Brittle-Plastic Structures Provide Constraints on the Rapid Exhumation of the Central Range: Taiwan

*Lauren Donati[1], Lindsey Aman[1], Susan Adams[1], Jonathan C Lewis[1]

1. Indiana University of Pennsylvania

Taiwan records some of the highest late Cenozoic exhumation rates in the world as the result of the collision between the Luzon volcanic arc and the passive margin of Eurasia. To understand how such rapid exhumation is accommodated, we focus on late-stage plastic and early brittle structures in river outcrop exposures along the eastern Central Range. We specifically focus on the youngest metamorphic fabric in these outcrops documented as S3, syn-kinematic veins, and crosscutting well developed joint sets. We suggest that veins document the bridge between the plastic and brittle regime, as mm-scale veins are locally cut by S3, while others cross-cut the outcrop. The geometry of these structures shows relative consistency. S3 is a shallow-dipping fabric that is locally well developed in cm- and mm-scale folds of older metamorphic fabrics. The veins and joints mostly strike NW-SE and dip nearly vertically. We focus on the details of these geometries over >100 km along strike, and in strike-normal transects along the Chingsui, Hongye, and Xinwulu/Dalun rivers. We see slight variation in the sub-horizontal orientation of S3 from N to S, with the biggest deviation occurring along the Chingsui River near where high-pressure rocks have been discovered. Joints show small changes in dip angle, however consistency in strike, with again, the greatest change in dip along the Chingsui River. Overall the veins are sub-parallel to the joints and show similar along-strike variations, with one exception in the area of the Chingsui River where the veins show more variation in strike. In the strike-perpendicular transects, S3 shows some variation in orientation, while veins and joints seem to change mostly in dip steepness. The patterns we see in the S3, veins, and joints provide constraints in the plastic-to-brittle transition in 3 dimensions. We suggest that S3, as the oldest structure, records the greatest variation in geometry and this reflects post-S3 processes. Similarly, the younger veins and joints show consistent strike and slight dip variation along strike. We suggest that the veins and joints formed in a uniform stress field and were differentially rotated passively in response to gradients in uplift rate and/or magnitude.

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