

2006 to 2010 by the authors. Previous work includes reconnaissance mapping and sampling from 1978 to 1980 (Camp, 1981; Swanson and others, 1981) and in 1982 by Paul Myers (unpublished), as well as more detailed mapping by Lund (1984), and Lund and others (1993). Some structural data and contacts from Myers (unpublished) and Lund (1984)

The western part of the quadrangle is underlain by Miocene lava flows of the Columbia River Basalt Group. Permian to Cretaceous metamorphic rocks and Cretaceous intrusive rocks are exposed in much of the remaining part of the quadrangle, locally capped by Columbia River basalts. Contact of the basalt and basement rocks is unconformable; outcrop patterns indicate the basalt flowed onto an irregular, dissected topography. Tertiary gravel deposits, both within and on top of the basalt sequence, form local deposits throughout the quadrangle and likely represent adjustments to stream drainages during emplacement and postemplacement of the basalts. Pleistocene till and outwash occur in the southeastern part of the quadrangle, which is adjacent to the glaciated mountains of the Gospel Hump Wilderness. Quaternary alluvial deposits are found locally in stream drainages.

DESCRIPTION OF MAP UNITS

Intrusive rocks are classified according to IUGS nomenclature using normalized values of modal quartz (Q), alkali feldspar (A), and plagioclase (P) on a ternary diagram (Streckeisen, 1976). In addition, we use a normative feldspar classification scheme (Barker, 1979) to distinguish tonalite and

SEDIMENTARY AND MASS MOVEMENT DEPOSITS Alluvial Deposits

Qas Stream alluvium (Holocene)—Primarily stratified and rounded pebble to boulder gravel in channels of Slate Creek and Mill Creek. The unit is 1.5-9 m (5-30 ft) thick.

Sediments, undivided (Miocene to Pliocene?)—Well-rounded pebble to cobble gravels locally mixed with finer grained sediments interpreted to overlie Columbia River Basalt flows. Good exposures are extremely rare; typically inferred by abundant loose pebbles and cobbles on the surface. Clasts include quartz, quartzite, porphyry, granitic rocks, and basalt. Some of the nonbasalt clasts may be reworked from older *Tli* sediments.

Latah Formation sediments (Miocene)—Silt, sand, and gravel deposits within or beneath the Columbia River Basalt sequence and equivalent to the Latah Formation. Gravels are well rounded, with quartz, quartzite, porphyry, and other pre-Tertiary rock clasts. Basalt clasts are absent or rare. Deposits are poorly exposed and discontinuous. Thickness of deposits difficult to determine, but some may be 10-30 m (30-100 ft) thick. Several of the landslide areas in the south part of the quadrangle may result from these deposits at the basalt-prebasalt rock contact.

Mass Movement Deposits

Talus (Holocene and Pleistocene)—Angular blocks of basalt below a thick entablature of N₁ Grande Ronde Basalt in upper North Fork Skookumchuck Creek.

Called Landslide deposits (Holocene and Pleistocene)—Poorly sorted and poorly stratified angular rock debris mixed with silt and clay. Primarily deposited by slumps and slides. Map may also show the landslide scarp and the headwall (steep area adjacent to and below the landslide scarp) from which material broke away (see Symbols). Some are controlled by the presence of sediments within basalt units or at the basalt-basement rock contact. Most landslides in the quadrangle are ancient movements that are relatively stable features.

