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Major Fault Systems and Mountain Building Processes in the Gobi Corridor and North Tibetan Foreland, NW China and Southern Mongolia

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This presentation will be a review of the Quaternary-Recent deformation field and mountain building processes within the Gobi Corridor region of Central Asia, which includes the North Tibetan foreland, Beishan, Gobi Altai and easternmost Tien Shan. The region can be considered the 'soft core' of Central Asia which has been reactivated due to the continuing Indo-Eurasia collision to the south. Favorable preconditions for reactivation of Gobi Corridor basement include a mechanically weak Palaeozoic terrane collage sandwiched between rigid Precambrian basement blocks to the north and south, thermally weakened crust due to Jurassic-Miocene volcanism and widespread Palaeozoic-Mesozoic granitic magmatism with associated high radiogenic heat production, and crustal thinning due to widespread Cretaceous rift basin development. The network of Quaternary-Recent faults within the entire region defines a diffuse sinistral transpressional deformation field that has generated a transpressional basin and range physiographic province. Typically, thrust and oblique-slip thrust faults are WNW-striking and reactivate basement faults and fabrics, whereas left-lateral strike-slip faults are ENE-striking and cut across basement trends. The angular relationship between SHmax and pre-existing basement structural trends is the fundamental control on the kinematics of Late Cenozoic deformation. Along-strike and across-strike growth and coalescence of restraining bends, other transpressional ranges and thrust ridges is an important mountain building process. Thrust faults throughout the region are both NNE and SSW directed and thus there is no common structural vergence, nor orogenic foreland or hinterland. Root structures appear to be vertical faults, not low-angle decollements and flower structure fault geometries within individual ranges are common. Published earthquake and geodetic data are consistent with a diffusely deforming continental interior region with tectonic loading shared amongst a complex network of

faults.

In the Beishan region immediately north of Tibet, Quaternary deformation associated with the Indo-Eurasia collision is diffusely distributed and there is limited historical seismicity; the region is therefore generally regarded as tectonically uninteresting from a neotectonic standpoint. However, our preliminary work in the region coupled with satellite image analysis indicates that the region is cut by at least five major sinistral strike-slip fault systems that are potentially active and which parallel the Altyn Tagh fault which bounds northern Tibet directly to the south. These fault systems generate localised uplifts within the Beishan and show typical geomorphological characteristics of active intracontinental deforming belts such as sharply defined mountain fronts, Quaternary alluvial fan complexes and tilted Cretaceous peneplain remnants. Specifically, the Yushi Shan and Mazong Shan are Late Cenozoic restraining bends that show clear evidence for Quaternary thrusting and uplift. Other minor localised uplifts also appear fault-controlled. However, at first-order, regional Beishan topography is difficult to explain by Late Cenozoic upper crustal faulting, unlike Tibet to the south and the Gobi Altai to the north.

Directly adjacent to Tibet's northern margin, the Sanweishan and Nanjieshan blocks are thrust-bound basement-cored uplifts that interrupt the Tibetan sedimentary foreland in the Dunhuang-Anxi region. The faults that cut and bound these minor ranges appear to define an evolving transpressional duplex with north-directed thrusting, but perhaps surprisingly, also south-directed thrusting back towards the high Plateau. As noted by others, the Altyn Tagh Fault defines a profound topographic and structural boundary in Central Asia with significant differences in contractional strain on either side. The rigid Tarim block appears to be the major rheological control on the limited northward growth of the plateau in the Sanweishan-Nanjieshan region.

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Modern mountain building within the Gobi Corridor demonstrates that reactivation of ancient accretionary and collisional orogens within continental interiors can play an important role in continental evolution and the life cycle of orogenic belts. However, the signature of an ancient intracontinental, intraplate orogen may be subtle and elusive, especially if eroded flat, and perhaps only detectable by low-temperature thermochronometers,

preserved orogen-derived sedimentary sequences, fault zone evidence for younger brittle reactivation, and recognition of a younger class of cross-cutting tectonic structures.

Key words: Gobi Corridor; Beishan; northern Tibetan margin; transpression; crustal reactivation; intracontinental deformation