DIGITAL WEB MAP 177 **IDAHO GEOLOGICAL SURVEY** IDAHOGEOLOGY.ORG MOSCOW-BOISE-POCATELLO LEWIS AND OTHERS

Geologic Map of the Montour Quadrangle, Boise and Gem Counties, Idaho Reed S. Lewis, William M. Phillips, Dennis M. Feeney, Keegan L. Schmidt, and Spencer H. Wood Field work conducted 2014-2015. Base digitally scanned from 24,000-scale USGS film separates, 1985. This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, Shaded elevation from 10 m DEM. SCALE 1:24,000 USGS award no. G14AC00164. Topography by photogrammetric methods from aerial photographs taken 1980. Field checked 1981. Digital cartography by Jane S. Freed at the FEET Idaho Geological Survey's Digital Mapping Lab. Map edited 1985. 1000 2000 3000 4000 5000 6000 7000 Technical review status: Authors only. Projection: Idaho coordinate system, west zone (Transverse Map version 4-7-2016. Mercator). 1927 North American Datum. PDF (Acrobat Reader) map may be viewed online at 10,000-foot grid ticks based on Idaho coordinate system, west zone. Contour interval 40 feet www.idahogeology.org. 1000-meter Universal Transverse Mercator grid ticks, zone 11. Declination from NOAA National Geophysical Data Center. The IGS does not guarantee this map or digital data to be free of errors nor QUADRANGLE LOCATION ADJOINING QUADRANGLES assume liability for interpretations made from this map or digital data, or Water wells shown with Idaho Department of Water Resources WellID number. Water well logs can be found at No vertical exaggeration http://www.idwr.idaho.gov/apps/appswell/RelatedDocs.asp?WellID=xxxxxx where "xxxxxx" is the six-digit WellID Canyon

No vertical exaggeration

Alluvial Deposits QUATERNARY Volcanic Rocks Intrusive Rocks CRETACEOUS *Personal communication from Mark Schmitz, 2015. Personal communication from Richard Gaschnig, 2015 INTRODUCTION

CORRELATION OF MAP UNITS

The geologic map of the Montour 7.5' quadrangle depicts the rock units exposed at the surface or underlying a thin cover of soil or colluvium; alluvial and man-made surficial deposits are also depicted where they form Payette River floodplain by a 16 to 27 m (52 to 89 ft) scarp. The scarp is significant mappable units. This map is a result of fieldwork conducted in higher on the north side of the Payette River than on the south. Thickness the summer and autumn of 2014 and the spring of 2015 by all authors, and estimated from water wells ranges from 18 to 21 m (60 to 70 ft). This is less earlier work in the late 1990s by Spencer Wood. Analysis of thin sections than scarp height in places because the terrace is underlain at shallow and XRF geochemical data by the authors supplemented the field studies. depths by fine-grained sediments of Tso or Tsy. Soil development on Classification for intrusive and extrusive igneous rocks is based on LeBas nongravelly sediments and degree of dissection (Gilbert and others, 1983) and Streckeisen (1991). Previous work in the area includes a study of the is roughly consistent with a late Pleistocene (Pinedale, circa 14-25 ka) age. geology and mineral resources of Gem and Payette counties by Savage Mined for sand and gravel in sec. 25, T. 7 N., R. 1 E. (1961), geological mapping of Gilbert and others (1983) performed in

