U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 99-583
Pamphlet accompanies map

Base from U.S. Geological Survey, 1990

Lambert conformal conic projection. 1927 North American datum
10,000-foot grid based on Oregon coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 11

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

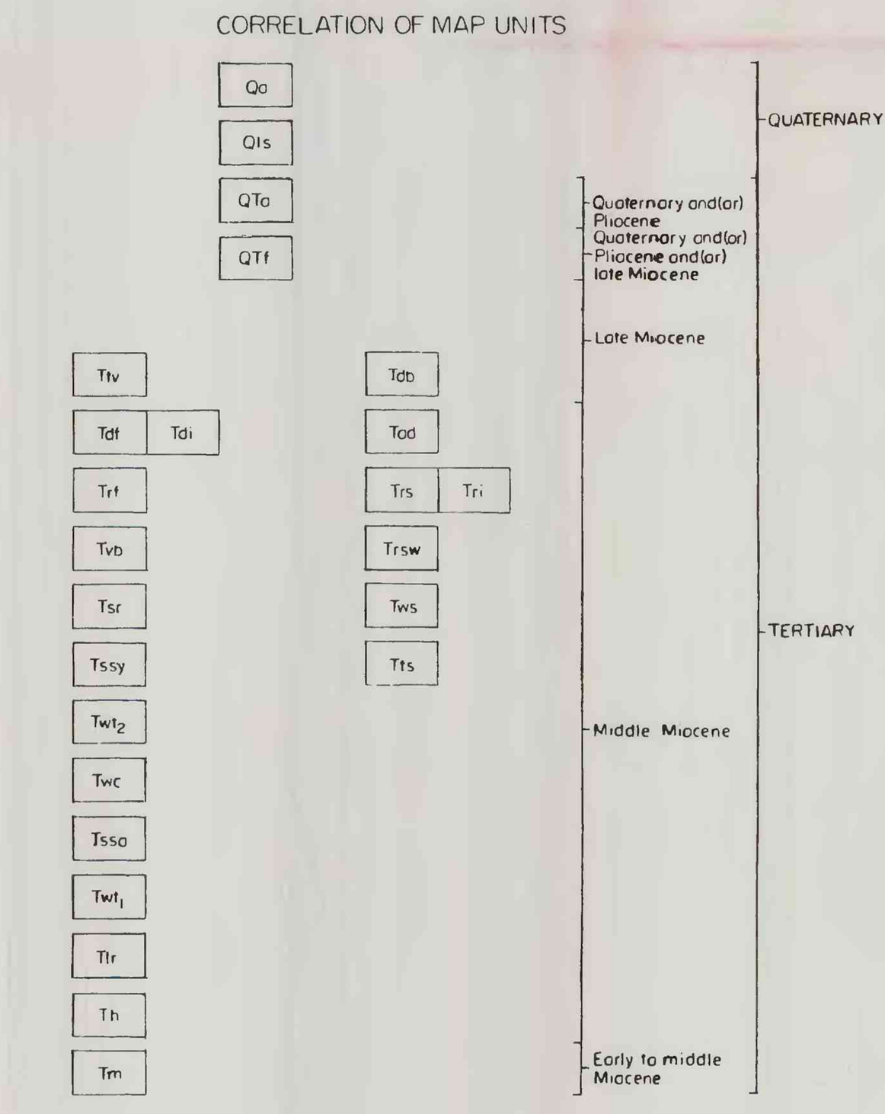
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Geology mapped in 1991-92

Manuscript approved for publication in 1999

CORRELATION OF MAP UNITS



DESCRIPTIONS OF MAP UNITS

Qa **Alluvium (Quaternary)**—Unconsolidated sand and graveldeposits that occupy stream drainages, especially in the western part of the quadrangle along Star Creek andSack Canyon. Smaller deposits are found along Road Canyon and Cold Spring Creek in the southeastern part of the quadrangle

Qls **Landslide deposits (Quaternary)**—Unconsolidated chaotic deposits of boulders that are found where resistant lava flows overlie poorly lithified sedimentary map units, especially where the lava flows have been weakened along faults. The largest landslide deposits are marginal to the dacite flows (map unit Tdf; see below) in eastern part of the quadrangle, and marginal to the Shumway Ranch Basalt (map unit Tsr; see below) in northwestern and central part of the quadrangle

QTa **Older alluvium (Quaternary and (or) Pliocene)**—Dark brown clay-rich silt deposits in E1/2 sec. 1, T. 25 S., R. 39 E. and SE1/4 sec. 36, T. 24 S., R. 39 E. along eastern margin of quadrangle.

QTf **Alluvial fan deposits (Quaternary, and (or) Pliocene, and (or) Late Miocene)**—Surface of deposits consists of unconsolidated gravel and boulder gravel. The few exposures and excavations show light brown, unlithified to moderately lithified, thick bedded (beds 15 to 200 cm thick) to massive silt, sand, and pebbly conglomerate, locally cemented with caliche, below as much as 2 m of unsorted overburden. The deposits may be as much as 100 m thick in the northwestern part of the quadrangle. The deposits may be diachronous, as suggested by the variable preservation of alluvial fan morphology and possibly different aggradation levels of parts of the extensive alluvial fan deposits in the western part of the quadrangle. Deposits could be as old as late Miocene and (or) as young as Quaternary.

