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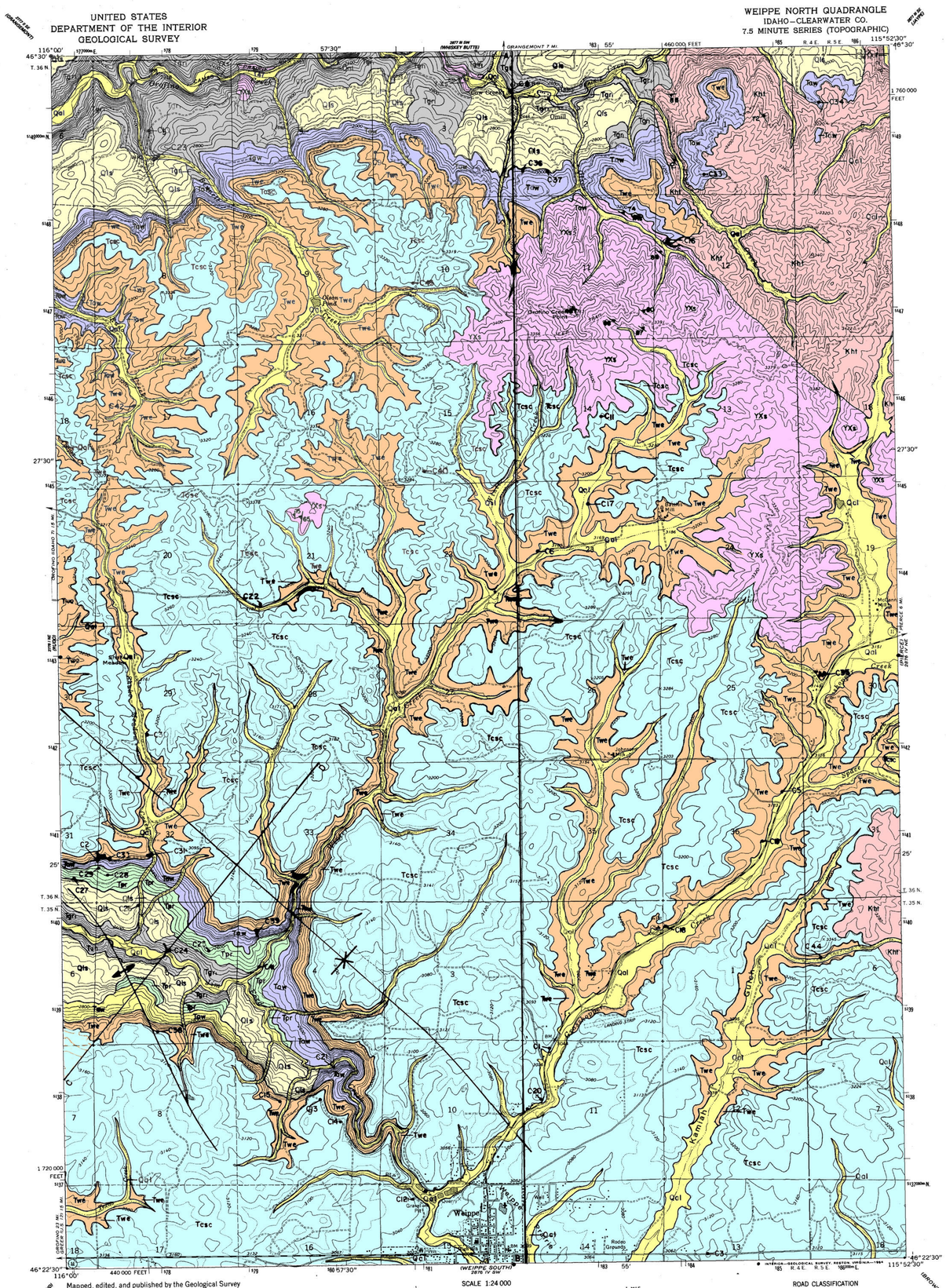
Bedrock Geologic Map of the Weippe North 7 1/2' Quadrangle, Clearwater County, Idaho

