Geologic Map of the Magic Reservoir East Quadrangle, Blaine and Camas Counties, Idaho

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2007

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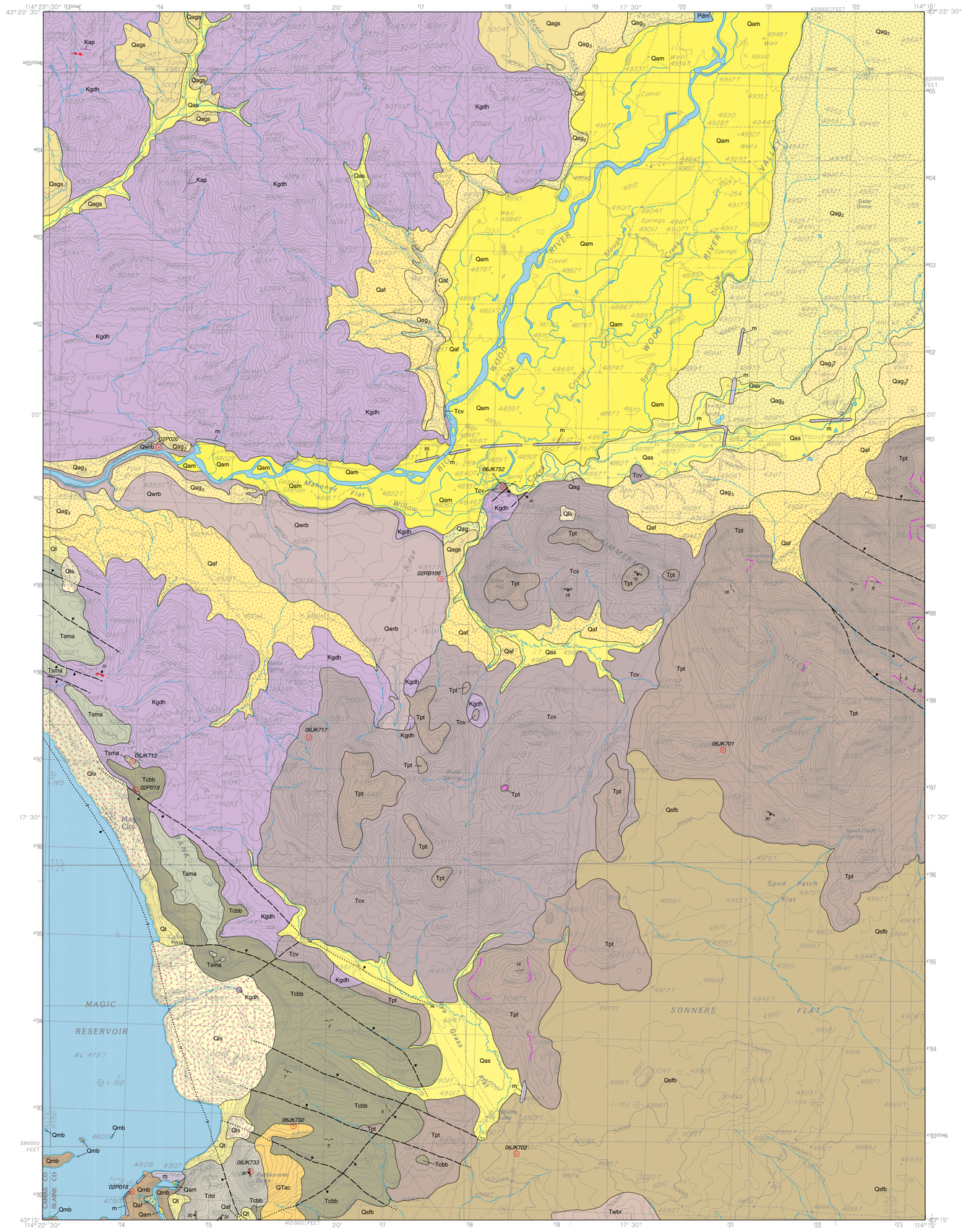

Base map scanned from USGS film-positive base, 1986.
Topography by photogrammetric methods from aerial photographs taken 1980. Field checked 1981. Map edited 1986.
Transverse Mercator. 1927 North American Datum.
10,000-foot grid ticks based on Idaho coordinate system, central zone.
1000-meter Universal Transverse Mercator grid ticks, zone 11.
National geodetic vertical datum of 1929.

