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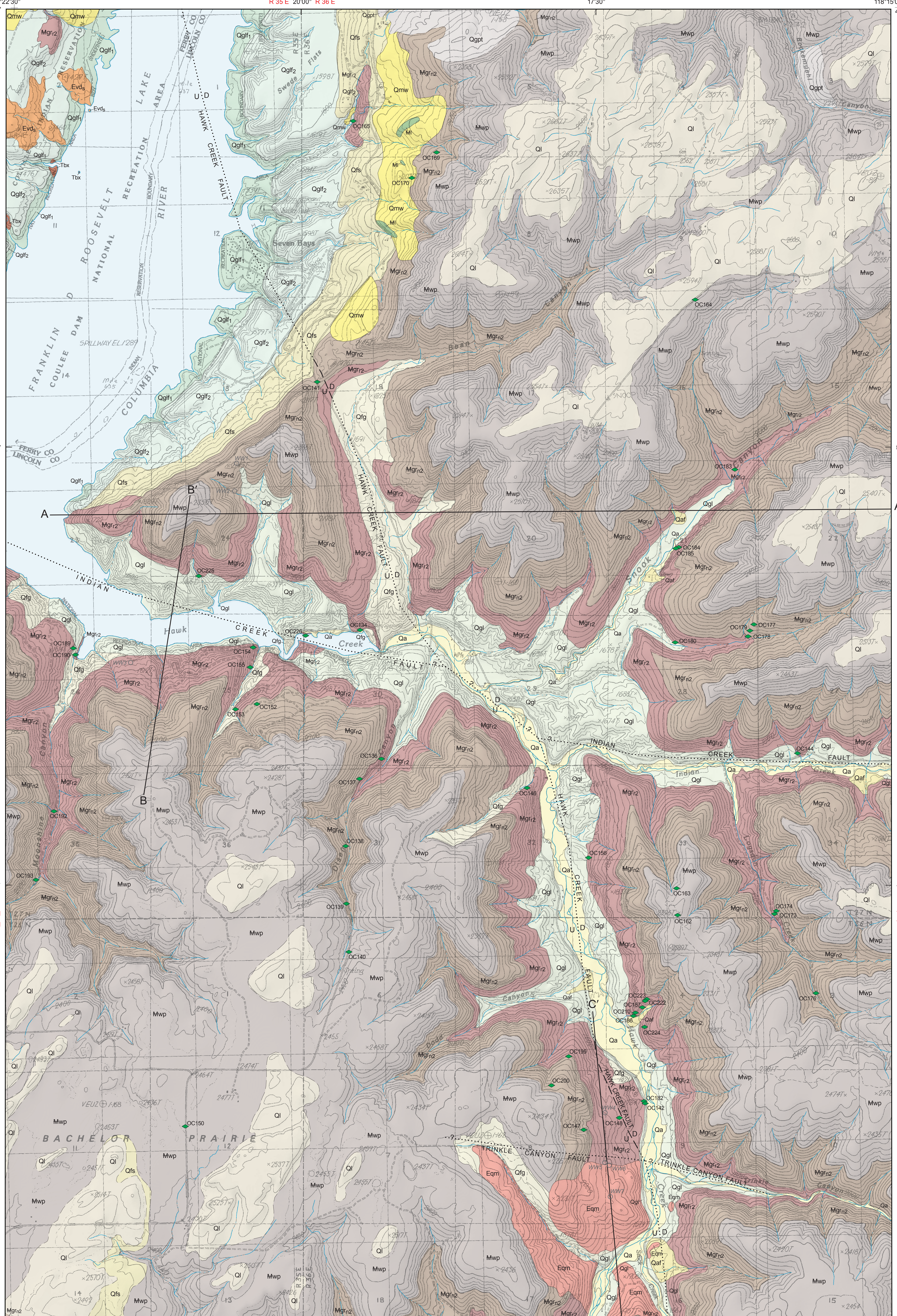

