BEDROCK GEOLOGIC MAP OF THE ELBERTON 7 ½ MINUTE QUADRANGLE, WHITMAN COUNTY, WASHINGTON

JOHN H. BUSH, DEAN L. GARWOOD, AND BRANT A. HALVER

2006

INTRODUCTION

The bedrock geologic map of the Elberton quadrangle was constructed primarily from examination of major outcrops and water well drill logs (Table 1). Regional maps by Swanson and others (1980) and Gulick (1994) were used to assist with regional trends. Mapping of the Columbia River Basalt Group (CRBG) was facilitated by the readily identifiable Roza flow that separates the Priest Rapids from the uppermost Grande Ronde in the western half of the quadrangle.

Distribution of loess of the Palouse Formation is not illustrated on the map in keeping with the emphasis on bedrock geology. For the same reason, colluvium next to topographic highs of pre-CRBG units is also not shown. However, alluvium and colluvium associated with the major streams is illustrated, because sedimentation patterns of modern streams help interpret bedrock contacts and structural relationships in basalt terrains. Continuous outcrops are rare and contacts between basalt and the older units are covered with loess and colluvium. Therefore, many of the contact lines are interpretative.

The lack of deep drill data makes structural interpretations on the Elberton quadrangle difficult. The most significant structural features in the basalt are broad folds with shallow plunges. Such folds are difficult to detect without detailed mapping on a regional scale. Geologic work in recent years has shown that the basalt is much more structurally complex in the Pullman-Moscow area than previously thought (Bush and others, 2001, Teasdale and others, 2001; Teasdale, 2002; Bush and Garwood, 2003). Dip slopes and folds are illustrated on the Elberton

quadrangle wherever possible. Regional geologic trends were used to assist in the map construction.

DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

Qac Alluvium and Colluvium (Holocene) – Stream, slope-wash, and debris-flow deposits in drainage areas. Composition consists of loess, basalt, and pre-CRBG materials. In the Palouse River, mixtures of granule and sand-sized basalt and quartz fragments are common. Locally near outcrops, cobbles and pebbles of basalt dominate. In the intermittent drainages reworked loess is more common. Close to pre-CRBG topographic highs fragments of loess and poorly rounded quartz and quartzite fragments occur in poorly sorted mixtures.

Ql Palouse Formation (Pleistocene) – Silty and clayey loess of the Palouse hills. Shown in cross-section only.

COLUMBIA RIVER BASALT GROUP

The stratigraphic nomenclature of the Columbia River Basalt Group (CRBG) is based on that presented by Swanson and others (1979). The group is divided into four formations: from base upward, these are the Imnaha Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt. On the Elberton quadrangle, no units of the Imnaha and Saddle Mountains formations have been identified. At the surface there are outcrops of the Priest Rapids and Roza members of the Wanapum and the upper units of the Grande Ronde.

WANAPUM FORMATION

Tpr Priest Rapids Member (Miocene) – Medium- to coarse-grained basalt with phenocrysts of plagioclase and olivine in a groundmass of intergranular pyroxene, illmenite blades, and minor devitrified glass. Other workers have previously identified and described these flows (Wright and others, 1973; Swanson and others, 1979). These flows have reverse magnetic polarity (Wright and others, 1973; and Swanson and others, 1979). The Priest Rapids is exposed in quarries and road cuts, and crops out along the Palouse River throughout the quadrangle. The Priest Rapids is approximately 200 feet in thickness.

Tr Roza Member (Miocene) – Consists of flows of basalts with abundant plagioclase phenocrysts. The phenocrysts average approximately 10 mm across and occur with phenocrysts of olivine and augite in an intergranular groundmass. The unit is approximately 100 feet thick along the western border, but it thins and pinches out in an eastward direction near the midpoint of the quadrangle.

