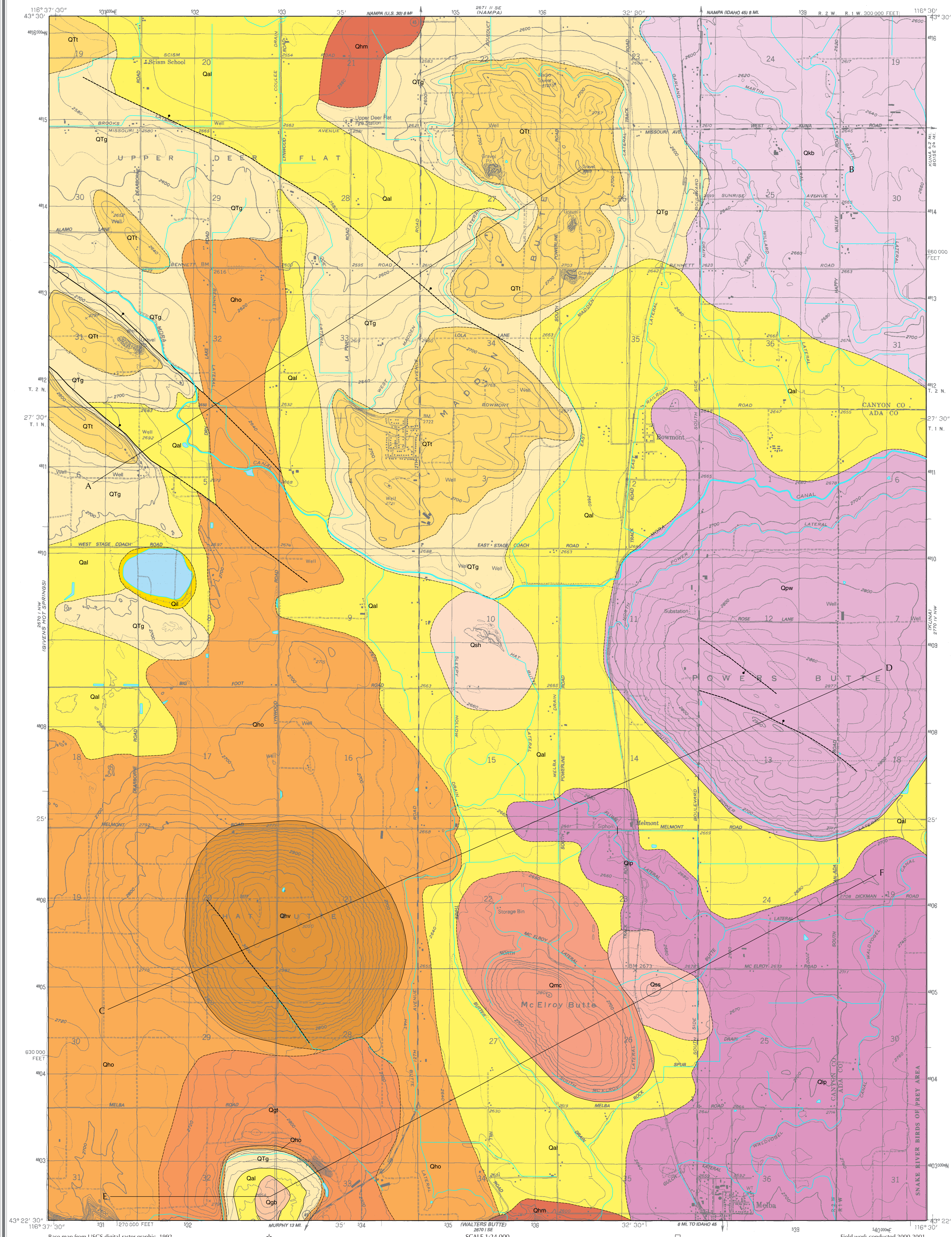


GEOLOGIC MAP OF THE MELBA QUADRANGLE, CANYON AND ADA COUNTIES, IDAHO

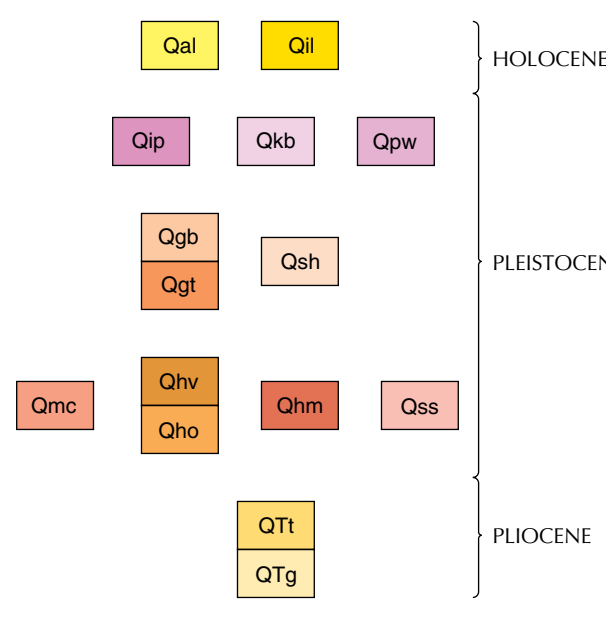
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Disclaimer: This Digital Web Map is an informal report and may be revised and formally published at a later time. Its content and format may not conform to agency standards.

Mapping and data are incorporated in and superseded by DWM-80, Geologic Map of Murphy 30 x 60 Minute Quadrangle, Idaho, 1:100,000 scale.



CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL UNITS

Qal Alluvium and bottom-land soil accumulations (Holocene)—Consists predominantly of fine-grained unconsolidated clastic materials deposited along intermittent stream courses and of soils that originally were less but which have been transported, accumulating along valley bottoms. Sand and gravel that occurs along intermittent streams is included. Near Madden Butte in the northern part of the quadrangle, and perhaps elsewhere, this unit may include substantial amounts of the Ten Mile Gravel and the Glens Ferry Formation. These sedimentary materials have been transported in some places, but elsewhere they may nearly be in place. Basalt and basaltic tephra may occur near or at the surface within this unit, locally. This unit also includes colluvial debris eroded from the crater walls and deposited at the bottom of the Grouch Drain maar.

Qil Intermittent lake deposits (Holocene)—Consists of unconsolidated clay and silt that are bottom-laid deposits in Dry Lake, a small topographic depression in the western part of the quadrangle. The Dry Lake basin intermittently contains a shallow lake, and at other times is a dry pan or a mud flat.

VOLCANIC UNITS

ALKALI-ENRICHED BASALT UNITS

