State of Oregon
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OPEN-FILE REPORT
O-06-16

PRELIMINARY GEOLOGIC MAP OF THE TABLE ROCK 7.5′ QUADRANGLE, UMATILLA COUNTY, OREGON

By

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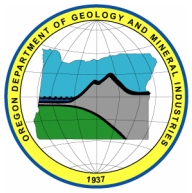

2006

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Oregon Department of Geology and Mineral Industries Open File Report
Published in conformance with ORS 516.030

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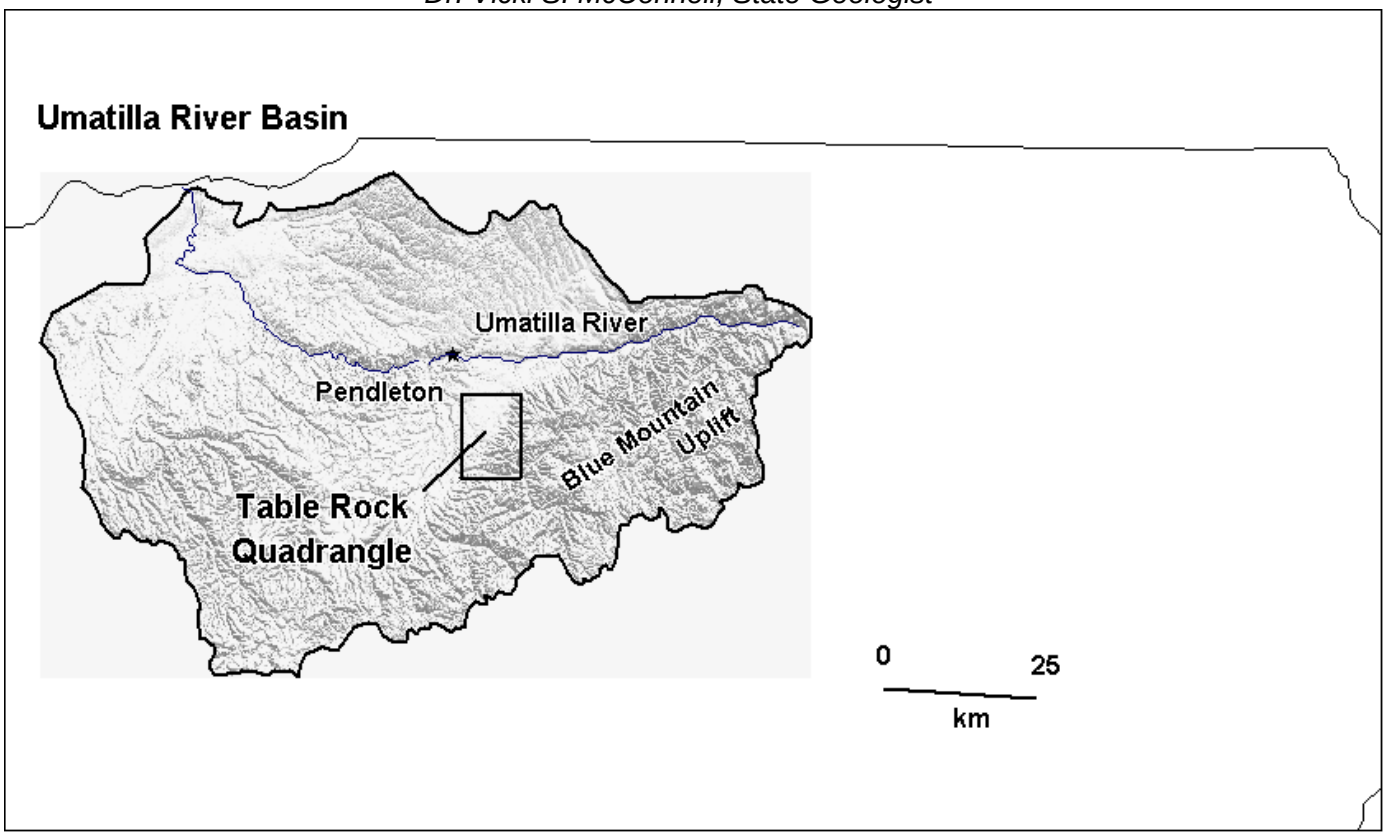