John H. Bush, Dean L. Garwood, John D. Kauffman, Kenneth F. Sprenke

2003



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1963. Field checked 1966

Polyconic projection. 1927 North American datum
10,000-foot grid based on Idaho coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

To place on the predicted North American Datum 1983 move the projection lines 15 meters north and 75 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1984 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purple and woodland compiled from aerial photographs taken 1982 and other sources.
Partial field check by U.S. Forest Service. Map edited 1984

ROAD CLASSIFICATION
Medium-duty — Light-duty
Unimproved dirt
State Route

QUADRANGLE LOCATION

WEIPPE NORTH, IDAHO
N4622.5—W11552.5/7.5
1966
PHOTOREVISED 1984
DMA 2876 IV NW—SERIES V893

INTRODUCTION

The bedrock geologic map of the Weippe North 7 1/2' quadrangle was produced from field mapping, existing research, and water well logs. Mapping was greatly enhanced by comparisons to parts of surrounding field maps by John Kauffman of the Idaho Geological Survey and Jon Payne of the Department of Geological Sciences, University of Idaho. The quadrangle is along the eastern margin of the Clearwater Embayment of the Columbia Plateau, where Miocene basalts rest on older rocks that comprise the Clearwater Mountains. The southern portion of the quadrangle is part of the Weippe Prairie, dissected by Jim Ford Creek. The very northern part of the quadrangle is bordered by Orofino Creek.

Good exposures are primarily limited to quarries, roadcuts, and outcrops on the canyon walls of Jim Ford and Orofino creeks. Away from canyon walls in the plateau areas the basalts are typically weathered to a light to dark brown saprolite that ranges from under one foot to over 15 feet in thickness. The prebasalt rocks are also deeply weathered, generally red to yellow in color. Where basalts are in close contact with the prebasalt rocks, the saprolite is red to red-brown in color. Attitude and mineral composition determinations of prebasalt rocks generally require excavation of overlying regolith and soil. However, a few unweathered exposures do occur in places along Orofino Creek and Placer Creek.

The folds mapped on the quadrangle are shallow, low amplitude, long wavelength folds with narrow anticlinal ridges and wide synclinal troughs. Deformation occurred during and after emplacement. For example, examination of the Saddle Mountains sequence along Jim Ford Creek shows more thickening in the Asotin-Wilbur Creek Members over synclinal areas than does the overlying basalt of Weippe. The folds illustrated were determined from field observations, detailed tracing of individual contacts, air photo examination, and drainage pattern interpretation. Though they are subtle, these folds are believed to be important in that they controlled distribution patterns of the Saddle Mountains flows.

Forty-four basalt samples were analyzed by XRF for major and trace element compositions in the GeoAnalytical Lab at Washington State University (Table 1). The magnetic polarity was determined at numerous basalt outcrops with a field fluxgate magnetometer.

The magnetic field over the quadrangle, based on aeromagnetic survey data compiled by McCafferty et al. (1999), is shown in Figure 1. The magnetic pattern on the map is somewhat enigmatic. The magnetic low over the Weippe Prairie suggests that a strongly reversed basalt unit underlies the prairie. However the capping basalt units (the Craigmont and Swamp Creep Members) show a generally normal polarity in the field. A strong magnetic high in the northwest portion of the quadrangle is perhaps associated with the normal polarity Asotin and Wilbur Creek Members which crop out along Orofio Creek. However, the Grand Ronde R1 Member also crops out in the creek with surprisingly little influence on the magnetic field. The older intrusive and metamorphic rocks in the northeast portion of the quadrangle cause a significant moderation of the magnetic field relative to the intensely magnetized basalt flows.

