

*Age of the Palouse Formation in the  
Walla Walla and Umatilla River Basins,  
Oregon and Washington*

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THE Walla Walla and Umatilla River basins are the first two major valleys north of the Blue Mountains anticline, which trends northeast in northeastern Oregon and southeastern Washington (Figure 1). The Blue Mountains terminate the plateaus that extend south 100 miles from the Okanogan

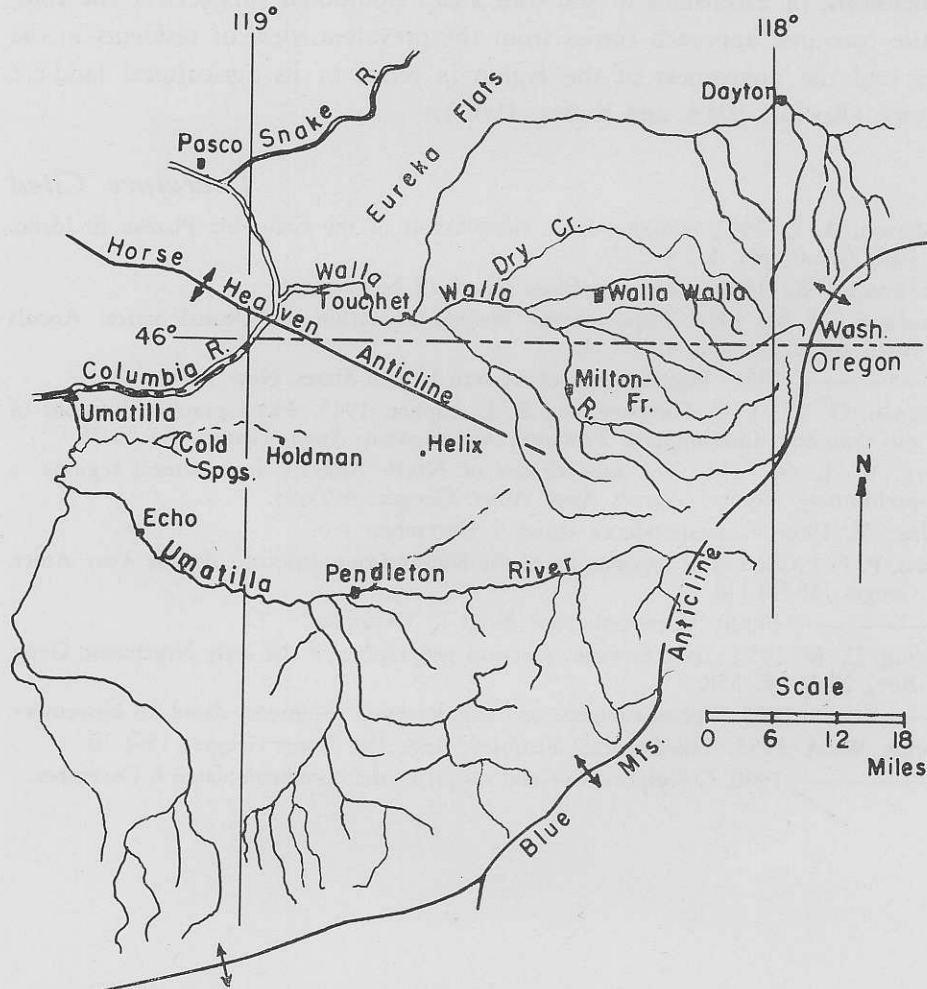


Figure 1. Index map of the Walla Walla and Umatilla River basins.

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Highlands. The plateaus have loessial soils, parts of which were long called the Palouse soil. The entire loess deposit has been named the "Palouse" Formation by Scheid (1940, p. 56), as previously suggested by Treasher (1925, p. 469). The name without quotation marks was approved by the United States Geological Survey in 1946.

Within the altitude range of 300 to 6,000 feet, the river basins traverse different belts of surficial material, ranging from glaciofluvial and fluvial deposits in their lower parts, across alluvial and eolian materials in their middle parts, to eolian and residual soils in the mountain uplands. Some of the overlapping relationships of these materials give evidence of the age of the Palouse Formation.

Loess that seems to belong to the typical Palouse soil, hence also to the Palouse Formation, is referred to herein as typical Palouse Formation; other kinds of loess that have at times also been called Palouse soil are referred to in this paper as younger loess.

Many types of loess in many different parts of this region have been called Palouse soil. The Palouse soil problem (Bryan, 1927) is disregarded, except as it must be mentioned in bringing out evidence on the age of the typical Palouse Formation and on the age of other material that some workers have included with the Palouse Formation.

### *Relations of the Units*

The typical Palouse Formation underlies much of the surface at intermediate altitudes—the upper parts of the valley plains and the adjoining foothills. Its general altitude range is 1,100 to 3,000 feet. Characteristically, it is a light to dark buff, weakly cohesive, clayey silt that is massive and rather uniform vertically. It contains calcareous tubes and streaks as well as a faint columnar block structure near the darker, surface part, which constitutes the soil. In these parts of the basins it is similar to the loess in the commonly accepted type area of the Palouse Formation, the "core area" of the "Colfax, Pullman, and Moscow triangle." Likewise, the occurrence of the darker loess soil coincides with areas of greater precipitation, and hence, with the more luxuriant native prairie vegetation of the soil-darkening kind.

The typical Palouse Formation mostly underlies gently rolling or hilly land, where it mantles the subdued rolling terrain of the preloess surface. It also underlies some nearly flat plateau and terrace surfaces where it was deposited upon uniform valley slopes of the antecedent topography. Some of these loess plains are preserved northeast of Pendleton and in the Mill Creek and Cottonwood Creek areas northeast and southeast of Walla Walla.