Geologic Map of the Olsen Canyon 7.5-minute Quadrangle, Lincoln and Stevens Counties, Washington

by Robert E. Derkey and Michael M. Hamilton

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INTRODUCTION

Miocene Columbia River Basalt Group rocks cover Eocene and older igneous and metamorphic rocks in and adjacent to the Olsen Canyon quadrangle. Most of the quadrangle is located just east of the southward projection of the Lincoln metamorphic core complex detachment zone (Stoffel and others, 1991). Traces of that structure are preserved in the northwest part of the map area. Pre-basalt rocks exposed in the quadrangle are Eocene quartz monzonite and dacite flows and flow breccia and the Latah Formation. The basalt units range from 1100 ft elevation in the deepest well to just above 2500 ft elevation. Despite the topographic relief, well-exposed, continuous sections of basalt are rare. Contacts between flows are rarely exposed; they can be approximately located in a zone between flows that typically consists of vesicular basalt and rubble. Top-of-flow vesicular zones are thicker than the pillow basalt that occurs at the base of many of the flows in the Olsen Canyon quadrangle. The vesicular and pillow zones commonly are several tens of feet thick. Spacing of topographic contours can suggest the location of the contact zone; more closely spaced contours are typically present just above the base of a flow, more widely spaced contours in the vesicular and pillow zones. Contact zones can also be traced by vegetation, which is more abundant there because of available water.

Whole-rock geochemistry was used to identify basalt flow units and establish the basalt stratigraphy in the quadrangle. The two exposed basalt formations are Grande Ronde Basalt and Wanapum Basalt. Exposed units of Grande Ronde Basalt are magnetostratigraphic units R_2 and N_2; the only representative of the Wanapum Basalt is the Priest Rapids Member. These formations range in age from about 16 ±0.5 Ma to 14.5 Ma (Reidel and others, 1989). Within Grande Ronde R_2, S. P. Reidel (Wash. State Univ. – Tri-City College, oral commun., 2008) informally identified the Wapshilla Ridge and Grouse Creek units. Unit N_2 overlies R_2 and includes the Ortley and Sentinel Bluffs units, also identified by Reidel. However, sampling was insufficient to draw contacts between individual flows in Grande Ronde R_2 and N_2. These units are in turn overlain by the Wanapum Basalt, Priest Rapids Member, Rosalia chemical type. Geochemical analyses of basalts in the quadrangle and adjacent areas are listed in Table 1.

Andesitic flows, flow breccia, tuff, and minor intercalated sandstone, shale, and conglomerate are exposed in the Enterprise Valley northeast of the Olsen Canyon quadrangle. Waggoner (1990) considered these various volcanic units correlative with the Sanpoil Volcanics (Muessig, 1967; Pearson and Obradovich, 1977) that are exposed northwest of the map area in the Republic graben. Waggoner's designation (unit Evd_s) is used for the dacite flows and flow breccia in the northwest corner of the quadrangle.

The quartz monzonite of Hawk Creek (unit Eqm) (Waggoner, 1990) exposed at the southern border of the quadrangle contains blocks of fine-grained tuff, which we interpret as stoped blocks from overlying volcanic rock. Locally, the quartz monzonite contains abundant phenocrysts in a fine-grained matrix, suggesting shallow crystallization. This unit has not been dated; however, because of its proximity to Eocene Sanpoil Volcanics, the only known volcanic rocks in the region, and similarity to Silver Point Quartz Monzonite (Derkey and Hamilton, 2007; Derkey and others, 2003), we have assigned an Eocene age to the quartz monzonite.

Pleistocene outburst floods from glacial Lake Missoula produced the current terrain of the Olsen Canyon quadrangle, which is located at the northern margin of the Davenport–Creston channeled scabland tract. Pleistocene deposits include sediments from these floods and lacustrine deposits of glacial Lake Columbia, which occupied the area when glaciers of the Okanogan lobe dammed the Columbia River downstream of the quadrangle. Flood

Mgr$_{n2}$ — N_2 contains opaline and red amorphous secondary minerals filling some vesicles and is 300 to 400+ ft thick. It has normal magnetic polarity. S. P. Reidel (Wash. State Univ. – Tri-City College, oral commun., 2008) informally identified the Sentinel Bluffs and Ortley units in this map area from whole-rock chemistry analyses (Table 1), but the units are not shown separately on the map. Sample OC169 was mapped as in place, but is apparently a slump block of Wanapum Basalt, Priest Rapids Member (unit Mwp).

