conglomerate occasionally containing coherent clasts of shale; locally sandy and moderately sorted with graded bedding in Shady Cove. Clasts are typically angular to subrounded with low to moderate sphericity. Interpreted as lahar deposits, locally transitional to hyperconcentrated flow deposits. Unit frequently found at or near base of unit **Tr**. Thickness widely variable, with maximum about 180 m (600 ft)

Tom **Tuff of Mosser Mountain (lower Oligocene)**—Olive, tan, or less frequently buff, welded, latitic, lithic, plagioclase- and orthoclase-phyric vitric lapilli ash-flow tuff. Informally designated herein as the tuff of Mosser Mountain. Top contact locally scoured by volcanogenic conglomerates (lahar deposits) of disconformably overlying unit **Trc**. Thickness varies widely, with maximum about 370 m (1,200 ft) at Mosser Mountain

Tbc **Tuff of Bond Creek of Smith and others (1982) (lower Oligocene, 34.9 Ma)**—Buff to tan, welded, rhyolitic to rhyodacitic, biotite-, orthoclase-, and quartz-phyric vitric ash-flow tuff. K-Ar age of 34.9±1 Ma on biotite (Smith and others, 1980; Fiebelkorn and others, 1983). Thickness approximately 180 m (600 ft) in northwest corner of quadrangle; thins rapidly to the south, pinching out at Mosser Mountain

Toeu **Volcanic and volcanogenic rocks, undivided (lower Oligocene to upper Eocene?)**—Interbedded, gray-weathering, tan, olive, and brown volcanogenic conglomerate, mudstone, tuff, andesite, and basalt not mapped separately. Conglomerate is predominantly chaotic, poorly sorted, and matrix supported; interpreted as mudflow (lahar) deposits; clasts to 2 m, angular to rounded, usually subrounded, typically andesite, basalt, and welded tuff. Mudstone is thickly laminated, lobate, lensoidal, and crystal bearing. Andesite is platy to massive with phenocrysts of plagioclase, pigeonite, and augite. Basalt contains plagioclase and augite (±olivine) phenocrysts and is often celadonitized; occurs as small flows or sills intercalated with boulder conglomerate. Ash and lapilli tuff are crystal lithic. Lithologies are similar to those reported from the northern part of the Colestin Formation (Wells, 1956) in the Medford 30-minute quadrangle. In the adjacent Boswell Mountain quadrangle, this unit is intercalated with fluvial conglomerate and sandstone of Payne Cliffs Formation near the base (Wiley and Hladky, 1991). Maximum thickness about 460 m (1,500 ft)

Toea **Andesite**—Gray-weathering, dark-olive or dark-purple, medium-grained. Euhedral plagioclase (andesine) phenocrysts up to 4 mm and subhedral augite and pigeonite up to 0.5 mm in a pilotaxitic to hyalopilitic groundmass of andesine microlites, chlorite, hematite, magnetite, pyroxene, crypto-felsic minerals, and glass. Exposed primarily along Rogue River. Maximum thickness about 60 m (200 ft)

Toeb **Basalt**—Tan-weathering, gray to black, fine- to medium-grained. Plagioclase (zoned labradorite), pigeonite, augite, magnetite, orthoclase, and <1 percent corroded olivine in an intergranular groundmass of plagioclase, augite, pigeonite, chlorite, and magnetite. Exposures in the Wedgewood Drive area, secs. 7, 8, and 17, T. 35 S., R. 1 W., may represent hypabyssal, surface-breaching intrusions. Flow portions recognized by rubbly flow tops and underlying paleosols. ^{40}Ar/^{39}Ar incremental heating experiments on basalt from Boswell Mountain summit area in adjacent quadrangle yielded age of 33.8±1.9 Ma (Hladky and others, 1992). Maximum thickness about 60 m (200 ft)

