KIILSGAARD, STANFORD, AND LEW MOSCOW-BOISE-POCATELLO Geologic Map of the Deadwood River 30 x 60 Minute Quadrangle, Idaho Mapped and Compiled by Thor H. Kiilsgaard, Loudon R. Stanford, and Reed S. Lewis Base map from digitally scanned USGS 1:100,000 composite film base, 1982. Prepared in cooperation with the U.S. Geological Survey. Projection and 10,000-meter grid, zone 11, Universal Transverse Mercator. 25,000 foot grid ticks based Funded in part by the USGS Mineral Resource Program and 1 0 1 2 3 4 5 KILOMETERS 1 0 1 2 National Cooperative Geologic Mapping Program. 1927 North American Datum. Field work conducted 1979-1984 and 2000-2005. Note on printing: The map is reproduced at a high resolution of 600 dots per inch. The inks are resistant Reviewed by Authur A. Bookstrom and William M. Phillips. Edited by Roger C. Stewart. PDF map (Acrobat Reader) may be viewed at www.idahogeology.org. Digital cartography and GIS data capture by Jane S. Freed, Loudon R. Stanford, Vance T. MacKubbin, Map version 5-26-2006. Hornblende-biotite granodiorite (Cretaceous)—Gray to dark gray, medium- to Coarse-grained deposits in glaciated upland valleys (Holocene and late Older terrace gravel, undivided (Pleistocene)—Weathered to unweathered, Kiilsgaard, T.H., and W.E. Hall, 1995, Radioactive black-sand placer deposits, Dikes and Plugs **Pleistocene**)—Mostly alluvial and debris-flow fan deposits composed of moderately sorted to well-sorted terrace gravel. Weathered deposits clayey coarse-grained, equigranular to porphyritic granodiorite. Weak to strong in Geology and Mineral Resources Assessment of the Challis 1° x 2° INTRODUCTION **Dikes, undivided (Tertiary)**—Dikes of uncertain composition. Most are probably angular, well-sorted to poorly sorted coarse sand, sandy pebble gravel, and silt, silty sand, and decomposed coarse sandy pebble to cobble gravel. foliation. Contains plagioclase, quartz, and potassium feldspar; biotite Quadrangle, Idaho: U.S. Geological Survey Professional Paper 1525, rhyolitic to andesitic but were not subdivided during mapping. sandy cobble to sandy boulder gravel. Sandy to cobbly boulder gravel where Unweathered deposits composed of silty sand to coarse sandy pebble gravel generally 8-15 percent; hornblende generally 1-5 percent. Commonly Much of the map was compiled from field work by Thor Kiilsgaard and his Lewis, R.S., 1984, Geology of the Cape Horn Lakes quadrangle, south-central broad valleys are bordered by steep terrain. Unit also includes some recent (Othberg, 1987). Clasts subangular to subrounded. Terrace height above associated with xenoliths and roof pendants on high ridges suggesting it field assistants from 1979-1984 and originally published at 1:250,000 scale Diabase and lamprophyre dikes (Tertiary)—Diabase and subordinate lamprophyre modern drainages at or above level-3. Typically deeply weathered, eroded, alluvium, bouldery till, and outwash gravels. Thickness 0.5-35 m (1-120 Idaho: University of Washington M.S. thesis, scale 1:24,000. represents a marginal facies. on the Challis 1° x 2° quadrangle (Fisher and others, 1992). The geology on dikes. Diabase forms laterally continuous dikes that trend north-northwest. Lewis, R.S., and T.H. Kiilsgaard, 1991, Eocene plutonic rocks in south-central and tilted. Represents old alluvial or glaciofluvial valley fills. Includes fluvial Hornblende-biotite tonalite (Cretaceous)—Gray to dark gray, medium- to coarse-7.5- and 15-minute field sheets by Kiilsgaard was digitally captured at original Some or all of the diabase may be related to the Miocene Columbia River Idaho: Journal of Geophysical Research, v. 96, no. B8, p. 13,295-13,312. and lacustrine deposits (QTd) of Schmidt and Mackin (1970). Near Crouch scale for this map and a GIS database. Additional published and unpublished Qalc Fine-grained deposits in glaciated valleys and periglacial