mous Ph.D. by James Fitzgerald (1981, 1982, and 1984). dunes, and/or colluvium. Thickness estimated from topographic profiles is 16 to 22 m (52 to 72 ft). Soil development and degree of dissection are The basement rocks of the Montour 7.5' quadrangle are Late Cretaceous roughly consistent with a late Pleistocene (early Pinedale-Bull Lake, circa hornblende-biotite granodiorite and Eocene diorite. Lower Columbia River 60-150 ka) age (Gilbert and others, 1983, Table C-1). 18 to 25° to the west. A date of 16.85 ± 0.21 Ma (Jarboe and others, 2008) Qaf Alluvial fan deposits (Holocene-middle Pleistocene)—Brown sandy silt from atop Squaw Butte (2 km to the west-northwest) places these basalts in derived from loess and Tertiary sediments with lesser pebbles and cobbles the older part of Columbia River Basalt Group, most likely Steens Basalt of granitic and basaltic composition. Thickness ranges from <3 to 6 m (<10 (Camp and others, 2013). These are overlain by Grande Ronde Basalt in the north, and a younger xenocryst-rich basaltic andesite in the south. Fluvial and lacustrine Tertiary sediments were deposited contemporaneous with Older alluvial fan deposits (Holocene-middle Pleistocene)—Fine-grained and later than Columbia River basalts. The Isotope Geology Laboratory at indurated sediments described in water well logs as "claystone" or "shale" Boise State University analyzed U-Pb isotopic ratios from zircons we capped with 3 to 5 m (10 to 15 ft) of brown silty clay. Surface is commonly collected from a basal ash layer of older Tertiary sediments; results indicate littered with rounded cobbles and boulders of basaltic clasts. Near a depositional age of about 9.9 Ma or younger. Older Tertiary sediments Roystone Hot Springs (SW 1/4 SW 1/4 sec. 9, T. 7 N., R. 1 E.) consists of locally generally trend to the north-northwest with a dip of 12° to 19° to the west, silicified, well-rounded basaltic pebbles and cobbles in a clay-rich matrix. whereas younger Tertiary sediments are flat or gently dip towards Sweet Thickness estimated from topographic profiles ranges from 17 to 34 m (56 Creek or the Payette River. All faults depicted are normal faults; faults are

support of seismic hazard analysis of the Black Canyon Dam west of the

quadrangle, an unpublished field map by Don Adair, and the field maps,

field notes, fluxgate magnetometer data, XRF analytical data, and posthu-

Gilbert and others (1983) recognized six terrace deposits in the Payette River valley about 15 km (9 mi) upstream and downstream of the Black Canyon Dam. These deposits were labeled in relationship to their height above the Payette River floodplain (Qap). Terrace ages were defined on the basis of degree of dissection, number of nongravelly (loess) deposits overlying gravelly alluvium, and degree of soil development. We simplified this scheme by including terraces <3 m (<10 ft) above the floodplain into Qap, and combining the highest two terraces into a single unit, Qtp₄. Note that we number terraces from the floodplain upward; Gilbert and others (1983)

used the opposite procedure.

 \searrow^{51} Strike and dip of bedding.

⊕ Horizontal bedding.

∷ No fabric.

 \triangle^{Δ} Tectonic breccia.

10RMG022 ■ Geochronologic sample.

Strike and dip of foliation.

Contact: dashed where approximately located.

Strike and dip of bedding, strike approximate.

Approximate strike and dip of volcanic flows

Bearing and plunge of mineral lineation.

Landslide scarp and headwall.

14RL063 • Geochemical sample (see Table 1).

386478 Water well showing Well ID number.

Sand, gravel, and rock quarry locations

Estimated strike and dip direction of volcanic flows.

...... Normal fault: ball and bar on downthrown side; dashed where

approximately located; dotted where concealed.

generally not exposed and are mapped on stratigraphic or geomorphic

SYMBOLS

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

constructed in floodplains; also includes small earthen dams along side

Placer and Davis Placer); abandoned gold and silver surface mine devel-

oped in gravelly alluvial deposits (*Qtp*₄?). Also includes placer in reworked

ALLUVIAL DEPOSITS

cobbles, pebbles, and boulders in an arkosic sandy matrix; consists of the

braided river floodplain of the Payette River and adjacent low terraces <3 m

(<10 ft) above the floodplain. The low terraces form islands in the Black

Canyon Reservoir and are composed of stratified sandy gravels topped with

fine sand, silts, and clays. Many more islands are exposed during low water

conditions than are depicted on the map. Thickness estimated at 5 to 14 m

well-rounded basaltic and granitic cobbles derived from Quaternary

terrace deposits and Tertiary sediments; thickness generally <3 m (<10 ft).

