Constraints on kinematics, timing, and along-strike variations in the western Idaho shear zone, West Mountain, west-central Idaho

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The West Mountain, west-central Idaho, contains dominantly orthogneisses deformed by the western Idaho shear zone (WISZ). Interleaved within orthogneisses are screens of metamorphosed sedimentary rocks and a migmatite complex, which constrain metamorphism associated with the WISZ to upper amphibolite facies conditions. Steeply E-dipping, N-NNE oriented foliations and a down-dip lineation characterize the fabric within orthogneisses and metasedimentary rocks; mafic segregations exclusively associated with the migmatite complex show a deviation in the lineation, pitching 20°N. Dextral transpressional kinematics at high-temperature conditions is inferred from both consistent shear sense indicators observed on planes perpendicular to both foliation and lineation, and crystallographic preferred orientation (CPO) analysis on quartzites. The West Mountain is spatially coincident with the location of where the WISZ, and the western edge of the North America craton is crossed by the 450 km-long, EW-oriented IDOR seismic line.

New geochronologic and geochemical data constrain the tectonic evolution of the WISZ. U-Pb analyses on zircons from orthogneisses within West Mountain span the ages of 111-91 Ma, indicating both precursory and continuous magmatism coeval with WISZ deformation. The youngest unit on West Mountain is the undeformed Rat Creek granite (88.2 ± 3 Ma). Two Lu-Hf dates on garnets, 97.3 ± 0.7 Ma and 99.5 ± 1.4 Ma, are interpreted to indicate peak metamorphism during WISZ deformation. Geochemical analyses suggest that the westernmost orthogneissic units are dominantly derived from continental material, and thus oceanic-derived material is either not adjacent to the western edge of the WISZ at West Mountain, or not exposed.

The structural, geochronological, and geochemical data together provide a tectonic framework of the WISZ. The foliation declination changes from 005° to 024°, from the northern to the southern part of West Mountain, indicative of a change in orientation of the WISZ. This along-strike variation in foliation declination is regionally consistent and formed during WISZ deformation, and not as a result of subsequent tectonism. The westernmost unit in West Mountain has a U-Pb zircon age of 100.9 ± 3 Ma, yet is only weakly deformed. We interpret that this unit was emplaced pre-tectonically, thus constraining the initiation of the WISZ. Cessation of the WISZ is constrained by the post-deformational emplacement of the undeformed Rat Creek granite (88.2 ± 3 Ma). The complex age pattern from all of the orthogneiss units – temporally equivalent with the Lu-Hf dates on garnets - suggests that magmatism accompanied WISZ deformation.