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PRELIMINARY GEOLOGIC MAP OF THE McKAY RESERVOIR 7.5′ QUADRANGLE, UMATILLA COUNTY, OREGON

By

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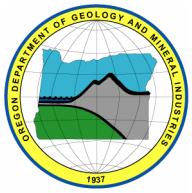

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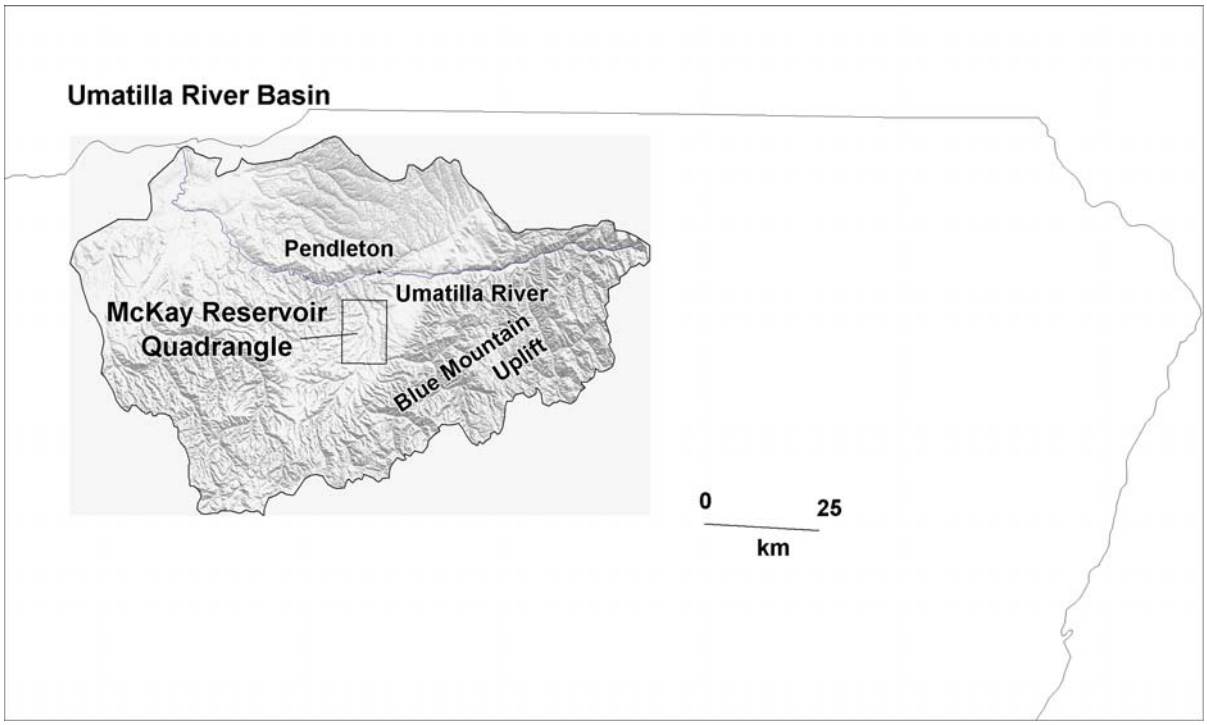


INTRODUCTION

The McKay Reservoir 7 ½' quadrangle is located along the northwest flank of the Blue Mountains Province of northeastern Oregon, just east of Pendleton, Oregon. McKay Reservoir and the McKay Creek National Wildlife Refuge are located in the northeast quadrant of the quadrangle. 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 McKay Reservoir 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 McKay Reservoir quadrangle was partially funded by the U.S. Geological Survey's National Cooperative Geologic Mapping Program. The map is released as an interim map product as part of a larger mapping project covering the Umatilla River basin (Figure 1). 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combining new mapping with published and unpublished data from air photos, orthophotoquads, and digital shaded relief images derived from USGS 30 m DEM (Digital Elevation Model) grids.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 McKay Reservoir 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 – MC KAY RESERVOIR 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 and Birch 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 Birch Creek and 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 Birch and 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)** 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 of rhyolitic composition. 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

Only two flow packages of the Columbia River Basalt Group are exposed in the McKay Reservoir quadrangle. The locally capping Frenchman Springs member is the base of the Wanapum Basalt. The underlying Sentinel Bluffs member marks the top of the Grande Ronde Basalt in the Pendleton area (Ferns and others, 2004a,b).

WANAPUM BASALT

Tcwf **Frenchman Springs basalt (middle Miocene)** Flow-on-flow sequence of black to grayish-black, generally medium- to coarse-grained, iron-rich basalt and basaltic andesite lava flows that weather to shades of brownish gray, brown, and bright orangish-brown. Fresh samples are generally dark grayish black to dark blue in color and are commonly sparsely phyric, with small plagioclase feldspar phenocrysts and/or microphenocrysts. One porphyritic flow exposed near the base of the unit contains scattered 1 cm-wide, blocky plagioclase phenocrysts that are a translucent yellowish-brown color. May contain knots of intergrown plagioclase, clinopyroxene, and olivine crystals. 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, including the flow that marks the base of the unit in the southern part of the quadrangle, are Sentinel Gap.