Tpcu **Payne Cliffs Formation of McKnight (1971), upper part (upper Eocene)**—Conglomerate, sandstone, siltstone, mudstone; nonmarine, fluvial; provenance variation suggests local derivation in part. Pebble conglomerate is light olive to gray, weathers grayish brown, green, or yellowish orange; generally clast-supported, locally imbricated or cross bedded; typical clasts are sub- to well-rounded, oblate spheroids, average clast diameter 2 cm, maximum clast diameter less than 10 cm, occasional wood and coalified wood fragments; mainly porphyritic intermediate volcanic (to 70 percent) and quartzite containing subordinate mafic volcanic, siltstone, mudstone, silicic volcanic, metamorphic, chert, vein quartz, and intrusive clasts. Sandstone and pebbly sandstone are gray, green, tan, white, or red (altered), weathering grayish green to yellowish orange or brown, lithic to arkosic, micaceous. Mudstone is gray to grayish green and may contain concretions or leaves. Brown (1956) reports minimum late Eocene age based on fossil leaves from the middle part of the formation near Ashland. Intruded by basaltic dike with late Eocene K-Ar whole-rock minimum age of 36.9 ± 0.8 Ma in adjacent Boswell Mountain quadrangle (Wiley and Hladky, 1991). Thickness approximately 150 m (500 ft). Present interpretation on southwest border of map favors more restricted distribution of unit **Tpcu** than shown on adjacent Boswell Mountain quadrangle map (Wiley and Hladky, 1991)

INTRUSIVE ROCKS

Tim **Mafic dikes and small intrusive bodies (Tertiary)**—Gray to black, columnar, fine-grained basalt in secs. 15 and 34, T. 34 S., R. 1 W. Hypabyssal intrusions may have breached surface, but exposures are inadequate to determine this with certainty. In secs. 20 and 21, T. 35 S., R. 1 W., exposure of orange-weathering, light-gray, coarse-grained gabbro containing augite (up to 5 mm), subophitic to intergranular zoned plagioclase (labradorite, up to 1 cm), pigeonite sometimes with augite lamellae, minor orthoclase, magnetite, and, where altered, clay minerals, chlorite, and iddingsite

Tii **Intermediate dikes and small intrusive bodies (Tertiary)**—Tan-, brown-, and orange-weathering gray, medium- to coarse-grained andesite. Finer grained parts of unit consist of zoned plagioclase (andesine, up to 4 mm), augite and pigeonite (up to 1 mm), minor orthoclase, and <0.1 percent anorthoclase in a pilotaxitic to hyalopilitic groundmass of crypto-felsic minerals, oligoclase, and andesine microlites, magnetite, and brown glass. Coarse-grained parts of unit **Tii** are intergranular, devoid of glass

MAP SYMBOLS

——— – – – **Contact**—Approximately located, dashed where inferred

Fault—Dashed where inferred; dotted where concealed; ball and bar on downthrown side; number and arrow indicate dip. Arrows in cross section indicate direction of relative movement

- - - - - - **Bedding plane form line**—Delineates prominent local marker bed

20 **Strike and dip of beds**

25 **Strike and dip of beds (approximate)**

⊕ **Horizontal bed**

75 **Strike and dip of intermediate dikes**

▲9 **Rock sample location and map number** (Tables 1 and 2, Plate 2)

⚒M3 **Mine site and map number** (Table 3, Plate 1)

Tables 1 and 2 are on Plate 2

STRUCTURE

Tertiary rocks generally form a regional, gently east-dipping, homoclinal sequence that is complicated by initial dips of volcanic units, pinching and swelling of units, local disconformities, and local changes in attitude near faults (see cross-sections A-A', B-B'). In the northwest part of the quadrangle, strata dip to the northeast, part of slight doming also evident in the adjacent Boswell Mountain and Cleveland Ridge quadrangles.

Steeply dipping faults strike northwest, northeast, or north-northwest and have both easterly and westerly dips. A predominance of west-dipping faults, in concert with regional downwarping associated with the Western Cascades, may accomodate part of the eastward regional tilt. Surface traces of faults are usually partly or wholly obscured by colluvium, soil, and vegetation.