INTRODUCTION

The Table Rock 7 ½' quadrangle is located along the northwest flank of the Blue Mountains Province of northeastern Oregon, just east of Pendleton, Oregon. Much of the quadrangle lies within the tribal lands of the Confederated Tribes of the Umatilla Indian Reservation. Dry land wheat and cattle are the main agricultural products. Primary geologic resource is groundwater, the long term sustainability of which is presently unknown.

The Table Rock quadrangle is underlain by an unknown thickness of Miocene flood basalts (Columbia River Basalt Group). Two flow packages exposed at the top of the Columbia River Basalt Group have sufficiently distinct geomorphic expressions and geochemical signatures to allow mapping across the quadrangle.

Methodology and Previous Work

The 1:24,000 scale geologic map of the Table Rock quadrangle was funded by the USGS National Cooperative Geologic Mapping Program. The views and conclusions contained in this document are those of the aurthors and should not be interpreted as

necessarily representing the offical policies , either expressed or implied, of the U.S. Government. The map is released as an interim open-file map product as part of a larger mapping project covering the Umatilla River basin (Figure 1) and has not yet been peer reviewed. The United States Government is authorized to reproduce and distribute reprints for governmental use. Geologic data were collected at the 1:24,000 scale combining new mapping with published and unpublished data from air photos, orthophotoquads, and digital shaded relief images derived from USGS 30 m DEM (Digital Elevation Model) grids. Mapping was supplemented with x-ray fluourescence (XRF) geochemical analyses from Washington State University and Franklin and Marshall. Subsurface geology in cross sections is based on analyses of water-well drill records.

Geologic studies in the Table Rock quadrangle first began in the1960's when Hogenson (1964) released a report on the geology and groundwater of the Umatilla River basin. Reconnaissance mapping in the late 1970's by the U.S. Geological Survey, resulting in the 1:250,000 scale map of the Pendleton quadrangle (Walker, 1973). Columbia River Basalt Group units were later mapped in detail by Swanson and others, 1980; who also collected a considerable amount of geochemical data (Wright and others, 1980; 1982). Additional work by Gonthier and Harris (1977), Gonthier and Bolke (1993) and Whiteman and others (1994) dealt primarily with Columbia River Basalt Group aquifers.

PRELIMINARY DESCRIPTION OF GEOLOGIC UNITS – TABLE ROCK QUADRANGLE, UMATILLA COUNTY, OREGON

Surficial Deposits

Qa Stream alluvium (Holocene and late Pleistocene) Gravel, sand, and silt deposited in active stream channels and on adjoining flood plains. Includes gravel and channel sand deposited in active or recently channels and overbank silt and mud deposited along the modern flood plain of McKay Creek.

Qt Terrace deposits. (Pleistocene) Unconsolidated to weakly consolidated, brown to orangish brown deposits of coarse boulder gravel and pebbly sand. Unit is exposed in road cuts through benches along McKay Creek. Gravels are typically matrix supported and made up of angular and subangular to subrounded clasts of aphyric and porphyritic lava. Clasts are typically brown to dark reddish brown in color. Includes both stream terrace and cut-off alluvial fan deposits at the mouths of

tributary streams to McKay Creek. Generally no more than 10 m thick. Locally mantled by pale yellowish brown silt or white ash.