Horst section

Ttv **Trachyandesite valley**-fill flows (Late Miocene)—Dark gray to black platy to blocky, locally vesicular, lava flows. Rock contains as much as 5 percent phenocrysts as long as 3 mm in very fine-grained groundmass. Unit is continuous with map unit Ttv in adjacent Skull Springs quadrangle (Evans and Binger, 1999b). Age is based on interpretation of the unit as paleovalley fill following uplift and erosion of the middle Miocene rocks and the possibility that the lava flows originated from the late Miocene Cedar Mountain volcanic center, which is 5 km to the east

Tdf **Dacite flows (Middle Miocene)**—Gray, dark gray, and purple platy and fractured lava flows that show flow laminations on weathered surfaces. The unit caps a small mesa in the east-central part of the quadrangle and forms a northeast-trending ridge called The Roostercomb that extends into the adjacent Skull Springs quadrangle (Evans and Binger, 1999b). The rock contains as much as 15 percent phenocrysts of plagioclase, and orthopyroxene as long as 2 mm. In places, the rock contains as much as 5 percent angular xenoliths as much as 3 cm across of black fine-grained basalt or basaltic andesite. Rock contains angular to rounded xenocrysts of quartz; olivine is inferred from presence of iddingsite; neither mineral is clearly part of the paragenesis. The groundmass consists of plagioclase laths as long as 0.2 mm, very fine-grained disseminated magnetite, and pyroxene. Groundmass domains defined by plagioclase laths as long as 0.1 mm are also present adjacent to xenoliths and xenocrysts (micro-chill zones?). Most phenocrysts and xenoliths are eroded by the groundmass. Olivine is altered to iddingsite; pyroxene is altered to biotite. Total thickness of the unit is about 50 m. Age is estimated from interpretation of The Roostercomb as dacite fill of a paleovalley cut into middle Miocene rocks.

Tdi **Dacite (Middle Miocene)**—Dacite intrusion that may be the source of the dacite flows and domes (?) (see text). Shown only in cross-section AA'

Trf **Rhyolite flow (Middle Miocene)**—White, light gray, and gray, glassy, locally perlitic, laminatedrhyolite and maroon flow breccia that underlie the dacite flows in a small area in the east-central part of the quadrangle. The rhyolite contains abundant vesicles that are commonly lined with white chalcedony and tridymite, and locally contains abundant lithophysae as much as 2 cm across. The flow breccia contains 50 percent angular fragments of rhyolite generally less than 3 cm across (maximum 8 cm) of dark green and gray aphanite. As much as 25 percent of the rock consists of grains of feldspar and quartz as much as 0.02 mm across in a glassy matrix that has disseminated hematite and discrete magnetite grains that are partly altered to hematite. Manyfeldspar and quartz grains appear to have recrystallized to a mass of smaller grains, probably of feldspar and quartz. The few phenocrysts are of plagioclase, potassium feldspar, and quartz as long as 1.5 mm. Many of the phenocrysts are rounded and contain glassy domains suggesting partial melting. Rounded to angular xenoliths of mafic volcanic rock as much as 1 cm across in the rhyolite show recrystallized plagioclase, and clinopyroxene altered to magnetite. The unit is as much as 30 m thick. Age of the unit is based on its probable close association with the dacite flows unit (map unit Tdf; see above; see text for discussion of relation to Tdf)

Tvb **Volcanic breccia (Middle Miocene)**—Red-brown and brown breccia varying upwards to dark gray, and consisting of angular fragments of laminated rhyolite and dacite forms a kilometer-long dike in secs 3 and 10, T. 25 S., R. 39 E. and may be one of the vents for the rhyolite and dacite flows (map units Tdf and Trf; see above). Most of the dike is very hard, but the northern end of it weathers to dark red-brown clay with boulders of breccia. Thin sections show the breccia to be a lapilli tuff that has about 50% angular fragments of hematite-rich welded tuff and angular fragments of fine-grained basalt or basaltic andesite in a matrix of laminated welded tuff. Mafic minerals are altered to hematite. Two samples of the dike were analysed for major oxides and are rhyolitic (table 2, samples 89 and 90). Age of unit is based on its probable close association with the dacite flows unit