GLACIAL DEPOSITS

Qgt Till deposits (late Pleistocene)—Unsorted, unstratified, loose to compact gray till. Composed of gravelly coarse sand with a silty fine sand matrix. Gravel clasts are pebble to boulder in size and angular to subrounded. Forms moraine remnants in southeast corner of map where Slate Creek valley glacier overtopped a divide and flowed northwest into Mill Creek. Deposit relatively unweathered; boulders of tonalite (Ktg) and quartzite at surface; soils weakly developed. Thickness of the deposits is highly variable and

Old till deposits (early Pleistocene)—Unsorted, unstratified, relatively compact yellowish brown till. Composed of gravelly coarse sand with a silty, clayey matrix. Gravel clasts are pebble to boulder in size and subangular to subrounded. Clast lithologies exclusively quartz and quartzite. Deposit highly weathered; surface boulders nonexistent; tonalite clasts probably completely broken down by weathering. Forms eroded remnants of piedmont moraine deposited by early glaciations on a Tertiary erosion surface. Thickness of deposits is highly variable and ranges from 1 to 30 m

ranges from 3 to 30 m (10 to 100 ft).

Ogo Outwash gravel (late Pleistocene)—Subrounded to rounded, moderately sorted sandy cobble to boulder gravel that forms floor of glaciated Slate Creek valley. Unit includes local alluvium, talus, and lag boulders, and is

VOLCANIC ROCKS Columbia River Basalt Group

The Columbia River Basalt Group consists mainly of Imnaha Basalt and Grande Ronde Basalt, but includes a small area of Wanapum Basalt (Priest Rapids Member flow and dikes) and two Saddle Mountains Basalt dikes (basalt of Craigmont). Imnaha Basalt crops out only in the western part of the quadrangle on the slopes below Dairy Mountain and in a downdropped block east of Dairy Mountain along the North Fork Slate Creek. Grande Ronde Basalt, which consists of basalt, basaltic andesite, and occasionally andesite, conformably overlies Imnaha Basalt and, from oldest to youngest, is subdivided into the informal R₁, N₁, and R₂ magnetostratigraphic units (Swanson and others, 1979); it also forms caps on the Permian to Cretaceous basement rocks in the southern part of the quadrangle. The Priest Rapids Member of the Wanapum Basalt covers a small area southeast of the Adams Work Center and several dikes crop out along Slate Creek Road. Basalt of Craigmont (Saddle Mountains Basalt) dikes also crop out

major structural zone.

along Slate Creek Road near the Priest Rapids dikes, probably along a

Priest Rapids Member (Miocene)—Occurs as a flow covering a small area southeast of Adams Work Center and as several dikes in Slate Creek canyon. The flow is dark gray, fine grained, and contains small plagioclase phenocrysts 2-5 mm in length. The dikes are coarse grained and are probably intruded along the same structure as the Craigmont basalt dikes.

Grande Ronde Basalt Grande Ronde Basalt, R, magnetostratigraphic unit (Miocene)—Medium to dark gray, fine-grained basalt, commonly with a sugary texture. Uncommon 1-2 mm plagioclase phenocrysts. Reverse magnetic polarity, although field magnetometer commonly gives weak normal or conflicting results. Consists of one or two flows that cap several of the ridges, but it has mostly been eroded. Maximum thickness less than 90 m (300 ft).

Grande Ronde Basalt, N₁ magnetostratigraphic unit (Miocene)—Dark gray, fine-grained generally aphyric to plagioclase-microphyric basalt. Normal magnetic polarity. Consists of 3 or 4 flows. Colonnades of thin flows and entablatures of thick flows tend to form tiered cliffs on steep canyon slopes south of Dairy Mountain. Maximum thickness of the unit is about 120 m (400 ft).

Grande Ronde Basalt, R, magnetostratigraphic unit (Miocene)—Mostly dark gray, fine-grained aphyric to microphyric basalt. Common plagioclase phenocrysts 2-4 mm in length in one or more flows. Reverse magnetic polarity, although some flows have inconsistent and weak field magnetometer polarity readings. Maximum thickness is about 240 m (800 ft).

Imnaha Basalt (Miocene)—Medium- to coarse-grained, sparsely to abundantly plagioclase-phyric basalt; olivine common; plagioclase phenocrysts generally 0.5-2 cm, but some are as large as 3 cm. Flows examined in the field have normal polarity. Typically weathered to sooty brown granular detritus. Rests unconformably on pre-Tertiary rocks. Maximum exposed thickness in this quadrangle is about 150 m (500 ft).