A steeply west-dipping, zigzagging fault, whose orientation may relate to conjugate northwest- and northeast-striking fault sets, is inferred to control the systematic right-stepping channel of the Rogue River. This fault is interpreted to have been active during the Tertiary, and segments of it offset unit Toeu by as much as 400 ft (see cross-section B-B'). Quaternary slip as much as a few tens of feet produced a regular series of escarpments, now partially eroded, on the east bank of the river. Gravel (unit Qoa) east of the Rogue River is slightly elevated relative to gravel west of the river (see cross section B-B'). No scarps are preserved, however, in terrace gravels (unit Qoa), and gravel thickness is variable due to local bedrock highs and local erosion.

A fault, synthetic to the Rogue River system, has produced an escarpment in the tuff of Mosser Mountain at or near its contact with unit Toeu in sec. 15, T. 35 S., R. 1 W. Small, mafic intrusive bodies and dikes occur along this fault.

Tightly spaced (within decimeters), parallel, northwest-trending faults are exposed in sandstones of the Payne Cliffs Formation in SW¼ SW¼ sec. 18, T. 35 S., R. 1 W., behind a garage. These fault sets display less than 3 ft of offset individually; their collective offset is unknown.

A low-angle fault in secs. 19, 20, and 29, T. 34 S., R. 1 W., displaces the tuff of Bond Creek. It is interpreted as being rooted in unit Toeu (see cross section A-A'); however, its trace across unit Toeu is largely inferred.

GEOLOGIC HISTORY

Rocks within the Shady Cove quadrangle record the evolution of volcanism with time along the early Cascade arc. Initial volcanism was mainly basaltic or andesitic in composition, as indicated by clasts within fluvial strata of the upper Eocene Payne Cliffs Formation and by basaltic flows, intrusions, lahar deposits, and andesitic tuffs beneath the 34.9-Ma rhyodacitic tuff of Bond Creek. Dominantly mafic volcanism was briefly succeeded by voluminous, regional silicic volcanism, including the tuff of Bond Creek, a 160-km-long marker. Subsequently, a less extensive latitic ash-flow tuff was erupted, herein informally named the tuff of Mosser Mountain. Overlying the ash-flow tuffs are predominantly andesitic flows and tuffs, signaling more effusive, edifice-building activity, dated previously as beginning about 28-31 Ma (Fiebelkorn and others, 1983).

The oldest rocks exposed in the Shady Cove quadrangle comprise unit Tpcu, the upper part of the upper Eocene Payne Cliffs Formation (McKnight, 1971, 1984). Unit Tpcu is exposed in the southwest corner of the quadrangle. It consists of tuffaceous sandstone, pebbly sandstone, siltstone, and mudstone. Tuffs and volcanogenic conglomerate at the base of unit Toeu are locally interbedded with Payne Cliffs Formation fluvial sandstone and conglomerate beds in the adjacent Boswell Mountain quadrangle (Wiley and Hladky, 1991). Mapping by Smith and others (1982) and Sherrod and Smith (1989) show this contact as an unconformity farther south. Volcanic provenance of conglomerate clasts and lithic sandstone in this area indicate that unit Tpcu is equivalent to the upper part of the Payne Cliffs Formation in its type area (McKnight, personal communication, 1990). The Payne Cliffs Formation dips gently beneath volcanic flows and lahar deposits of undivided Oligocene-Eocene rocks.

Upper Eocene to lower Oligocene volcanic and related sedimentary rocks of units Toeu, Toea, and Toeb show wide lateral variation in their lithologic and textural characteristics, which is indicative of rapid changes in volcanic facies. Unit Toeu is an undivided unit of volcanogenic conglomerate (lahar deposits), tuff, and subordinate andesite and basalt. Clastic facies of unit Toeu coarsen to the north and west, and, in general, the unit thins to the south and east. Andesite (unit Toea) and basalt (unit Toeb) are mapped separately where possible. The geologic relationships of the different lithologies are often obscured by colluvium, soil, and vegetation. The tuff of Bond Creek (Smith and others, 1980, 1982) overlies units Toeu, Toea, and Toeb. Problematically young K-Ar ages for unit Toeb lavas (Wiley and Hladky, 1991) have been reconciled to field geologic relationships by ^{40}Ar/^{39}Ar incremental heating experiments on one of the questionable samples, yielding an age of 33.8±1.9 Ma (Hladky and others, 1992).