DESCRIPTION OF MAP UNITS

The stratigraphic nomenclature for the Columbia River Basalt Group is based on that presented by Swanson and others (1979b). In Idaho the group is divided into four formations: from base upward, these are the Imnaha, Grande Ronde, Wanapum, and Saddle Mountains. The Imnaha does not crop out on the Weippe North quadrangle. The Grande Ronde Basalt is interpreted to be made up entirely of the R1 magnetostratigraphic unit. The remaining three Grande Ronde magnetostratigraphic units which overlie the R1 to the west were not identified on the Weippe North quadrangle. Flows of the Priest Rapids Member of the Wanapum Basalt crop out along Jim Ford Creek. Five chemical types of the Saddle Mountains Basalt were identified: Asotin, Wilbur Creek, basalt of Weippe, Craigmont, and Swamp Creek.

Two prebasalt units were identified on the Weippe North quadrangle. Intrusive rocks related to the Cretaceous aged Idaho batholith occur along the eastern edge and northeastern part of the quadrangle. Precambrian rocks of the Syringa metamorphic sequence are poorly exposed on Orofino Creek Point and at one locality northwest of the point. Small, but fresh exposures crop out along the northern border of the quadrangle in Orofino Creek. The extensive soil cover made interpretation of the prebasalt-basalt contact very difficult to locate. The most difficulty occurred in the eastern and southeastern part of the quadrangle where large areas contained no outcrops. Thus, many contacts over parts of the quadrangle were located using only topographic expression.

SURFICAL DEPOSITS

Qal Alluvium (Holocene)–Stream and slope wash deposits. Predominantly sand, silt, and clay occur in the smaller drainage systems. In Orofino and Jim Ford Creeks, pebbles and cobbles are common. Large boulders over 2 meters in diameter dominate Jim Ford Creek in the northern part of section 9 and the southwestern part of section 4 (T35N, R4E). In Orofino Creek, the composition is variable consisting of mixtures of quartz-rich granitoids and basalt. In Jim Ford Creek, composition is nearly 100 percent basalt. The drainage pattern in the southeastern part of the quadrangle is inconsistent with normal stream development. Southwest flowing drainage systems join the northwest flowing Jim Ford Creek suggesting structural control by the northeast limb of the northwest trending syncline.

Qls Landslide deposits (Pleistocene-Holocene)–Highly varied rock and soil masses ranging from slumped coherent blocks to earthflows of unsorted, unstratified colluvium. Landslides include large blocks of basalt and sedimentary interbeds in a matrix of poorly sorted basalt rubble. Most landslides are related to sediments on top of and below the Asotin-Wilbur Creek Members. Some landslides along Orofino Creek are related to the location of the prebasalt-basalt contact.

LATAH FORMATION

Tls Latah Sediments (Miocene)–Clay, silt, sand, and gravel deposits that in places separate individual basalt flows. These deposits are only illustrated on the cross sections and the map as locations since outcrops are rare and mapping them as continuous units is difficult. Of note are the gravels below and above the Asotin-Wilbur Creek unit. These gravels are dominated by quartzite and quartz-rich granitoids. They lack basalt fragments, are well rounded, and have a very high sphericity. Sizes range from 2 mm to 25 cm with a 10 cm average. The interbeds are important because they are in places more laterally continous than can be illustrated, and in part, are responsible for the numerous slump blocks and landslides on the quadrangle.

COLUMBIA RIVER BASALT GROUP

SADDLE MOUNTAINS BASALT

Tcsc Craigmont and Swamp Creek Members, undivided(Miocene)– Craigmont consists of fine- to medium-grained basalt with scattered plagioclase phenocrysts up to 10 mm in length. Camp (1981) raised the Craigmont basalt to member status and reported one flow with normal polarity. Our polarity readings were somewhat inconsistent, but in general, they were normal. Thickness estimated at 50-150 feet. K-Ar age determination of a dike sampled by Camp (sample VC79-214) in the Big Cedar quadrangle resulted in a date of 11.9 ± 0.7 Ma (results provided by S.P. Reidel, Pacific Northwest National Laboratory).

