Geologic Map of the Jerome Quadrangle, Gooding, Jerome, and Twin Falls Counties, Idaho

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2005

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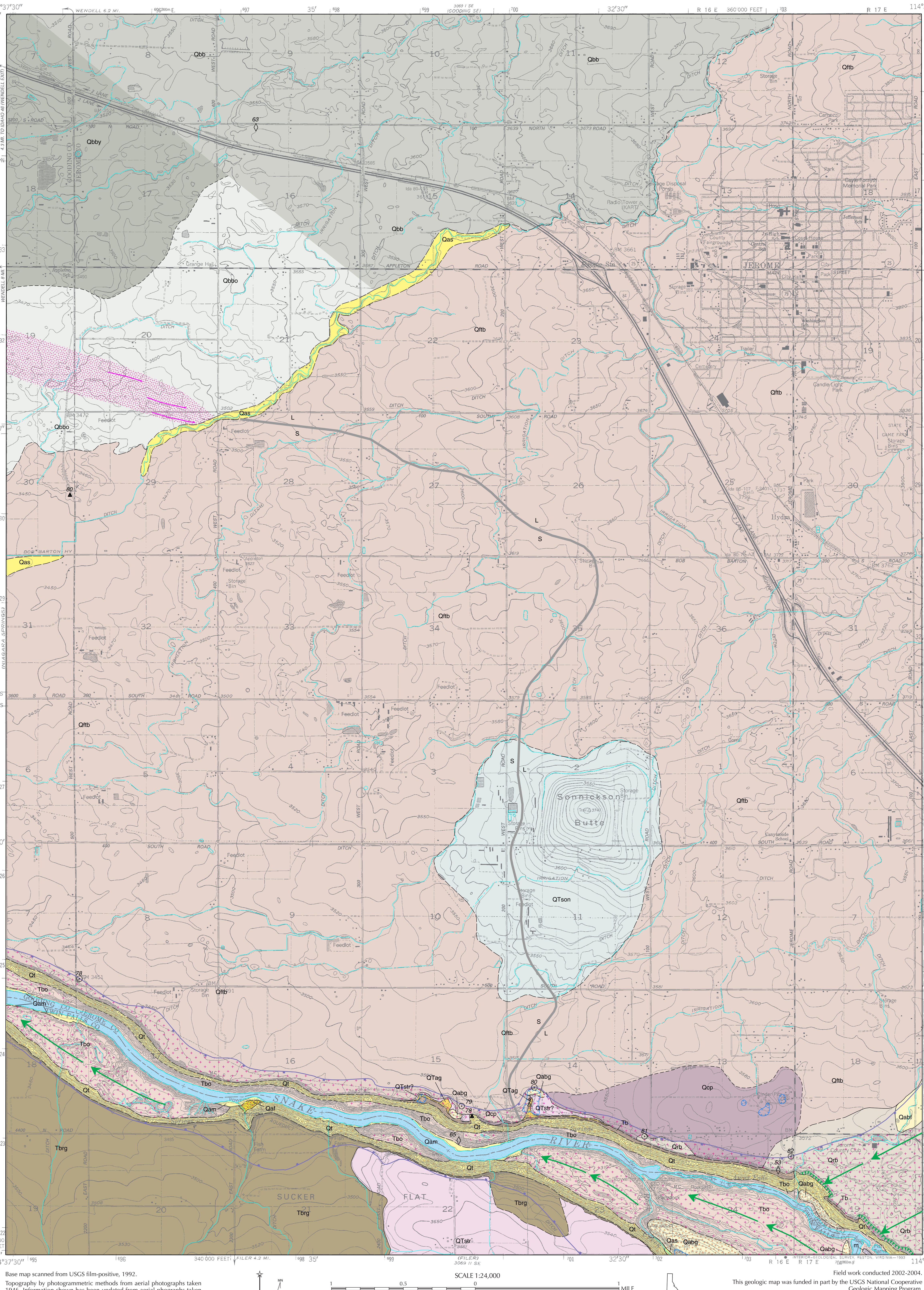


Base map scanned from USGS film-positive, 1992.

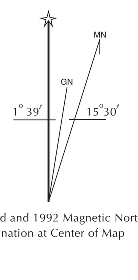
Topography by photogrammetric methods from aerial photographs taken 1946. Information shown has been updated from aerial phographs taken 1987 and field checked. Map edited 1992.