TERTIARY VOLCANIC AND SEDIMENTARY UNITS

Tms **McKay Formation (late Miocene)** McKay Formation of Farooqui and others (1981) Conglomerate with subordinate sandstone to siltstone interbeds. Clast-supported conglomerate beds are made up of subrounded basalt and basaltic andesite cobbles and pebbles and contain occasional boulders as large as 30 cm in length. Includes discontinuous lenses of coarse- to medium-grained, pale yellowish brown to yellowish gray, pebbly volcanic sandstone that is locally cross-bedded, medium to fine-grained volcanic sandstone, siltstone, and reworked ash. In places the sandstone and siltstone include pale brown paleosols that contain burrows, root molds, and vertebrate fossils. Unit is mapped largely on the basis of rounded land forms, water well logs, and rounded gravel float. Exposed only in road cuts, ditches and along the shoreline of the McKay Reservoir. Based on water well logs, unit is as much as 90 m thick. Over 99.9 % of the gravel clasts are fine-grained, aphyric volcanic rock fragments derived from the Grande Ronde Basalt. Conglomerates also contain rare, well-rounded cobbles and pebbles of dark green amphibolite, weathered white rhyolite, white vein quartz, and white granite. Grande Ronde Basalt clasts typically marked by thin (<0.2 cm) light olive gray to light bluish gray weathering rinds. Sandstones comprised mostly of angular to subangular plagioclase grains, with subordinate angular to subangular grains of pyroxene (mainly augite) and magnetite and subangular to subrounded grains of quartz. Sandstones also contain minor amounts of hornblende, olivine, in addition to rare garnet grains. Irregularly scoured contacts separate gravel and sandstone beds. Conglomerates are mostly clast-supported and locally contain contain large rip up blocks(~ 1m in length) of sandstone. Individual conglomerate beds typically ~ 1 – 2 m thick. Locally includes tabular sets of cross-beddded sandy basalt pebble to cobble gravel. orm packets > 10 m thick.. Cross-bedded coarse grained pebbly volcanic sandstone locally grades upward into parallel bedded medium- and fine-grained sandstone and siltstone. Zones of caliche occur in both gravel and sandstone near beneath the present day erosional surface. Includes interbedded lenses of grayish-white, water-lain ash. Age, based on vertebrate faunas of the Hemphillian Stage (Shotwell, 1956) is late Miocene or early Pliocene. Unconformable onto an eroded surface of Columbia River Basalt Group lavas;

generally resting on Frenchman Springs but in places sets directly on Sentinel Bluffs.

COLUMBIA RIVER BASALT GROUP

Most of the lava flows exposed in the Table Rock quadrangle are stratigraphically part of the Grande Ronde Basalt, the largest formation within the Columbia River Basalt Group. Top of the section is defined by two or more flows of the Frenchman Springs member, which here defines the base of the Wanapum Basalt. The two uppermost magnetostratigraphic members (N2 and R2) in the Grande Ronde Basalt underlie the Wanapum Basalt. Two chemically and petrographicaly distinctive flow packages have been separated out in the N2 magnetostratigraphic unit. The Sentinel Bluffs member, which everywhere in the Table Rock quadrangle is at the top of the Grande Ronde Basalt N2 magnetostratigraphic unit, overlies the Winter Water member, which overlies both N2, R2, and pre-Columbia River Basalt Group units (Ferns and others, 2004a,b).

WANAPUM BASALT

Tcwf **Frenchman Springs basalt (middle Miocene)** Flow-on-flow sequence of black to grayish-black, generally fine- to medium-grained, iron-rich basalt and basaltic andesite lava flows that weather to shades of brownish gray, brown, and bright orangish-brown. Fresh hand samples are generally dark grayish black to dark blue in color and are commonly sparsely phyric, with small plagioclase feldspar phenocrysts. One porphyritic flow exposed near the base of the unit contains larger blocky plagioclase phenocrysts that are a translucent yellowish-brown color. The translucent phenocrysts are widely scattered and may be as much as 1 cm in width. Usually sparsely microporphyritic in thin section, with scattered microphenocrysts of plagioclase and crystal clots of plagioclase and clinopyroxene or set in variously textured groundmass intergrowths of plagioclase, clinopyroxene, opaques, and glass. Based on limited thin sections, scattered euhedral olivine microphenocrysts may be restricted to the Sand Hollow chemical type flows. Groundmass clinopyroxene can occur as minute interstertal grains or as optically continuous subophitic masses. Opaques occur as either needle-shaped lathes or blocky euhdral crystals. Opaques are highly magnetic. Over much of the quadrangle, poorly exposed, tending to erode to form rounded hills with the best exposures at road cuts and rock quarries or along to stream channels. Individual flows are generally no more than 30 m thick and, where exposed in road cuts, are made up of