The 34.9-Ma rhyodacitic tuff of Bond Creek (unit Tbc) was erupted over subdued relief on top of unit Toeu within the Shady Cove quadrangle. The tuff of Bond Creek ponded in local depressions, which may account in part for local variations in thickness. Previously mapped only west of the Rogue River (Smith and others, 1982), the tuff of Bond Creek crosses the Rogue River and pinches out at Mosser Mountain, where it lies with slight disconformity on unit Toeu.

The latitic tuff of Mosser Mountain (unit Tom) was erupted from an unknown source, perhaps farther south and east. The unit swells to its greatest thickness where the tuff of Bond Creek pinches out. Its thickness varies widely.

A complex pile of andesite, latite, tuff, and conglomerate (lahar deposits), indicative of constructional stratovolcanic edifices, was deposited onto unit Tom. These rocks are correlated with the Roxy Formation of Wells (1956) as redescribed by Jad D'Allura (Southern Oregon State College, written communication, 1991). The Roxy Formation in the Shady Cove quadrangle is characterized by a predominance of andesitic flows. Local conglomerates (unit Trc) deposited onto unit Tom indicate substantial relief (stratovolcanoes).

Old Quaternary alluvium (unit Qoa), primarily terrace gravel, was deposited, perhaps as early as Pleistocene time, over a broad plain that extends from Shady Cove to the Agate Desert. The entrenchment of the Rogue River into these gravels and the underlying bedrock is inferred to have been partly controlled by faulting that produced the regular right-stepping channel and a slight elevation of gravels east of the river relative to gravels west of the river. As the local base level was lowered, the Rogue River and its system of tributaries cut through Pleistocene terrace gravel and older bedrock. Young Quaternary alluvium (unit Qya) can be found along modern stream channels.

GROUND-WATER RESOURCES

Areas underlain by the Eocene Payne Cliffs Formation are characterized by low matrix porosity and permeability. Ground-water flow is typically controlled by secondary permeability (fracture sets), which results in compartmentalized ground-water storage. Ground-water levels are subject to significant seasonal fluctuations. In some wells, efficiency has been observed to decline through time. Possible factors contributing to decreased well efficiency include (1) mineral precipitation within the matrix and (2) matrix collapse coincident with water-pressure decreases (Doug Woodcock, Oregon Water Resources Department, personal communication, 1992).

Areas underlain by Eocene and Oligocene volcanic rocks and volcanogenic sedimentary rocks have variable matrix porosity and permeability. Permeability is often restricted to rubbly interflow zones and fractures within andesite and basalt. Wells are frequently finished in rubbly interflow zones. Welded tuffs, such as the tuff of Bond Creek, are characterized by low matrix porosity and permeability, and ground-water flow is typically controlled by fracture sets, either primary (related to cooling) or secondary (related to faulting). Volcanogenic sedimentary rocks have matrix characteristics that vary according to the degree of compaction, cementation, and secondary fracturing (Doug Woodcock, Oregon Water Resources Department, personal communication, 1992).

Unconsolidated alluvium is less than 8 m (25 ft) thick and does not constitute a significant aquifer (Doug Woodcock, Oregon Water Resources Department, written communication, 1991).

GEOCHEMISTRY

Sampling methods

Rock samples were collected and analyzed for combined major and minor oxides (whole-rock analysis, Table 1) and trace elements (Table 2) to provide an indication of their compositions. The number of samples was insufficient to determine the complete range of "normal" chemical compositions for the rock types in the quadrangle.

Altered rock samples were collected specifically for trace-element analysis where field evidence indicated alteration or mineralization.

Sample preparation

The rock samples were crushed to minus ¼-in. in a Braun chipmunk crusher and then crushed to about minus 10 mesh in a Marcy cone crusher. Both crushers employed manganese-steel crushing media. Each crushed sample was split in a Jones-type splitter to obtain a nominal 250-g subsample for trace-element analysis (TEA) and, where required for whole-rock analysis (WRA), a nominal 100-g subsample. The subsamples were milled to about minus 200 mesh: each TEA subsample in chrome-steel media and each WRA subsample in corundum media. All sample preparation was done in the Oregon Department of Geology and Mineral Industries (DOGAMI) laboratory. (Contact this laboratory for detailed sample-preparation information.)