UTM Grid and 1986 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 20 feet.
Supplemental contour interval 10 feet.

IDAHO
QUADRANGLE LOCATION

Field work conducted 2006.
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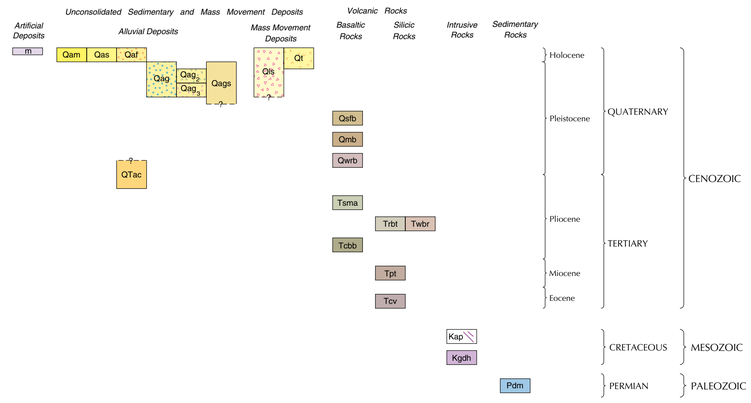
Digital cartography by Theresa A. Taylor and Jane S. Freed at the Idaho Geological Survey's Digital Mapping Lab.
Note on printing: The map is reproduced at a high resolution of 600 dots per inch. The inks are resistant to run and fading but will deteriorate with long-term exposure to light.
PDF map (Acrobat Reader) may be viewed at www.idahogeology.org.
Map version 7-1-2010.

CORRELATION OF MAP UNITS



INTRODUCTION

The geologic map of the Magic Reservoir East quadrangle depicts rock units exposed at the surface or underlying thin surficial cover of soil and colluvium. Thicker surficial deposits are also depicted where they mask or modify the underlying rock units or form significant mappable units. The map is the result of field work conducted in 2006 by the authors. Mapping by previous workers, noted below, was field checked and incorporated where appropriate. Soils information is from Johnson (1991, 2002).

Previous work in the area includes that of Malde and others (1963), Schmidt (1961), Leeman (1982), Struhsacker and others (1982), and Honjo (1986). Malde and others conducted regional reconnaissance mapping, which included the Magic Reservoir area, and established a regional stratigraphy. Schmidt mapped the Bellevue area and provided a more detailed stratigraphy and description of units, although his main focus was on Quaternary units and stream diversions by basalt flows. Leeman, using Schmidt's stratigraphic units, proposed a "Magic Reservoir eruptive center" to account for much of the volcanism in the area. Struhsacker and others worked in the northwestern part of the Magic Reservoir area and slightly modified Schmidt's stratigraphy, but concentrated on the rhyolitic units and provided little new mapping. Honjo essentially used the stratigraphic sequence of these previous workers. Our observations of several stratigraphic units in the Magic Reservoir East and adjacent quadrangles do not support the stratigraphic interpretations of these previous workers. The discrepancies are noted and discussed below in the "Description of Map Units." After Schmidt's investigations, the extent of field mapping by these subsequent workers may have been inadequate to identify the stratigraphic problems we observed. In addition, varying use of the terms "Moonstone Rhyolite," "rhyolite of Magic Reservoir," and "rhyolite ash-flow tuffs of Magic Reservoir" for in some instances equivalent units and in other cases different units has confused the stratigraphic picture. Therefore we avoid using these terms. Instead, we use local geographic features or rock types for naming most units, noting correlation to the previous units. Our mapping does not entirely resolve the stratigraphic questions, but it provides additional information and alternatives that should be considered and evaluated in future research and geologic mapping.

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

m — **Made ground (Holocene)**—Artificial fills composed of excavated, transported, and emplaced construction materials typically derived locally. Primarily includes highway fills and the fill portion of Magic Dam.

