RECONSTRUCTING PAST CLIMATES OF THE PACIFIC NORTHWEST: AN ANALYSIS OF PALEOSOLS AND WEATHERING PROFILES OF THE SADDLE MOUNTAINS BASALT GROUP

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The Columbia River Basalt Group is composed of approximately 300 individual basalt flows that were extruded between 16.8 and 5.5 Ma, covering much of Eastern Washington and Oregon. Stratigraphically younger flows in the Saddle Mountains Basalt Group (13-5.5 Ma) cover a smaller spatial extent and are less exposed than earlier flows of the Wanapum and Grande Ronde Basalts. Upon deposition, each basalt flow was exposed to surface weathering conditions for a period of time. Weathering profiles are then preserved within the rock record as younger eruptions flood the landscape. Variations found within individual basalt weathering profiles capture information about the paleoclimate at time of deposition, marking a transition from a wetter to drier climate. We investigated weathering profiles developed on Saddle Mountain basalts at three sites within the Columbia Basin: ZJ1, RBQ, and 9M3. All three sites expose a basal flow identified as the Umatilla Member of the Saddle Mountains basalt (~13 Ma). At the ZJ1 and RBQ site, the Umatilla member is overlaid by the Pomona Member (~11.8 Ma); the 9M3 site is a contact between the Umatilla member and the Ice Harbor Member (~8.5 Ma). In the field, we preliminarily identified each flow using pXRF, then excavated each contact and described the soil profile. We quantified the degree of weathering by field-based morphological descriptions and determined elemental abundances of weathered and unweathered basalt using XRF. Elemental abundances are used to identify basalt flows and further quantify the degree of post depositional alteration by weathering indices. In all three sites, the basalt was subjected to sufficient physical and chemical weathering for a distinct soil profile to develop. The contact between basalts exhibited a transition from unweathered underlying basalt to a gradation of spheroidal weathering and breakdown of massive basalt parent material into smaller clasts laced with secondary minerals and paleosol horizons before a distinct shift to the overlying Saddle Mountain flow. However, we observed extensive variation between weathering profiles at individual sites despite the geographic proximity of all sites studied.

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