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Mountain building processes in intracontinental intraplate transpressional mountain belts: Lessons from the Altai and Gobi Altai, Mongolia

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Intracontinental intraplate transpressional mountain belts such as the Mongolian Altai and Gobi Altai comprise a unique class of orogen with structural and basinal elements that are distinct from contractional and extensional orogens. Late Cenozoic uplift and mountain building in the Mongolian Altai is dominated by regional-scale dextral strike-slip faults that link with thrust and oblique-slip faults within a 300 km-wide deforming belt sandwiched between the more rigid Junggar Basin block and Hangay Precambrian craton. Dominant orogenic elements in the Mongolian Altai include double restraining bends, terminal restraining bends, partial restraining bends, single thrust ridges, thrust belts linked by strike-slip faults, and triangular block uplifts in areas of conjugate strike-slip faults. The overall pattern is similar to a regional strike-slip duplex array, however the significant amount of contractional and oblique-slip displacement within the range and large number of historical oblique-slip seismic events renders the term "transpressional duplex" more accurate. Structural vergence is inconsistent throughout the Altai and many ranges have bilateral vergence suggesting asymmetric flower-structure cross-sectional fault geometries. Deformation is discretely localised along active structures approximately 25 ± 5 kms apart with intervening areas appearing tectonically inactive and geomorphologically mature. Intramontane and range flanking basins can be classified as ramp basins, confined thrust basins, open-sided thrust basins, pull-apart basins, and strike-slip basins. Neither a classic fold-and-thrust orogenic wedge geometry nor a bounding foredeep exists. The manner in which upper crustal transpressional deformation is balanced in the lower crust is unknown, crustal thickening by lower crustal inflation and northward outflow of lower crustal material are consistent with existing geological and geodetic data and could account for Late Cenozoic regional epeirogenic uplift in the Russian Altai and

Sayan regions.

The Gobi Altai differs from the Altai in that prior to the onset of Late Cenozoic mountain building, the region was a continental rift province. The region today has a basin and range physiography, however major mountain ranges are generally thrust-bound and intervening basins have a compound Jurassic-Cretaceous clastic infill overlapped by Late Cenozoic alluvial fan deposits. During summer 2004, we found evidence for topographically inverted rift sequences within several major restraining bend mountain ranges; in some areas bounding normal faults are exposed and uninverted. The extent of thrust reactivation of normal faults is under investigation, the most convincing examples are where basinal thrust faults near mountain fronts are directed back towards the front. Thus although the Altai and Gobi Altai contain similar transpressional mountain range types, the Gobi Altai contains the added complication of variably reactivated older rift structures. Both regions provide superb natural laboratories for studying the way in which continental interiors terminally accommodate intraplate strain by oblique-deformation.