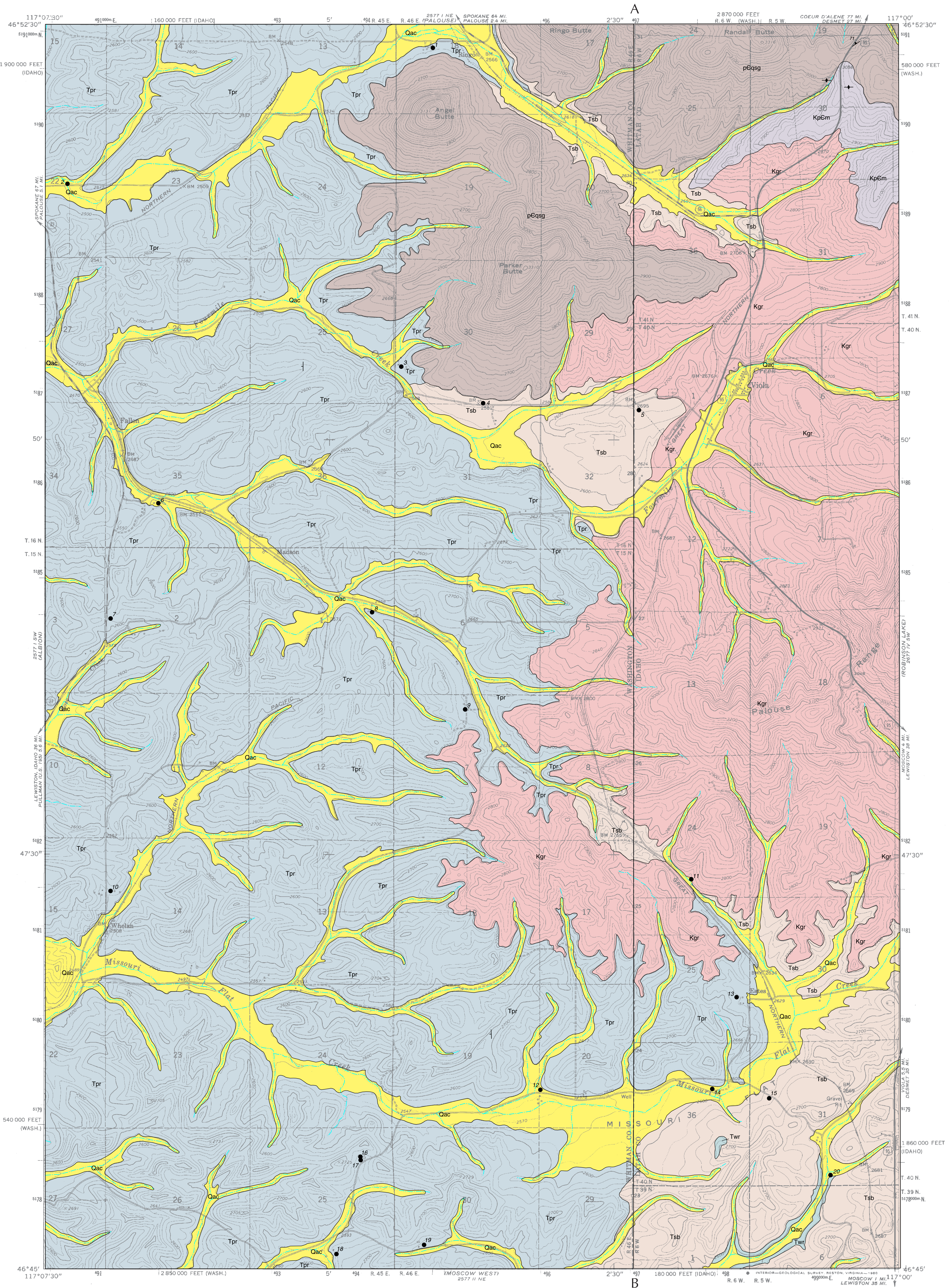
BEDROCK GEOLOGIC MAP OF THE VIOLA QUADRANGLE, LATAH COUNTY, IDAHO, AND WHITMAN COUNTY, WASHINGTON