Second highest terrace alluvium (Late Pleistocene)—Terrace surface about 4 m

Third highest terrace alluvium (Late Pleistocene)—Discontinuous, slightly

dissected terrace remnant of Sweet Creek about 9 m (30 ft) above Ot...

in composition to Qap; capped with 1 to 1.5 m (3 to 5 ft) of soil; separated

from the Payette River floodplain by a scarp about 3 to 4.5 m (10 to 15 ft)

high. This terrace includes most of Montour Valley. Maximum thickness

estimated from water wells to be about 4.9 m (16 ft). Subject to flooding

similar in composition to unit *Qap*; separated from *Qtp*, by scarp 3 to 5 m

(10 to 15 ft) high. Thickness estimated from water wells ranges from 11 to

sand similar in composition to *Oap* capped by 2 to 3.4 m (7 to 11 ft) of

brown sandy silt and sand interpreted to be loess and/or interfingering

alluvial fans (Qaf). This terrace is the major high terrace of the Payette River

valley in the map. The terrace is separated from lower terraces and the

Second highest alluvium of Payette River (Late Pleistocene)—Gravel and sand

Third highest terrace alluvium of Payette River (Late Pleistocene)—Gravel and

(15 to 45 ft). Subject to flooding and/or a seasonally high water table.

Qas Alluvium of side streams (Holocene)—Arkosic sand, silty sand, and lesser

Qt, Lowest terrace alluvium (Holocene)—Terrace surface about 2 m (7 ft) above

(13 ft) above level of Qt_i ; forms the largest Sweet Creek terrace.

Qtp. Lowest terrace alluvium of Payette River (Holocene)—Gravel and sand similar

Placer deposits (Holocene)—Gatfield Ranch Placer (also known as Cruikshank

m Man-made land (Holocene)—Fill used to elevate roads and bridge abutments

Qap Alluvium of Payette River (Holocene)—Well-rounded basaltic and granitic

streams. Thickness is generally <3 m (10 ft).

Tso on tributary of Johnson Creek.

active channel of Sweet Creek.

and/or seasonally high water tables.

13 m (36 to 43 ft).

SEDIMENTARY DEPOSITS Younger sedimentary deposits (Pliocene-Miocene)—Poorly exposed sand,

mudstone, and gravel. Locally silicified in the vicinity of Roystone Hot Springs. Dips tend to be less than 3° and to the east, in contrast to most exposures of the *Tso* unit, which typically dip west and more steeply. Feldspar and quartz are the most abundant grain types; basaltic pebbles are subordinate to pebbles of felsic intrusive and extrusive rocks. Base of unit in northwest part of quadrangle contains sand with abundant feldspar, quartz, and biotite; intervals there contain pebbles of light pink aphyric rhyolite and subordinate basalt. Obsidian pebbles are present locally in this area. The obsidian is aphyric and likely correlative with obsidian reported by Sappington (1981), Clemens (1990), and Corn (2006) at Timber Butte, 12 km (7 mi) to the northeast. Kirkham (1931) mentions 1,180 ft of ash and shale on the east side of Squaw Creek Valley that he thought was interbedded in the Columbia River basalts and thus best assigned to the Pavette Formation. Our interpretation is that the sediments there dip less steeply (and are younger) than the basalt (*Tcrl*).

Fourth highest terrace alluvium of Payette River (late Pleistocene)—Dis-

continuous remnants of dissected gravelly deposits with clast compositions

similar to *Qap*; overlain by nongravelly silt and sand interpreted to be loess,

to 111 ft). Forms the largest alluvial fan in the map. The lobate edges of

deposit and flow-like surface morphology visible in lidar images suggest

origin from liquefaction of unit Tsy followed by deposition of basaltic fan

sediments. Age uncertain; limited dissection suggests relatively young age.