Mgr$_{r2}$ — R_2 possesses some vesicles lined by botryoidal carbonate and red amorphous secondary minerals. The thickness exceeds 420 ft, and the unit has reversed polarity. S. P. Reidel (Wash. State Univ. – Tri-City College, oral commun., 2008) informally identified the Grouse Creek and Wapshilla Ridge units from whole rock chemistry analyses (Table 1), but the units are not shown separately on the map.

Tertiary Sedimentary Rocks

Ml — **Latah Formation (middle Miocene)**—Siltstone, claystone, and minor sandstone; finely laminated lacustrine and fluvial deposits; light-gray to yellowish gray and light-tan; commonly weathers brownish yellow with stains, spots, and seams of limonite; poorly indurated. Exposures in the map area occur in mass-wasting deposits (unit Qmw) and are also present in water wells. Well logs from the Olsen Canyon quadrangle show that in many places this unit is interbedded with Grande Ronde Basalt, the thickest bed found between the N_2 and R_2 magnetostratigraphic units. Fossil plant assemblages indicate a Miocene age (Knowlton, 1926; Griggs, 1976).

Tertiary Igneous Rocks

Eqm — **Quartz monzonite of Hawk Creek (Eocene)**—Hornblende-biotite quartz monzonite; medium- to dark-gray, in places with greenish tinge; medium-grained, locally fine-grained; characterized by primary epidote present as dispersed grains (<1 mm) and clusters of grains; epidote veinlets as much as 2 mm wide; anhedral biotite and hornblende occurring together in the interstices between quartz and feldspar. Most biotite is fresh, and most hornblende is chloritic; quartz is gray or clear; feldspar is white and pink. The unit contains blocks of fine-grained tuff. The only known volcanic rocks in the region are the Eocene Sanpoil Volcanics. Therefore we suggest that the quartz monzonite of Hawk Creek is also Eocene. Our conclusion is also based on the similarity of the quartz monzonite of Hawk Creek to the Eocene Silver Point Quartz Monzonite described by Derkey and Hamilton (2007) and Derkey and others (2003) in quadrangles east of the Olsen Canyon quadrangle. Quartz monzonite of Hawk Creek is exposed only near the southern border of the quadrangle.

Evd$_s$ — **Dacite flows and flow breccia of the Sanpoil Volcanics (Eocene)**—Flows and flow breccia, subordinate tuff and sedimentary rocks, and minor hypabyssal intrusive rocks (Atwater and Rinehart, 1984); abundant plagioclase phenocrysts, some hornblende, pyroxene, and biotite phenocrysts, and sparse quartz phenocrysts in a granular to glassy groundmass. This unit occurs only in the northeast part of the quadrangle.

Tectonic Unit

Tbx — **Tectonic breccia (Tertiary)**—Breccia; heterogeneous mixture of volcanic and granitic rock fragments ranging in size from <1 mm to 1 m; weakly lithified; local shattered, green, siliceous dikes. The tectonic breccia marks the trace of the low-angle, east-dipping fault separating the mylonitically deformed rocks in the Lincoln metamorphic core complex (lower plate) to the west from the brittlely deformed rocks in the upper plate (Waggoner, 1990).

GEOLOGIC SYMBOLS

Contact—Long dash where approximately located, short dash where inferred or indefinite.

Fault, unknown offset—Long dash where approximately located, dotted where concealed; queried where uncertain.

U / D — High-angle dip-slip fault—Relative movement shown by U and D; long dash where approximately located; dotted where concealed; queried where uncertain.

WW5 — Water well—Numbers correspond to well numbers on cross sections.

OC147 — Basalt geochemistry sample location—Numbers correspond to sample numbers in Table 1.

