# ACTIVE FAULTS AND FOLDS IN THE KYRG

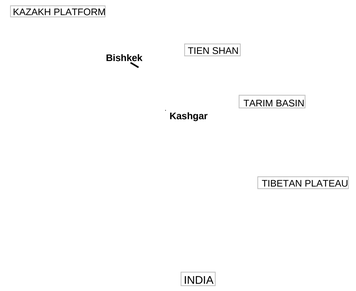
Weldon, R.J.(1), Abdrakhmatov, K.(2), Turdukulov, A.(2), Thompson, S.C.(3), Stimac, J.P.(1),
Miller, M.G.(1), Mikolaichuk, A.V.(6), McLean, J.K.(4), Korjenkov, A.(2), Chedia, O.(2)

(1)Dept. Geological Sci., U. of Oregon, Eugene, OR 97403; (2)National Academy of Sciences, Inst. of Seismology, Bishkek, Kyrgyzstan; (
Ellensburg, WA 98926; (5)Engineering-geological and Geo-ecology Science Center, Moscow, Russia; (6)Inst. of High Temperatures, Bishkek, Kyrgyzst

## INTRODUCTION

As part of a multidisciplinary NSF Continental Dynamics investigation to understand intracontinental mountain building processes in the Tien Shan, Central Asia, we have produced a map of active faults and selected folds of the Kyrgyz central Tien Shan. Based on seismic moment tensors (Molnar and Deng, 1984), GPS observations (Abdrakhmatov et al., 1996), and geology (e.g., Avouac et al., 1993), it has been inferred that 1/3 to 1/2 of the India/Asia collision occurs in this 2500 by 400 km wide intra-continental belt, 1000 to 3000 kms from the plate boundary. Mountain peaks above 7 km and vertical structural relief of up to 10 km on an early Cenozoic surface exemplify vigorous tectonic activity throughout the late Cenozoic (Makarov, 1977; Sadibakasov, 1990).

The active structures and landforms on our map provoke intriguing hypotheses for the kinematics and evolution of crustal deformation across the central Tien Shan. Features of interest include: 1) widespread occurrence of active structures of both north and south vergence, at essentially every basin/range boundary and many other locations, 2) comparable magnitudes of late Pleistocene surface offsets across structures between the northern range front and intermontane basins, suggesting an equal partitioning of strain, 3) widespread evidence for basinward migration of flat detachment and ramp anticline geometries, recorded in deformed Neogene basin strata and fluvial terraces, at both frontal and intermontane basin margins, 4) evidence for oblique structures, in particular left-reverse structures near the right-lateral Talas Fergana fault, and 5) evidence for a continuous evolution of the mountain range throughout the late Cenozoic, characterized by similarity in the style of deformation, evolution of structurally controlled basins, and propagation of faults and folds that created the range.