Swamp Creek consists of medium- to coarse-grained basalt with common plagioclase phenocrysts up to 10 mm and olivine phenocrysts a few millimeters in diameter. Camp (1981) gave member status to Swamp Creek. Normal magnetic polarity, although field magnetometer readings sometimes inconsistent. Poorly exposed, but directly underlies the Craigmont Member at one exposure a mile north of Weippe. Thickness not determined but probably less than 75 feet. K-Ar age determination of a sample collected by Camp (sample VC79-317) in the Elk Creek Falls quadrangle resulted in a date of 11.4 ± 0.8 Ma (results provided by S.P. Reidel, Pacific Northwest National Laboratory).

The Craigmont and Swamp Creek form the capping basalt unit on the Weippe quadrangle. Both basalts are interpreted to have erupted from local vents filling shallow downwarps in the Weippe area. One dike for the Craigmont was identified on the north side of Jim Ford Creek in the southeast corner of section 31. In places the flows filled the downwarps and spread over the more extensive Weippe Member. The Craigmont was found to overlie the Swamp Creek at one locality, but the lack of exposures throughout the quadrangle made interpretation of the relation between the two difficult to determine. Therefore, the Swamp Creek and Craigmont are mapped as one unit.

Twe Basalt of Weippe (Miocene)–Medium- to coarse-grained basalt with abundant plagioclase and olivine phenocrysts. The Weippe ranges from 120 to 200 feet thick and is best exposed along State Highway 11 northeast of Weippe. This unit, along with the underlying Asotin-Wilbur Creek Members, filled lows that are believed to have formed primarily by deformation during and after emplacement of the Grande Ronde. In the plateau areas of the quadrangle exposures are poor because of extensive saprolite development. Typically, only remnants of basal columns crop out. Polarity recordings were inconsistent using a field fluxgate magnetometer.

Swanson and others (1979a) reported that the Weippe is petrographically and chemically similar and probably equivalent to the Pomona Member in the Lewiston basin. However, the Pomona in the Lewiston basin is 25 miles west of the westernmost outcrops the basalt of Weippe. Camp (1981) used the term "basalt of Weippe" and did not suggest raising it to member status. Hooper (2000) reports that magnetic discrepancies along with different isotopic signatures prove that they represent two different eruptions even though they have similar ages and chemical compositions, although he does not provide the data for comparison. A date of 12.9 ± 0.8 Ma was obtained on the basalt of Weippe on the adjoining Grangement quadrangle. A laboratory examination of paleomagnetic directions by the Idaho Geological Survey from the same site show that the basalt of Weippe does not match published data for the Pomona.

Taw Asotin and Wilbur Creek Members, undivided (Miocene)– Consists of fine- to coarse-grained basalt that is sparsely plagioclase-phyric and has normal magnetic polarity. Rapid grain size changes from fine to coarse are common. These two members form resistant benches along Orofino and Jim Ford creeks. The entire unit ranges from 80 to 280 feet in thickness. It thickens and thins in response to pre-emplacement deformational lows and highs. This thickening and thinning is visible along the south-west facing exposures in Jim Ford Creek near the center of section 4 (T35N,R2E), northeast of Weippe. Typically columnar structures are varied and complex but the uppermost part consists of a well preserved hackly, vesicular basalt. Locally, the Asotin occurs as slump blocks on the Grande Ronde.

Most researchers have attempted to separate the Asotin and Wilbur Creek members (Swanson and others, 1979a; Swanson and others, 1980; and Hooper and others, 1985). Where there are good outcrops the two members can be distinguished using stratigraphic and chemical data. However, the basalts were emplaced as valley and structure-filling flows over irregular surfaces and it has been shown that they are difficult to map as laterally continuous units over long distances (Bush and Garwood, 2001; Garwood and Bush, 2001). In addition, Reidel and Fecht (1987) have shown that flows from these two members locally mixed at the surface to form the Huntzinger flow in the Pasco basin, an indication of nearly simultaneous eruption. Garwood (2001) also concluded that the two members mixed in the Lewiston basin. Therefore we have mapped them as one unit.