MASS WASTING DEPOSITS

hummocky flows; developed in areas underlain by basaltic lavas (Tcrl and

Landslide deposits (Holocene-Pleistocene)—Rotational slumps and

Tbab), and by weakly consolidated sediments (*Tso*).

Boulder deposits (Pleistocene-Pliocene)—Mantle of rounded boulders of the

Tso Older sedimentary deposits (Miocene)—Poorly exposed sand, gravel, mudstone, and ash. Sand is largely quartz and feldspar and commonly contains granules. Unit is interpreted to be present at depth under Tsy in Sweet Valley (cross section A-A'). Exposures along Johnson Creek contain small faults with a few centimeters to decimeters of offset; most are steep and oriented approximately north-south.

Ash deposit (Miocene)—Light-gray ash in a single bed in the southwest corner of the map. Locally contains small lapilli. LA-ICPMS analysis on 96 zircon crystals from sample 14RL065 yielded a dominant peak at ca. 10 Ma with scattered dates between ~50 Ma and ~105 Ma and a few older analyses up to ~2500 Ma, suggestive of a volcaniclastic character (Mark Schmitz, written communication, 2015). Six additional CA-IDTIMS analyses yielded a spread of dates from ~9.8 Ma to ~11.5 Ma. A second set of seven analyses yielded a spread of dates from ~9.9 Ma to ~10.3 Ma with two anomalously high ages (~15.2 and 278.6 Ma). The two youngest yielded similar ²⁰⁶Pb/²³⁸U dates at ca. 9.9 Ma, which is interpreted to represent a maximum depositional age for the sample.

Sedimentary deposits interbedded with Columbia River Basalt Group (Miocene)—Sand and mudstone. Abundant coarse quartz and feldspar; likely derived from granitic sources to the east. Silicified in westernmost exposure. Exposure northeast of Sweet was estimated from inspection of Google Earth images and not visited; additional interbeds may be present east of the one shown on map.

VOLCANIC ROCKS

Tbab Basaltic andesite of Baltic Creek (Miocene or Pliocene)—Dark-gray, aphyric to sparsely porphyritic basaltic andesite. Rocks fracture conchoidally and have a fresh appearance; outcrops are entablature and talus development is common. Groundmass contains plagioclase microlites, clinopyroxene, and olivine in an opaque-rich glass. Xenocrysts and possible phenocrysts constitute about 5 to 7 percent of the rock and consist of quartz (1-2.5 mm) with reaction rims of clinopyroxene, and plagioclase (0.8-2 mm) most of which exhibits disequililibrium textures (internally corroded). Contains 51.46 to 52.66 percent SiO₂ (Table 1), which may be elevated due to the presence of xenocrystic quartz; vent location is uncertain.

Tdt Dacite tuff (Miocene or Pliocene)—Light pinkish-gray, densely welded dacite tuff; exposed only in the southwest part of the map. Lower part is a vitrophyre with light-colored lenticular lenses of flattened pumice as much as 2 cm in length in a waxy glass-rich matrix. Vitrophyre contains about 5 percent plagioclase phenocrysts 1-3 mm in length and about 1 percent quartz of similar size. Upper part is devitrified and more massive. Basal contact not well exposed, but unit appears to overlie the Tcrl unit and dip more to the southwest than west. Possibly correlative with the Soldier Creek dacite of Clemens (1990) in the Timber Butte area 21 km (13 mi) to the northeast.