stacked flow lobes of massive lava that are separated by thin vesiculated flow tops and basal flow breccias. Cores to flow lobes form 1- 4 m thick, discontinuous, horizontal ledges that may extend for distances as great as 5 km. Flow cores are marked by widely spaced vertical joints and weather to form blocks. Coarser-grained flows commonly weather to form grussy slopes marked by spheroidal-weathering core stones. In quadrangle, appear to erode more readily than the underlying Grande Ronde Basalt. Distinguished on basis of geochemistry from other Columbia River Basalt Group units by high titanium (~3.00 wt percent TiO_2). Although separated elsewhere into 5 geochemical units on the basis of minute geochemical differences (e.g. Beeson and others, 1985), individual Frenchman Springs members could not be mapped separately in the McKay Reservoir quadrangle. Using the criteria established by Beeson and others (1985), the base of the Frenchman Springs is locally marked by a Sand Hollow flow, distinguished by low P2O5 and high Cr. Based on P2O5 and Cr abundances, most of the flows in the Table Rock quadrangle are Sentinel Gap.

GRANDE RONDE BASALT

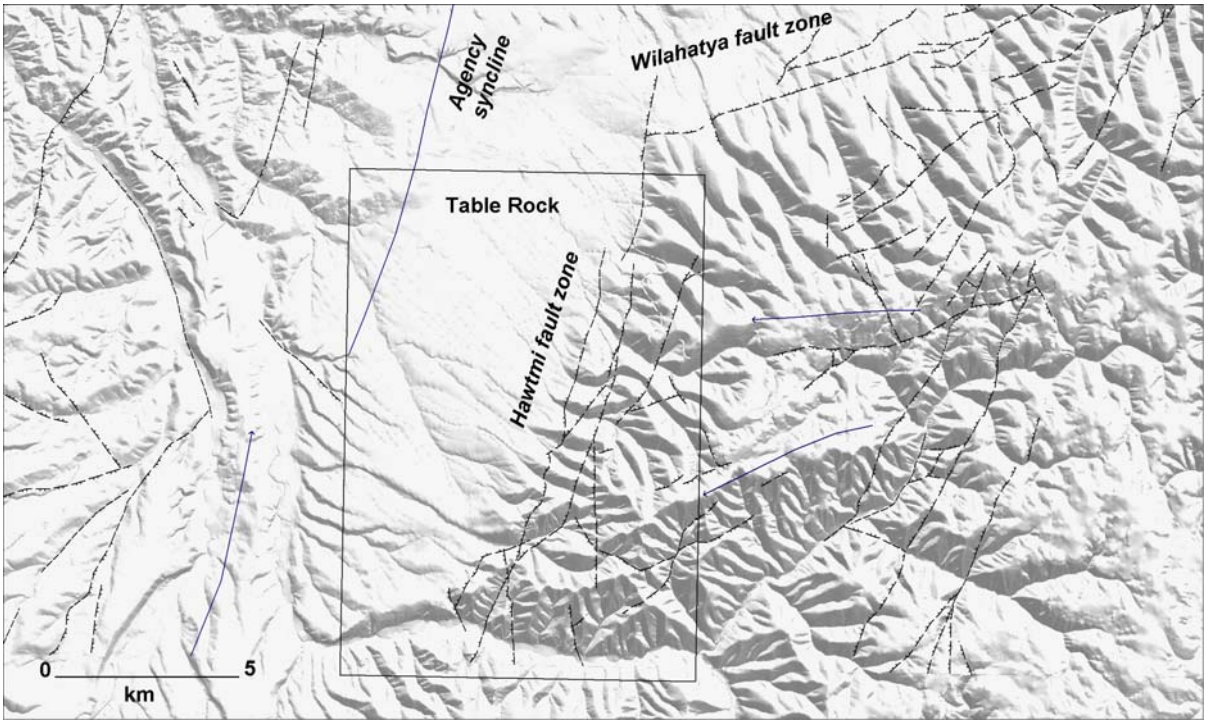
Tcgs Sentinel Bluffs unit (middle Miocene) Flow-on-flow sequence of dark grayish black, medium-grained, holocrystalline, iron-rich basalt and basaltic andesite lava flows. Unit is made up of thin flows and flow lobes, generally < 5m thick, that are marked by vesicular flow tops and basal flow breccias. Weathered surfaces are shades of brownish gray, reddish brown, and red. Thickest flows, which are as much as 20 m thick, are platy jointed. Based on strong geochemical similarities, unit is made up of chemically discrete lava flows that form individual flow packages as much as 30 m thick wherein overlapping flow lobes are separated by vesiculated flow tops and basal flow breccias. Brownish gray, weathered surfaces to coarse grained flows sometimes display diktytaxitic textures defined by a groundmass of randomly oriented, lathe-shaped plagioclase crystals Generally medium to coarse grained and holocrystalline in hand sample. In thin section, commonly displays interstitial textures wherein scattered blocky microphenocrysts of plagioclase are set in a hollocrystalline groundmass of clinopyroxene and plagioclase with minor opaque minerals. May also contain minor amounts of olivine microphenocrysts. Base not exposed, but unit thickens to the northwest, where it is as much as 70 m thick in the Barnhart quadrangle. In many places separated from the overlying Frenchman Springs flows by either a thin red soil zone or brown pebbly conglomerate (Vantage Horizon). In