Tsr **Shumway Ranch Basalt (Middle Miocene)**—Named by Kittleman and others (1965). Gray, dark gray and black platy and blocky basalt flows, with angular to subspherical weathered blocks as much as 2 m across. The rock is typically diktytaxitic and has amygdules of carbonate and clear opal. In places, the rock contains as much as 10 volume-percent vesicles that are usually no more that 2 cm across (maximum 15 cm). The rock contains as much as 35 percent phenocrysts as long as 5 mm of plagioclase, clinopyroxene, and olivine, which tend to be glomeroporphyritic. The locally pilotaxitic groundmass consists of plagioclase laths as long as 0.5 mm, magnetite, subophitic to ophitic clinopyroxene with oikocrysts as much as 1 mm across, and interstitial glass that contains disseminated magnetite and magnetite microlites. Some pyroxene grains contain enough very fine-grained magnetite to be opaque. Modal composition is: plagioclase 50 to 70 percent; olivine as much as 15 percent; clinopyroxene 10 to 30 percent; magnetite 5 percent; and glass as much as 5 percent. Olivine is altered to bowlingite and magnetite. Seven samples of the unit were analyzed for major oxides (table 2). Compositions include basalt, basaltic andesite, andesite, and trachyandesite. The andesite and trachyandesite compositions are in the lower parts of the unit where platy fracturing is common. Maximum thickness of the unit in the central part of the quadrangle is about 120 m. In the Monument Springs area (sec. 27, T. 24 S., R. 39 E.), the unit is inlerlayered with a 12- to 30-m-thick tongue of the younger sandstone unit Tssy (see below). Age of the unit is based on K-Ar ages (see text)

Tssy **Younger Sandstone (Middle Miocene)**—White, light brown, and gray medium- to coarse-grained sandstone interbedded with minor siltstone and conglomerate. The sandstone is poorly to moderately lithified with variable amounts of silica and hematite cement. The unit overlies theWildcat Creek Welded Ash-Flow Tuff (see below) and is overlain by the Shumway Ranch Basalt (see above). A tongue of the unit is intercalated with Shumway Ranch Basalt (see above) in the Monument Springs area. Beds are usually poorly defined and vary from 15 to 200 cm. Local conglomeratic beds include pebbly sandstone (near SE corner sec. 22, T. 24 S., R. 39 E., near Monument Springs) that has rounded pebbles of well lithified sandstone; conglomerate (in NW1/4 sec. 34, T. 24 S., R. 39 E., upper Sack Canyon) with angular to rounded clasts of white to pale gray laminated tuff generally less than 15 cm across (maximum 1.5 m); and volcaniclastic conglomerate (in NE1/4 sec. 15, T. 25 S., R. 39 E., upper Road Canyon) that contains 50 percent clasts generally less than 4 cm across (maximum 20 cm) of white glassy welded tuff, dark gray basalt, vesicular perlite, and a light gray glassy rhyolite. Thickness of unit varies from 12 to 60 m. Age of unit is based on its stratigraphic position between middle Miocene units

Twt_2 **Younger welded tuff (Middle Miocene)**—White, light gray, and greenish gray strongly welded tuff and lapilli tuff in the central and southeastern part of the quadrangle where it is present within the younger sandstone unit (map unit Tssy). In sec. 34, T. 24 S., R. 39 E., where the lower part of the younger sandstone is missing, the welded tuff lies directly on Wildcat Creek Welded Ash-flow Tuff. The younger welded tuff contains as much as 10 percent phenocrysts as long as 3 mm of plagioclase, sanidine, quartz, and hornblende, and scattered xenoliths of rhyolite, basalt or basaltic andesite, granophyre with recrystallized hornblende, and xenoliths consisting of plagioclase and hornblende and hornblende and magnetite that may be pieces of a granitic pluton. The rock is mostly quartz derived from crystallization of glass shards; shard boundaries are preserved. Locally, the rock is strongly welded and shows no relict shard texture. The rock also contains disseminated very fine-grained magnetite, hematite, and, in some rocks, tourmaline. Phenocrysts are much embayed by the matrix and mafic volcanic xenoliths show much oxidation of mafic minerals and recrystallization of plagioclase. Five samples of the unit analyzed for major oxides are rhyolite (table 2). The unit is generally no more than 3 or 4 m thick; however, it attains a thickness of 30 m in NW1/4 sec. 34, T. 24 S., R. 39 E. Age of the unit is based on its stratigraphic position between middle Miocene units

Twc **Wildcat Creek Welded Ash-flow Tuff (Middle Miocene)**—Named by Kittleman and others (1965). Unit is maroon, red, light to dark gray, lavender, pink, black, and brown strongly welded tuff with well developed compaction foliation and red and light gray welded tuff breccia that is widespread in the eastern half of the quadrangle. The welded tuff weathers to plates 2 to 4 cm thick and thicker meter-long slabs. Some of the rock is phonolitic. Gas cavities are lenticular, parallel the compaction foliation, and contain white and brown chalky deposits, clear opal, yellow-green chalcedony, and quartz on the walls. In places the rock contains fiamme and flattened pumice lapilli as long as 3 cm. The welded tuff generally contains no more than 2 percent phenocrysts (maximum 20 percent) as long as 3 mm of plagioclase, potassium feldspar (including sanidine, perthite, and microcline), hornblende, hematite, orthopyroxene, magnetite, and tourmaline. The matrix consists largely of devitrified or perlitic glass shards and disseminated very fine-grained hematite, and embays phenocrysts. In some rocks, devitrification resulted in formation of spherulites and obliteration of shard texture. Lithic fragments other than glass and pumice, include fine-grained iron-rich basalt or basaltic andesite, basaltic scoria, welded tuff, rhyolite, and biotite-bearing vitrophyre as much as 3 cm across. Vapor phase crystallization in vesicles includes tridymite, quartz, albite, sericite, and carbonate. Biotite and sericite are developed along contacts between shards. Some mafic xenoliths (plagioclase+pyroxene) appear to have been recrystallized. Eight samples of the unit were analyzed for major oxides and are mostly rhyolitic (table 2). One of the samples is a trachydacite. Maximum thickness of the unit in the quadrangle is 34 m. Age of the unit is based on its stratigraphic position between between middle Miocene strata.

