MGS Happy Hour

LIVE in Missoula

Imagine Nation Brewing: *1151 W Broadway St.*
Donations welcome!

Wednesday November 20th - 5-8 pm

Social & Optional Dinner 5-6:30 pm
Talk 6:30-7:30

Billings Watch Party

MSUB Science Building: *YSHB 101, 1500 University Dr.*
Pizza will be provided. Donations welcome!

RSVP to montanageologicalsociety@gmail.com
by Nov. 19th

Dr. Stuart Parker
Field Geologist
Montana Bureau of Mines & Geology

Stuart Parker is a mapping geologist for the Montana Bureau of Mines and Geology, in Butte. In 2016, Stuart earned a Masters degree in structural geology from the University of Montana, studying under Jim Sears. A scholarship from the Montana Geological Society funded this work on the Centennial Shear Zone. He worked alongside the late Don Winston, correlating the Appekunny Formation across the Belt basin, before going on to a PhD program at Idaho State University in Pocatello. He continues to map the regional geology of Montana and often leads field trips with the Tobacco Root Geological Society and the Geological Society of America. Today he will be presenting a portion of his dissertation research, which he completed in 2021 under David Pearson.

Linking the Sevier and Laramide Belts in the Idaho-Montana fold-thrust belt

The Sevier and Laramide belts of the U.S. Cordillera are defined on the basis of their respective thin- and thick-skinned structural styles, with the later most often attributed to flat-slab subduction. In this presentation, I argue that the thin- and thick-skinned domains of the Idaho-Montana fold-thrust belt are gradational, stacked in a double-decker geometry, and kinematically linked. I begin by highlighting the Lemhi arch, an extremely thin segment of the passive margin near the Beaverhead Range. Here, the condensed carbonate and siliciclastic section lacks Neoproterozoic to Silurian strata, forming a thin veneer (<2.5 km thick) over the blunt pre-Devonian rift margin. Using detailed 1:24,000 scale mapping, we precisely locate the top of the Lemhi arch and describe not only the range of structural styles within the fold-thrust belt, but also the spatial and temporal relationship between structural domains. During the Cordilleran Orogeny, thick-skinned thrusts reactivated pre-Devonian normal faults, deforming the active thin-skinned belt above. To test this “double-decker” hypothesis, maximum burial temperatures were constrained for 42 Paleozoic carbonate samples, using Raman Spectroscopy of Carbonaceous Material (RSCM). RSCM results show elevated maximum temperatures (~200°C) across the hinterland, above the Lemhi arch, suggesting a combination of thin-skinned thrusting and wedge-top sedimentation between ~145 and 80 Ma. Isotherms and the thin-skinned basal detachment were later folded by large-wavelength (~75 km) folds with inferred detachments in the middle crust. A balanced and restorable cross section spanning the Idaho-Montana fold-thrust belt shows the final geometry. Our kinematic model suggests that at least ~245 km of shortening (36%) was partitioned between early thin-skinned shortening above the Lemhi arch (22% shortening), and subsequent thick-skinned thrusting (14%) in the underlying and adjacent basement rocks. Displacement on upper thin- and lower thick-skinned thrusts overlapped between ca. 90 and 70 Ma as a viscous mid-crustal décollement was activated, efficiently transmitting strain through the Lemhi arch to the foreland. Our kinematic model establishes continuity between thin- and thick-skinned thrust domains by a mid-crustal décollement, and does not require flat-slab subduction as a mechanism for thick-skinned thrusting. Instead, the structural style of protracted shortening during the Cordilleran Orogeny (ca. 145–55 Ma) can be explained by the pre-existing mechanical stratigraphy of the upper continental plate. In the Idaho-Montana fold-thrust belt, the Lemhi arch limited the availability of detachment horizons, thereby determining the style of shortening and giving rise to gradual emergence of thick-skinned thrusting.