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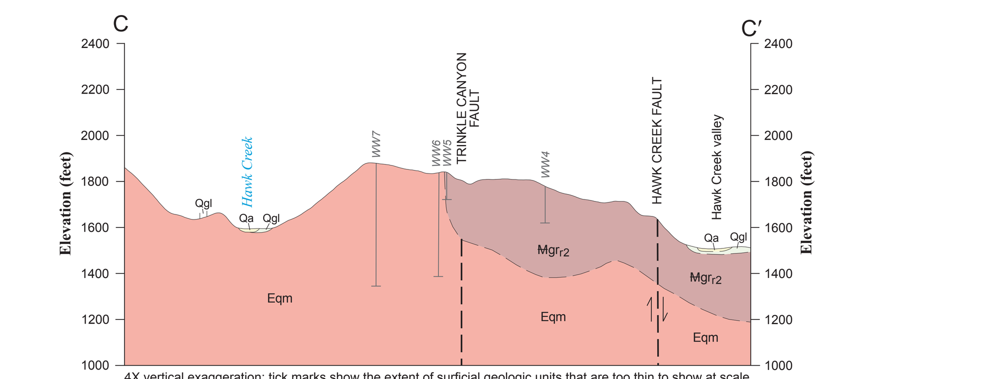
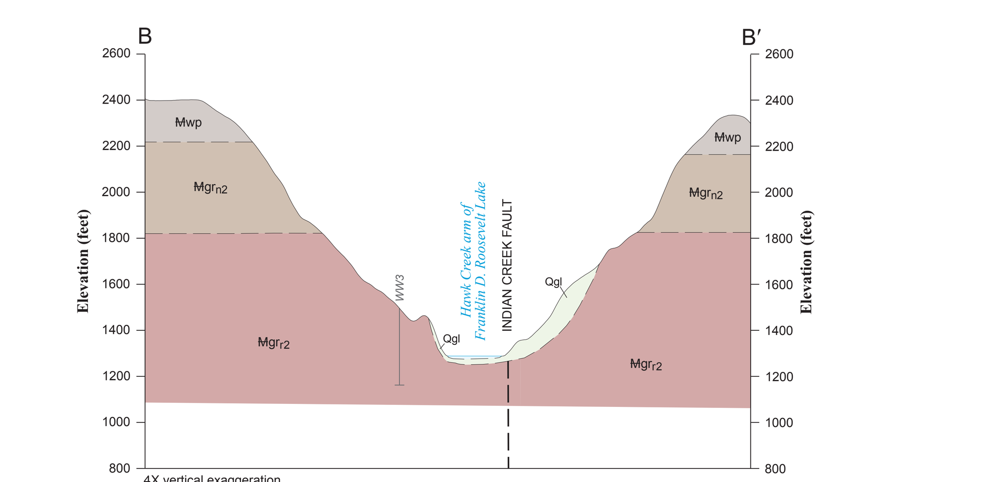
Table 1. Geochemical analyses of basalt samples from the Olsen Canyon quadrangle. Analyses performed at the Washington State University GeoAnalytical Laboratory; instrumental precision is described in Johnson and others (1998). Values for oxides are given in percent; single elements in parts per million (ppm). *, total Fe expressed as FeO. S. P. Reidel (Wash. State Univ. – Tri-City College, oral commun., 2008) provided identification of flow units.