Tsso **Older sandstone (Middle Miocene)**—White, light brown, pink, and green poorly to well lithified sandstone that lies between Littlefield Rhyolite (see below) and Wildcat Creek Welded Ash-Flow Tuff (see above). Where the Littlefield Rhyolite is absent, the sandstone rests on basalt of Malheur Gorge (map unit Tm; see below). The unit contains subordinate siltstone, tuff, and conglomerate. The sandstone has a silty matrix, and tends to be well sorted and thin-bedded (beds as much as 4 cm thick). Clasts are largely volcanic lithologies and siltstone, and locally contain diatoms. Unconformities and festoon cross-bedding are present. The sandstone is variably cemented with chalcedony. Conglomeratic beds contain as much as much as 50 percent angular to subangular clasts as much as 8 cm across (maximum 15 cm) of white laminated welded tuff, light gray and rusty brown pumice, gray glass, maroon and dark gray fine-grained basalt or basaltic andesite, and pink and pale yellow welded tuff. Maximum thickness of the unit is about 120 m in the southeastern part of the quadrangle, but thickness is highly variable across the quadrangle and on adjacent fault blocks. Age of the unit is based on its stratigraphic position between middle Miocene strata.

Tlr **Littlefield Rhyolite (Middle Miocene)**—Named by Kittleman and others (1965). The top of the rhyolite is exposed along Skull Creek near the northeastern corner of the quadrangle and along Sack Canyon in the center of the quadrangle. In the northeastern exposure the rhyolite is gray and contains about 30 volume-percent of spheroidal bodies and cavities as much as 2 mm across. The spheroids are mostly of clear chalcedony with a rim of light brown wallrock. The rhyolite along Skull Creek contains about 5 percent phenocrysts as long as 5 mm of feldspar and magnetite in a very fine-grained groundmass of quartz, feldspar and disseminated hematite. In Sack Canyon, the rhyolite is platy and contains 10 percent phenocrysts of feldspar and magnetite in a microcrystalline groundmass. No more than 12 m of the unit is exposed along Skull Creek, and 15 m is exposed in Sack Canyon. The age of the unit is based on $^{39}Ar/^{40}Ar$ dates (see text) and its stratigraphic position between middle Miocene strata.

Th **Hunter Creek Basalt (Middle Miocene)**—Named by Kittleman and others (1965). Black fine-grained aphyric basaltic andesite in secs. 14 and 15, T. 25 S., R. 39 E., upper Road Canyon. Some of the rock is vesicular and some of it has white amygdules about 1 mm across. Two samples of the unit were analyzed for major oxides and are basaltic andesite (table 2, samples 39 and 40), close to the icelandite composition of the unit farther north (Evans, 1990a,b). Only about 27 m of the unit is exposed in the quadrangle. Age of the unit is middle Miocene based on $^{39}Ar/^{40}Ar$ dates (see text) and its stratigraphic position between middle Miocene strata.

Tm **Basalt of Malheur Gorge (Early to middle Miocene)**—Named by Evans (1990a,b; formerly "unknown igneous complex of Kittleman and others, 1965). Black and dark green fine-grained generally aphyric basaltic lava flows covering about 5 km^2 in the southeastern part of the quadrangle. These are continuous with the much thicker section of basalt of Malheur Gorge mapped to the southeast in the Burnt Flat quadrangle (Ferns and Williams, 1993a). Some of the rock has as much as 5 percent phenocrysts of plagioclase, clinopyroxene, and hematite as long as 2 mm; some plagioclase contains rutile inclusions. The groundmass, which locally preserves flow layering, consists mostly of plagioclase laths as long as 0.1 mm, clinopyroxene, and magnetite partly altered to hematite. The rock is very fractured and locally contains veins of white chalcedony. The greenish color is from alteration of clinopyroxene, and plagioclase to epidote. A pale pink garnet porphyroblast was found in a sample with abundant epidote. In other samples, clinopyroxene is altered to biotite. Four samples of the unit were analyzed for major oxides; two are basaltic andesites and two are trachyandesites (table 2). Two samples from one site were analyzed for major oxides by the USGS and WSU and varied widely in composition (basaltic andesite/trachydacite). Age of the unit is based on $^{39}Ar/^{40}Ar$ ages (see text) and correlation of the unit with the Columbia River Basalt Group