These basaltic flows were erupted subaerially from small shield volcanoes and accompanying tephra and spatter cones in the Kuna and Initial Point quadrangles east and southeast of the Melba quadrangle. In the Melba quadrangle, the Powers Butte shield volcano is part of this group. These basalts have elevated contents of alkali elements in comparison to other basalts in the Melba quadrangle or in adjacent parts of the western Snake River Plain. This alkali-enriched group of basalts generally correspond to White and other's (2000) M3 group, which are mildly alkaline and have chemical and isotopic properties similar to ocean-island basalts, suggesting they originated within the Earth's asthenosphere, from depths greater than the other Melba area basalts. Radiometric ages for this group (Ohlberg and others, 1995) include a date of 0.387 Ma for the lava flow, Qob, that occurs in the northeastern corner of the quadrangle, and a date of 0.414 Ma, for the Initial Point flow, Qop. The basalts of this group are paleomagnetically normal.

Qip Basalt of Initial Point (Pleistocene)—This basalt flow in the southeastern corner of the quadrangle was erupted from Initial Point, about 9 km (5.5 miles) east of the southeastern corner of the Melba quadrangle. In the Melba quadrangle, where the Initial Point basalt is somewhat distal from its source, the basalt contains abundant olivine and plagioclase phenocrysts that, in some areas, are aggregated into cumulo-phic clumps. This basalt typically is vesicular and locally shows flow segregation of plagioclase phenocrysts in its flow-margin areas.

Qkb Basalt from the Kuna Butte area (Pleistocene)—This basalt flow in the northeastern corner of the quadrangle appears to have flowed into the Melba quadrangle from the adjacent Kuna quadrangle. Its probable vent area is Hill 2812 (elevation), located about 2 km (1.2 miles) east of the eastern edge of the Melba quadrangle. It outcrops along Bennett Road; this basalt flow contains scattered small olivine phenocrysts.