WANAPUM BASALT

Tpr Priest Rapids Member(Miocene)- Fine- to medium-grained basalt with microphenocrysts of plagioclase. In comparison to Preist Rapids basalts over much of the Columbia Plateau the basalt is finer grained, and lacks easily visible phenocrysts of plagioclase and olivine in hand specimen. The basalt can be distinguished by its distinctive chemistry. On the Weippe North quadrangle the basalt is of the Rosalia chemical type first described by Wright and others (1973), and is only exposed along Jim Ford Creek.

GRANDE RONDE BASALT

Tgr_1 R_1 magnetostratigraphic unit (Miocene)–Several fine-grained aphyric reverse magnetic-polarity flows of Grande Ronde chemical type (Wright and others, 1973: Swanson and others, 1979; Reidel and others 1989). This unit is 580 feet thick along Orofino Creek in the northern part of the quadrangle. The flows exhibit radiating columnar structures up to 300 meters high and 200 meters across. These structures, named "war bonnets" by Waters (1960), are curvilinear at the top but are generally "flat floored" with an abrupt transition to larger, more regular well-formed vertical columns below. Many of the war bonnets are partly covered and the irregular columns give the impression of dipping basalt units. Vesicular zones are missing throughout much of the sequence.

PREBASALT ROCKS

INTRUSIVE ROCKS

Kht Hornblende-biotite tonalite and quartz diorite (Cretaceous)–Foliated to locally massive, medium- to coarse-grained, hornblende-biotite tonalite and quartz diorite. Foliation is generally caused by orientated biotite but also by hornblende. In places, the biotite has replaced the hornblende. Fresh exposures occur primarily in the northeastern part of the quadrangle. Location of the intrusive-metamorphic contact is based on trends including previous mapping by Hietanen (1963).

SYRINGA METAMORPHIC ROCKS

YXs Schist and gneiss of the Syringa metamorphic sequence (Proterozoic)–Medium- to coarse-grained muscovite-biotite schist and gneiss, and minor quartzite and calc-silicate rocks. Typically weathers orange-red and/or purple-red. Where fresh exposures exist along Orofino Creek biotite dominates with common muscovite porphyroblasts. Most exposures south of Orofino Creek are highly weathered with only muscovite and quartz remaining. Variants include rocks with either mica exclusively. Sillimanite is common, comprising up to 25 percent of the rock in places. Garnet is abundant locally and in places is aligned with the primary foliation. Hietanen (1963) mapped this unit on Orofino Creek Point as the Wallace Formation of the Belt Supergroup but did not note the exposures along Orofino Creek. In the southeast part of the quadrangle, mapping of this unit was based entirely on regional trends because no outcrops or float were noted.

SYMBOLS

- Contact approximately located
- 77 — Attitude of major foliation trends
- C2 — Location of chemistry reported in Table 1
- Dike
- Syncline axial trace
- Anticline axial trace