PRE-TERTIARY ROCKS

Rocks older than the Columbia River Basalt Group underlie much of the central part of the quadrangle and consist of: 1) Permian to Cretaceous (?) metasedimentary and metaplutonic rocks of the eastern Salmon River belt near the west edge of the map and as pendants and screens in the central part of the map; 2) North American basement rocks in the eastern part of the map; and 3) Cretaceous plutonic rocks that are concentrated in the east, but present across the entire map. The initial 87Sr/86Sr 0.704/0.706 line shown on the map is based on analyses of plutonic rocks (Criss and Fleck, 1987; King and others, 2007) and reflects the change (at depth) from the island-arc related rocks of the eastern Salmon River belt to rocks with continental affinity. This line approximates the location of the Salmon River suture, a major lithospheric boundary marking the western margin of cratonal North America that has been extensively intruded and subsequently sheared by transpressional deformation on the Early Cretaceous Western Idaho shear zone.

Cretaceous Intrusive Rocks

Ktg Tonalite and granodiorite (Cretaceous)—Mixed unit of medium to dark gray biotite tonalite, hornblende-biotite tonalite gneiss, and biotite granodiorite in southeast corner of map. Initial ⁸⁷Sr/⁸⁶Sr values are greater than 0.704 (Criss and Fleck, 1987; King and others, 2007). U-Pb age determination of 85.0 ± 1.5 Ma (sample 98IB34 on map; Gaschnig and others, 2010) was from a relatively massive exposure of biotite tonalite containing about 4 percent potassium feldspar. Sr concentrations range widely (204, 476, 491, 889, 904, 916, and 980 ppm; Fleck and Criss, 1987, King and others, 2007, and Table 1) indicating multiple intrusive phases.

Kto Tonalite and trondhjemite (Cretaceous)—Light gray medium-grained hornblende-biotite tonalite, biotite tonalite, and biotite-muscovite trondhjemite. Weathers to micaceous light tan grus. Micas locally define a foliation and garnet is locally present. Hornblende-biotite tonalite contains primary epidote. Initial 87Sr/86Sr values are less than 0.704 (Criss and Fleck, 1987; King and Valley, 2001). Normative values of muscovite-bearing sample 09RL730 from the McKinzie Creek quadrangle to the west (Kauffman and others, in prep.) plot in the trondhjemite field on an Ab-An-Or diagram (after Barker, 1979) but all of the samples analyzed from the Dairy Mountain quadrangle plot in the tonalite field. Unit belongs to a suite of 124-111 Ma tonalite and trondhjemite plutons that occur along and west of (outboard) the Salmon River suture and which include the Blacktail pluton 16 km (10 mi) to the northeast (Myers, 1982). U-Pb zircon dating of a sample described as foliated biotite granodiorite (sample 87KL017) collected 5 km (3 mi) west of the map yielded a 113.1 \pm 0.6 Ma age (Unruh and others, 2008). A similar U-Pb age of 111.0 ± 1.6 Ma has been obtained

Eastern Salmon River Belt

for the Blacktail pluton (McClelland and Oldow, 2007).

The eastern Salmon River belt (Gray and Oldow, 2005) consists of poorly dated metamorphic rocks east of the Rapid River thrust, located 10 km (6 mi) west of the map. We extend the belt as far east as the North American basement rocks in the eastern part of the map. Rocks in the southwestern corner of the map are on the eastern flank of the Slate Creek antiform. From structurally lowest to highest levels the antiform contains calcareous banded phyllite (only at depth and entirely west of the map), marble of Sheep Gulch (KPms), and Fiddle Creek Schist (KPfc). We are uncertain of the age or stratigraphic position of any of these units. The only age constraint in the area is that they are intruded by, and thus older than, the 113 Ma Kto unit.

of Vallier (1977).