Stockade Mountain volcanic center

Tdb **Drinkwater Basalt (Late Miocene)**—Named by Bowen and others in Shotwell (1963). Unit is continuous with Drinkwater Basalt as mapped by Greene and others (1972). Dark gray diktytaxitic and vesicular, fine- to medium-grained basalt with as much as 15 volume-percent interconnecting vesicles as much as 4 cm long. Weathers into pentagonal slabs as much as 2 m across. Locally, unit contains abundant amygdules of white and clear chalcedony and a white chalky substance. Plagioclase grains are gradational in size, so that a phenocryst phase is not clearly definable. The unit is at least 30 m thick. Age is based on a K-Ar date (see text)

Tad **Andesite dike (Middle or late Miocene)**—Black andesite in secs. 7 and 18, T. 25 S., R. 39 E. that has as much as 15 volume-percent vesicles, some of which are lined with a white chalky material. White opalite is deposited on fractures. The rock contains 10 percent plagioclase phenocrysts as long as 2 mm in a very fine-grained groundmass that includes glass. The dike is not closely associated with any flows, although its composition of highly alkaline andesite (table 2, sample 502) suggests that it could have been a source of, or is connected to, the source of the lower andesitic flows included within map unit Tsr (see above)

Trs **Rhyolite of Star Mountain (Middle Miocene)**—Named by Ferns and others (1993b) for its occurrence on Star Mountain in the southwestern corner of the quadrangle. Light gray, brownish gray, purplish gray, brown, maroon, and lavender rhyolite and black vitrophyre at its base. The rhyolite shows 1- to 2-cm-thick layering on weathered surfaces, commonly has interfering spherulites as much as 1 cm across, or has as much as 5 volume-percent vesicles, some lenticular and as much as 10 cm long parallel to crude sheeting. In places, the rock is cut by white chalcedony veins and contains thundereggs. The rhyolite contains 1 to 25 percent phenocrysts as long as 4 mm of potassium feldspar and quartz that are much embayed by the groundmass. The groundmass consists of feldspar and quartz grains as much as 0.1 mm across and disseminated, very fine-grained magnetite and hematite, except where groundmass is replaced by mutually interfering spherulites. The vitrophyre contains 25 to 50 percent phenocrysts as long as 4 mm of potassium feldspar and quartz. Vitrophyre is cut by breccia zones that are cemented by red vesicular glass and shows perlitic alteration. The rhyolite is at least 133 m thick on Star Mountain. Age is based on radiometric data and stratigraphic position (see text)

Trsw **Vesicular welded tuff (middle Miocene)**— Light gray very vesicular glassy welded tuff mostly in sec. 27, T. 25 S., R. 39 E. The unit overlies sandstone unit Tssy and underlies the rhyolite at Star Mountain to the south in northern Crowley quadrangle (Ferns and Williams, 1993b). Weathers to orange-stained irregular angular blocks. Unit is possibly a pyroclastic phase that preceeded eruption of the overlying rhyolite at Star Mountain (map unit Trs; see above). Two samples of the welded tuff, analyzed for major oxides (table 2) are rhyolite, close in composition to some of the analyzed samples of the rhyolite at Star Mountain. Age of the unit is based on its inferred magmatic relation to the rhyolite of Star Mountain.

Tri **Rhyolite (Middle Miocene)**—Rhyolite intrusion that may be the source of the rhyolite flows at Star Mountain (see text). Shown only in cross-section AA'

Tws **Welded tuff of Star Mountain (Middle Miocene)**—Named informally here for the welded tuff in the southwestern part of the quadrangle and along its southern margin. The rock is light gray, gray, pale pinkish gray, pink, lavender, light green, and brown, devitrified laminated welded tuff, with black vitrophyre at its base. The rock tends to weather to slabs as much as 10 cm thick, and locally weathers orange. Parts of the unit have as much as 35 volume-percent vesicles as much as 1 cm across (maximum 8 cm), some of which are lined with white tridymite. The rock is largely devitrified glass shards, or microcrystalline material where devitrification has obliterated the shard texture, or spherulites as much as 5 mm across are present. As much as 5 percent of the rock consists of disseminated hematite and clumps of hematite grains as much as 0.4 mm across. In places, carbonate veins and red veins of hematite and possibly cinnabar are present. Angular lapilli of red-brown tuff, pumice, and hematite-rich basalt or basaltic andesite are present locally. Thickness of the unit is at least 73 m. Age is based on unit's relation to overlying rhyolite of Star Mountain and the presence of rounded clasts of it in middle Miocene conglomerates along the western margin of the Oregon-Idaho graben (see text)

Tts **Tuffaceous sandstone (Middle Miocene)**— Light brown sandstone and white to pale gray laminated welded tuff in southwestern part of quadrangle. The sandstone is cemented with white, light brown, and clear chalcedony. At least 75 m of the unit is exposed under the welded tuff of Star Mountain. Age of the unit is based on that relationship-MAP SYMBOLSContactFault. Dotted where concealed; bar and ball on down-thrown side.Location of unaltered rock sample listed in Table 1Location of altered rock sample listed in Table 5Coincident location of unaltered and altered rock samples

MAP SYMBOLS

Contact

Fault. Dotted where concealed; bar and ball on down-thrown side.