SEDIMENTARY AND MASS MOVEMENT DEPOSITS

Alluvial Deposits

Qam — **Alluvium of the Big Wood River (Holocene)**—Moderate- to well-sorted gray sandy pebble and cobble gravel with few boulders; stratified with gravelly coarse sand. Gravel clasts subrounded to rounded Paleozoic sedimentary and metamorphic rocks, Cretaceous granitic rocks, and Eocene felsites. Thickness more than 10 feet.

Qas — **Alluvium of side streams and local drainages (Holocene)**—Stratified clay, silt, sand, and gravel in channels and flood plains of Little Rock Creek, Willow Creek, Grass Flat, and an unnamed drainage south of Timmerman Hills. Thickness generally less than 20 feet.

Qaf — **Alluvial-fan deposits (Holocene and Pleistocene)**—Primarily poorly sorted silty sand and granules of reworked grus where coalesced fans flank granitic hills (*Kgdh*). Poorly sorted silty, clayey sand and angular gravel in coalesced fans in the Timmerman Hills. Thickness highly variable, ranging 5-25 feet.

Qag_1 — **Alluvial gravel terrace deposits, undivided (Pleistocene)**—Moderate- to well-sorted gray sandy pebble and cobble gravel deposited by the ancestral of Big Wood River. Gravel clasts subrounded to rounded Paleozoic sedimentary and metamorphic rocks, Cretaceous granitic rocks, and Eocene felsites.

Qag_2 — **Alluvial gravel terrace deposits, 2nd terrace (Pleistocene)**—Deposited by glacial outwash from late Wisconsin alpine glaciers in the headwaters of the Boulder and Pioneer mountains. Equivalent to Pinedale gravels of Schmidt (1961) and the Boulder Creek outwash gravels of Pearce and others (1988). Forms terrace 10-30 feet above present Big Wood River flood plain.

Qag_3 — **Alluvial gravel terrace deposits, 3rd terrace (Pleistocene)**—Deposited by glacial outwash from pre-Pinedale glaciations in the headwaters of the Boulder and Pioneer mountains. Equivalent to Bull Lake gravels of Schmidt (1961) and Prairie Creek outwash gravels of Pearce and others (1988). Forms terrace 40-60 feet above present Big Wood River flood plain. In the Wood River Valley, unit characterized by a thin (4-6 feet thick) gray clay capping the gravel. Downstream of Mahoney Flat correlation inferred from longitudinal profile of terrace remnants.

Qags — **Alluvial gravel deposits of sidestreams, undivided (Pleistocene)**—Poorly sorted and crudely bedded pebble to boulder gravels with a sand, silt, and clay matrix. Forms remnant terraces, incised alluvial fans, and surfaces of old pediments.

QTac — **Alluvial and colluvial deposits (Pleistocene to Pliocene)**—Possible remnant alluvial deposits on the north and east flank of Rattlesnake Butte. Consists of subangular to subrounded pumice fragments and uncommon well-rounded pebbles of probable Challis Volcanics and quartzite in the overburden. Schmidt (1961) mapped this area as Poison Creek tuff, probably because the pumice fragments resemble that unit where it is exposed on the Magic Reservoir West quadrangle. We believe the fragments were eroded from a pumice layer in the rhyolite of Rattlesnake Butte (see *Trbt* description below).

Mass Movement Deposits

Qt — **Talus (Holocene and Pleistocene)**—Angular pebble-, cobble-, and boulder-sized fragments fallen and rolled from bedrock outcrops and accumulated below. Deposits are characterized by a steeply sloping surface that is at or near the angle of repose. Mostly stabilized by vegetation.

Qls — **Landslide deposits (Holocene and Pleistocene)**—Poorly sorted and poorly stratified angular basalt cobbles and boulders mixed with silt and clay. Deposited by slumps, slides, and debris flows.