John H. Bush and Andrew P. Provant

1998



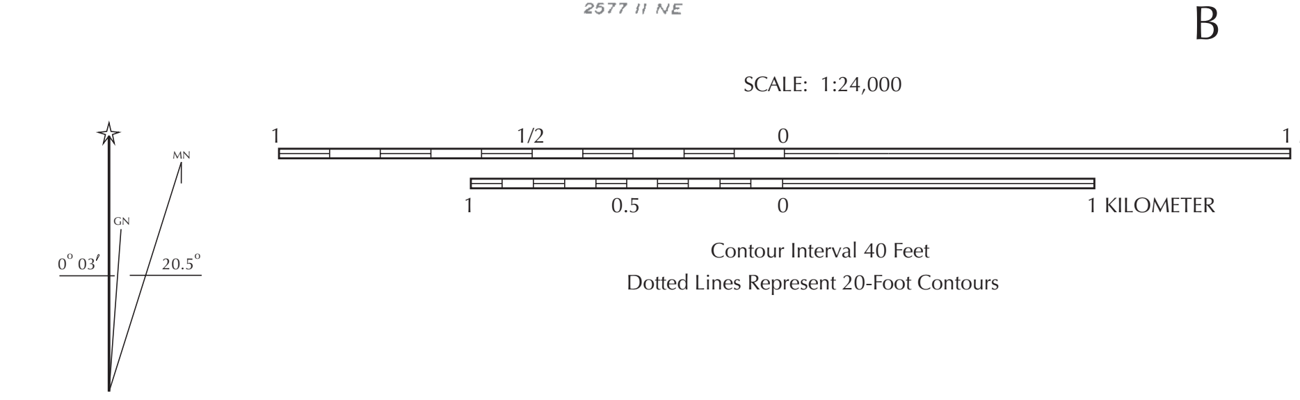
Base map from USGS digital raster graphic.
Hydrography from Idaho Department of Lands digital line graph.

Control by USGS and USC&GS.

Topography by photogrammetric methods from aerial photographs taken 1957.

Polyconic projection. 1927 North American datum. 10,000-foot grids based on Washington coordinate system, south zone and Idaho coordinate system, west zone.
1000-meter Universal Transverse Mercator grid ticks, zone 11.

To place on the predicted North American datum 1983, move the projection lines 16 meters north and 78 meters east, as shown by dashed corner ticks.



UTM Grid and 1971 Magnetic North Declination at Center of Map

SCALE: 1:24,000

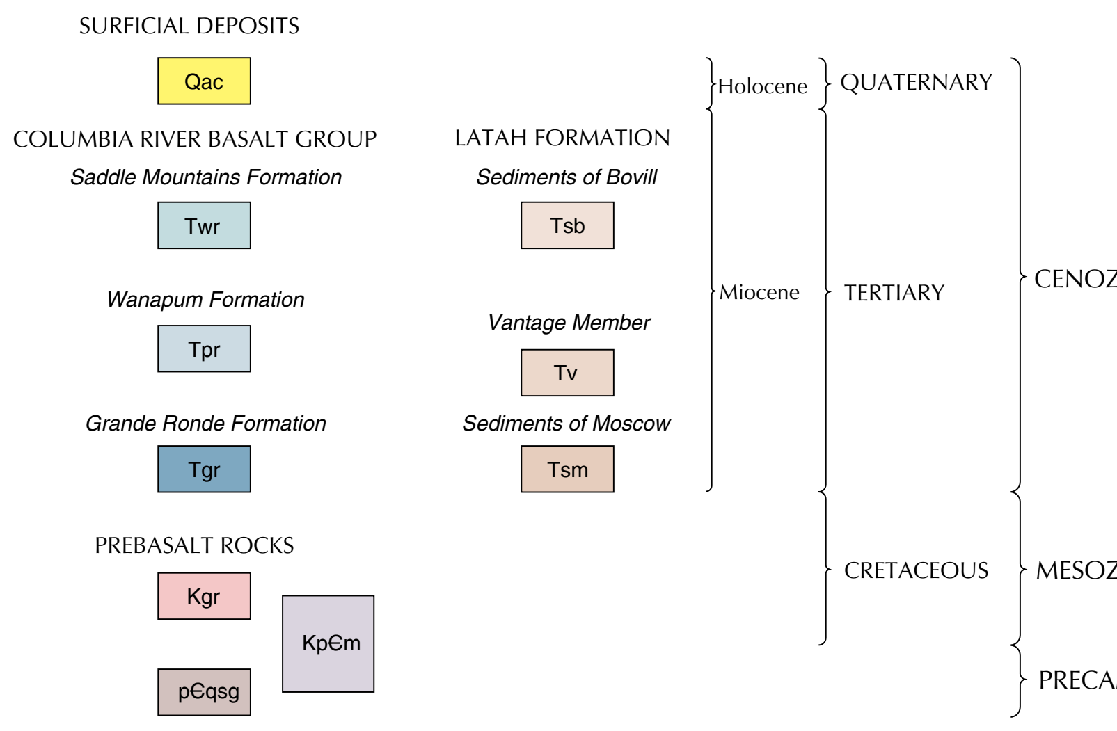
Contour Interval 40 Feet
Dotted Lines Represent 20-Foot Contours