Location of unaltered rock sample listed in Table 1

Location of altered rock sample listed in Table 5

Coincident location of unaltered and altered rock samples

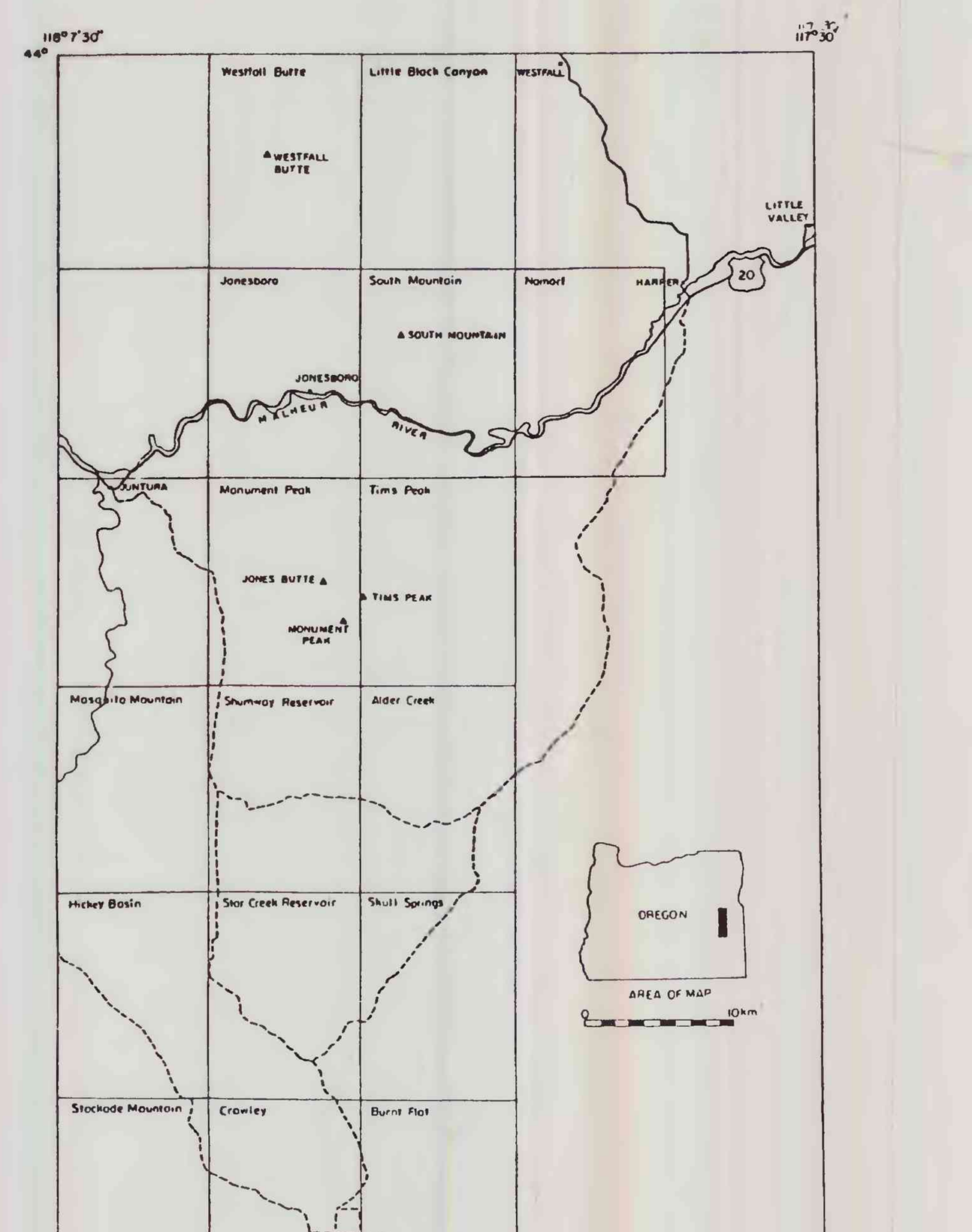


Figure 1. Index map showing locations of the Star Creek Reservoir quadrangle, adjacent quadrangles, and other quadrangles mentioned in this report. The thicker uninterrupted line is U.S. Highway 20; dashed lines are dirt roads.