GRANDE RONDE FORMATION

Tgr_{N2}, Tgr_{R2} (Miocene) – Consists of flows of fine-grained to very fine-grained aphyric basalt. The uppermost part the Grande Ronde is exposed in small outcrops along the Palouse River. The deepest well (W-5, Table 1) in the Grande Ronde is only 200 feet deep.

Tl LATAH FORMATION (Miocene) – Consists of clay, silt, sand, and gravel deposits that range from a few feet to over 50 feet in thickness. The sand is angular to subrounded, poorly sorted, and consists primarily of quartz with muscovite common in places. The term “Latah Formation” is typically used for any sequence of sediments interlayered with or associated with Miocene basalt flows of the Columbia River Basalt Group in the eastern part of the Columbia Plateau. On the Elberton quadrangle, thin (<15 feet) interbeds of the Latah Formation above and below the Roza Member crop out along Silver Creek in the northwest part of the quadrangle.

PRE-CRBG UNITS

The pre-CRBG units on the Elberton quadrangle are difficult to subdivide due to the lack of exposures. All of these units lack the ability to transmit large quantities of ground water and understanding their contact with the basalt units is important. All existing well, float, and outcrop data available was used to construct the geologic map and associated cross-sections. However, it must be understood that the contact lines represent a working basis for future workers and are interpretive.

BELT SUPERGROUP

Pasp Undivided argillite, siltite, and phyllite (Precambrian) – Consists of greenish-gray argillite and light gray siltite with minor micaceous phyllite in places. Relict bedding consists of alternating light gray siltite and dark gray argillite laminations and microlaminations. Gulick (1994) noted small occurrences of the unit in the southeast and east portions of the quadrangle. From those occurrences, the unit was mapped using small exposures, float, and shallow well data. This unit and the quartzite exposed on Kamiak Butte, located to the south, form a pre-CRBG high that the Palouse River flows around to the north-northwest. The laminations and microlaminations of this unit are typical of the Belt Supergroup throughout nearby northern Idaho.

A small outcrop of pre-CRBG rock occurs near the eastern border where the Palouse River flows onto the quadrangle. The exposure consists of only weathered pieces of siltite, and it is not possible to correctly place the outcrop in its correct stratigraphic position. Gulick (1994) noted the same outcrop and placed it in his metasedimentary quartzite unit.

GENERAL GEOLOGIC DISCUSSION

Regionally the basalt units on the Elberton quadrangle are part of the Palouse Slope located on the eastern edge of the Columbia Plateau (Reidel and others, 2002). West of the quadrangle the slope dips primarily to the southwest. Though the Elberton quadrangle is on the Palouse Slope, the directions of basalt dips throughout the area are quite varied. Those variations are due to the

presence of pre-CRBG rocks, shallow folds, and the intersection of fold trends. These features also influence the course of the Palouse River across the quadrangle.

The Palouse River enters the quadrangle flowing northwesterly out of a basin on the Palouse quadrangle in a northwest-trending syncline. This northwest direction is also due to the fact that the river is flowing around pre-CRBG rocks that occupy the southern part of the Elberton quadrangle and the northern part of the Albion quadrangle. Near the eastern edge of the quadrangle the river crosses a subsurface structure in the basalt that overlies a ridge of buried pre-CRBG rocks. The elevation of the upper Grande Ronde is lower in the city of Palouse than it is on the eastern edge of the Elberton quadrangle, which indicates that the slope of the Grande Ronde is rising to the northwest towards the eastern edge of the quadrangle. That slope must then drop in elevation towards Elberton on the northwest corner of the quadrangle. It is concluded that the Palouse River cuts across a subsurface high in the upper Grande Ronde near the eastern edge of the quadrangle. A small outcrop of pre-CRBG rock along the river is located in the projected high. The basalt units dip away to the east and west from this high.