Grande Ronde Basalt undifferentiated (Miocene)—Dark-gray and mottled

yellow-green, fine-grained aphyric to microporphyritic basaltic andesite. Conchoidal fracturing common. Plagioclase, clinopyroxene, and opaque oxides are the primary minerals and the matrix is glass-rich. Contains less than one percent microphenocrysts of plagioclase 1 mm or less in length. Lower Columbia River Basalt Group (Miocene)—Light-purple or light- to dark-gray, interlayered aphyric and plagioclase-megaphyric basalt. Weath-

ers to a coarse soil: talus is rare. Aphyric flows contain microphenocrysts of plagioclase, olivine, iddingsite after olivine, clinopyroxene, and oxides, and 40 to 60 percent groundmass. In plagioclase-megaphyric flows, plagioclase crystals range from 1 to 4 cm in length and comprise about 40 percent of the rock. Groundmass in both varieties contains plagioclase, olivine, clinopyroxene, and opaque oxides; ophitic intergrowth of plagioclase and pyroxene common, but not everywhere present. Samples of *Tcrl* range from 48.02 to 51.05 percent SiO₂ fitting within the IUGS classification as basalt. Fitzgerald (1981, 1982, and 1984) mapped Tcrl as Imnaha Basalt and noted a paleomagnetic transition from reverse to normal on Squaw Butte, 2 km (1.6 mi) northwest of the quadrangle; Martin (1984) confirmed the paleomagnetic results. Hooper and others (2002) suggested the paleomagnetic transition marks the change from R_0 to N_0 , and the boundary between older Steens and younger Imnaha. Jarboe and others (2008) reported an age of 16.85 ± 0.21 Ma on a plagioclase-phyric sample at the top of Squaw Butte (44.0057°, -116.4083°); that age incorporates the oldest Imnaha (16.7 Ma; Barry and others, 2013) but fits well within Steens Basalt (16.6 -16.8; Barry and others, 2013). Camp and others (2013) used XRF data to correlate a section along the Black Canyon Reservoir in the Northeast Emmett quadrangle to the west with lower and upper Steens Basalt. In this map and neighboring Northeast Emmett quadrangle (Feeney and others, in press) we collected over 40 samples of lower Columbia River basalt, analyzed them by XRF, then compared them with 32 analyses collected by Fitzgerald (1981 and 1984) and 36 samples analyzed by Victor Camp (written communication, 2013). Samples with megaphyric plagioclase (14DF504, 14DF517, 14DF529, 14RL063) have high Al₂O₂ content (18.04 to 18.74) percent) and low MgO content (3.2 to 4.3 percent) relative to the aphyric flows. The two basalt types could not be used for stratigraphic control because of complex interlayering and presumed faulting. It is our belief that the plagioclase- megaphyric flows are indicative of Steens Basalt and that most if not all of the Columbia River basalt flows in the central and western

INTRUSIVE ROCKS

Montour quadrangle are Steens Basalt.

Granite dikes (Eocene)—Pink to light-gray, coarse-grained, porphyritic biotite granite. Potassium feldspar, quartz, and plagioclase are present in roughly equal amounts. Biotite is generally less than 5 percent. Potassium feldspar is present as anhedral grains as much as 3 cm in length. Plagioclase is unzoned, subhedral, and as much as 5 mm in length. Interstitial quartz is as much as 4 mm across. A granophyric texture consisting of extensive graphic intergrowth of quartz and potassium feldspar is developed along quartzplagioclase grain boundaries. Biotite is euhedral and typically altered to chlorite. Accessories include zircon and apatite. Granite dikes strike east-northeast, form prominent outcrops, and weather easily to a coarse,

Porphyritic dacite dikes (Eocene)—Dark-gray to dark-green dacite dikes containing as much as 60 percent phenocrysts. Termed dacite porphyry dikes by Anderson (1934), who determined the following phenocryst modes: 30-40 percent plagioclase; 15 percent biotite and hornblende; and variable quartz. Zoned plagioclase is euhedral to anhedral, reaches 4 mm in length, and is variably altered to sericite and calcite. Subhedral biotite and euhedral hornblende typically attain 3 mm in size and are extensively altered to chlorite and some epidote. Hornblende uncommonly contains pyroxene cores. Quartz is typically anhedral and is as much as 2 mm in width. Accessory minerals include allanite, zircon, apatite, and magnetite. Granular aphanitic groundmass consists of plagioclase, quartz, and potassium feldspar. Some dikes contain as much as 20 percent crystals of strongly resorbed potassium feldspar, plagioclase, and quartz. These crystals are generally larger than phenocrysts in the rock; potassium feldspar crystals attain 3 cm in length and quartz as much as 5 mm in width. Anderson (1934) classified these particular dikes as rhyolite porphyry. We believe these were dacite porphyry magmas that incorporated xenocrysts from batholith host rocks. Dacite porphyry dikes generally strike east to northeast.