VOLCANIC ROCKS

Qsfb — **Basalt of Sonners Flat (Pleistocene)**—Fine- to medium-grained, dense to coarsely diktytaxitic, plagioclase-phyric, olivine basalt flows. Some flows have interlocking plagioclase phenocrysts 5-7 mm in length and scattered small olivine crystals. Other flows are finer grained with glomerocrysts of plagioclase and olivine as large as 1 cm. Some olivine is altered to amber iddingsite(?). Remanent magnetic polarity is normal, as determined in the field. Probably erupted from ridge extending north from Wedge Butte, although no spatter or other vent-related deposits were found. Covers Sonners Flat and may extend to Big Wood River south of Magic Reservoir. Stream drainage is moderately well developed. Basalt surface covered by silt and clay (loess?) 2-5 feet thick and includes a well-developed soil caliche (duripan). Variations in soil characteristics and vegetation form a patterned ground visible on aerial photographs.

Qmb — **Basalt of Myrtle (Pleistocene)**—Fine-grained basalt with rare to common glomerocrysts of plagioclase and olivine as large as 1 cm. Reverse magnetic polarity, as determined in the laboratory for the flow at the Magic Reservoir spillway, but mapped unit includes a normal magnetic flow, as determined in the field. An $^{40}Ar/^{39}Ar$ date on the spillway flow resulted in a plateau age of 0.59 ± 0.19 Ma and an inverse isochron age of 0.79 ± 0.16 Ma (Idaho Geological Survey, unpublished data), which places the unit in the reverse polarity Matayuma Chron. Source or sources probably southwest of the quadrangle.

Qwrb — **Basalt of Wind Ridge (Pleistocene)**—Fine-grained basalt with common glomerocrysts of weathered, eroded plagioclase and olivine as large as 7 mm; olivine altered to purplish iddingsite. Fresh surfaces have a faint purplish hue. In the field, magnetic polarity was strong and very sensitive to inclination of the sample; at Sheep Bridge a sample was reverse, as measured in the laboratory. In places the flow deflects a compass needle. Source is a vent about 1 mile southwest of Ditto Hill. Cinders and welded spatter occur near the vent. Spatter fragments and basalt near the vent have abundant xenocrysts of plagioclase and quartz, and some granitic xenoliths. Thickens westward from about 30 feet near Ditto Hill to at least 70 feet at Sheep Bridge where the base is not exposed. Thickening is probably due to irregularities in the preflow topography. Stream drainage is moderately well developed. Basalt surface covered by silt and clay (loess?) 2-4 feet thick and includes a well-developed soil caliche (duripan). Variations in soil characteristics and vegetation form a patterned ground visible on aerial photographs.

Formerly divided into "upper" and "lower" units by Schmidt (1961), and Struhsacker and others (1982) report three flows. However, we could find no conclusive evidence of separate flows, although there do appear to be several internal vesicular zones in the outcrop at Sheep Bridge. An $^{40}Ar/^{39}Ar$ date on the flow just west of Ditto Hill (Schmidt's upper flow) resulted in a plateau age of 1.54 ± 0.13 Ma and an inverse isochron age of 1.48 ± 0.22 Ma (Idaho Geological Survey, unpublished data). For the flow at Sheep Bridge (Schmidt's lower flow), an $^{40}Ar/^{39}Ar$ date resulted a plateau age of 1.17 ± 0.21 Ma and an inverse isochron age of 1.06 ± 0.19 Ma (Idaho Geological Survey, unpublished data). Chemical composition of samples from the "upper" unit near Ditto Hill and the "lower"unit at Sheep Bridge is indistinguishable (samples 02RB106 and 02P020; Table 1).

Tsma — **Andesite of Square Mountain (Pliocene)**—Fine-grained andesitic unit with plagioclase phenocrysts and locally common quartz and plagioclase xenocrysts; also a few granitic or rhyolitic xenoliths. Forms capping unit on Clay Bank Hills east of Magic City where it is in unconformable, probably erosional, contact with basalt of Clay Bank Hills or granitic rock of *Kgdh* unit. Maximum thickness is about 100 feet. Thin erosional remnants extend south to just north of Rattlesnake Butte. Remanent magnetic polarity inconclusive, but probably reverse; both normal and reverse readings were obtained in the field. Commonly has curving, platy jointed zone 5-10 feet thick below a stocky, crudely columnar top. The top weathers into large subrounded blocks as much as 3 to 6 feet in diameter. One analyzed sample (sample 06JK712; Table) plots in the upper part of the andesite field on the total alkali-silica diagram of Le Maitre (1984). Chemical composition of our sample is very similar to those for the Square Mountain ferrolatite reported in Honjo (1986) and Honjo and Leeman (1987), which also plot in the upper andesite field.