Sample no.	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Total	Ni	Cr	Sc	V	Ba	Rb	Sr	Zr	Y	Nb	Ga	Cu	Zn	Pb	La	Ce	Th	Nd	U	Latitude	Longitude
WANAPUM BASALT, PRIEST RAPIDS MEMBER (unit Mwp)																																
OC140	48.89	3.547	12.54	14.38	0.236	4.34	8.39	2.63	1.38	0.785	97.11	13	10	39	412	582	33	289	227	51	17.1	22	23	155	6	34	70	7	40	1	– – –	– – –
OC150	48.69	3.590	12.59	14.66	0.236	4.23	8.41	2.65	1.19	0.779	97.03	14	12	39	415	680	30	294	224	50	16.5	22	24	156	8	35	64	6	40	0	– – –	– – –
OC162	48.90	3.587	12.47	14.59	0.235	4.15	8.42	2.61	1.24	0.778	96.98	13	10	38	417	599	31	294	226	50	17.0	21	23	154	5	34	67	5	39	1	– – –	– – –
OC163	48.77	3.624	12.69	14.38	0.235	4.32	8.41	2.52	1.21	0.771	96.94	14	11	39	424	590	29	294	226	49	16.7	21	23	157	6	37	72	7	40	2	– – –	– – –
OC164	49.24	3.604	12.57	14.60	0.244	4.22	8.45	2.61	1.25	0.780	97.57	14	10	39	420	689	30	299	227	49	16.2	20	23	156	5	33	70	7	41	1	– – –	– – –
OC169	48.94	3.588	12.56	14.61	0.237	4.24	8.37	2.56	1.20	0.773	97.07	12	11	38	419	583	31	294	225	49	15.9	22	23	154	5	36	66	5	39	2	– – –	– – –
OC170	48.51	3.583	12.49	14.61	0.238	4.17	8.51	2.57	1.14	0.775	96.60	13	13	38	421	595	31	299	224	49	16.2	22	24	155	6	35	66	5	42	1	– – –	– – –
GRANDE RONDE BASALT, SENTINEL BLUFFS AND ORTLEY UNITS, N_2 MAGNETOSTRATIGRAPHIC UNIT (unit Mgr$_{n2}$)																																
OC137	51.63	1.979	13.58	11.81	0.214	4.44	8.68	2.74	0.96	0.293	96.33	8	27	37	342	585	25	322	156	33	10.2	19	34	116	7	20	37	3	23	1	– – –	– – –
OC138	52.75	1.806	13.89	11.37	0.205	4.95	8.67	2.88	1.12	0.314	97.97	13	43	37	307	484	28	309	156	33	9.1	19	34	114	5	20	41	3	23	2	– – –	– – –
OC139	52.21	1.826	14.07	11.15	0.197	4.82	8.87	2.83	1.03	0.306	97.30	13	45	37	318	470	24	313	156	33	9.9	20	31	117	6	22	39	3	23	1	– – –	– – –
OC141	51.88	1.989	13.47	11.99	0.213	4.82	8.57	2.81	1.19	0.291	97.23	9	25	38	338	446	26	307	155	33	9.6	19	33	119	6	25	39	4	23	1	– – –	– – –
OC147	52.55	1.821	13.80	11.31	0.202	4.82	8.55	2.82	1.14	0.330	97.35	11	40	36	305	508	28	309	158	33	9.4	20	32	117	6	22	43	4	25	0	– – –	– – –
OC152	53.68	1.870	14.02	11.12	0.201	3.87	7.72	2.83	1.36	0.483	97.16	13	16	34	335	688	35	325	171	36	9.7	20	32	117	7	28	48	4	26	3	– – –	– – –
OC174	52.30	2.032	13.56	11.86	0.207	4.37	8.36	2.69	1.10	0.420	96.90	9	34	36	287	587	27	312	171	37	11.0	19	32	125	6	28	45	4	27	2	– – –	– – –
OC176	53.21	1.857	13.94	11.26	0.212	4.44	8.69	2.85	1.19	0.350	98.00	10	40	36	308	546	28	319	163	34	10.9	20	33	118	5	23	47	4	26	2	– – –	– – –
OC177	53.08	1.853	14.08	10.87	0.191	4.40	8.69	2.76	1.07	0.336	97.33	12	41	37	313	572	26	321	162	34	9.7	19	34	121	6	27	44	3	24	1	– – –	– – –
OC179	53.27	2.088	13.67	11.78	0.213	4.37	8.34	2.83	1.28	0.433	98.28	8	34	37	284	587	31	317	172	37	10.8	20	30	125	6	24	49	3	29	2	– – –	– – –
OC193	54.59	1.868	13.77	11.24	0.190	3.91	7.62	3.00	1.53	0.308	98.02	11	14	34	328	641	42	319	168	32	10.8	18	31	116	6	25	42	5	24	2	– – –	– – –
OC199	52.69	1.982	13.72	11.49	0.203	4.16	8.17	2.76	1.18	0.424	96.78	7	33	37	269	596	31	322	175	39	11.6	19	30	125	6	27	44	4	29	2	– – –	– – –
OC200	52.63	1.807	14.17	10.83	0.197	4.90	8.90	2.74	1.08	0.276	97.54	15	48	39	326	462	23	314	155	32	9.4	19	38	115	5	21	44	4	25	1	– – –	– – –
GRANDE RONDE BASALT, GROUSE CREEK AND WAPSHILLA RIDGE UNITS, R_2 MAGNETOSTRATIGRAPHIC UNIT (unit Mgr$_{r2}$)																																
OC134	53.76	2.296	13.27	12.12	0.204	3.33	6.92	3.15	1.76	0.453	97.26	6	10	32	341	717	47	319	204	40	11.9	21	17	134	10	30	56	5	35	1	– – –	– – –
OC136	53.59	1.855	13.63	11.10	0.187	3.94	7.60	2.94	1.55	0.302	96.69	12	12	33	330	617	41	320	166	33	11.0	20	33	117	8	26	46	4	25	1	– – –	– – –
OC142	53.92	1.815	13.69	10.90	0.185	4.02	7.66	2.85	1.45	0.300	96.80	11	14	34	319	608	39	316	160	30	9.4	21	31	112	7	22	46	4	25	2	– – –	– – –
OC144	54.42	1.789	13.75	10.79	0.183	4.13	7.70	3.00	1.61	0.289	97.66	14	16	33	322	614	42	314	165	32	10.1	18	37	118	9	24	44	5	25	3	– – –	– – –
OC146	52.61	2.179	13.36	12.63	0.200	3.86	7.62	3.03	1.52	0.381	97.40	21	17	35	429	646	39	330	173	35	11.1	20	47	128	7	22	46	5	28	1	– – –	– – –