1927 North American Datum.

Projection and 10,000-foot grid ticks based on Idaho coordinate system, west zone.

1000-meter Universal Transverse Mercator grid ticks, zone 11.

National geodetic vertical datum of 1929.



UTM Grid and 1992 Magnetic North Declination at Center of Map

SCALE 1:24,000

1 0.5 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0.5 0 1 KILOMETER

Contour interval 40 feet
Supplementary contour interval 20 feet

QUADRANGLE LOCATION

Field work conducted 2002-2004.

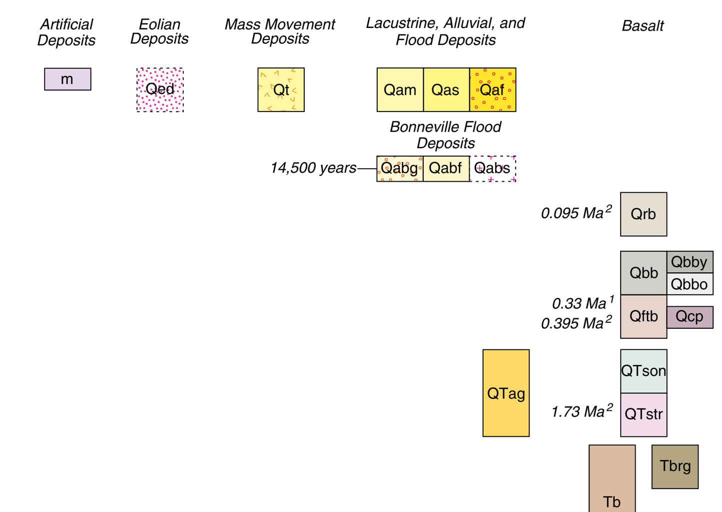
This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program.

Digital cartography by B. Benjamin E. Studer, and Jane S. Freed at the Idaho Geological Survey's Digital Mapping.

Map version 11-29-2005.

PDF map (Acrobat Reader) may be viewed at idahogeology.org.

CORRELATION OF MAP UNITS



Sources of age determination:
[1] $^{40}Ar/^{39}Ar$ weighted mean age, Esser (2005).
[2] $^{40}Ar/^{39}Ar$ weighted mean average plateau age, Tauxe and others (2004).
[3] K-Ar age determination, Armstrong and others (1975).

INTRODUCTION

The geologic map of the Jerome quadrangle identifies both the bedrock and surficial geologic units. It shows the geographic distribution of rock types at the surface and in the shallow subsurface. Basalt is the principal rock type in the area. Much of the basalt surface is mantled by deposits such as wind-blown sand and silt which form the soils that are cultivated. The geologic units in the area control soil development, slope stability, groundwater movement and recharge, and geotechnical factors important in construction design and waste management. Land uses in the area include irrigated agriculture, rural and urban residential development, industrial and commercial enterprises, and dairy farms with confined animal feeding operations. The Snake River Plain aquifer underlies the area and discharges to the west of the Jerome quadrangle as springs in the Snake River Canyon.

Previous geologic studies include work by Gillerman and Schiappa (1994, 2001) who did an investigation of western Jerome County to assess groundwater vulnerability to contamination. Geology of the area south of the Snake River was compiled from previous mapping by Bonnichsen and Godchaux (1997). Earlier studies by Malde and others (1963) and Covington and Weaver (1990) were also reviewed. Field checking of these maps was combined with new field investigations in 2002-2004 of both bedrock and surficial geology. Exposures of the geology were examined and selectively sampled. Aerial photographs were studied to aid in identifying boundaries between map units through photogeologic mapping of landforms. In most areas map-unit boundaries (contacts) are approximate. Contacts are inferred where lack of exposures and poorly defined landforms prevent greater mapping precision. The information depicted at this scale furnishes a useful overview of the area's geology but is not a substitute for site-specific evaluations.