uplands (Holocene Basalt Group. Primary constituents of the diabase are plagioclase and grained tonalite and granodiorite. Massive to highly foliated. Andesine is Lewis, R.S., T.H. Kiilsgaard, E.H. Bennett, and W.E. Hall, 1987, Lithologic and mapping provided further information (see Index to Sources of Geologic pyroxene. Lamprophyre dikes have restricted strike length and contain augite, and late Pleistocene)—Mostly lake deposits and low-energy stream. Composed predominant mineral; generally 5-15 percent biotite and 2-8 percent chemical characteristics of the central and southeastern part of the southern of sand, silt, and clay. Some bouldery till and outwash gravels. Thickness hornblende, biotite, and plagioclase. hornblende. Sphene common. Biotite K-Ar ages from two localities north lobe of the Idaho batholith, in T.L. Vallier and H.C. Brooks, eds., Geology Glacial Deposits 0.5-10 m (1-30 feet). of the quadrangle are 71.9 \pm 2.5 and 81.6 \pm 2.9 Ma (Fisher and others, of the Blue Mountains Region of Oregon, Idaho, and Washington: The Idaho Descriptions of Tertiary igneous rocks are taken largely from Lewis and Rhyolite and rhyolite porphyry dikes and plugs (Eocene)—Light colored and Batholith and Its Border Zone: U.S. Geological Survey Professional Paper Kiilsgaard (1991), Fisher and others (1992), and Bennett and Knowles (1985). Qtg₁ Terrace deposits, level-1 above modern stream (Holocene or late Pleistocene?)— Ogti Deposits in cirques and upland valleys (Holocene)—Poorly sorted, highly angular generally porphyritic rhyolite and minor quartz latite. Phenocrysts are Kgdmg Megacrystic granodiorite (Cretaceous)—Coarsely porphyritic granodiorite and Descriptions of rocks of the Idaho batholith are largely from Kiilsgaard and boulder gravel, sandy boulder gravel, and boulder till from rock glaciers, embayed quartz, potassium feldspar, and subordinate plagioclase. Includes Sandy cobble gravel and coarse sand deposited on stream-cut bedrock Lindgren, Waldemar, 1898, The mining districts of the Idaho basin and the Boise Lewis (1985), Lewis and others (1987), and Fisher and others (1992). Plutonic protalus ramparts, and glaciers. Primarily on north and east aspects in cirques rhyolite stock with pre-Tertiary roof pendants on ridge southeast of Cape benches. In the South Fork Payette River drainage, terrace surface has been tonalite. Megacrysts of potassium feldspar as long as 10 cm (4 inches). Ridge, Idaho: 18th Annual Report of the U.S. Geological Survey, pt. 3, rock ages are from a compilation in Fisher and others (1992). For additional and valleys above 2,440 m (8,000 feet) in the west part of the map and Horn Creek. Stock is red weathering, yellowish gray aphanitic rhyolite locally scoured. Level-1 terraces are 0.6-1.5 m (2-5 feet) above modern Exposures on ridge tops in northeast corner of area are dark gray, medium information on faults in the quadrangle see Kiilsgaard and Lewis (1985). 2,770 m (9,100 feet) in the east. Deposits observed locally are ice cored containing sparse phenocrysts of quartz as long as 1 mm. flood plain except along the South Fork Payette River where the terrace to coarse grained, and typically foliated. Most contain hornblende in addition Luthy, S.T., 1981, Petrology of Cretaceous and Tertiary intrusive rocks Red in high sheltered areas. Three nested moraine sets exist in the cirques of the surface is higher at 10-14 m (35-45 feet). Terraces may correlate to a late to biotite. Those northeast of Deadwood Reservoir and in the east-central Mountain-Bull Trout Point area, Boise, Custer, and, Valley counties, Idaho: Surficial units in the northwest and central parts of the area were largely Rhyodacite dikes (Eocene)—Pinkish gray and gray dikes that typically contain North Fork Baron Creek. The outer moraines have trees with diameters as part of the map are light gray and