Previously mapped as part of the Square Mountain basalt by Schmidt (1961) who placed it stratigraphically below the basalt of Clay Bank Hills (Schmidt's Clay Bank basalt). Struhsacker and others (1982) placed the Square Mountain basalt above their "older rhyolite" and below their Tuff 1 of Magic Reservoir (equivalent to Schmidt's Poison Creek tuff), which they dated at 5.64 Ma. Honjo (1986), following Schmidt's (1961) and Struhsacker and others (1982) stratigraphic sequence, also placed this unit below the basalt of Clay Bank Hills and below the Poison Creek tuff. However, we have found it capping and probably filling irregularities on the basalt of Clay Bank Hills and also capping the Poison Creek tuff. On the basis of our preliminary field work in the Magic Reservoir West quadrangle, we believe there is an older xenolithic and xenocrystic unit stratigraphically lower than the basalt of Clay Bank Hills and above the older rhyolite of Magic Reservoir unit of Struhsaker and others (1982) that resembles the Square Mountain unit. Schmidt (1961) places the Square Mountain basalt stratigraphically above the rhyolite on Moonstone Mountain and Honjo and others (1986) report an age of ~3.0-3.4 Ma for rhyolite at Moonstone Mountain. As noted below, we obtained an age for the basalt of Clay Bank Hills of ~4.0 Ma. Therefore, our stratigraphic position of the andesite unit above the basalt of Clay Bank Hills is in accord with the reported ages.

Trbt — **Tuff of Rattlesnake Butte (Pliocene?)**—Light gray to light pinkish gray rhyolite tuff(?) with scattered phenocrysts of quartz, plagioclase, and sanidine, and a few mafic crystals (hornblende?) with weathered rinds. Layering (flow layering or compaction foliation?) of cliff-forming outcrop on top of Rattlesnake Butte strikes N15°W and dips 30°W. Source unknown; possibly an extrusive unit related to rhyolite of Wedge Butte. Previously included in the Moonstone rhyolite (Schmidt,1961; Leeman, 1982) or the young domes unit (Honjo, 1986). Honjo and others (1986) obtained a K-Ar date of 2.92 ± 0.04 Ma for this unit. However, it appears that the basalt of Clay Bank Hills, which as noted below has an age of about 4.0 Ma, abuts and flanks the north and east sides of Rattlesnake Butte and therefore should be younger than the tuff. Alternatively, the unit may have been extruded through the basalt. The dates support the latter alternative.

As noted above in the description of unit *QTag*, an area on the north and east flank of the butte was previously mapped as Poison Creek tuff by Schmidt (1961). Pumice fragments in the overburden are weathered light orangish-brown and resemble pumice from the Poison Creek tuff unit at the north end of Magic Reservoir, just west of the quadrangle boundary. However, fresh surfaces of fragments are feathery light gray pumice with phenocrysts of quartz and sanidine, as well as minor hornblende, which resembles the tuff of Rattlesnake Butte unit (*Trbt*). A sample of the pumice fragments (sample 06JK732; Table 1) has chemical composition very similar to the tuff of Rattlesnake Butte (sample 06JK733; Table 1) and different than that of the Poison Creek tuff. We conclude, therefore, that the fragments were eroded from a pumice layer in the tuff of Rattlesnake Butte. Most fragments are subangular to subrounded and at one location overlie the basalt of Clay Bank Hills.

Twbr — **Rhyolite of Wedge Butte (Pliocene?)**—Pinkish gray rhyolite with abundant phenocrysts of quartz, sanidine, and plagioclase. This phenocryst abundance gives the rock a coarse-grained, granitic appearance, both in hand sample and outcrop. Previously included in Moonstone rhyolite unit (Schmidt, 1961; Leeman, 1982) or the young domes unit (Honjo, 1986). Armstrong and others (1975) report an average K-Ar date (two feldspar separates) of 3.06 ± 0.04 Ma from Wedge Butte. Honjo and others (1986) obtained a K-Ar date on Dinosaur Ridge dome of 3.29 ± 0.05 Ma. All of these buttes are surrounded by Quaternary basalt flows. As with the tuff of Rattlesnake Butte, stratigraphic relationship of these domes to the basalt of Clay Bank Hills is unclear, but based on the dates, the domes are younger.