quadrangle, generally more resistant to erosion than the overlying Frenchman Springs member, tending to erode to benches and tablelands. Separated from overlying Frenchman Springs flows on the basis of outcrop characteristics and geochemistry, most notably containing lesser amounts of titanium (<2.0 wt percent TiO_2) and phosphorous (<0.35 wt percent P_2O_5) than the Frenchman Springs. Equivalent to the Sentinel Bluffs unit of Reidel and others (1989) and the high MgO flows of Wright and others (1973) which mark the top of the Grande Ronde Basalt N2 magnetostratigraphic unit in the Pendleton area.

Tcgw Winter Water unit (middle Miocene) Hackly jointed, fine-grained, generally glassy, iron-rich basaltic andesite and iron-rich andesite lava flows. Unit is made up of as many as 4 flow packages each of which has coalesced to form thick, hackly jointed cooling units as much as 50 m thick. Typically forms ridge crests marked by gray and grayish-brown, angular, equidimensional blocks typically 10 cm in diameter. Flow cores, as exposed in road cuts and quarries, are marked by thin, undulating columnar joints that extend across horizontal, vesicle-rich bands. Flow top breccias typically chaotic, with orange-red breadcrust blocks and, in places, red spatter. Flow bases marked by dense, glassy, hackly jointed breccias containing thin selvages of yellow brown palagonitic glass. Aphyric to sparsely plagioclase phyric in hand samples. Basal zones typically glassy In thin section, generally hyalophitic with semi-aligned plagioclase microcrysts set in a black opaque groundmass. Cores display hyalophitic to intergranular ground mass textures, with granular clinopyroxene and black opaques. Scattered phenocrysts and glomerocrysts of plagioclase and clinopyroxene are not uncommon. In the Table Rock quadrangle, separated from the overlying Sentinel Bluffs unit on the basis of differing outcrop characteristics and geochemical analyses. The generally glassy and thicker Winter Water flows are markedly more silicic ($\geq$ 55.00 wt per cent SiO2) and contain lower amounts of magnesium (< 3.5 wt percent MgO) and higher amounts of potassium (> 1.7 wt percent K2O) than do the Sentinel Bluffs unit. . In the southern part of the quadrangle, thick hackly jointed, glassy flows are locally separated by thin holocrystalline flows with slightly higher magnesium (3.77 wt percent MgO) content. Unit is as much as 220 m thick in the south half the quadrangle, where it rests on R2 magnetostratigraphic unit flows and an older andesite dome complex. Considered to be correlative with the Winter Water unit of Reidel and others (1987) but may include flows of their Umtanum and and Ortley units.