GRANDE RONDE BASALT

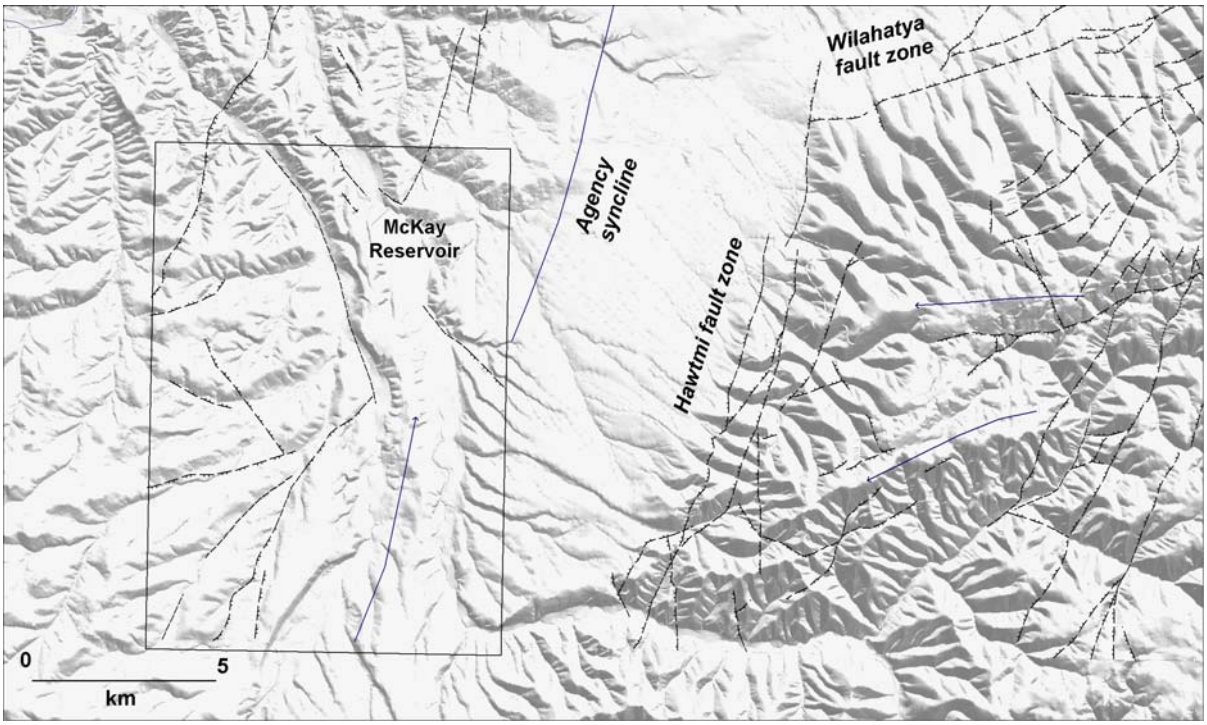
Tcgs Sentinel Bluffs unit (middle Miocene) Flow-on-flow sequence of dark grayish black, iron-rich basaltic andesite lava flows. Only the top of the unit is exposed in the McKay Reservoir quadrangle where it typically forms a resistant bench. Unit is made up of thin flows and flow lobes, generally < 5m 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. Generally holocrystalline. Brownish gray, weathered surfaces to coarse grained flows sometimes display diktytaxitic textures defined by a groundmass of randomly oriented, lathe-shaped plagioclase crystals. Some flows contain olivine microphenocrysts. Base not exposed, but unit thickens to the northwest, where it is as much as 70 m thick in the Barnhart quadrangle. Although separated from overlying Frenchman Springs flows by a thin red soil zone (Vantage Horizon). In quadrangle, more resistant to erosion than the overlying Frenchman Springs member, forming bench or tablelands. Readily distinguished from overlying Frenchman Springs flows on the basis of geochemistry, notably low titanium (<2.0 wt percent TiO_2) and phosphorous (<0.35 wt percent P_2O_5). 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.

STRUCTURE

The McKay Reservoir quadrangle lies on the west limb of a broad, north-northeast trending, north plunging downwarp or fold generally referred to as the Agency syncline. East flank of the downwarp is marked by the Hawtmi fault zone, which separates the uplands of Blue Mountains uplift from the lowlands through which the middle reach of the Umatilla River flows. The lower reaches of Birch and McKay Creek follow a graben structure marked by northwest trending normal faults. This northwest-trending graben is coincident with what is now the thickest part of the Miocene McKay Formation.

Paleocurrent indicators in the form of imbricated pebbles all indicate a north-northwest trend to the stream system in which the McKay Formation was deposited. If the orientation of that stream system was structurally controlled, the small, northwest-trending graben in the McKay Reservoir quadrangle may be an older structure that was active during

the middle Miocene. 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 post-date the middle Miocene.



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