contain less biotite and only rare hornblende. glacial advance: Virginia Lake deposits of Stanford (1982a,1982b) and Alpine University of Montana M.S. thesis, scale 1:24,000. derived from work by Schmidt and Mackin (1970). Using air-photo potassium feldspar, plagioclase, quartz, and biotite phenocrysts. Hornblende much as 2.5 feet, and boulders are lichen covered on the distal slopes. Inner Creek moraine of Borgert (1999). Terrace deposits become unmappable A U-Pb zircon age of 88 \pm 6 Ma and a hornblende K-Ar age of 84.7 \pm 2.9 Othberg, K.L., 1987, Landforms and surface deposits of Long Valley, Valley interpretation, Schmidt and Mackin's surficial geology was recompiled on present locally. Micrographic textures common in groundmass. slopes and younger moraines are free of trees and lack extensive lichens upstream of Kirkham Hot Springs (lat 44.0717°, long -115.5483°) in the Ma have been obtained east of Stanley from the southeast extension of the County, Idaho: Idaho Geological Survey Map 5, scale 1:62,000. 7.5-minute maps before digitization. Surfical geology for the rest of the map (Stanford, 1982a and 1982b). Thickness 1-30 m (3-100 feet). Othberg, K.L., and L.R. Stanford, 1992, Geologic map of the Boise Valley and South Fork Payette River valley. Thickness 0.5-6 m (1-20 feet). dark gray megacrystic granodiorite (Fisher and others, 1992). Td Dacite dikes (Eocene)—Greenish gray dikes, typically porphyritic, containing was compiled from existing mapping (Stanford, 1982a) and photogeology adjoining area, western Snake River Plain, Idaho: Idaho Geological Survey using 1:15,840- and 1:40,000-scale photography and then field checked. phenocrysts of plagioclase, hornblende, biotite, and quartz. Quartz is visible Glacial deposits of the last local major glacial advance (late Pleistocene) Terrace deposits, level-2 above modern stream (late Pleistocene)—Moderately Map 18, scale 1:100,000. PROTEROZOIC TO PALEOZOIC Unsorted to moderately sorted sandy boulder till, sandy gravel, and coarse to well-sorted sandy cobble gravel, coarse sand, and sandy pebble gravel Reid, R.R., 1963, Reconnaissance geology of the Sawtooth Range: Idaho Bureau deposited on stream-cut bedrock benches. Pebbly boulder gravel outwash sand. Clasts subangular to rounded. Includes deposits of the last local major METASEDIMENTARY ROCKS of Mines and Geology Pamphlet 129, 37 p., scale 1:63,527 Andesite and porphyritic andesite dikes (Eocene)—Greenish gray dikes that DESCRIPTION OF MAP UNITS advance and younger up-valley glacial deposits. Landforms include terminal, where unit traces to terminal moraines (Qgt_2). Level-2 terraces are 1.5-3 m Rychner, Larry, Unpublished geologic mapping of parts of the Cape Horn Lakes, contain plagioclase, hornblende, biotite, and minor quartz. Some contain PzYrp Roof pendants, undivided (Proterozoic to Paleozoic)—Quartzite, calc-silicate medial, and lateral moraines, kame terraces, and collapsed or slumped (5-10 feet) above modern flood plain except along the South Fork Payette Banner Summit and, Bull Trout Point quadrangles, Idaho: scale 1:24,000. pyroxene. Locally porphyritic but more commonly equigranular or SURFICIAL DEPOSITS quartzite, carbonate rocks, and schist. River where the terrace surface is higher at 7.5-18m (25-60 feet). Clasts moraines. Moraine surfaces are hummocky with many closed depressions, Schmidt, D.L., and J. Hoover Mackin, 1970, Quaternary geology of Long and and crests are steep-sided with many exposed boulders. Granitic clasts are subangular to well rounded. Air photos show braided-stream pattern on Bear Valleys, west-central Idaho: U.S. Geological Survey Bulletin 1319-D, PzYqc Carbonate-rich quartzite (Proterozoic to Paleozoic)—Roof pendants of carbonate-Made Deposits unweathered. Lateral moraine crests in the Stanley Lake area rise to 213 m some terrace surfaces. Gravel mostly