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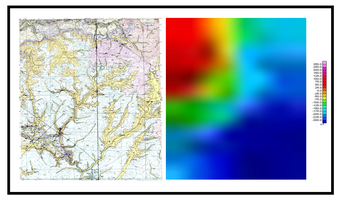
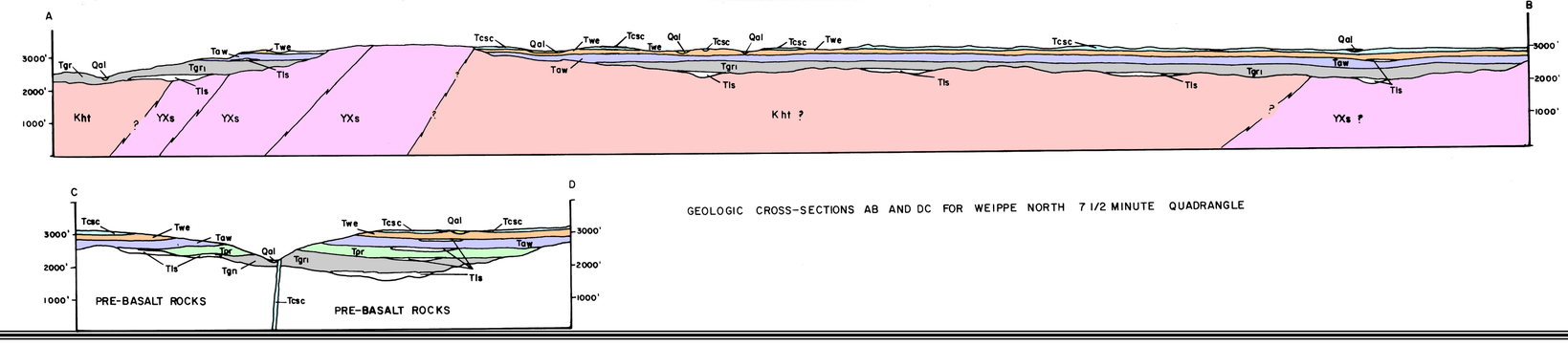


Figure 1. Comparison of geological map (left) and aeromagnetic map (right) over the Weippe North Quadrangle.

Table 1. Normalized whole rock major oxide chemistry for the Weippe North quadrangle