Tcgr$_2$ R$_2$ magnetostratigraphic unit (middle Miocene) Flow-on-flow sequence of aphyric to sparsely plagioclase-phyric lava flows. Includes iron-rich basaltic andesite lava flows and flow breccias. Tops to individual flows commonly marked by red-weathering, blocky flow breccias. Individual cooling units appear to be discontinuous and cannot be traced laterally in outcrop with certainty. Top of the unit on Mckay Creek is marked by a 15 m thick, red-weathering flow that crops out to form cliffs. Easternmost exposures are largely made up of chaotically broken flow breccias that appear to be aa flows. In thin section, typically hyalophitic to intergranular groundmass textures with phenocrysts and glomerocrysts of plagioclase and clinopyroxene. In the Table Rock quadrangle, unit appears to be made up of solely of high titanium – low magnesium flows (> 2.3 wt percent TiO2 and < 3.7 wt percent MgO) that may be equivalent to the Wapshilla Ridge unit as defined by Reidel and others (1989). On McKay Creek, unconformably overlies an older andesite dome complex. Age of the R$_2$ unit lies between 15.7 +/- 0.3 and 15.9 +/- 0.2 Ma (Baksi, 1989).

Tjad Andesite (Oligocene or early Miocene) Gray to dark gray, porphyritic andesite dome complex. Margin and top marked by red-weathering, matrix-supported scoraceous breccia that contains blocks up to .5 m in width of dark gray, porphyritic andesite. Core marked by vertically jointed, conspicuously porphyritic vitrophyre that weathers to shades of gray and pinkish gray. Weathers to form granular soils. Vitrophyre is made up of ~ 20 % plagioclase phenocrysts set in an opaque, dark gray to black glass. Vitrophyre has a mottled appearance in hand samples due to abundant sub-euhedral plagioclase phenocrysts as much as 0.5 cm in length. Vitrophyre is hyalophitic with plagicolase, potassium feldspar, clinopyroxene, and quartz phenocrysts. Vitrophyre also contains holocrystalline xenoliths. Chemically an andesite with ~ 59.0 wt % SiO2; 16.0 wt % Al2O3; and 0.98 wt % TiO2. Considered to be Oligocene or early Miocene in age, based on geochemical similarities (> 15.5 wt % Al2O3 and < 1.00 wt per cent TiO2) to porphyritic andesites and dacites associated with the Tower Mountain Caldera (Ferns and others, 2001). Forms a basement high that remained unburied until the last of the Grande Ronde Basalt flows erupted.



STRUCTURE

The Table Rock quadrangle lies on the east limb of a broad, north-northeast trending, north plunging downwarp or fold generally referred to as the Agency syncline (Hogenson, 1964). East flank of the downwarp is marked by the Hawtmi fault zone (Ferns and others, 2005), which is made up of a series of north- northwest-trending, down-to-the-west high-angle faults. Amount of down-to-the west displacement along the Hawtmi fault zone increases from south to north. Although the relative ages of the Agency syncline and Hawtmi fault zone are not known, no changes of the thicknesses of middle Miocene units can be identified across the structures; suggesting that both structures post-date the middle Miocene.

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