Tcbb — **Basalt of Clay Bank Hills (Pliocene)**—Mostly medium-grained, coarse-textured basalt; texture results from abundant plagioclase phenocrysts 2-5 mm in length. Flow south of Rattlesnake Butte is fine grained and essentially aphyric. Olivine occurs in the groundmass and is altered to amber to purplish iddingsite(?). Laboratory determination of remanent magnetic polarity of the unit on the ridge above Magic City was normal; field determination on the unit south of Rattlesnake Butte gave conflicting readings. Maximum thickness is about 200 feet. Equivalent to the Clay Bank basalt of Schmidt (1961) and other previous workers. Flows north of Rattlesnake Butte are cut by west-northwest-trending down-to-the-north block faults that dip 5-7° to the south. The faults predate the basalt of Sonners Flat, which is not disrupted. An $^{40}Ar/^{39}Ar$ date from the flow on the ridge above Magic City resulted in a plateau age of 4.2 ± 1.3 Ma and an inverse isochron age of 3.8 ± 1.6 Ma (Idaho Geological Survey, unpublished data).

Tpt — **Picabo tuff (Miocene)**—Light gray, tan, and purplish tan crystal-poor tuff. Phenocrysts of quartz, plagioclase, and minor sanidine compose less than 5 percent of the rock. Commonly has compaction foliation layers spaced 1-3 mm. Probably consists of several ash flows or cooling units as indicated by vitrophyric layers and associated zones with irregularly shaped lithophysal cavities from several centimeters to tens of centimeters in size. The lithophysal zones commonly form ledges 6-30 feet high. The unit weathers into granular fragments. Composes most of the ridges of the Timmerman Hills east of Highway 75 and caps ridges west of Highway 75. Extruded onto irregular topography of Challis Volcanics or Cretaceous granitic rocks. Maximum exposed thickness is about 500 feet. Equivalent to the Picabo tuff of Schmidt (1961). Honjo and others (1986) obtained a K-Ar date on plagioclase for Picabo-B unit (Schmidt, 1961) of 8.98 ± 0.12 Ma.

Tcv — **Challis Volcanics, undivided (Eocene)**—Mostly medium to dark gray, pink, or purple hornblende dacite porphyry. Plagioclase phenocrysts common to abundant; hornblende phenocrysts uncommon to common and in places altered and oxidized. Typically has wavy compaction(?) foliation layers several mm thick. At a few isolated exposures the rock is light gray and contains abundant small hornblende, plagioclase, and biotite phenocrysts. Also locally consists of breccia with pale (altered?) multi-colored fragments or jade-colored clasts.

INTRUSIVE ROCKS

Kap — **Aplite dikes (Cretaceous?)**—Fine-grained, light-colored granitic dikes cutting *Kgdh* unit. More abundant than shown, based on presence of fragments in the overburden.

Kgdh — **Hornblende-biotite granodiorite (Cretaceous)**—Gray, medium- to coarse-grained, equigranular to porphyritic hornblende-biotite granodiorite. Biotite is in distinct books up to 4 mm across. Plagioclase displays oscillatory zoning (An_{70}–An_{40}). Sphene unusually ambundant, perhaps as much as 1 percent locally. Equivalent to *Kgdk* unit of Worl and others (1991), who indicate it is a potassium-rich intrusive, having high K_2O content for a given SiO_2 content relative to other intrusives to the northwest. Also notable for the relative abundance of gold-bearing quartz veins (Lewis, 1989; Worl and Lewis, 2001). Map unit includes locally derived thin gravel and sand in terrace remnants (Qsmr and Qsw of Schmidt, 1961).

SEDIMENTARY ROCKS

Pdm — **Dollarhide Formation, Middle Member (Lower Permian)**—Light-colored calcareous sandstone, siliceous sandstone, sandy limestone, silty argillite, and minor conglomerate.