outwash of *Qgt*₂. Also includes some rich quartzite, calc-silicate gneiss, and skarn. Layers 1-20 cm (0.4-8 inches) (700 feet) above valley floor. Near glacier terminus and on outwash plain Plutonic Rocks Stanford, L.R., 1982a, Surficial geology of the upper South Fork Payette River possible Qtg₁-age terraces deposits upstream from Kirkham Hot Springs (lat Gold and radioactive placer tailings and mine waste (Holocene)—Gold was thick and tightly folded. Calcite composes as much as 80 percent of carbonatesoils are less than 1 m (3 feet) thick with a cambic B horizon (Stanford, area, south central Idaho: Idaho Geological Survey Technical Report 82-7, 44.0717°, long -115.5483°) in the South Fork Payette River valley. Many extracted from placer deposits along Grimes Creek, from adjoining Charlotte Granite (Eocene)—Pink and less commonly light gray, medium- to coarserich beds. Locally graphitic. Rocks contain varied amounts of quartz, 1982b). Grandjean area soils have calcium carbonate-cemented zone at 60 terraces are partly or wholly covered by a wedge of alluvial and debris-flow Gulch near Grimes Pass, and from Muddy Creek, a tributary to Grimes Creek plagioclase, diopside, scapolite, wollastonite, tremolite, garnet, clinozoisite, grained monzogranite and subordinate syenogranite. Highly perthitic alkali Stanford, L.R., 1982b, Glacial geology of the upper South Fork Payette River, cm (2 feet). Radiocarbon ages taken in equivalent deposits in the Alturas fan deposits in valleys with steep canyon walls. Includes Pinedale outwash, located southwest of Grimes Pass (Anderson, 1947). The radioactive minerals, forsterite, and chondrodite (Lewis, 1984). feldspar; plagioclase is oligoclase, commonly with thin albite rims. Biotite, Lake drainage, southeast of area, indicate ice had begun to retreat from south central Idaho: University of Idaho M.S. thesis, 83 p. undivided (Qpo) of Schmidt and Mackin (1970) in Long, Round, and Bear monazite and euxenite, were mined in the 1950s from the Big Meadow magnetite, and rare hornblende constitute less than 7 percent of the rock. valleys. Thickness 0.5-10 m (1-30 feet). maximum about 16,860 cal. yr B.P. (Thackray and others, 2004). Thickness Stanford, L.R., Unpublished surficial geologic mapping and photo reconnaissance PzYs Schist (Proterozoic to Paleozoic)—Biotite schist and subordinate carbonate, placer deposit in upper Bear Valley (Schmidt and Mackin, 1970; Kiilsgaard Contains miarolitic cavities, locally lined with smoky quartz crystals, and mapping of the Deadwood River 30 x 60 minute quadrangle: scale 1:24,000. 0.5-30 m (1-100 feet). Includes Virginia Lake deposits of Stanford (1982) calc-silicate rocks, and granofels. Largest mass is in the Thompson Peak area and Hall, 1995). There are mine dumps and mill tailings at the Deadwood is more radioactive than granodiorite of the Idaho batholith. Hornblende K-Alluvium and colluvium that grades to Qgt2 and Qtg2 (late Pleistocene)and Alpine Creek moraine of Borgert (1999). Thackray, G.D., K.A. Lundeen, and J.A. Borgert, 2004, Latest Pleistocene alpine at the east edge of the map where Reid (1963) describes biotite-quartzmine, which was active during World War II. Poorly to moderately sorted coarse sandy pebble gravel and coarse sand. Ar age of 44.3 \pm 1.3 Ma obtained from stock east of Banner Creek (Fisher glacier advances in the Sawtooth Mountains, Idaho, USA: Reflections of plagioclase schist, quartz-diopside marble, diopside quartzite, and diopside-Glacial deposits of intermediate age (Pleistocene)—Sandy cobble and boulder Alluvial, colluvial, and periglacial deposits in small side streams mostly in midlatitude moisture transport at the close of the last glaciation: Geology, quartz-bytownite granofels. till and coarse sand. Clasts subangular to rounded. Surface boulders weathered the granitic uplands. Sediment primarily