The Jerome quadrangle lies near the center of the Snake River Plain, a large arcuate, lava-filled depression crossing southern Idaho. The incised Snake River Canyon cuts west-northwest across the Jerome quadrangle and is the most prominent topographic feature. It exposes a thick pile of nearly horizontal basalt flows topped by a thin skin of surficial loess and sand. Some of the older basalts, exposed in the bottom of the canyon, are altered or weathered. Rhyolite forms a basement to the basalts east of the Jerome quadrangle at the Perrine Bridge near Twin Falls city. Thin layers of sediment and pillow basalt exposed in the canyon walls are evidence of local lakes and streams that existed while the Pleistocene shield volcanos were active. The Bonneville Flood, which occurred approximately 14,500 years ago, filled the ancestral Snake River Canyon and flowed overland in the southeast corner of the quadrangle forming a relict cataract at the canyon rim. The flood scoured the canyon and some of the upland basalt surfaces and deposited coarse-grained gravel. These deposits have been mined for aggregate.

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

m — **Made ground (Holocene)**—Artificial fills composed of excavated, transported, and emplaced construction materials typically derived locally. Primarily areas modified for fish ponds.

ALLUVIAL DEPOSITS

Qam — **Alluvium of mainstreams (Holocene)**—Channel and flood-plain deposits of the Snake River. Primarily stratified sandy silt and silty sand of bars and islands. Gravelly where channel is shallow and formed directly in basalt. Typically 1-10 feet thick.

Qas — **Alluvium of side-streams (Holocene)**—Channel and flood-plain deposits of tributaries to the Snake River. Includes fine sand in a poorly developed stream drainage from Flat Top Butte which becomes Cedar Draw Creek (Gooding County) in the adjoining Niagara Springs quadrangle. Probably eroded and reworked dune sand. Deposits primarily relict. Natural drainage now mostly part of irrigation systems.

Qaf — **Alluvial-fan deposits (Holocene)**—Stratified silt, sand, and gravel that form small fans adjacent to the Snake River in the canyon. Merges and is interstratified with mainstream alluvium (*Qam*). Thickness varies, but typically ranges 5-30 feet.

Bonneville Flood Deposits

Qabg — **Sand and gravel in giant flood bars (Pleistocene)**—Boulders, cobbles, and pebbles of basalt in a matrix of basaltic sand. Forms giant expansion bars with large-scale crossbeds, and eddy deposits in which gravel sizes are smaller (O'Connor, 1993). Similar to Melon Gravel (Malde and Powers, 1962; Malde and others, 1963; and Covington and Weaver, 1990), but restricted to Bonneville Flood constructional forms and deposits.

Qabs — **Scabland of flood pathways (Pleistocene)**—Flood-scoured basalt surface. Where above the canyon rim, approximates extent of flood at maximum stage (O'Connor, 1993). Character of scoured surface ranges from areas of original basalt morphology stripped of pre-flood soils, to areas where the original basalt surface has been plucked, gouged, and molded. Includes thin and discontinuous sheets and bars of flood sand and gravel that are not mapped at this scale. Some areas include pavements or strings of boulders transported by flood traction forces or that are lags from erosion by lower-energy regime during late stages of the flood.

Qabf — **Fine-grained deposits in slack-water basins (Pleistocene)**—Sand and silt deposited in basins of basalt surface that were protected from high-energy water flow.

QTag — **Alluvial gravel, undifferentiated (Pleistocene or Pliocene)**—Sand and gravel stream-channel deposits interbedded with basalt flows.

EOLIAN DEPOSITS

Qed — **Dune sand (Holocene)**—Stratified fine sand of stabilized wind dunes. Shown only where identified on aerial photographs (1972 NASA false-color infrared; 1993 NAPP black and white). Formerly more extensive based on descriptions of Poulson and Thompson (1927) and Youngs and others (1929). Fine-sand soils with little or no pedogenic horizonation were associated with dune morphology when present in the early 20th century (Poulson and Thompson, 1927). These have recently existed only where seen on aerial photographs dated 1993 (NAPP black and white) and 1972 (NASA color infrared photography). Poulson and Thompson (1927) describe "hummocky or dune-like" landforms and areas of actively blowing sand after field plowing in the early 20th century. Continued agricultural modifications to the land have tended to smooth topography and homogenize soils. The result has been an obliteration of the original topography, which probably included extensive areas of stabilized dunes.