Reviewed by Roy M. Breckenridge and Kurt L. Othberg, Idaho Geological Survey.

Digital cartography by Jane S. Freed at the Idaho Geological Survey's Digital Mapping and Information Lab.

QUADRANGLE LOCATION

CORRELATION OF MAP UNITS



INTRODUCTION

The geologic map of the Viola quadrangle represents a compilation of previous research, water well data (Table 1), and additional field work. The loess distribution of the Palouse Formation was not illustrated in keeping with the emphasis on bedrock geology. The varying thickness of loess forms the rolling Palouse topography and buries the nearly flat upper surface of basalt in the eastern margin of the Columbia Plateau. As a result, the Priest Rapids Member of the Wanapum Basalt (Tpr) appears thicker and the upper surface is flatter than shown on the map. Outcrops are rare, and all contact lines are interpretative. Regional maps by Rember and Bennett (1979) and Swanson and others (1977, 1979a, 1980) as well as maps by Tullis (1940, 1944) were used in the compilation.

DESCRIPTION OF MAP UNITS

Prebasalt rocks here and on surrounding quadrangles have been previously mapped as several different units, including Precambrian pre-Belt Supergroup, Belt Supergroup, metamorphosed Belt Supergroup, Cambrian quartzite, and Cretaceous metamorphosed and unmetamorphosed Idaho batholith (Tullis, 1940, 1944; Bond, 1978; Swanson and others, 1980; Rember and Bennett, 1979; Hooper and Webster, 1982; and Anderson, 1991). For this map, the prebasalt rocks were divided into a Precambrian quartzite, gneiss, and schist unit, a Precambrian-Cretaceous mixed unit, and a Cretaceous undifferentiated Idaho batholith unit.

The stratigraphic nomenclature for the Columbia River Basalt Group is based on that presented by Swanson and others (1979b). The group is divided into four formations: from base upward, these are the Imnaha, Grande Ronde, Wanapum, and Saddle Mountains. No basalt of the Imnaha and Grande Ronde Formations is exposed in the Viola quadrangle.

Overlying the basalt flows is a deposit of unconsolidated sediments of the Latah Formation. Earlier researchers on the Moscow area referred to these sediments as the Canfield-Rogers deposit (Hubbard, 1956; Hosterman and others, 1960). There are similar deposits throughout Latah County. Informally, this unit is named the sediments of Bovill for exposures in clay pits near Bovill in eastern Latah County. The term is to be used for Miocene sediments that are laterally equivalent with and generally overlie the uppermost laterally extensive basalt flow. In places, the sediments lie directly on Precambrian or Cretaceous prebasalt rocks.

SURFICIAL DEPOSITS

Qac **Alluvium and colluvium (Holocene)**—Stream, slope-wash, and debris-flow deposits. Compositions variable: commonly reworked loess or mixtures of loess, basalt, and granitoid fragments. Most occurrences are stream deposits that grade laterally into loess of the Palouse Formation and contain slope-wash deposits derived from the loess-covered hills.

LATAH FORMATION

Tsb **Sediments of Bovill (Miocene)**—Clay, silt, sand, and gravel deposits that are laterally equivalent and generally overlie the Priest Rapids Member. In places, they overlie prebasalt rocks. The clays are white, yellow, red, and brown, kaolinite-rich, and in places over 100 feet thick. Exposures are rare, but in places the sediments of Bovill are visible beneath thin loess deposits and in small overgrown exploration pits and quarries.

The distribution of this unit was interpreted primarily from water well logs and reports on the Canified-Rogers deposit (Hubbard, 1956; Hosterman and others, 1960). Depositional interpretations are obtained from regional studies. Upward-fining sequences of gravel or sand to clay are common close to source areas, and couplets of minor silt overlain by thick clay units are common away from source areas.