eroded from grus. Locally includes v. 32, no. 3, p. 225-228. Alluvial and Mass Movement Deposits Quartz monzodiorite suite (Eocene)—Varied unit dominated by quartz PzYq Quartzite (Proterozoic to Paleozoic)—Roof pendants of light gray, medium- to and partly buried. Landforms include lateral and terminal moraines. Commonly U.S. Geological Survey and U.S. Bureau of Mines, 1986, Mineral resources of angular to subangular cobble to boulder gravel in talus or patterned ground. monzodiorite, granodiorite, and monzogranite. Minor monzodiorite, diorite, deeply eroded and covered by younger glacial deposits. Moraine surfaces Qal Main stream and side stream alluvium (Holocene)—Channel and low terrace the eastern part of the Sawtooth National Recreation Area, Custer and Blaine Includes alluvium and colluvium (Qpa) of Schmidt and Mackin (1970). coarse-grained quartzite and minor schist and carbonate-rich quartzite. and quartz diorite. Most is porphyritic and medium grained. Typically smooth with no closed depressions. Includes Bull Lake age morainal deposits counties, Idaho: Plate 1: Geologic and aeromagnetic map of the eastern deposits are primarily pebble to cobble gravel; however, in the Deadwood, Thickness 0.5-4.5 m (1-15 feet). Quartzite contains plagioclase and locally biotite, potassium feldspar, contains 10-30 percent euhedral biotite and hornblende and a few percent (Qbt) of Schmidt and Mackin (1970) and Camp Creek glacial deposits of part of the Sawtooth National Recreation Area, Custer and Blaine counties, Bear Valley, and Bull Trout Lake drainages, Qal is commonly composed of phlogopite, and sillimanite (Lewis, 1984). Sparse interlayers of schist contain Otg3 Terrace gravel level-3 above modern stream (Pleistocene)—Mostly coarse sandy magnetite. Plagioclase strongly zoned and dominantly andesine. Hornblende Stanford (1982a and 1982b). Soils in the Grandjean area show a moderately Idaho: U.S. Geological Survey Bulletin 1545, scale 1:62,500. coarse sand and medium pebble gravel derived from decomposed Idaho biotite, plagioclase, and sillimanite. Locally they contain corundum, potassium K-Ar ages of 47.7 ± 1.1 Ma and 48.2 ± 3.0 Ma have been obtained from cobble gravel and coarse sand deposited on stream-cut bedrock benches. developed argillic B horizon 51-150 cm(20-60 inches) deep. Granitic batholith (grus). Side stream deposits range from cobble gravel in the steepfeldspar, or andalusite partly replaced by sillimanite (Lewis, 1984). Thin Pebbly boulder gravel outwash where unit traces to terminal moraines (Qgt_3). the Jackson Peak stock (Fisher and others, 1992). cobbles found in soils have oxidation rinds of less than 1 cm (0.5 inch); a sided valleys to coarse sand and colluvial grus in the nonglaciated uplands. carbonate-rich intervals are similar to *PzYqc* unit. Terraces partly or wholly covered by a wedge of alluvial and debris-flow Includes some gravel and sand deposited in alluvial and debris-flow fans. Hornblende-biotite granite (Eocene)—Medium-grained hornblende biotite fan deposits. Terraces in the Bear Valley are 7.6-11 m (25-35 feet) above Thickness 0.5-5 m (1-15 feet). Ogt₄ Glacial deposits of early age (Pleistocene)—Thin dissected and discontinuous granite and minor granodiorite, quartz monzonite, and quartz monzodiorite. modern flood plain. Terraces adjacent to the South Fork Payette River are INDEX TO SOURCES OF Subunit of Tamd characterized by striking porphyritic texture and more Landslide deposits (Holocene and Pleistocene)—Poorly sorted and poorly sandy cobble and boulder till. Moraine remnants on bedrock 135 m (440 50 m (160 feet) above the modern stream. Terrace surfaces in the Valley REFERENCES GEOLOGIC MAPPING potassium feldspar than average Tqmd. Includes Boise Basin stock, mapped feet) above flood plain in the South Fork Payette valley. Near Stanley Lake, stratified pebbles, cobbles, and