Qpw Basalt of Powers Butte (Pleistocene)—This basalt unit consists of lava flows erupted from Powers Butte in the eastern part of the quadrangle, and that built the Powers Butte shield volcano up to a height of 60 m, or more. The Powers Butte basalt has olivine phenocrysts that vary from sparse to abundant and from small to large, and contains scattered small plagioclase phenocrysts. The basalt varies from dense to vesicular.

BASALTIC PHREATOMAGMATIC DEPOSITS

Basaltic phreatomagmatic deposits occur at two places within the Melba quadrangle. The better exposed deposits are associated with the Grouch Drain maar in the southern part of the quadrangle. There, the deposits consist of blast and tephra layers that formed during the excavation of the maar crater, and a basalt pond and flow that partially filled the crater and flowed more than a kilometer southwestward in the Walters Butte quadrangle (Bonnichsen and Godchaux, 1998), through a breach in the maar's margin. The Grouch Drain maar erupted approximately 0.73 Ma ago (White and others, 2000). The Grouch Drain basalt is paleomagnetically normal, and is included in White and other's (2000) mildly alkaline M3 group. The other phreatomagmatic basaltic tephra occurrence is in an open-pit mine near the center of the quadrangle. This unit is the basaltic tephra of Sleepy Hollow; its stratigraphic relationship to the other Melba quadrangle basaltic units is not known. These phreatomagmatic deposits were formed during a widespread episode of phreatomagmatic volcanism that occurred throughout the western Snake River Plain during the Pliocene and Pleistocene epochs (Godchaux and others, 1992).

Qgt Basalt of Grouch Drain maar (Pleistocene)—This unit consists of a small lava pond and a basalt flow which was extruded at the end of the Grouch Drain eruption to partially fill the crater. The Grouch Drain basalt contains abundant olivine and plagioclase phenocrysts which are large and, in places, arrayed in cumulo-phic aggregates.

Qgb Tephra and blast deposits of Grouch Drain maar (Pleistocene)—This unit contains unconsolidated blast deposits and partially consolidated juvenile tephra deposits that erupted from the Grouch Drain maar. These deposits are best exposed in excavations that extend for about 300 m along the northeastern margin of the maar crater. There, 10 to 20 m of outer-wall blast deposits are exposed lying above the older Hat Butte basalt. The blast deposits, in turn, are overlain by 10 to 20 m of juvenile basaltic tephra. The blast deposits generally are grey in color and consist of angular fragments, ranging to as much as 0.5 m across, of Hat Butte basalt in a matrix of fine-grained broken rock and recycled sediments derived from the underlying Glens Ferry Formation. Gravel clasts recycled from the Ten Mile Gravel also are scattered throughout the blast deposit. The upper half of this unit is basaltic tephra, which varies in color from yellowish upwards to reddish, to black at the top of the section. Hat Butte basalt fragments are common throughout these reddish and black tephra beds. Layering is weak to nearly non-existent in most portions of the blast and tephra deposits of the Grouch Drain maar, although a conspicuous thin layer of fine-grained blast material marks the boundary between the blast and tephra portions. Locally, fragments of Grouch Drain basalt, probably derived from dikes that were present during the early stages of the eruption, as well as Grouch Drain basaltic spatter clots, occur in the tephra.

Qsh Basaltic tephra of Sleepy Hollow (Pleistocene)—This unit consists mainly of massive beds of reddish basaltic tephra which dip shallowly northeastward. This tephra is exposed only in the walls of an open-pit mine near the center of the quadrangle. Neither the base nor the margins of this deposit are visible, although a thickness of nearly 20 m of material is exposed in the pit. The tephra generally is unconsolidated and consists principally of reddish, vesiculated, juvenile tephra clasts typically 10 cm or less across. Neither spatter clots nor fragments of older basalt were found; there are, however, many conspicuous fragments of baked, light-colored, fine-grained sedimentary material, likely derived from the underlying beds of the Glens Ferry Formation, scattered throughout the tephra. Some of these baked sediment fragments are as much as a meter long. Also, a few recycled gravel clasts with lithologies from the Ten Mile Gravel were noted. At the bottom of the pit the tephra beds are yellowish and black in color, rather than reddish. No basaltic dikes were observed to cut the tephra beds. The area of the basaltic tephra of Sleepy Hollow map unit does not show any sort of pre-ignited elevated terrain, such as eruptive points or crater walls, and the surrounding area is flat and covered by deep soil that is formed, so the primary nature of this deposit is enigmatic. The nature, size, and distribution of the tephra particles suggest that the eruption was of the Strombolian type. The shallow, generally northeastward dip of the layers and the large size of some of the sediment clasts suggests that the venting area was close by, probably southwest of the pit.