4X vertical exaggeration; tick marks show the extent of surficial geologic units that are too thin to show at scale



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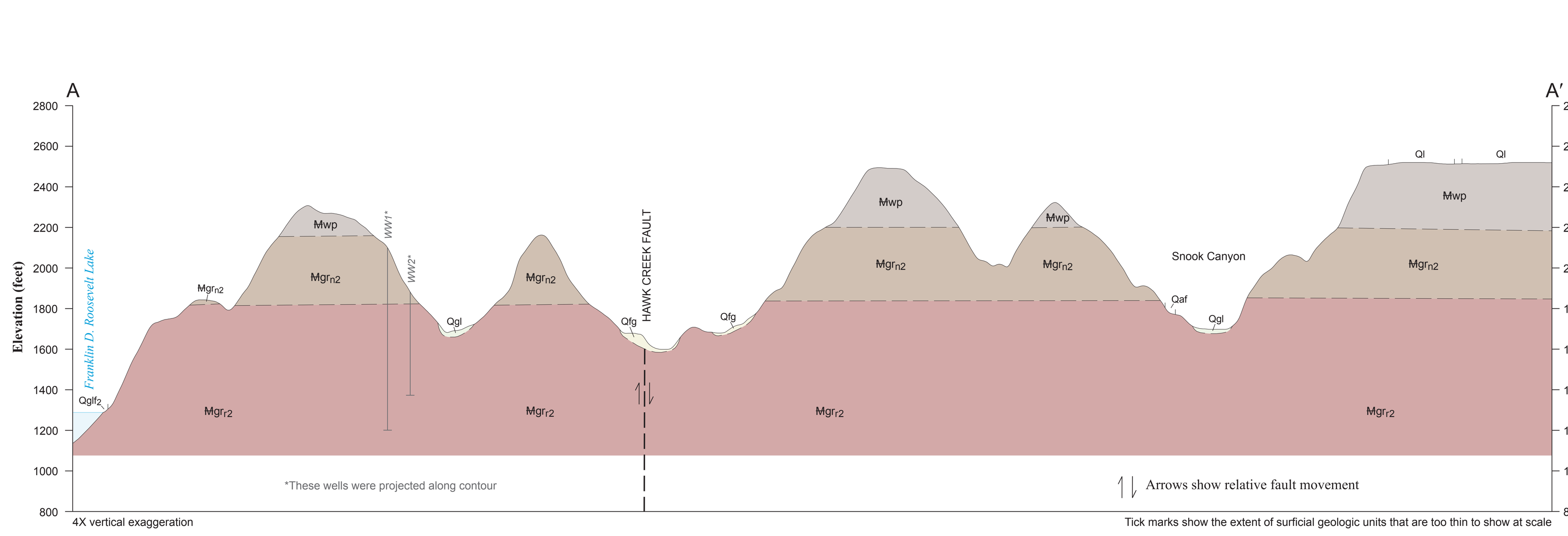

4X vertical exaggeration

Tick marks show the extent of surficial geologic units that are too thin to show at scale