KPms | Marble of Sheep Gulch (Cretaceous to Permian)—Coarsely crystalline light gray marble on the flanks of the Slate Creek antiform. Interlayered with, but largely above, the KPcp unit. Previously mapped by Hamilton (1963) as Triassic Martin Bridge Formation. This unit is best correlated with limestone of the Martin Bridge Formation if the section is overturned. If stratigraphically upright, an alternative correlation is with the upper (carbonate-rich)

part of the Squaw Creek Schist near Riggins (Hamilton, 1963). **Chair Point Igneous Complex** Igneous rocks in the southwest part of the quadrangle are the northeast

extension of a mass of trondhjemite recently determined to be Permian by U-Pb dating of zircon (Karen Lund, oral commun., 2009). Contact relations with the Riggins Group (KPfc) are unknown. Relationship of these Permian rocks to felsic intrusive rocks of Permian age in the Cougar Creek complex of the Wallowa terrane is uncertain, but similarity of age and composition indicate the Chair Point complex may also be basement to the Seven Devils Group (Wallowa terrane). Mafic igneous rocks (now largely metamorphosed) are also present within the Chair Point complex but have not been dated. As noted below, they may be as young as Cretaceous.

Mafic schist and gneiss (Cretaceous to Permian)—Garnet-plagioclasehornblende schist and gneiss intermixed with Pt unit. May represent metamorphosed mafic dikes or, alternatively, screens of mafic country rock. Biotite trondhjemite (Permian)—Light to medium gray biotite trondhjemite, typically foliated, that is characterized by recrystallized grains of quartz and feldspar. The recrystallized grains are small (1-3 mm across) and many are within larger mosaics of a single mineral type. Locally, thin large (1-3 cm across) irregular biotite masses give rock a spotted appearance on foliation

tonalite (Kto), presumably because of the presence of sodic plagioclase.

Rocks in the North Fork assemblage are roughly coincident with those in the North Fork block of Lund and others (1993) and consist of amphibolite-facies metasedimentary rocks of uncertain age that are immediately west of continental North American rocks. The term "assemblage" is used here because we are not certain they are part of a fault-bounded block as envisioned by Lund and others (1993). We also include them as an eastern subunit within the eastern Salmon River belt. Along strike to the northeast they have been mapped and described by Myers (1982), Hoover (1986), and Kauffman and others (2008). They may be equivalent to the Orofino series exposed 80 km (50 mi) to the north (Anderson, 1930; Hietanen, 1962) or to the Squaw Creek Schist of the Riggins Group of Hamilton (1963) exposed 25 km (15 mi) to the southwest.

surfaces. Rock is characterized by low Sr concentrations (<160 ppm) and low

CaO concentrations (<2.2 weight percent) relative to Cretaceous biotite

Ultramafic rocks (Cretaceous to Permian)—Metamorphosed pyroxenite or peridotite with clusters of radiating amphiboles (anthophyllite), talc, and chlorite. Light green to orange on fresh surfaces, gray when weathered. These rocks are found as elongate, discontinuous bodies forming low rounded ridges within the *KPgs* unit. Bonnichsen and Godchaux (1994) studied the ultramafic rocks north of the quadrangle and reported anthophyllite, chlorite, tremolite, and talc, with minor amounts of opaque oxides and serpentine. They also report hornblende-garnet ("blackwall zone") rock with ilmenite and spinel. Another exposure in that area was studied by Hoover (1986) and Bonnichsen and Godchaux (1994) who reported talc-olivine-anthophyllite rock and pyroxenite.