boulders mixed with sand, silt, and clay. Creek drainage are 17-20 m (55-65 feet) above creek level near Meadow as quartz monzonite porphyry by Anderson (1947), which contains white deposits are at least 30 m (100 feet) above modern drainage, and moraines Includes rock-fall deposits in the Warm Springs Creek drainage. Unit does Creek, but downstream near the Iron Creek confluence are only 6-7.6 m Anderson, A.L., 1947, Geology and ore deposits of Boise Basin, Idaho: U.S. plagioclase phenocrysts and fewer hornblende and biotite crystals in a are massive and similar in form to younger moraines of Sawtooth Valley. not include the hundreds of small earth and debris-flow scarps and deposits (20-25 feet) above creek level. Qtg₃ in the Valley Creek area rests on saprolitic Geological Survey Bulletin 944-C, scale 1:24,000. pinkish granular groundmass rich in potassium feldspar and quartz. Few boulders exposed at surface. Subsurface granitic boulders are mostly from the winter of 1996-1997 weather-related landslide cluster (see Qfg). bedrock indicating long surface exposure before burial and incision. Includes Axelrod, D.I., 1964, The Miocene Trapper Creek flora of southern Idaho: University oxidized and disintegrated. Paleosols near Warm Springs Creek have strongly Thickness highly varied, but probably ranges from 0.5 to 60 m (1-200 feet). Bull Lake outwash, undivided (*Qbo*) of Schmidt and Mackin (1970). Thickness ्राचेक्क्षे Quartz monzodiorite (Eocene)—Medium grained hornblende-biotite quartz of California Publications in Geological Sciences, v. 51, p. 1-102. developed argillic horizon and prismatic structures that are buried by young Bennett, E.H., and C.R. Knowles, 1983, Tertiary plutons and related rocks in monzodiorite and minor monzodiorite. Subunit of Tqmd that consists largely Alluvial fan deposits (Holocene and Pleistocene)—Angular to subangular, poorly soils developed in slope wash (Stanford, 1982a and 1982b). central Idaho, in D.H. McIntyre, ed., Symposium on the Geology and Mineral of quartz monzodiorite. Includes Long Gulch stock, Monumental Butte stock, sorted to unsorted sandy pebble and cobble gravel. Sand and granule gravel Alluvium and colluvium that grades to Qgt_3 and Qtg_3 (Pleistocene)—Poorly Deposits of the Challis 1° x 2° Quadrangle, Idaho: U.S. Geological Survey Qgu Glacial deposits previous to last local major glacial advance, undivided and Rocky Peak stock. where the source is grus. Sandy to cobbly boulder gravel where broad valleys to moderately sorted coarse sandy pebble gravel to coarse sand. Alluvial, Bulletin 1658, p. 81-95. (Pleistocene)—Poorly sorted sand and boulder till. Includes older glacial are bordered by steep terrain (e.g., Garden Valley and the upper South Fork colluvial, and periglacial deposits in small side streams mostly in the granitic Borgert, J.A., 1999, Late Pleistocene glaciation in the Sawtooth Mountains, Tdi Diorite (Eocene)—Relatively small bodies of dark gray, fine- to medium-grained deposits and deposits of probable glacial origin south of Stanley Lake. Payette River valley near Grandjean). Clast size in these deposits, however, uplands. Sediment primarily eroded from grus. Includes alluvium and central Idaho: Idaho State University M.S. thesis, 100 p. diorite, monzodiorite, and quartz diorite. Typically equigranular with "salt colluvium (Qba) of Schmidt and Mackin (1970). also depends on the degree of weathering in the bedrock. For example, Fisher, F.S., D.H. McIntyre, and K.M. Johnson, 1992, Geologic map of the Challis and pepper" texture. Abundant biotite and hornblende; subordinate pyroxene. older weathered surfaces in Idaho batholith rocks provide thicker grus 1° x 2° quadrangle, Idaho: U.S. Geological Survey Miscellaneous Investigations Pliocene and Miocene Deposits Plagioclase strongly zoned. See Anderson (1947) for a more detailed