and south quadrangle margins there are ferrobasalts which are noted to be part of the Hat Butte-McElroy Butte basalt type unit, Qhm. The field mapping was unable to establish from which of these sources, or another, these basalts were erupted. The stratigraphic relationship between the flows from Hat and McElroy Buttes is not known, nor has their temporal relationship to the South Side Boulevard basaltic spatter been established. Radiometric age-dates suggest the Melba quadrangle ferrobasalt flows range between 0.9 Ma and 1.0 Ma. Supporting this are a 0.922 Ma date for the basalt of Upper Deer Flat (Ohlberg and others, 1995) from a sample collected 0.4 km north of the Melba quadrangle margin, and which is chemically the same as the Hat Butte-McElroy Butte type of basalt (cinders) which are entirely mantled by the thin surface basalt flows. This is suggested by the comparison of the shapes of these constructs to other western Snake River Plain shield volcanoes. Perhaps the hidden interiors of Hat and McElroy Buttes contain substantial amounts of basaltic tephra (cinders) which are entirely mantled by the thin surface basalt flows. This is suggested by the comparison of the shapes of these constructs to other western Snake River Plain shield volcanoes.

Qhv Basalt of Hat Butte vent area (Pleistocene)—This unit consists of thin basalt flows and other basaltic materials that mantle the flanks and top of Hat Butte. The basalt commonly is diktytaxitic and contains sparse, small plagioclase and olivine phenocrysts at many localities but is aphyric at others. The basalt mantling the flanks of Hat Butte is essentially identical to the outflow basalt from Hat Butte.

Qho Outflow basalt from Hat Butte (Pleistocene)—This unit is a sequence of basalt flows extending several kilometers south, west, and north from Hat Butte. The basalt flows vary only slightly from place to place. Typically they contain sparse amounts of small olivine and plagioclase phenocrysts; only rarely are the phenocrysts abundant or large. Where the Hat Butte basalt forms the rim above the Snake River in the adjacent Walters Butte and Glens Ferry quadrangles, this unit commonly consists of 2 or 3 flows, and in some places it can be seen that the lowest of these flows ran into water, to become pillowed. In the Melba quadrangle, however, the Hat Butte basalt seems to have been emplaced subaerially.

Qmc Basalt of McElroy Butte (Pleistocene)—This unit consists of basalt flows that mantle the flanks of McElroy Butte, and which extend as outflow about a kilometer northward from the butte. The McElroy Butte basalt is very much like that of Hat Butte, being a ferrobasalt and either being aphyric or containing sparse, tiny plagioclase phenocrysts and, at some localities, scattered small olivines.

Qhm Basalt of the Hat Butte and McElroy Butte-type (Pleistocene)—Basalt, which in chemical and petrological attributes, is like that of Hat and McElroy Buttes is present at localities in the north part and along the southern edge of the Melba quadrangle. These occurrences have been mapped as the undifferentiated Qhm unit, inasmuch as it is unclear where their source vents are.

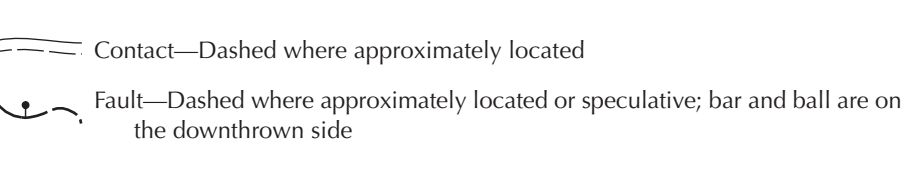
Qss Basaltic spatter of South Side Boulevard (Pleistocene)—This unit is confined to the vicinity of a small eruptive point, Hill 2725 (elevation), located just east of McElroy Butte in the southeastern part of the quadrangle. Hill 2725 stands about 20 m above its surroundings and is less than a kilometer across. The basalt erupted from it is essentially aphyric, and consists of scoriarious clots of spatter and tephra that have been welded together to form a solid basaltic mass in which the boundaries of the individual spatter clots are variably visible. Only limited flattening of the bombs is evident. Most of the layering in Hill 2725 dips inward, indicating the preserved material consists of inner-wall crater deposits. Inclusions of gravel, lake sediments, or of older basalts have not been observed to occur within the basaltic spatter of South Side Boulevard.