Gneiss and schist (Cretaceous to Permian)—Fine- to medium-grained plagioclase-hornblende gneiss that grades into hornblende ± biotite ± chlorite schist and muscovite-plagioclase-quartz ± biotite ± zoisite schist. Also includes calc-silicate rocks. Light gray or green to black, weathering to a fine gray brown soil. Calc-silicate rocks contain zoisite, epidote, chlorite, plagioclase, quartz, pyroxene, and sphene. Garnet is common. Exposure near the mouth of the North Fork of Slate Creek contains kyanite. Although some plagioclase-amphibole gneiss may be metavolcanic in origin, most of the unit is probably metasedimentary. Southeasternmost exposures in Willow Flat area are rich in calc-silicate rocks and only tentatively assigned to this unit. An alternative interpretation is that they are North American

North American Basement Rocks Relicts of probable North American basement are preserved as screens within Cretaceous plutonic rocks in the eastern part of the map. Gneiss and schist are the primary rock types. In contrast to country rocks to the west,

biotite is abundant and hornblende is rare. Zgs Gneiss and schist (Neoproterozoic?)—Medium-grained biotite-quartzplagioclase gneiss and biotite schist. Just east of the map and along strike to the northeast is feldspar-poor quartzite interlayered with gneiss and schist. Such quartzite is typical of the Neoproterozoic units in the region.

STRUCTURE

The structural history of this area is complex and long-lived. The area straddles the Salmon River suture and includes the west-vergent fold and thrust belt immediately west of the suture. It also includes fabrics that are likely related to the Late Cretaceous western Idaho shear zone in the southeastern part of the map. Early contractional structures include folds and faults that deform Paleozoic-Mesozoic age rocks and are oriented parallel to the regional northeast-southwest structural grain. Final deformation occurred on north-northeast brittle faults that probably reactivated older contractional shear zones.

WESTERN IDAHO SHEAR ZONE

Foliations east of the Mill Creek fault are mostly steeply east dipping. This fabric may be related to the western Idaho shear zone as mapped on strike to the south along the Salmon River (Blake and others, 2009). This shear zone is interpreted as a Late Cretaceous dextral transpressional structure that formed along the eastern boundary of the eastern Salmon River belt

and overprinted earlier motion along the Salmon River suture.

SYMBOLS

_____ - Contact: dashed where approximately located.

.-... Normal fault: ball and bar on downthrown side; dashed where approximately located; dotted where concealed.

Thrust fault: teeth on upper plate; dashed where inferred. Estimated strike and dip of bedding or volcanic flows.

⊗ Horizontal bedding.

 \checkmark^{81} Strike and dip of foliation. Strike of vertical foliation.

Strike and dip of mylonitic foliation.

✓65 Strike and dip of compositional layering.

→ 29 Bearing and plunge of lineation, type unknown.

Bearing and plunge of small fold axis.

➤ 25 Bearing and plunge of mylonitic lineation.

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and northeastern Oregon: U.S. Geological Survey Bulletin 1437, 58 p.