SYMBOLS

Contact: Line showing the approximate boundary between one map unit and another.

Fault: Approximately located; dashed where inferred; dotted where concealed; bar and ball on downthrown side; arrow indicates bearing and plunge of slickenside lineation on fault plane.

Quartz vein; dip shown by arrow.

Strike and dip of basalt flow or volcanic layer.

Strike and dip of flow foliation.

Zone of lithophysal cavities.

Estimated strike and dip of basalt flow or volcanic layer.

Sample location and number.

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Table 1. Major oxide and trace element chemistry of samples collected in the Magic Reservoir East quadrangle.

Sample number	Latitude	Longitude	Unit name	Map unit	Major elements in weight percent										Trace elements in parts per million																	
					SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Ni	Cr	Sc	V	Ba	Rb	Sr	Zr	Y	Nb	Ga	Cu	Zn	Pb	La	Ce	Th	Nd
02P018	43.25295	-114.36239	basalt of Myrtle	Qmb	46.61	3.090	14.88	13.94	0.215	7.22	10.49	2.46	0.43	0.676	81	198	33	315	526	6	307	261	38	24.5	20	42	138	7	29	68	2	39
02P019	43.29451	-114.36183	basalt of Clay Bank Hills	Tcbb	47.02	2.435	14.89	13.74	0.231	6.94	11.62	2.43	0.30	0.405	88	241	40	342	394	0	200	161	34	16.3	18	71	125	5	20	41	2	26
02P020	43.32997	-114.35861	basalt of Wind Ridge, "lower" unit	Qwrb	47.42	3.256	14.53	14.54	0.220	6.89	9.63	2.56	0.59	0.350	85	187	29	317	368	7	312	216	32	16.5	21	44	142	4	14	41	2	24
02RB106	43.31632	-114.31865	basalt of Wind Ridge, "upper" unit	Qwrb	47.30	3.171	14.67	14.40	0.217	7.18	9.64	2.56	0.52	0.358	87	186	30	314	473	7	326	217	32	15.5	21	28	142	5	15	41	4	29
06JK701	43.29864	-114.27857	Picabo tuff	Tpt	76.00	0.301	12.05	2.56	0.016	0.04	0.49	3.01	5.50	0.036	4	1	5	8	795	214	38	465	52	46.1	24	3	82	30	94	51	34	72
06JK702	43.25686	-114.30788	basalt of Sonners Flat	Qsfb	47.10	3.318	14.24	14.19	0.219	6.92	10.07	2.44	0.66	0.859	76	173	31	309	519	10	330	309	42	26.9	20	35	152	6	32	80	1	48
06JK712	43.29743	-114.36228	andesite of Square Mountain	Tsma	60.71	1.915	14.96	8.75	0.103	1.69	4.86	3.33	3.24	0.441	12	11	17	149	1920	64	278	517	60	37.9	22	11	121	18	91	133	5	77
06JK717	43.29993	-114.33727	Challis Volcanics, undivided	Tcv	70.16	0.557	14.68	3.41	0.048	1.15	3.03	3.34	3.46	0.172	12	20	8	53	1603	88	783	182	11	12.4	18	11	56	21	46	85	13	32
06JK732	43.25972	-114.33944	pumice fragments	in QTac	73.97	0.070	12.98	1.31	0.053	0.17	2.63	3.27	5.49	0.058	0	4	1	3	176	442	35	124	153	107.8	31	5	120	63	25	58	51	32
06JK733	43.255	-114.34556	rhyolite of Rattlesnake Butte	Trbt	75.48	0.060	13.64	1.38	0.038	0.03	0.37	4.13	4.84	0.037	4	2	2	4	33	492	13	146	102	121.2	36	2	99	69	33	78	62	28
06JK752	43.32583	-114.30972	Challis Volcanics, undivided	Tcv	65.79	0.683	16.21	4.31	0.051	2.39	3.13	4.16	3.03	0.249	85	146	12	75	1558	69	608	194	12	11.0	22	21	69	25	49	87	11	34

* Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO.
All analyses performed at Washington State University GeoAnalytical Laboratory, Pullman, Washington.

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