CHARACTERIZING PALEOSOL VARIABILITY IN SOUTH-EASTERN WASHINGTON: AN ANALYSIS OF SOIL PROFILES ASSOCIATED WITH THE FRENCHMAN SPRINGS MEMBER OF THE WANAPUM BASALT

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The Columbia River Basalt Group (CRBG) is a vast series of flood basalts that erupted over 12 million years during the Miocene. The Frenchman Springs Member of the Wanapum Basalt is a subunit of the CRBG that erupted at about 15 Ma. The Frenchman Springs Member accounts for most of the basalt exposed in South-Eastern Washington. Exposure of this unit was aided by the erosion of loess and colluvium from the Missoula floods (15 Ka). The degree of weathering seen in the basalt preserves a record of the paleo weathering environment, during the interval before subsequent volcanic eruptions. In this study, we documented soil development on basalt flows of the Frenchman Springs Member capped by the Umatilla Member in the Columbia Basin. We excavated sites looking for distinctive basalt flow-top characteristics such as pahoehoe texture, reddened material, and highly vesicular rock. Basalt flows were tentatively identified in the field using pXRF. Weathering profiles were excavated, cleaned, and described in the field to assess the degree of weathering. Additional samples were collected for thin sections. Natural exposures of weathered basalt flow tops are rarely seen due to slope forming weathering processes and therefore excavation was crucial to the analysis of these weathering profiles. Samples were analyzed using WDXRF to determine the cation depletion within the weathered basalt to quantify the degree of weathering. Chemical weathering and formation of secondary minerals between basalt layers vary significantly by site. Paleosols formed between the Frenchman Springs and Umatilla flows demonstrate an extreme depth of weathering provided by the presence of saprolite and deeply weathered core stones. The degree of weathering found in these soils correlates with characteristics of Vertisols and Oxisols. These soils differ from the modern Aridisols that are characteristic of South-Eastern Washington. Modern weathering profiles exhibit clear contacts between loess and basalt with minimal soil horizon development. This contrast between modern soils and paleosols shows a warmer, wetter climate in the time before the Umatilla's deposition (13-15Ma) to a more arid environment after the majority of the CRB erupted.

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