The sediments of Bovill have several origins ranging from in situ weathered granite to shallow lacustrine deposits. However, most of these sediments are believed to have formed in fluvial environments primarily caused by Priest Rapids flows that created a raised base level, which in turn caused deposition from streams eroding weathered exposures of nearby prebasalt rock.

Tv **Vantage Member (Miocene)**—Consists of sediments between the lowermost Priest Rapids and uppermost Grande Ronde in the Moscow-Pullman area (Siems and others, 1974; Brown, 1976; Kopp, 1994). The unit exceeds 300 feet in thickness beneath Moscow but thins westward to less than 20 feet at Pullman (Lin, 1967). The Vantage is not exposed in Moscow. All data are from water well logs. The sediments consist of interlayered sand, silt, and clay. Wood fragments are commonly found. The sand units are poorly sorted with a high clay content, and the coarse grains of quartz and feldspar are angular with only slightly rounded edges (Cavin, 1964).

Tsm **Sediments of Moscow (Miocene)**—Interbeds of sand, silt, and clay between Grande Ronde flows and between the lowermost flow and prebasalt rocks. Several discontinuous interbeds are in the subsurface beneath Moscow. However, two major units over 100 feet thick can be correlated between wells (Cavin, 1964; Lin, 1967). Eastward, the sand content increases as does the grain size. Westward, these interbeds pinch out or thin to less than a few feet in thickness (Brown, 1976).

COLUMBIA RIVER BASALT GROUP

Saddle Mountains Formation

Twr **Weissenfels Member (Miocene)**—Medium- to coarse-grained basalt with microphenocrysts of plagioclase and olivine in an intergranular groundmass with minor glass (Hooper and others, 1985). In the Pullman area, flows of this member belong to the basalt of Lewiston Orchards (Hooper and Webster, 1982). The outcrops in NW 1/4 of sec. 6 were previously noted as basalt of Lewiston Orchards (Hooper and Webster, 1982). A similar flow on the adjoining Moscow West quadrangle was exposed during the construction of McClure Hall on the University of Idaho campus. Paleomagnetic and geochemical analyses indicated the flow to be the basalt of Lewiston Orchards. It is interpreted as a intracanyon flow overlying the Priest Rapids Member without great lateral extent.

Wanapum Formation

Tpr **Priest Rapids Member (Miocene)**—Medium- to coarse-grained basalt with microphenocrysts of plagioclase and olivine in a groundmass of intergranular pyroxene, ilmenite blades, and minor devitrified glass. Well data and exposures suggest the unit consists of one or two flows with a composite thickness of 160-200 feet. Several workers have previously identified and described these flows (Bingham and Grolier, 1966; Wright and others, 1973; Swanson and others, 1977, 1979b). The flows have reversed magnetic polarity (Wright and others, 1973; Swanson and others, 1979b).

Exposed in numerous roadcuts throughout the quadrangle, but exposures of contacts between individual flow units and flows were not noted. Hooper and Webster (1982) report three chemical types of this member in the Pullman and Moscow area to the south and southwest.

Tgr **Grande Ronde Formation (Miocene)**—Consists of flows of fine-grained to very fine-grained aphyric basalt of Grande Ronde chemical type (Wright and others, 1973; Swanson and others, 1977, 1979a; Reidel and others, 1989). No exposures in mapped area but interpreted to be present in basalt wells exceeding 250 feet in depth.

PREBASALT ROCKS

Kgr **Undifferentiated intrusive rocks (Cretaceous)**—Undifferentiated intrusive and metamorphosed intrusive rocks of the Idaho batholith. Most exposures consist of medium-grained (2 to 3 mm) granodiorite. An exposure of this unit near Viola was dated by potassium-argon methods at 67.8 +/- 2.5 m.y. (Webster and Nunez, 1980). Foliation and pegmatitic zones locally common. Pattern indicates where this unit is known or interpreted to occur beneath the sediments of Bovill.