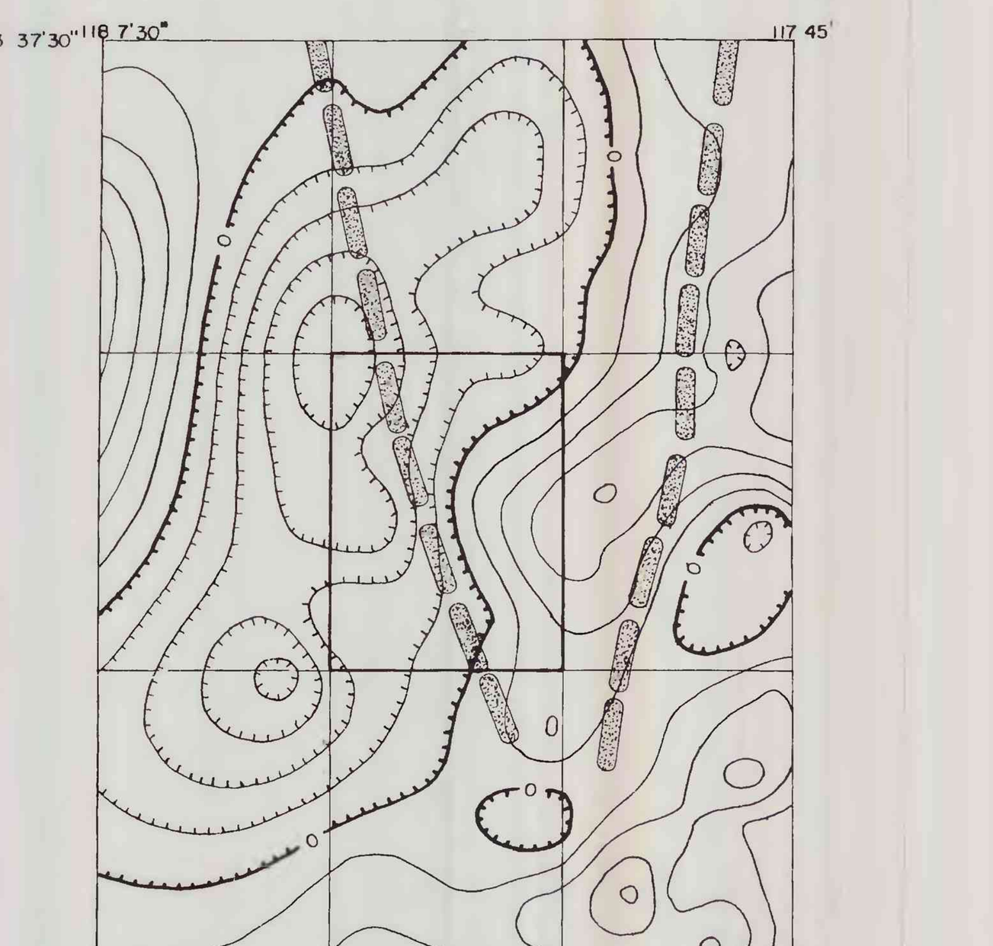


Figure 2. Isostatic residual gravity anomaly map of the Star Creek Reservoir quadrangle (bold outline) and adjacent quadrangles. Modified from Griscom and Halvorson (1994). Contour interval 2 milligals. Hachures indicate closed lows. Large dots are locations of gravity stations. Stippled hot-dogs mark the western margin (fault zone) of the Oregon-Idaho graben (NNE) and the western margin of the horst (NNW). See figure 1 for names of quadrangles adjacent to the Star Creek Reservoir quadrangle.