Younger loess that some authors have included in the Palouse Formation occurs mainly at the western ends of the Walla Walla and Umatilla River basins and at altitudes lower than the typical Palouse deposits. In general, it is more silty, more sandy, lighter in color, and less cohesive than the typical Palouse. The westward progression from the typical Palouse Formation to younger loess ends in the eolian soils that thinly mantle the Touchet Beds of Flint (1938, p. 494). These latter soils have the highest proportions of silt and sand and are lightest in color. The names "Sagemoor" and, in places, "Ritzville" are applied to the soils directly overlying the Touchet Beds (Harper, and others, 1948, map).

#### *Data on the Age of the Palouse Formation*

##### Lower Limits

In the Umatilla River basin the eroded top of a conglomerate of Hemphillian (middle Pliocene) age (Shotwell, 1955, p. 141) underlies the typical Palouse Formation in the plains and low plateaus east of Pendleton. One of the largest areas underlain by this vertical sequence is the low plateau north of the Umatilla River seven miles east of Pendleton (Hogenson, 1956, map). In that area, the typical Palouse Formation in places is covered by one to three feet of younger, light gray-buff eolian silt and some volcanic ash of Recent age.

In the Walla Walla River basin the typical Palouse Formation, such as occurs in the Prospect Point Ridge between Mill Creek and Russell Creek, just east of Walla Walla, lies upon basaltic gravels (Figure 2), which are inclined westward and form a part of the widespread stratum of old gravels of Pleistocene age that underlies the valley plains to the south and west. On the basis of similar lithology and similar relation to the Horse Heaven anticlinal uplift, the old gravels and interfingering old clays are believed to be equivalent to the Ringold Formation. The Ringold was assigned a middle to late Pleistocene age by Strand and Hough (1952, p. 154). Where the old gravels can be observed directly above the bedrock basalt, no loess lies between. It may be reasoned that streams depositing these cobbly gravels would have removed any soil that was present, hence, the absence of loess between the gravels and basalt would not establish the loess as entirely postgravel in age. However, the loess overlying the gravels is similar in thickness and lithology to the loess where the gravels are lacking, suggesting that the loess is entirely younger than the old gravels, hence post-Ringold or late Ringold in age.

##### Upper Limits

Many observers consider the type Palouse Formation to predate the main glacial episode of this region. However, unanimity is lacking, probably because



Figure 2. Old gravels overlain by typical Palouse Formation (loess) in road-bank on south side of Prospect Point Ridge, three miles southeast of Walla Walla. The loess becomes thicker in the slope to the right (north). These gravels are the uppermost part of a stratum whose thickness increases westward beneath the Walla Walla Valley.

of the want of distinction between Palouse Formation and Palouse soil and because some postglacial loess has been referred to as Palouse soil. The writer's observations agree with those of Flint (1937, p. 222) that but one glacial stage, the Wisconsin, occurred in this region. That one stage may have had various substages caused by resurgences and uneven recession. In the past, confusion as to which loessial deposits belonged to the Palouse Formation left in doubt the age assigned the end of the deposition of the Palouse Formation. Because the younger loessial materials are not typical of the Palouse deposits, the writer does not consider these younger materials to be a part of the Palouse Formation.

The typical Palouse Formation, as described above, is overlain by the glaciofluvial Touchet Beds, which are considered to be late Wisconsin in age. This relation is clearly shown at the overlap of the thin outer edge of the Touchet Beds and their associated erratics at the west end of Prospect Point Ridge, just east of Walla Walla, and by many exposures in the Dry Creek drainage north of Walla Walla. Farther west, the typical Palouse and the Touchet Beds are both overlain by materials of the more silty and lighter-colored, younger loess, which was derived largely from wind reworking of the Touchet Beds and associated glaciofluvial deposits. The southern part

of Eureka Flats is underlain by this sandy loess, which lies upon Touchet Beds. In the hill lands to the east of the Flats, this late Pleistocene and Recent silty loess mantles the older loess. Similar occurrences are present in the Umatilla River valley, where the silty loess thinly overlies the windworked top of Touchet Beds and other glaciofluvial deposits in the Echo-Cold Springs area and is flanked to the east by the silty light-colored loess of the Holdman-Helix area.

Soil surveyors recognize this eastward succession of light-colored, silty, and younger loess in their descriptions of soil types such as the Ritzville, Walla Walla, and Athena silt loams; they use the name "Palouse silt loam" only for the darker soils of the foothills and lower mountains (Harper, and others, 1948, map). The soils mapped as the "Palouse," "Athena" and, in part, "Walla Walla silt loams" are developed on the loess referred to herein as the typical Palouse Formation.

### *Conclusions*

The typical Palouse Formation of the Walla Walla Valley is considered by the author to be middle to late Pleistocene.

The greatest deposition of the Palouse Formation closely followed, or accompanied, the deposition of the Ringold Formation and preceded the Wisconsin Glacial Stage. This dating agrees in general with the age findings of Culver (1937, p. 60), is slightly younger than the age assigned by Scheid (1940, p. 57), and narrows a broader time interval given by Bryan (1926, pp. 37 and 45).

If younger eolian deposits that have been termed Palouse soil, especially those in the western parts of the Walla Walla and Umatilla River basins, are to be included in the Palouse Formation, the age would be middle Pleistocene to Recent.

The evidence in these basins suggests that the whole Palouse soil problem would be clarified by restriction of the term "Palouse" to the pre-Wisconsin loess.

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