MASS MOVEMENT DEPOSITS

Qt — **Talus (Holocene)**—Angular pebble-, cobble-, and boulder-sized fragments of basalt that have broken off nearly vertical rock walls and accumulated below. Deposits are characterized by a steeply sloping surface that is at or near the angle of repose. Talus postdates the Bonneville Flood, and the thick, mappable talus has nearly to completely buried a "stepped" canyon wall formed by differential erosion of younger versus older basalt exposed in the canyon. Thin talus partially covers the older basalt, but is not mapped. Talus includes small deposits of eolian or water-reworked fine sand that typically occur at the toes of the talus slope. In side-stream canyons, talus interfingers and is mixed with loess and slopewash deposits.

BASALT UNITS

The surface geology of the Snake River Plain north of the Snake River is primarily Pleistocene basalt flows of the Snake River Group. On the Jerome quadrangle, the basalt flows primarily originated from the shield volcanoes of Flat Top Butte, five miles east of Jerome, and Bacon Butte, 6 miles northeast of Jerome. Each volcano probably extruded numerous lava flows or flow lobes, although individual flows cannot easily be mapped because the surfaces are subdued by surficial deposits. Nearly all of the basalt is vesicular to extremely vesicular and most of the units are also diktytaxitic to some degree (i.e., containing voids with protruding crystals). Even units with a fine-grained groundmass have a coarse, grainy texture.

Petrography of selected basalt samples shows that phenocrysts consist of fine to coarse-grained, fresh plagioclase laths and euhedral to anhedral olivine grains. Square chromite inclusions occur in the euhedral olivine. Swallowtail shapes to skeletal plagioclase suggest rapid crystal growth and quenching. Matrix is basaltic glass to crystalline clinopyroxene plus opaque iron-titanium oxides. Textures are ophitic to hyalophitic. Youngest flows (*Qrb* and *Qbby*) have the most glassy texture. The oldest unit, *Tb*, includes the most altered flows.

Qrb — **Basalt of Rocky Butte (Pleistocene)**—Fine-grained, dark gray to black, glassy basalt with common to abundant olivine grains 0.5-1 mm and clusters 1-3 mm in diameter. Common to abundant small plagioclase laths to about 1 mm in length. Remanent magnetic polarity is normal, as determined in the field and through laboratory analysis. Erupted from a shield volcano located 22 miles northeast of Twin Falls city of in the Eden NE topographic quadrangle, which shows a permanent horizontal-control mark labeled "Rocky" at 4526 feet on the south rim of the vent (sec. 14, T. 8 S., R. 20 E.). Equivalent in part to Sand Springs Basalt of Malde and Powers (1962), Malde and others (1963), Covington (1976), and Covington and Weaver (1990). Covington and Weaver (1990) identified the source as "Butte 4526." Tauxe and others (2004) report an $^{40}Ar/^{39}Ar$ weighted mean plateau age of 0.095 Ma for "Sand Springs" basalt. The location of their sample, on the north rim of the Snake River canyon near Shoshone Falls, is from the unit we map as basalt of Rocky Butte. Many lava-flow features, like pressure ridges, are exposed and 30-75 percent of the surface is basalt outcrops. Loess (silt and fine sand) is thin and primarily accumulated in swales and depressions. Surface drainage is poorly developed. Loess thickness ranges 1-10 feet; commonly 1-3 feet thick. Soil caliche (duripan) is generally limited to thin soil horizons and coatings on the basalt surface at the base of the soil (Poulson and Thompson, 1927; Ames, 2003). Small, discontinuous areas are cultivatable, but most of area generally unfit for cultivation. Area of scour by Bonneville Flood (*Qabs*) has 90 percent outcrop and patchy deposits of sand and gravel deposited by the flood water.