compared to that from glacially scoured rocks. Wet winters in conjunction with sudden thaws and rain contribute large amount of debris (e.g., the winter of 1996-1997). These flows had their source in the older grus soils mostly on south-facing treeless slopes between 1,200 and 1,500 m (4,000 and 5,000 feet; Governor's Landslide Task Force, 1997). Fans form a wedge of debris typically covering terrace deposits and thin toward valley centers. Thickness 0.5-55 m (1-180 feet).

Stream and Mass Movement Deposits

Proterozoic or Paleozoic Metasedimentary Rocks

CORRELATION OF MAP UNITS

Dikes and Plugs

Terrace gravel level-4 and level-5 above modern streams (Pleistocene?) boulder gravel deposited on stream-cut bedrock benches. Highly weathered and dissected. Bedrock bench is saprolitic in the Valley Creek area. Soils have well-developed argillic B horizon in which granitic clasts are mostly oxidized and disintegrated. The level-4 terrace surface is about 130 m (425 feet) above flood plain in the South Fork Payette River valley and 18-24 m (60-80 feet) above the Valley Creek flood plain. Level-5 surface is represented by one outcrop on State Highway 21 about 180 m (600 feet) above Lowman. Level-5 may be equivalent to *Thgg*. Maximum thickness at least 10 m (33

Plutonic Rocks

NEOGENE

PALEOGENE

CRETACEOUS

*Ages from IUGS/ICS Stratigraphic Chart, 2000 and 2004

Thackray and others, 2004

TERTIARY

MESOZOIC

PALEOZOIC

PROTEROZOIC

Thog High gravel (Pliocene)—Poorly sorted to unsorted sand, gravel, cobbles, and

fills in the Muddy Creek area southeast of Grimes Pass. May grade to Bonneville Point gravel of Othberg and Stanford (1992). Tsp Sediments of the Payette Formation (Miocene)—Well sorted, laminated silt and silty sand. Cut and backfilled with river gravel near the Middle Fork Payette River. Originally described by Lindgren (1888); type locality unknown. Miocene fossil plant flora present in similar deposits in the Thorn Creek drainage south of area (Axelrod, 1964). Volcanic ash in the Boise Basin dated at 11.8 \pm 0.2 Ma (Forester and others, 2002). West-dipping sediments near Crouch are downfaulted by a normal fault. Thickness is more than 183 m (600 feet) near Crouch.

boulders of the Idaho batholith and intrusive dikes. Limited to older alluvial

TERTIARY IGNEOUS ROCKS Volcanic Rocks Tcb Columbia River Basalt Group? (Miocene?)—Small area of basalt near Grimes Pass. Dense, fine-grained rock with a mottled weathering pattern that is atypical of more thoroughly studied Columbia River basalt to the west. Chemically similar, however, to some flows of the Imnaha Basalt (John Kauffman, oral commun., 2004). Maximun thickness 34 m (110 feet). Trv Rhyolitic volcanic rocks (Eocene)—Yellowish gray to pale red to purple rhyolite flows and subordinate tuffs. Flows contain 5-15 percent phenocrysts of sanidine, quartz, and minor plagioclase (Lewis, 1984). Well-developed flow banding. Tuffaceous rocks poorly exposed but may constitute 30 percent of unit. Block and lapilli tuff contains blocks as much as 0.5 m across in 5-15 mm pumice and lithic matrix. Tuff contains about 10 percent broken sanidine and quartz grains. Undated, but probably correlative with dated Eocene

Challis Volcanics east of the area.