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Sample number		Longitude	Unit name	Map unit	Major elements in weight percent									Trace elements in parts per million															
	Latitude				SiO ₂	TiO ₂	Al_2O_3	FeO*	MnO	MgO	CaO	Na ₂ O	K ₂ O	P_2O_5	Ni	Cr S	e V	Ва	Rb	Sr	Zr	Y	Nb	Ga	Cu	Zn P	b La	Се	
09DG502	45.7165	-116.0792	R ₂ Grande Ronde Basalt	Tgr ₂	55.57	2.161	13.76	12.21	0.207	3.54	7.18	3.25	1.69	0.433	13	7 3	359	770	44	327	194	43	13.2	20	21	137 8	3 23	54	
09DG504	45.7128	-116.0491	R ₂ Grande Ronde Basalt	Tgr_2	55.76	2.162	13.78	11.86	0.207	3.54	7.21	3.19	1.87	0.428	13	8 33	358	738	44	334	194	43	13.2	20	19	138 8	3 24	55	
09DG505	45.6600	-116.0986	R ₁ Grande Ronde Basalt	Tgr ₁	54.12	2.560	13.89	12.40	0.210	3.91	7.87	3.03	1.60	0.405	13	10 33	371	561	44	364	216	39	15.5	23	33	134 7	7 21	52	
09DG506	45.6916	-116.0662	R ₂ Grande Ronde Basalt	Tgr_2	55.05	2.188	13.92	12.43	0.209	3.57	7.25	3.22	1.73	0.437	12	8 33	359	786	41	324	197	44	12.8	21	20	137 7	7 30	58	
09DG508	45.6836	-116.0725	R ₁ Grande Ronde Basalt	Tgr ₁	54.82	2.179	13.72	12.61	0.224	3.59	7.59	3.22	1.60	0.448	15	4 3	401	717	38	329	193	44	13.2	20	52	136 7	7 23	48	
09JK096	45.6299	-116.0736	Priest Rapids dike	Tpr	49.36	3.381	13.19	15.00	0.243	5.22	9.12	2.56	1.08	0.853	41	79 39	369	493	29	277	195	48	16.9	22	47	148 5	5 25	64	
09JK100	45.6407	-116.0446	N ₁ Grande Ronde Basalt (in Qls)	Tgn ₁	56.68	1.954	14.32	10.55	0.170	3.83	7.24	3.16	1.81	0.280	12	10 28	3 295	660	49	356	201	35	13.5	22	25	118 1	0 24	53	
09JK101	45.6426	-116.0327	R ₂ Grande Ronde Basalt	Tgr_2	55.61	2.178	13.77	12.09	0.201	3.56	7.20	3.18	1.76	0.445	15	8 33	362	762	46	331	196	44	13.9	22	22	138 6	5 22	54	
10JK003	45.6465	-116.0524	R ₂ Grande Ronde Basalt	Tgr_2	55.68	2.050	14.06	11.78	0.191	3.63	7.64	3.12	1.51	0.342	12	9 3	355	644	39	325	184	38	12.9	19	39	124 8	3 24	48	
10JK007	45.6445	-116.0494	R ₁ Grande Ronde Basalt	Tgr ₁	53.97	2.307	14.13	11.91	0.206	4.16	8.07	3.10	1.75	0.410	26	29 32	336	562	40	343	199	38	14.0	21	80	122 8	3 20	47	
10JK008	45.6441	-116.0470	R ₁ Grande Ronde Basalt	Tgr ₁	54.28	2.341	14.27	11.83	0.213	3.70	8.23	3.05	1.66	0.425	26	30 34	337	605	42	353	199	36	14.2	21	82	126 8	3 21	50	
10JK009	45.6715	-116.0967	Imnaha Basalt	Tim	50.02	2.537	15.57	12.57	0.195	5.58	9.17	3.01	0.96	0.383	97	114 30	275	415	20	395	209	37	14.9	21	129	126 5	5 15	51	
10JK037	45.6540	-116.0500	R ₂ Grande Ronde Basalt	Tgr ₂	56.20	1.980	14.59	10.64	0.172	3.91	7.42	3.13	1.67	0.290	12	13 29	9 295	701	45	362	204	35	13.1	22	26	119 1	0 25	51	
10JK040	45.6440	-116.0477	R ₁ Grande Ronde Basalt	Tgr ₁	54.09	2.344	14.04	11.93	0.199	4.12	8.10	3.03	1.74	0.407	28	30 33	334	576	41	346	199	37	13.1	20	79	125 7	7 25	50	
10JK043	45.6414	-116.0397	N ₁ Grande Ronde Basalt	Tgn ₁	56.08	1.817	14.60	10.26	0.190	4.21	8.00	2.99	1.61	0.246	8	6 3	323	695	37	335	165	33	11.6	21	14	121 8	3 18	43	
10JK045	45.6423	-116.0393	N ₁ Grande Ronde Basalt	Tgn ₁	55.57	1.970	13.95	11.83	0.198	3.91	7.53	3.13	1.57	0.347	11	13 33	357	653	42	328	178	37	11.3	21	33	125 7	7 19	49	