Qbb — **Basalt of Bacon Butte, undivided (Pleistocene)**—Fine-grained, dark gray basalt with common to abundant plagioclase laths as much as 5 mm in length and common olivine grains and clots, commonly as intergrowths with plagioclase. Locally diktytaxitic. May exhibit abundant carbonate accumulation in vesicles and fractures. Remanent magnetic polarity is normal, as determined in the field and through laboratory analysis. Flows erupted from a shield volcano with third-order elevation mark 4054 (Shoshone SW 7.5' quadrangle) located 6 miles northeast of Jerome. The name "Bacon Butte" is derived from nearby Bacon Ranch, located on the east side of the unnamed butte. The name was also used by Covington and Weaver (1991). Included in Thousand Springs Basalt (*Qtt*) by Malde and others (1963). West of Jerome, the unit is divided into younger and older units as noted below. Mapped separately as Big Olivine Basalt by Gillerman and Schiappa (2001). Few basalt pressure ridges rise above nearly complete mantles of loess and dune sand. Surface drainage is moderately developed. Prior to agriculture about 10-30 percent of the surface was basalt outcrop (Poulson and Thompson, 1927). Farming has reduced outcrops to about 10 percent of the surface. Loess thickness ranges 3-25 feet; commonly 3-12 feet thick. Soil caliche (duripan) is commonly well developed within the soil profile (Poulson and Thompson, 1927; Ames, 2003) and at the soil-basalt contact, but the thickness of caliche is highly variable. Most of the land is cultivatable.

Qbby — **Basalt of Bacon Butte, younger unit (Pleistocene)**—Fine- to medium-grained, dark gray basalt with common to abundant olivine as grains and clots as large as 3 mm and scattered small plagioclase laths. Similar in texture and appearance to basalt of Notch Butte, although slightly coarser grained overall. Remanent magnetic polarity is normal, as determined in the field and through laboratory analysis. Forms a raised, hilly surface of partly exposed pressure ridges on *Qbbo* in the vicinity of Wendell and extends 12 miles westward to the Snake River canyon in the Sand Springs area, where Malde and others (1963) mapped it as Sand Springs Basalt. However, we interpret it as a younger flow or series of flows erupted from Bacon Butte that entered the Snake River valley in the Sand Springs area. Surface drainage is poorly developed. Discontinuous loess and eolian sand deposits cover less than 50 percent of the surface and are 1-10 feet thick. Soil caliche (duripan) is commonly well developed within the soil profile (Poulson and Thompson, ; Ames, 2003; Johnson, 2002) and at the soil-basalt contact, but the thickness of caliche varies considerably. Some of the land is cultivatable and some is used as pasture.

Qbbo — **Basalt of Bacon Butte, older unit (Pleistocene)**—Fine-grained, dark gray basalt with common to abundant plagioclase laths as much as 5 mm in length and common olivine grains and clots; olivine commonly forms intergrowths with plagioclase. Locally diktytaxitic. May exhibit abundant carbonate accumulation in vesicles and fractures. Remanent magnetic polarity is normal, as determined in the field and through laboratory analysis. Also erupted from Bacon Butte shield volcano northeast of Jerome. Included in Thousand Springs Basalt (*Qtt*) by Malde and others (1963) and mapped as West Basalt by Gillerman and Schiappa (1994; 2001). Topography contrasts with area of basalt of Notch Butte (*Qnb*) to the northeast and the basalt of Bacon Butte, younger unit (*Qbby*). Almost no basalt pressure ridges rise above a nearly complete mantle of loess and dune sand. Surface drainage is moderately developed. Thickness of mantle ranges from 3-25 feet; commonly 3-12 feet thick. Soil caliche (duripan) is typically well developed within the soil profile (Poulson and Thompson, 1927; Ames, 2003; Johnson, 2002) and at the soil-basalt contact, but the thickness of caliche varies considerably. Most of the land is cultivatable.

Qcp — **Basalt of Jerome Cinder Pits (Pleistocene)**—Basalt flow or flows associated with cinder pits located 6 miles south of Jerome in sec. 13, T. 9 S., R. 16 E. Lithologically similar to and possibly a secondary vent for early basalts erupted from Flat Top Butte and mapped as Thousand Springs Basalt by Gillerman and Schiappa (2001). Identified in the vent areas and characterized by glassy cinders and welded spatter of dark red to black scoriaceous lavas. Strongly to spectacularly glomerophyric with clusters of plagioclase and olivine intergrowths as large as 10 mm in diameter. Remanent magnetic polarity is normal as determined in the field. Surface drainage is moderately developed. Prior to agriculture about 10-30 percent of the surface was basalt outcrop (Poulson and Thompson, 1927). Farming has reduced outcrops to about 10 percent of the surface.