Kp€m **Mixed rocks (Precambrian-Cretaceous)**—Consists of mixed units of granodiorite, gneiss, schist, and quartzite. Thinly banded, black and white schist and gneiss dominate this unit. Quartzites are recrystallized, with bedding and foliation destroyed in most places. Granodiorite, which in places is pegmatitic, follows and cross-cuts the foliation of the other units.

p€qsg **Quartzite, schist, and gneiss (Precambrian)**—Consists of interlayered units of quartzite, schist, and gneiss. The quartzite crops out on several ridge tops in the northern parts of the quadrangle. The quartzite consists primarily of recrystallized quartz with muscovite, biotite, and zircon accessories. Mapping on this quadrangle and adjoining quadrangles to the north and east indicates these quartzites are resistant remnants from a unit of quartzite, gneiss, and schist rather than a unit dominated by quartzite. Eastward, on the adjoining Princeton and Moscow Mountain quadrangles, the quartzite, gneiss, and schist grade into Belt Supergroup rocks of rippled and laminated argillite, siltite, and quartzite. Exposures on Randall Butte, Parker Butte, and Angel Butte in the northeast corner of the quadrangle suggest that the quartzites are increasing in grain size towards the west. On Randall Butte, the quartzites are at least 200 feet thick.

SYMBOLS

⌒	Contact: approximately located
71 ↘	Attitude of major foliation trends
88 ⊥	Attitude of basalt flows
1 ●	Location of wells reported in Table 1
─◆─	Vertical or near-vertical foliation trend

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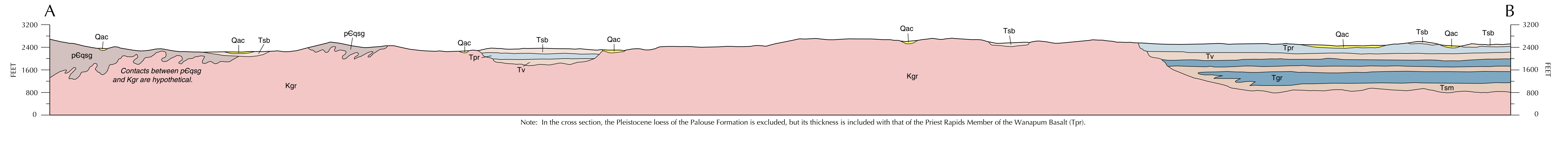
Table 1. Wells on the Viola Quadrangle

Number on Map	Owner	Year Drilled	Well Depth (ft)	Land Surface Elev. (ft)	Reported Depth to Water (ft)	Well Type[1]	Depth to Bedrock (ft)	Uppermost Rock Units	Remarks
1	Main, K.	--	225	2570	--	D	--	--	Data from owner
2	Rupp, E.	--	165	2470	--	D	--	Tpr	Lum II (1990)
3	Lawson, R.E.	--	130	2555	--	D	--	--	Data from owner
4	Hill, Brock	--	80	2585	--	D	--	--	Data from owner
5	Viola Wtr & Swr Dist.	1984	350	2695	--	M	30/134	Tsb/Tpr	Driller's log
6	Swan, Roger	1988	155	2510	11	D	--	--	Driller's log
7	Kimball	--	325	2620	--	D	--	--	Data from owner
8	Mader, John	1953	26	2575	--	D	--	--	Walters (1969)
9	Fleenor, S.	--	100	2625	--	--	--	Tpr	Lum II (1990)
10	McGreevy, Daniel	1990	324	2535	235	D	--	--	Driller's log
11	Fleener, Loyal	--	25	2718	10	D	--	--	Crosthwaite (1975)
12	O'Donnell, John	1953	59	2575	--	D	--	--	Walters (1969)
13	O'Donnell, John	1962	130	2665	46	D	--	--	Ross (1965)
14	O'Donnell, W.M.	1948	204	2608	77	D, S	--	--	Crosthwaite (1975)
15	Carson, A.N.	--	135	2610	1	D	--	Tpr	Lum II (1990)
16	Boyd, Merrill	1953	137	2645	--	D	--	--	Walters (1969)
17	Boyd, Merrill	--	215	2650	--	D	--	--	Walters (1969)
18	Boyd, L. (W.M.)	1941	264	2609	--	D	65	Tpr	Lum II (1990)
19	Motley	1994	230	2615		D	--	--	Data from owner
20	Niehenke, Norbert	1991	128	2620	89	D	85	Tpr	Driller's log

[1] D = domestic well; M = municipal well; S = spring



Note: In the cross section, the Pleistocene loess of the Palouse Formation is excluded, but its thickness is included with that of the Priest Rapids Member of the Wanapum Basalt (Tpr).

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