andesite dikes (Eocene)—Dark-gray andesite dikes. These contain less than 20 percent phenocrysts of strongly zoned and strongly resorbed plagioclase as much as 1 mm in length and subhedral hornblende as much as 2 mm in length. Groundmass is trachytic and composed mostly of plagioclase microlites and opaque oxides. In sec. 33, T. 7 N., R. 1 E., in the west-central part of the map, a northeast-striking andesite dike continues as an igneous autobreccia with 1 cm breccia fragments that contains abundant angular fragments of potassium feldspar, plagioclase, and quartz that range from 0.1 to 3 mm in size. We interpret this exposure as a hydrothermal explosion deposit that incorporated finely brecciated fragments of granodiorite host rock.

Diorite dikes and stock (Eocene)—Mafic intrusive complex comprised of stocks and dikes of variable composition. The main stock is 13 km (8 mi) long, extending north-northeast from the southern part of the map to about 3 km (2 mi) northeast of Horseshoe Bend, and varies from 150 to 2100 m (500-7000 ft) in width (Anderson, 1934). Numerous dikes oriented east-northeast are present in the vicinity of the main stock. The Pearl historic mining district south and east of the quadrangle is centered on the

Anderson (1934) describes compositions in the complex as mostly gabbro, diorite, and quartz diorite, and less common granodiorite, and aplitic granite. Quartz diorite with 5 to 10 percent quartz and abundant clinopyroxene was the most common rock type we observed. Color is dark to light gray. Textures range from coarse grained equigranular to porphyritic with a fine-grained granular groundmass. Phenocrysts include plagioclase, pyroxene, hornblende, biotite, quartz, and potassium feldspar, with dark-colored minerals comprising 20 to 45 percent of the rock. Plagioclase is mostly euhedral, as much as 5 mm in length, and weakly to strongly zoned. Pyroxene is subhedral, includes both orthopyroxene and clinopyroxene, is as much as 3 mm in size, and is uncommonly rimmed by hornblende. Hornblende is subhedral and is as much as 2.5 mm in length. Biotite is subhedral to anhedral, is present as much as 3 mm in size, and is locally altered to chlorite. Quartz is interstitial in grains as much as 1.5 mm in width. Potassium feldspar is commonly an interstitial accessory mineral, but is more common in rare granodiorite and aplitic granite. Other accessory minerals

Kgdh Hornblende-biotite granodiorite (Cretaceous)—Light- to medium-gray, medium- to coarse-grained, equigranular, hornblende-biotite granodiorite, hornblende-biotite tonalite, and some biotite granodiorite. The biotite granodiorite is most common in the northeast part of the quadrangle where it is locally porphyritic. More detailed mapping might show this to be a separate hornblende-free intrusive phase. Plagioclase feldspar is the principal constituent (35-70%), followed by quartz (15-30%) and potassium feldspar (2-10%). Biotite and hornblende comprise approximately 15 percent of the rock. Plagioclase is euhedral to subhedral, attains lengths as much as 1.5 cm, exhibits weak zoning, and is locally altered to sericite and calcite. Anderson (1934) determined an andesine composition for plagioclase. Quartz is interstitial in grains as much as 8 mm in width and commonly displays subgrain development and uneven extinction. Potassium feldspar is interstitial, as much as 8 mm in size, and locally displays myrmekitic intergrowth with quartz. Biotite is anhedral, is present in grains as much as 4 mm in size, and is locally altered to chlorite. Hornblende is euhedral to subhedral, typically 2 to 5 mm in length, glomeroporphyritic in masses as much as 8 mm in size locally, and displays blue-green and brown-green pleochroism. Accessories include allanite (as much as 1.5 mm in length), sphene (as much as 2 mm in length), zircon, and apatite. Minor primary muscovite is present locally in some of the biotite granodiorite. Zircon U-Pb age determination of 84.4 ± 1.7 Ma was obtained from a biotite granodiorite sample collected along State Highway 52 (sample 10RMG022; Richard Gaschnig, written communication, 2015).

include zircon and apatite.