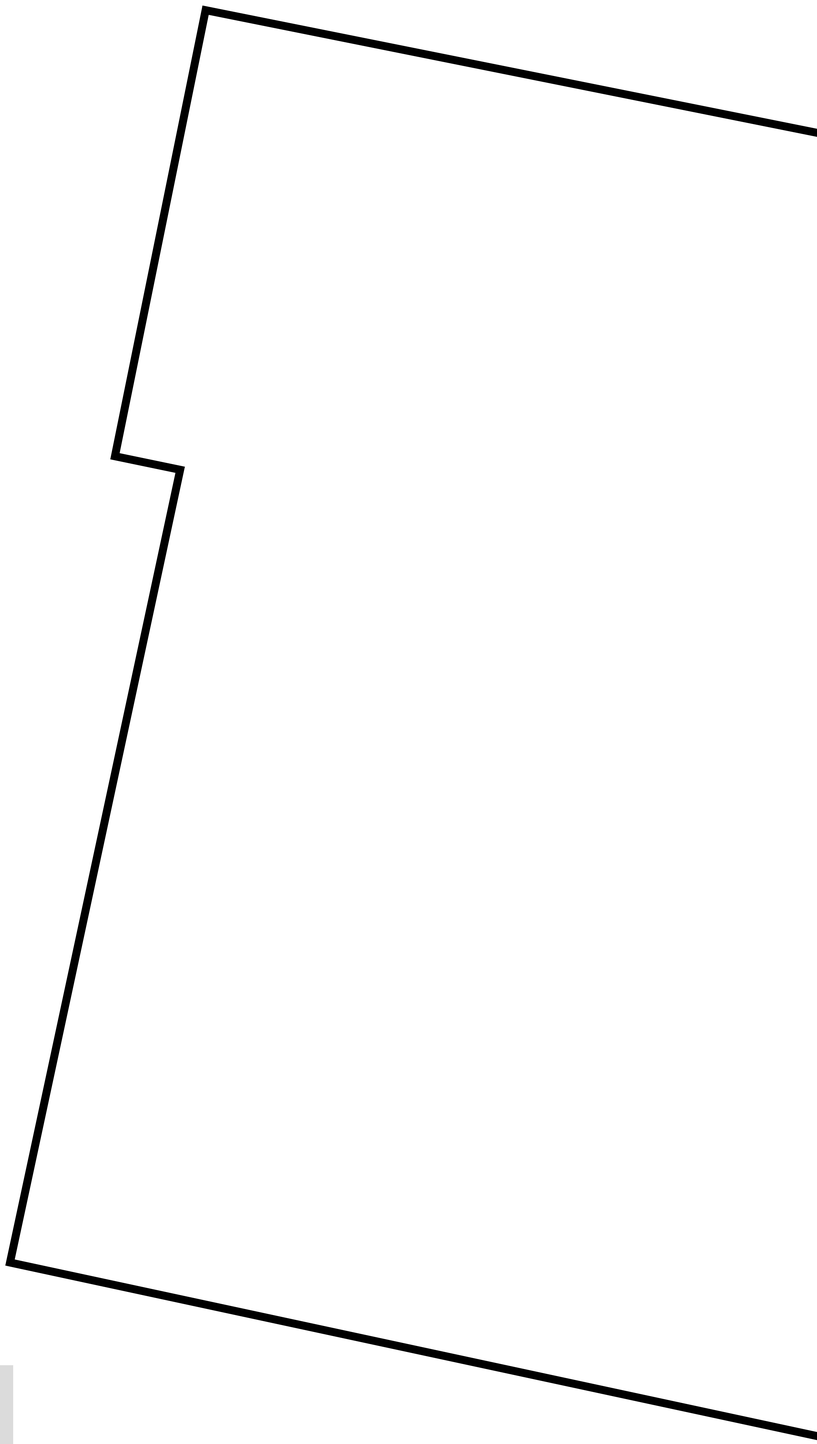

Shaded-relief DEM of northern India and central Asia, showing the geographic setting of the Tien Shan mountains. Location of the Landsat MSS mosaic is boxed in yellow. Our collaborative research project will focus along the green transect line.

## ABOUT THE MAP

Our map is constructed from existing Kyrgyz and Russian data (e.g., Makarov, 1977; Chedia, 1986; Sadibakasov, 1990), aerial photographs, satellite images (Landsat MSS and U.S. Declassified Intelligence Satellite Photography), a two-week reconnaissance to the southern Naryn and At-Bashi basins, and one field season in the northern part of the orogen. Areas without mapped structures reflect incomplete data acquisition (due to inaccessibility, incompetence, etc.) or lie outside our area of study. Active folds are underrepresented on our map.

We have assigned the following ages to active structures: late Cenozoic (violet), Quaternary (green), and late Pleistocene/Holocene (red). For this preliminary map and classification, we assume that all structures deforming Cenozoic sedimentary basin deposits have been active since Neogene time, despite the tenuous nature of regional stratigraphic correlation and few chronometric data for these units. Structures classified "late Cenozoic" deform basin sediments but lack geomorphic or stratigraphic evidence for significant Quaternary activity. "Quaternary" structures (green) have stratigraphic and/or geomorphic evidence for more recent activity, such as offset Plio-Pleistocene conglomerate or a faceted hanging wall escarpment. Many structures classified "Quaternary" have been active in the late Pleistocene, but lack evidence of significant cumulative offset or recent events. Evidence for "late Pleistocene/Holocene" structures (red) includes spectacular vertical scarps across late Quaternary fans and terraces, lateral offsets of streams and moraines, and uplifted and folded terraces. Many of these structures have produced scarps cutting recent and modern deposits and surfaces, and will be excavated for paleoseismic investigation next field season.

View of the Issykata fault and the Kyrgyz Range as seen from an apartment window in Bishkek, capitol city of Kyrgyzstan. The Issykata fault is the northernmost thrust fault in the Tien Shan at the longitude of Bishkek; basinward migration of flat-ramp structures is common at active basin margins across the Kyrgyz Tien Shan. The western 21 km of the Issykata fault ruptured in 1885 (M 6 1/2), and scarps up to 8 m high across young fans indicate Holocene activity along its ~120 km strike length.



Folded Neogene basin sediments, western Djumgal Basin. Structural mapping and magnetic stratigraphy from localities such as this will be used to determine timing, amounts, and rates of late Cenozoic deformation across the Tien Shan.

## REFERENCES

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## THE IMAGE

The map base is a mosaic of three Landsat MSS scenes. Resolution after resampling is approximately 200 meters. The image is a false color display: RED = band 7 (0.95㎜), GREEN = band 5 (0.65㎜), BLUE = band 4 (0.55㎜). Image mosaicing and processing were done in Adobe Photoshop.