ROCKS OF THE IDAHO BATHOLITH

Leucocratic granite (Cretaceous)—Light gray to white, fine- to medium-grained granite having distinctive anhedral texture. Forms resistant dikes and irregularly shaped stocks. Scree may be extensive on hillsides and give the impression of being eroded from larger masses than actually exist. Consists of roughly equal amounts of quartz, plagioclase, and potassium feldspar. Biotite may constitute as much as 2 percent of rock; garnet and magnetite common; a trace of muscovite. Biotite K-Ar ages in and to the north of the quadrangle range from 63.6 ± 1.4 to 72.6 ± 2.5 Ma (Fisher and others, 1992). Muscovite-biotite granite (Cretaceous)—Light gray, medium- to coarse-grained, equigranular to porphyritic granite and granodiorite. Consists chiefly of

and averages about 2 percent, as does biotite. Muscovite in laminated books or plates large enough to see in hand specimen. Transitional into Kbgd through a zone 2 km (6,000 feet) or more wide. Muscovite K-Ar ages in and to the north of the quadrangle range from 68.8 ± 0.2 to 74.7 ± 2.7 Ma (Fisher Kbgd Biotite granodiorite (Cretaceous)—Light gray, medium- to coarse-grained, equigranular to porphyritic granodiorite and granite. Contains plagioclase (An₂₂₋₃₀), quartz, and potassium feldspar; biotite generally 2-8 percent and

 $2.6 \text{ to } 78.9 \pm 2.8 \text{ Ma}$ (Fisher and others, 1992).

oligoclase, quartz, and potassium feldspar; muscovite as much as 5 percent

averages 5 percent; trace muscovite and rare hornblende. Biotite K-Ar ages

to the north of the quadrangle away from altered zones range from 72.7 \pm

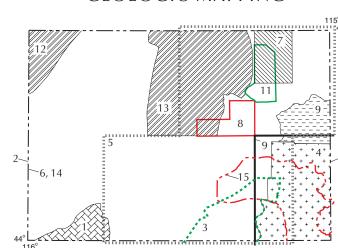
Series I-818, scale 1:250,000. Forester, C.S., S.H. Wood, and B.P. Nash, 2002, An 11.8 ± 0.2 Ma silicic volcanic ash in the Miocene Payette Formation, Boise Basin, Idaho: Geological Society of America Abstracts with Programs, v. 34, no. 4, p. 48. Governor's Landslide Task Force, 1997, Recommendations for Idaho communities, infrastructure, and resources at risk from landslides and related events: Report from the Governor's Landside Task Force to Governor Philip E. Batt, July 1997, http://www.bhs.idaho.gov/bhslibrary/reports/landslidetaskforce.pdf>. International Commission on Stratigraphy, 2000, International stratigraphic chart, 2000 edition: International Union of Geological Sciences and UNESCO. International Commission on Stratigraphy, 2004, International stratigraphic chart,

2nd edition: International Union of Geological Sciences and UNESCO.

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Quadrangle, Idaho: U.S. Geological Survey Bulletin 1658, p. 29-42.

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N=Whitehawk Mountain. CR=Crooked River. B=Béar Valley. C=Cape Horn. SP=South Fork Payette River. S=Stanley Lake. I=Iron Creek. WP=Warbonnet Peak, Sawtooth Range. Figure 1. Oblique view looking north over the map area showing the approximate last glacial maximum for this area. This first approximation of glacial extent was compiled using depositional evidence, topographic expression in cirques and valleys, equilibrium line altitudes (~paleo snow line), and glacial threshold altitudes. Red lines are major highways.

indicates dip of fault plane.

Strike and dip of foliation.

Strike and dip of flow foliation in volcanic rocks.

Strike and dip or attitude of bedding in rocks.

Quartz vein: arrow indicates dip of vein.

SYMBOLS

Contact: line showing boundary between one map unit and

ault: line showing surface trace of displacement between rocks; dashed where approximately located, dotted where

concealed; bar and ball on downthrown side; arrow

another; dashed where approximately located or inferred.