SEDIMENTARY UNITS

Qti Ten Mile Gravel (Pliocene)—This unit consists of detritic and alluvial gravels that were deposited near the margin of Lake Idaho (Jenks and others, 1989; Wood and Clemens, 2000) as the lake level was declining near the close of the Pliocene epoch. Clasts consist predominantly of dioritic to granitic intrusive rocks that probably were derived from the Idaho batholith; felsic volcanic rocks that match the lithologies in the Challis volcanics, and sparse metamorphic rocks. Clasts range up to 30 cm or so, in diameter. Rhyolite and basalt clasts, like rocks of these types which occur throughout the Snake River Plain, are rare and seen non-existent at most localities. Clearly, the clasts in the Ten Mile Gravel have come from a northeastern source, and the unit can be seen to extend eastward nearly to the northeastern margin of the western Snake River Plain on the geologic map by Ohlberg and Stanford (1992). Lenses of sand are interstratified with the gravelly sand and the unit grades downward into the sandy to silty beach and lacustrine deposits of the Glens Ferry Formation. Since the contact between these two units is gradational and is covered throughout the quadrangle it is probable that some Glens Ferry Formation occurrences have been included within the Ten Mile Gravel map unit.

Qtg Glens Ferry Formation (Pliocene)—This unit consists of bedded sand and silt that was deposited near the margin of, and within, Lake Idaho during its waning stage in the latter part of the Pliocene epoch (Jenks and others, 1989; Wood and Clemens, 2000). The unit likely extends 100 m in thickness throughout the Melba quadrangle, based on its thickness being greater than this in adjacent areas to the south and west. At some localities the Glens Ferry Formation map unit may contain areas underlain by the Ten Mile Gravel, either as material that was not detected because of poor exposure, or as gravels that were eroded and redeposited on areas of Glens Ferry Formation.

SYMBOLS



REFERENCES

Bonnichsen, Bill, and M.M. Godchaux, 1998. Geologic map of the Walters Butte Quadrangle, Ada, Canyon, and Owyhee Counties, Idaho: Idaho Geological Survey Geologic Map, GM-21, scale 1:24,000.

Godchaux, M.M., Bill Bonnichsen, and M.D. Jenks, 1992. Types of phreatomagmatic volcanoes in the western Snake River Plain, Idaho, USA: Journal of Volcanology and Geothermal Research, v. 52, p. 1-25.

Jenks, M.D., and Bill Bonnichsen, 1989. Subaqueous basaltic eruptions into Pliocene Lake Idaho, Snake River Plain, Idaho, in V.E. Chamberlain, R.M. Breckenridge, and Bill Bonnichsen, editors, Guidebook to the Geology of Northern and Western Idaho and Surrounding Area: Idaho Geological Survey Bulletin 28, p. 17-34.

Ohlberg, K.L., Bill Bonnichsen, C.C. Swisher III, and M.M. Godchaux, 1995. Geochemistry and geochronology of Pleistocene basalts of the western Snake River Plain and Smith Prairie, Idaho: Isochron West, v. 62, p. 1-14.

Ohlberg, K.L., and L.R. Stanford, 1992. Geologic Map of the Boise Valley and Adjacent Area, Western Snake River Plain, Idaho: Idaho Geological Survey Geologic Map, GM-18, scale 1:100,000.

White, C.M., W.K. Hart, Bill Bonnichsen, and Debra Matthews, 2000 (in press). Geochemical and Sr-isotopic variations in western Snake River Plain basalts, Idaho: in Bill Bonnichsen, C.M. White, and Mike McCurry, editors, Tectonic and Magmatic Evolution of the Snake River Plain Volcanic Province: Idaho Geological Survey Bulletin 30.

Wood, S.H., Clemens, and D.M. Clemens, 2000 (in press). Geologic and tectonic history of the western Snake River Plain, Idaho and Oregon: in Bill Bonnichsen, C.M. White, and Mike McCurry, editors, Tectonic and Magmatic Evolution of the Snake River Plain Volcanic Province: Idaho Geological Survey Bulletin 30.