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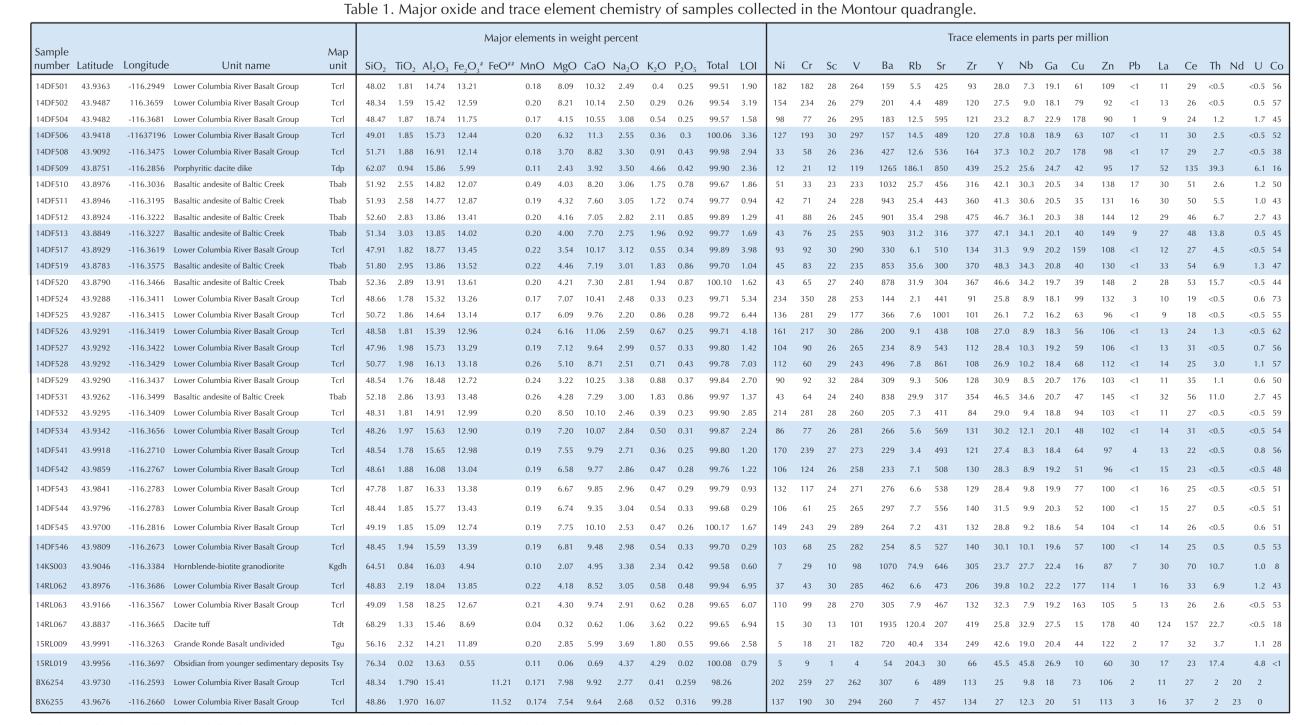
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All analyses performed at Franklin and Marshall College X-Ray Laboratory except samples with prefix BX which were sampled by James Fitzgerald in 1979 and reanalyzed in 2015 at Washington State University's Geoanalytical Laboratory for major and trace elements. *Franklin and Marshall College reports total iron as Fe₂O₃. **WSU Geoanalytical Laboratory reports total iron as FeO

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