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Mountain building process of Taiwan orogeny

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We propose a new approach to understanding small-scale orogenic processes, exemplified by the Taiwan orogen. Existing wedge deformation theories offer insight into overall dynamics but struggle to replicate the intricate complexity of natural processes, particularly involving ductile deformation. To address this, we introduce a novel D-layer wedge deformation theory, featuring three key concepts: the transition of mechanical property from brittle to ductile as depth increases, lithology-dependent hillslope diffusion (erosion and sedimentation), and complex basement geometry. This new model successfully reproduces intricate structures, thermochronology ages, metamorphic temperatures, cooling and exhumation rates, and strain conditions observed in the northern Taiwan orogenic belt. Notably, the model reveals that ductile deformation accounts for nearly half of the shortening and provides a tectonic framework for interpreting the recently discovered out-of-sequence fault in Taiwan's orogenic belt. The remarkable consistency between the model results and geological observations suggests the broader applicability of the D-layer model to other similar wedge orogenic systems.

Keywords: Taiwan orogeny, wedge deformation