Qftb — **Basalt of Flat Top Butte (Pleistocene)**—Fine-grained, medium gray basalt with scattered to very abundant plagioclase-olivine intergrowths 4-7 mm across and olivine grains and clots 1-4 mm in diameter. Flows typically vesicular near the top and more dense in the center, but diktytaxitic throughout with abundant fine-grained plagioclase laths. Carbonate coatings and fillings common in voids but not pervasive. Remanent magnetic polarity is normal, as determined in the field and through laboratory analysis. Erupted from the Flat Top Butte shield volcano east of Jerome. Equivalent to Thousand Springs Basalt of Malde and Powers (1962), Malde and others (1963), and Gillerman and Schiappa (1994, 2001). Tauxe and others (2004) report an $^{40}Ar/^{39}Ar$ weighted mean plateau age of 0.395 Ma for this unit (their sample sr09, Thousand Springs Basalt). An $^{40}Ar/^{39}Ar$ weighted mean age of 0.33±0.8 Ma was obtained on our sample 02P002B (Esser, 2005). Basalt flows of unit inundated through-flowing drainage and formed location of ancestral Snake River along which the present canyon has been cut. Few basalt pressure ridges rise above nearly complete mantles of loess and dune sand. Surface drainage is moderately developed. Prior to agriculture about 10-30 percent of the surface was basalt outcrop (Poulson and Thompson, 1927). Farming has reduced outcrops to about 10 percent of the surface. Loess thickness ranges 3-25 feet; commonly 3-12 feet thick. Soil caliche (duripan) is commonly well developed within the soil profile (Poulson and Thompson, 1927; Ames, 2003; Johnson, 2002) and at the soil-basalt contact, but the thickness of caliche is highly variable. Most of the land is cultivatable. Generally, the amount of loess increases and outcrop decreases with distance from vent. Also, dune sand transitions into loess from west to east across the quadrangle (see *Symbols*). The dune sand has been extensively modified by cultivation.

Qson — **Basalt of Sonnickson Butte (Pleistocene or Pliocene)**—Very poorly exposed basalt flows erupted from Sonnickson Butte located 3 miles south of Jerome. A few small outcrops and float samples of basalt, possibly from the butte, are fine to medium grained and diktytaxitic with common plagioclase phenocrysts and small olivine phenocrysts. Remanent magnetic polarity not determined. Equivalent to Thousand Springs Black Basalt of Gillerman and Schiappa (2001). The butte is surrounded by flows from Flat Top Butte. Topography is subdued and no relict volcanic features rise above a mantle of loess. Prior to agriculture outcrops were rare on upper slopes of volcano (Poulson and Thompson, 1927). Surface drainage is moderately well developed. Loess thickness ranges 3-25 feet. Thick soil caliche commonly encountered within several feet of the soil surface (Poulson and Thompson, 1927; Ames, 2003).

QTstr — **Basalt of Stricker Butte (Peistocene or Pliocene)**—Described by Williams and others (1991) as light-gray to gray, medium- to coarse-grained, dense basalt with small plagioclase laths 1-2 mm long and olivine grains 0.4-0.5 mm in diameter; olivine is amber to reddish brown and probably altered to iddingsite. Erupted from Stricker Butte located located 6 miles southeast of Twin Falls city. Remanent magnetic polarity is reverse as determined in the field. Tauxe and others (2004) also report reverse polarity from laboratory analysis and an age determination of 1.73 Ma from a site on Rock Creek just south of Stricker Butte. One flow of unit may be exposed in gravel pit (Section 14, T9S, R16E) on north side of Snake River Canyon overlying gravel lens (*QTag*). No basalt pressure ridges rise above a loess mantle. Surface drainage is moderately well developed. Loess thickness ranges 5-25 feet and typically comprises a younger deposit with weak soil development and an underlying older loess with a thick caliche (duripan) horizon (Baldwin, 1925; Ames, 2003).

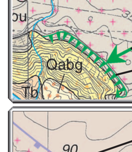
Tbrg — **Basalt of Burger Butte (Pliocene)**—Fine- to medium-grained basalt generally with abundant plagioclase phenocrysts as large as 5 mm and olivine phenocrysts about 1 mm in diameter. Remanent magnetic polarity is reverse as determined in the field and through laboratory analysis. Source is Burger Butte and associated satellite vents located 9 miles southwest of Twin Falls city. Most of the unit is equivalent to the "basalt of Sucker Flat" unit of Bonnichsen and Godchaux (1995a, 1996, and 1997b). No basalt pressure ridges rise above loess mantle. Surface drainage is moderately well developed. Loess thickness ranges 5-25 feet and typically comprises a younger deposit with weak soil development and an underlying older loess with a thick caliche (duripan) horizon (Baldwin, 1925; Ames, 2003).