10RL932	45.6268	-116.0201	Biotite tonalite	Ktg	67.77	0.476	17.22	2.80	0.046	0.96	4.26	4.27	2.03	0.162	3	5 3	39	996	53	889	191	11	11.2	21	0	70 1	2 38	74	
10RL933	45.6363	-116.0261	Biotite tonalite	Ktg	64.52	0.551	16.29	5.03	0.103	2.90	4.37	3.93	2.17	0.123	8	12 18	3 123	613	83	476	141	22	7.0	17	0	100 8	3 12	30	
10RL936	45.6317	-116.076	Biotite tonalite	Kto	68.94	0.234	17.96	1.48	0.023	0.45	4.79	5.36	0.69	0.064	2	3 4	19	447	9	941	135	6	4.8	20	4	39 5	5 3	4	
10RL937	45.6349	-116.0919	Biotite tonalite	Kto	66.98	0.476	16.73	3.67	0.076	1.45	4.76	4.36	1.36	0.133	7	7 8	80	552	28	604	91	10	3.3	21	0	70 4	1 11	21	
10RL938	45.6403	-116.1155	Biotite tonalite	Pt?	73.31	0.526	13.60	3.03	0.101	1.63	2.15	4.44	1.15	0.061	2	5 1	60	175	18	115	244	34	3.7	13	4	107 5	5 10	20	
10RL940	45.6594	-116.1008	Biotite tonalite	Kto	68.62	0.418	16.52	3.16	0.066	1.09	4.19	5.15	0.68	0.111	6	6 5	64	242	10	368	90	6	1.9	21	2	36 2	2 17	24	
**VC79-482	45.6286	-116.0717	Priest Rapids dike	Tpr	49.46	3.248	14.21	14.08	0.230	5.12	9.43	2.48	1.07	0.651															
**VC79-484	45.6319	-116.0771	basalt of Craigmont dike	Tcg	52.41	3.000	14.31	13.99	0.230	3.29	7.23	3.10	1.95	0.481															
**VC79-490	45.6426	-116.0277	Priest Rapids basalt	Tgr ₁	49.98	3.500	13.52	14.95	0.250	4.41	8.61	2.66	1.43	0.681															
**VC79-49	45.6803	-116.0250	R ₁ Grande Ronde Basalt	Tpr	54.67	2.174	14.48	12.41	0.230	3.61	7.42	3.06	1.54	0.391															
**VC79-680	45.6293	-116.1054	R ₁ Grande Ronde Basalt	Tgr ₁	55.35	1.924	15.22	10.61	0.240	4.12	7.69	2.87	1.65	0.321															
**VC79-693	3 45.6301	-116.0739	Priest Rapids dike	Tpr	50.05	3.066	14.54	14.16	0.240	5.02	8.95	2.19	1.09	0.681															
**VC79-694	45.6319	-116.0771	basalt of Craigmont dike	Tcg	52.29	2 926	14 52	14 08	0.240	3 84	7 3 2	2.49	1 02	0.461															

* * Samples by V.E. Camp, used with permission; no trace element analyses available. All analyses performed at Washington State University GeoAnalytical Laboratory, Pullman, Washington.

KPgs?

R3E R4E

QUADRANGLE LOCATION

ADJOINING QUADRANGLES

Field work conducted 2006-2010.

USGS Award No. G10AC00223.

online at www.idahogeology.org.

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Digital cartography by Jane S. Freed at the

PDF (Acrobat Reader) map may be viewed

Idaho Geological Survey's Digital Mapping Lab.

U.S. Geological Survey National Cooperative

116° 07 30"

Base digitally scanned from 24,000-scale USGS film

Topography compiled 1962. Planimetry derived from

imagery taken 1992. Public Land Survey System and

survey control current as of 1995. Partial field check

(Transverse Mercator). 1927 North American Datum.

1000-meter Universal Transverse Mercator grid ticks,

10,000-foot grid ticks based on Idaho coordinate

1997 Magnetic North

Projection: Idaho coordinate system, west zone

SCALE 1:24,000

Contour interval 40 feet

1000 2000 3000 4000 5000 6000

Shaded elevation from 10 m DEM.

by U.S. Forest Service 1995.