Chemical analysis

Whole-rock analysis

X-ray fluorescence (XRF) analyses were performed by X-ray Assay Laboratories (XRAL) of Don Mills, Ontario, Canada. 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.

FeO — Ferrous oxide was determined by use of a modification of the "Wilson" method. Blank-corrected volumes of titrant for three international standard reference materials are plotted against their certified values to produce an analytical curve from which the FeO contents of samples are determined. This "routine" method has coefficients of variation of 0.00-0.68 (mean = 0.09); it may be less exacting than the more common "Pratt" method, but it is considered to produce data adequate for calculating ferric/ferrous ratios. Results are reported on a volatile-free weight basis to conform with XRAL whole-rock analytical data.

Fe_2O_3 —Ferric oxide (volatile free) was calculated as follows:
Percent Fe_2O_3 = percent Fe_2O_3T - 1.111 x percent FeO.

H_2O- —The loss in weight caused by heating a sample to 105°C for four hours is labeled "H_2O-" in Table 1. This value can be deducted from LOI to obtain an estimate of the content of other volatile components in a sample.

Trace-element analysis:

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

15-element package—M.B. Associates (MBA; formerly Geochemical Services, Inc.) of North Highlands, California, performed the analyses for 15 trace elements including gold. The method employed a proprietary acid dissolution and organic extraction of a 15-g subsample. The finish was by induction coupled plasma (ICP) emission spectrometry for the elements other than gold; gold was determined by graphite furnace atomic absorption (GFAA) spectrometry. For gold, the detection limit was 0.5 ppb. The detection limits for the other elements are available from the DOGAMI laboratory. MBA considers the digestion to provide total metal contents except for gallium and thallium.

Nine elements and LOI—The DOGAMI laboratory performed flame emission analysis for lithium and flame atomic absorption analysis for barium, chromium, cobalt, copper, iron, manganese, nickel, and zinc. A 1-g sample was digested with nitric, hydrofluoric, and perchloric acids, taken to incipient dryness, and then redissolved and taken to 100-ml volume with 10 percent nitric acid. The digestion provides total metal content except for barium and possibly chromium. Loss on ignition (LOI) for altered rocks was determined by heating a 1-g sample to 950°C and holding at that temperature for four hours.

MINERAL RESOURCES

The Shady Cove quadrangle has produced only industrial rock materials; no metallic or energy minerals are known (Gray, 1991). Stone and "granite" (actually gabbro) have been produced from quarries in various rock units (Table 3). The tuff of Bond Creek (unit Tbc) is used as road metal and is favored for surfacing because of its softness. Andesite from the Roxy Formation (unit Tr) is used to produce a stable, durable road base. Gabbro (from unit Tim) from Mountain View Rock (mine site M9, Table 3) is suitable for decorative stone and monument stone in addition to crushed stone. Mine site M1 (Table 3), an old quarry for road metal in the tuff of Bond Creek, is the site of a mothballed and highly speculative mill that was to be used for extracting gold from Mazama ash.

Table 3. Mines and prospects, Shady Cove quadrangle, Jackson County, Oregon

Map no.	Name	UTM coordinates		Commodity	Rock unit
M1	Shady Cove/Long Branch	4718000N	511530E	Stone	Tbc
M2	Alexis Boutacoff	4716160N	512160E	Stone	Tbc
M3	Indian Creek Quarry	4715670N	516300E	Stone	Tr
M4	Toprock Pit	4715230N	510740E	Stone	Tbc
M5	Toprock Pit	4715310N	511110E	Stone	Tbc
M6	Gerald Schneider	4711500N	514660E	Stone	Toea
M7	Wedgewood	4709280N	511590E	Stone	Toeb
M8	Wedgewood	4709410N	512370E	Stone	Toeb
M9	Mountain View Rock	4706870N	514390E	Stone (granite)	Tim
M10	Nichols Gap	4706960N	519680E	Stone	Tr
M11	Modoc Rock Pit	4705100N	510660E	Stone	Qoa

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GEOLOGIC CROSS SECTIONS

Thickness of Quaternary units slightly exaggerated.