Tb — **Basalt flows, undivided (Pliocene?)**—Fine- to coarse-grained, unaltered to altered undivided basalt flows exposed in the Snake River canyon. Stratigraphically above *Tbo* unit and commonly separated from it by a thin orange baked soil or sediment horizon 1-2 feet thick. Source(s) unknown, but probably consists of flows from different sources of different ages. Includes some basalt mapped as "Sucker Flat basalt, altered" by Bonnichsen and Godchaux (1997). Sources may be Tertiary shield volcanoes southeast of the Jerome quadrangle.

Tbo — **Older basalt flows, undivided (early Pliocene to Miocene)**—Medium- to coarse-grained, gray to sooty brown, mostly altered and (or) weathered basalt flows primarily exposed in the lower part Snake River canyon. Thin section from near Auger Falls shows a typical basalt of plagioclase and olivine phenocrysts in matrix of crystalline pyroxene and sparse opaques, but lacking in open vesicles and with 25% of secondary minerals lining voids and replacing olivine and pyroxene. Alteration minerals include light green to brown clays, iddingsite and chlorite. Source(s) unknown but probably erupted from the south and southeast. Age poorly constrained but probably includes flows from different sources of different ages. One K/Ar age determination on this unit by Armstrong and others (1975), from an outcrop in the canyon 1.5 miles west of the Jerome at the base of Clear Lakes grade, resulted in an age of 4.9±0.6 Ma. All flows included in this unit that were analyzed for remanent magnetism have reverse polarity, although all may not be age-equivalent and not all flows were analyzed. Equivalent to the Banbury Basalt of Malde and Powers (1962), Malde and others (1963), Covington and Weaver (1990), and Gillerman and Schiappa (2001). Extensively scoured by the Bonneville Flood.

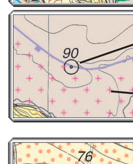
SYMBOLS

Contact: Line showing the approximate boundary between one map unit and another; dashed where inferred. The apparent ground width of the line representing the contact is about 80 feet at this scale (1:24,000).



Bonneville Flood flow direction.

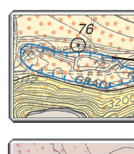
Relict cataracts of Bonneville Flood.



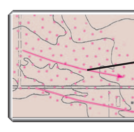
Location of reported evidence for maximum stage of Bonneville Flood (O'Connor, 1993).

Approximate extent of Bonneville Flood at maximum stage.

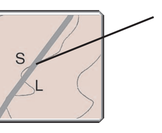
Flood-scoured basalt surface (see *Qabs* description).



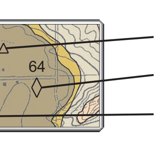
Gravel pit that exposes a map unit.



Trend of dune field. Arrow points in the downwind direction.



Indistinct, gradational transition zone between sandy eolian surface deposits (*S*) and silty eolian surface deposits (*L*). The transition zone is close to the pre-agriculture morphological change from dunes to blanket deposits of dust. The original topography has been largely obliterated by intensive agriculture. Based on 2002 field evidence and soil surveys (Poulson and Thompson, 1927; Youngs and others, 1929; Ames, 1998; Johnson, 2002). The transition zone was primarily based on a general distribution of loose, fine-sand soils associated with dunes and more compact loam to silt-loam soils (Poulson and Thompson, 1927). The sand to silt transition was chosen where generally the amount of silt begins to exceed 50% and sand tends to be less than 50%. In soils with little clay, typical of eolian deposits, the transition occurs between sandy loam and silt loam. In the Unified Soil Classification System used by engineers, the transition is between course-grained soils (<50% passes a #200 sieve) and fine-grained soils (>50% passes a #200 sieve).



Sample site for chemical analysis.*

Sample site for paleomagnetic analysis.*

Sample site for chemical and paleomagnetic analysis.*

*Data available at Idaho Geological Survey, igs@uidaho.edu.

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