Differential Uplift and Incision of the Yakima River Terraces

Details

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Abstract

The Yakima fold and thrust belt comprises 12 reverse-faulted folds deforming Miocene basalts of the ~14,000 km2 Columbia River Plateau in central Washington State. Contemporary N to NE-directed shortening of ~1–2 mm/yr occurs across the belt, but the distribution of Quaternary deformation among the individual Yakima folds and faults is unclear. The Yakima River incises roughly normal to several of these structures south of Ellensburg, WA, where topography mimics structural relief and fluvial incision may be a proxy for differential rock uplift. Here, we combine LiDAR analysis, field mapping, and cosmogenic isochron burial ages of gravels above strath terraces to quantify the rate of Quaternary incision through two of these folds, Manastash and Umtanum Ridges. We mapped terraces flanking the Yakima River at five levels—individual terraces consist of mixed rock-type river gravel deposits capping basalt straths. We sampled eight terrace gravels for isochron burial dating utilizing cosmogenic 10Be and 26Al to determine terrace ages and calculate incision rates. Preliminary isochron burial ages from two sampled terraces yield mid-to-early Quaternary ages for terraces ~60 and ~15 m above the modern Yakima River (1.08 ± 0.29 Ma and 1.59 ± 0.25 Ma, respectively). Although these ages overlap within error (1s), the younger, higher terrace lies within the core of the Manastash Ridge anticline, while the lower, older deposit occurs in the intervening syncline north of Umtanum Ridge. Corresponding incision rates are < 0.10 mm/yr, and are consistent with differential uplift of the Manastash Ridge anticline, despite large age uncertainties resulting from the narrow range of relatively low 10Be concentrations for analyzed samples. We

are processing additional samples to reduce burial age uncertainties, and characterize incision and uplift rates on six more strath terraces spanning heights of ~5-100 m above the active channel, distributed across the Manastash and Umtanum Ridge folds.

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