Map #	Unit	Smpl #	SiO_2	Al_2O_3	TiO_2	FeO	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5
C-1	Tcsc	01JB05	51.71	13.49	2.717	13.57	0.217	8.82	5.00	1.29	2.81	0.379
C-2	Taw	01SM01	49.32	16.46	1.454	10.04	0.162	11.47	8.44	0.31	2.18	0.158
C-3	Tcsc	01JB14	52.48	13.62	3.007	12.95	0.226	8.46	4.45	1.51	2.86	0.432
C-4	Tcsc	01JB15	51.38	13.82	2.763	13.78	0.221	8.92	4.85	1.16	2.71	0.387
C-5	Twe	01JB07	51.54	14.59	1.702	10.97	0.194	11.01	6.66	0.59	2.53	0.210
C-6	Twe	01JB11	51.28	14.92	1.685	11.00	0.195	10.99	6.73	0.43	2.57	0.204
C-7	Taw	01JB29	53.85	14.39	1.901	11.37	0.178	8.46	4.63	1.91	2.77	0.523
C-8	Tgr_1	01JB28	54.52	14.00	2.331	11.78	0.204	7.94	4.04	1.62	3.19	0.379
C-9	Twe	01JB30	50.35	15.13	1.757	11.55	0.193	11.13	6.97	0.31	2.40	0.211
C-10	Tgr_1	01JB34	57.19	13.41	2.236	11.81	0.199	6.67	2.95	2.14	3.04	0.357
C-11	Tcsc?	01JB21	55.17	14.81	3.77	9.42	0.124	8.23	3.03	2.02	2.97	0.445
C-12	Tcsc	01JB16	51.81	13.40	2.951	14.01	0.218	8.34	4.48	1.48	2.88	0.431
C-13	Tcsc	01JB33	52.39	13.57	2.995	13.13	0.211	8.40	4.40	1.58	2.89	0.433
C-14	Twe	01JB31A	51.00	14.99	1.710	10.86	0.193	11.15	6.92	0.36	2.61	0.206
C-15	Twe	01JB31B	51.42	14.64	1.710	11.03	0.197	10.99	6.74	0.49	2.57	0.216
C-16	Taw	01JB24	50.09	16.35	1.457	9.64	0.163	11.24	8.04	0.54	2.31	0.175
C-17	Twe	01JB20	51.59	14.81	1.675	10.66	0.190	11.10	6.69	0.54	2.55	0.206
C-18	Twe	01DG02	51.59	14.44	1.797	10.97	0.199	10.85	6.81	0.63	2.49	0.222
C-19	Twe	01DG03	51.47	14.73	1.725	10.89	0.188	11.02	6.65	0.60	2.52	0.206
C-20	Tcsc	01JB06	52.43	13.74	3.022	12.81	0.208	8.52	4.30	1.60	2.93	0.443
C-21	Taw	01JB32	49.96	16.13	1.399	9.58	0.162	11.29	8.57	0.52	2.22	0.165
C-22	Tcsc	01JB13	51.49	13.53	2.981	14.10	0.219	8.39	4.61	1.41	2.84	0.431
C-23	Taw	01JB25	49.94	16.15	1.460	9.62	0.168	11.29	8.35	0.53	2.30	0.184
C-24	Tcsc	01JB53	51.48	13.32	2.976	14.40	0.223	8.41	4.41	1.51	2.86	0.419
C-25	Tpr	01JB54	50.18	12.74	3.64	15.35	0.251	8.62	4.42	1.39	2.62	0.79
C-26	Twe	01JB55	51.20	14.58	1.833	11.28	0.193	10.86	6.73	0.50	2.59	0.231
C-27	Tpr	01JB56	50.31	12.85	3.66	14.98	0.248	8.64	4.38	1.51	2.62	0.80
C-28	Tpr	01JB57	50.94	12.73	3.57	14.99	0.26	8.41	4.33	1.40	2.59	0.77
C-29	Tpr	01JB58	51.21	12.89	3.58	14.55	0.26	8.45	4.28	1.43	2.57	0.77
C-30	Tcsc	01DG04	52.25	13.49	2.968	13.34	0.221	8.34	4.47	1.59	2.88	0.438
C-31	Twe	01SM06	51.77	14.40	1.895	11.50	0.184	10.55	6.30	0.57	2.56	0.258
C-32	Twe	01SM02	49.68	16.26	1.689	11.22	0.173	10.58	7.18	0.60	2.33	0.292
C-33	Taw	01DG10	50.91	16.32	1.481	8.70	0.166	11.41	7.97	0.64	2.22	0.186
C-34	Taw	01DG08	50.09	16.07	1.414	9.67	0.161	11.54	8.35	0.36	2.19	0.156
C-35	Twe	01JB68	51.07	14.85	1.705	11.14	0.192	11.14	6.80	0.39	2.52	0.197
C-36	Taw	01DG06	54.16	14.57	1.905	11.23	0.170	8.34	4.47	1.99	2.65	0.508
C-37	Taw	01DG05	49.98	16.20	1.470	9.97	0.162	11.02	8.26	0.56	2.20	0.179
C-38	Tcsc	01DG500	54.05	14.72	3.268	10.07	0.183	9.04	3.95	1.47	2.80	0.447
C-39	Twe	01DG53	51.75	14.54	1.799	10.92	0.196	10.94	6.60	0.56	2.46	0.228
C-40	Tcsc	01JB201	52.01	13.50	3.000	13.81	0.221	8.44	4.37	1.46	2.76	0.418
C-41	Tpr	01JB334	50.31	12.70	3.72	15.49	0.26	8.74	4.28	1.28	2.44	0.79
C-42	Twe	01JB40	51.45	14.42	1.862	11.56	0.209	10.85	6.45	0.50	2.47	0.236
C-43	Tcsc	01JB39	52.53	13.51	3.011	13.30	0.224	8.47	4.15	1.53	2.85	0.430
C-44	Twe	01DG12	51.88	14.64	1.734	10.64	0.188	11.12	6.55	0.55	2.50	0.205



GEOLOGIC CROSS-SECTIONS AB AND DC FOR WEIPPE NORTH 7 1/2 MINUTE QUADRANGLE

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