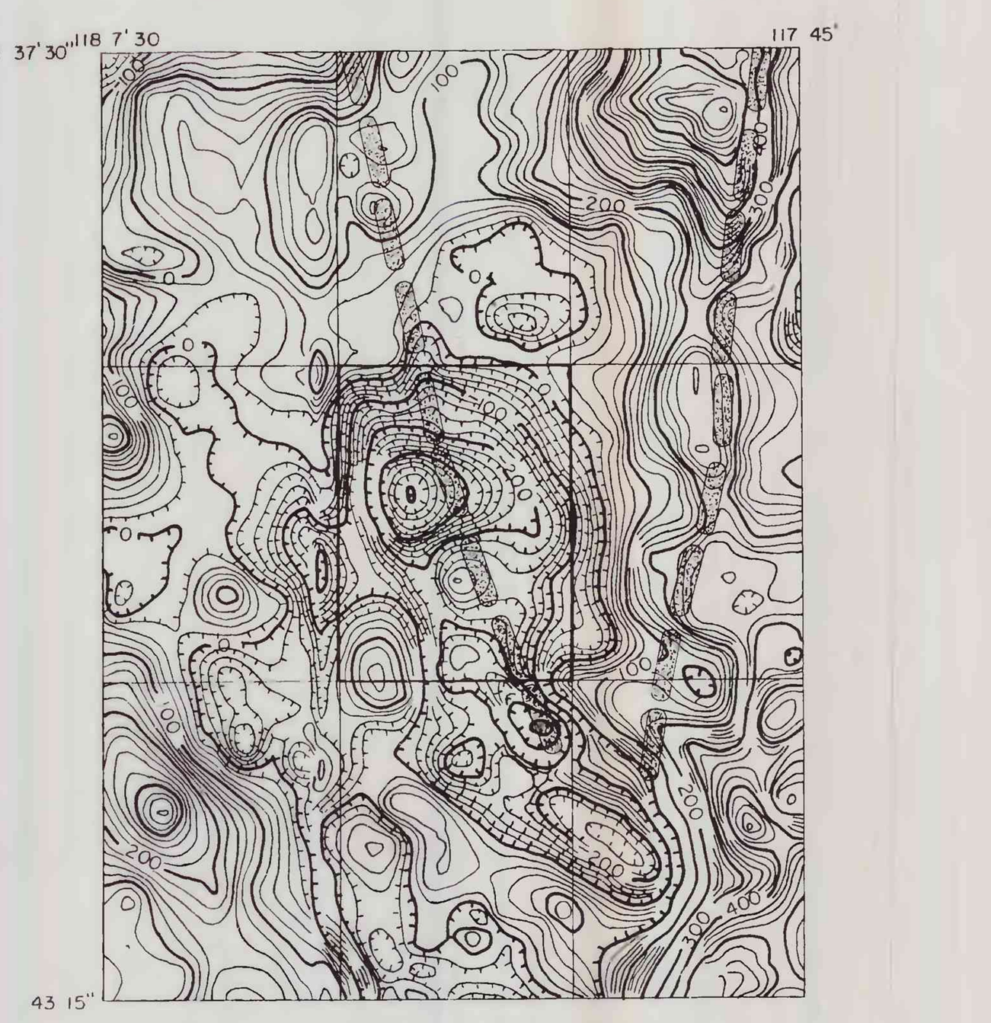
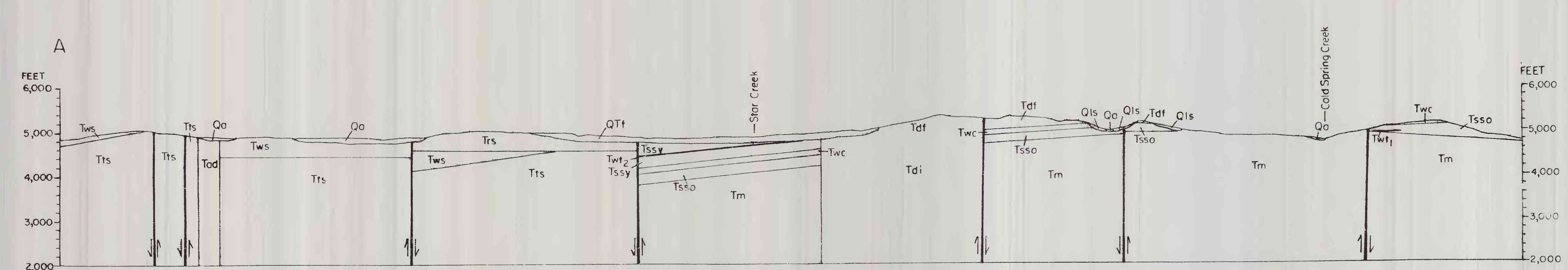
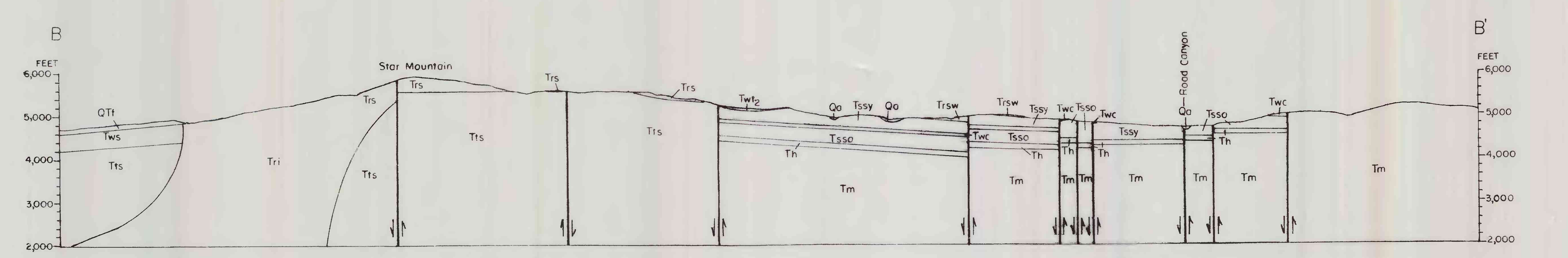


Figure 3. Aeromagnetic map of the Star Creek Reservoir quadrangle (bold outline) and adjacent quadrangles. Modified from Griscom and Halvorson (1994). Contour interval 20 and 100 nanoteslas. Hachures indicate closed lows. The stippled hot-dogs are aligned along the western margin (fault zone) of the Oregon-Idaho graben (NNE) and the western margin of the horst (NNW). See figure 1 for names of quadrangles adjacent to the Star Creek Reservoir quadrangle.





PRELIMINARY GEOLOGIC MAP OF THE STAR CREEK RESERVOIR 71/2' QUADRANGLE, MALHEUR COUNTY, OREGON

By
James G. Evans[1] and G. Benjamin Binger[2]

1999