The field relations of the Roza flow further substantiates the presence of a subsurface high. The Roza was emplaced from the west and enters the quadrangle at approximately 100 feet in thickness, but pinches out just west of the high. The Roza was emplaced after post-Grande Ronde basining against the high. Once the Palouse River crosses the gap in the central portion of the quadrangle it meanders and changes direction several times before flowing northwest into Elberton. The river then changes its northwest trend west of Elberton and flows primarily southwest towards Colfax.

GENERAL HYDROGEOLOGIC DISCUSSION

Our research did not note any high-production wells in the Grande Ronde and to our knowledge there are no deep wells into the Grande Ronde with stratigraphic and hydrological data available for the Elberton quadrangle. In the eastern part of the quadrangle, the basalt is confined by pre-CRBG rocks on the southern edge and similar rocks to the northeast on the adjoining Palouse quadrangle. It would be logical to assume flow to the northwest from Palouse towards Elberton.

However, the subsurface topographic high in the east-central part of the quadrangle could be an impediment to that flow in the Grande Ronde. On the west side of the high, the dip of the basalt units and the flow of the river are in the same direction and it is assumed that ground water flow towards Elberton is likely. Domestic well logs show minor production from the upper Grande Ronde, Roza, and Priest Rapids, depending on location.

The pinch out of the Roza does appear to have an effect on the ground water movement. There are several historical and present-day springs on the western part of the quadrangle in the vicinity of Elberton. The largest of those springs (Silver Springs) is located at the approximate area were the Roza pinches out. East of the pinch out, in particular east of the subsurface high, springs are rare. The basalt units in the subsurface should increase their westward dip on the west side of the projected high and it seems logical that ground water movement at the town of Elberton would be west and southwest.

Ground water flow near the contact of the basalt with the pre-CRBG units is expected to be varied. At most locations the basalt units rise in elevation towards the pre-CRBG rocks. This rise typically occurs over a distance of a mile or two. Movement should be down the dip of the basalt units. On the Elberton quadrangle, the contact is very irregular and at some locations movement could be in several directions. Well log data shows that wells in basalt near the contact were completed at shallow depths with high water levels.

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Table 1 - Wells used in Construction of Bedrock Map of the Elberton 7 ½ Minute Quadrangle, Whitman County, Washington.

Well No.	Original Owners Name	Total Depth (ft)	Overburden Thinkness (ft)	Geologic & Other Comments	Sources *
W-1	Walt Roach	145	39	Begins in Priest Rapids Roza at 126 ft.	Visual
W-2	Lynne Cooper	280	Unknown	Well completed in Grande Ronde.	Visual
W-3	Joe Meyer	68	3	Well begins in Grande Ronde.	?
W-4	Phil Liebe	88	7	Well begins in Grande Ronde.	Visual
W-5	Steven Backmeyer	200	25	Well begins in Grande Ronde.	Visual
W-6	Mald	370	85	Well completed in interbed near top of Grande Ronde? Roza is thin, 30 ft. or missing.	Visual
W-7	Terry Blair	220	17	Preist Rapids is 174 ft. thick, interbed is at least 46 ft. thick, and Grande Ronde is at ~2280 ft.	Visual
W-8	Raymond Romjue	108	8	Well is in Pre-basalt argillite and siltite.	Visual
W-9	Randy Baldec	105	34	Well is in Priest Rapids.	Visual
W-10	Lee Riddle	275	33	All Basalt, starts in Priest Rapids, no break with Roza or Grande Ronde noted.	Visual
W-11	Allen Slomaker	124	110	Overburden includes post - Priest Rapids sediments.	Visual
W-12	State Parks & Recreation Commission	170	143	Overburden includes post - Priest Rapids sediments.	Visual
W-13	D. F. Lange	237	20	Top of Roza approx. ~2240 ft.	Walter & Glancy, 1969.
W-14	John Gwinn	266	46	Base is Priest Rapids at 185 ft. in depth, top of Grande Ronde.	Walter & Glancy, 1969.

* Visual indicates location of buildings and well log location matched.