

**Late-Stage Extension Along the Main Mantle Thrust  
(Pakistan, Himalaya):  
New Field and Microstructural Evidence**

POSTER

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Recent geochronological work on metamorphic rocks from the Besham area of North Pakistan has yielded evidence of re-activation of the Main Mantle Thrust as a zone of late-stage crustal extension. This has been accommodated in the footwall and hangingwall by displacement along a set of E-W striking normal faults. This trend is roughly parallel to that of the Main Mantle Thrust. Local variations in strike occur as a result of folding of the Main Mantle Thrust into a minor syntaxis around the Besham region. The E-W trending normal faults cut across all the earlier ductile and brittle structures produced by south-verging deformation and are therefore late-stage.

E-W trending south-dipping normal faults in the Indian Plate rocks of the Main Mantle Thrust footwall exhibit topside to the south movement. Extensional fabrics displace the northerly dipping ductile shear fabric of the footwall rocks that were formed as a result of the collision between the Indian plate and Kohistan Island arc although, on a smaller scale, some extension was accommodated by brittle re-activation along fabric surfaces. These can be interpreted either as Riedel shears associated with the earlier south-verging thrusts or, surfaces along which extensional collapse of the entire metamorphic pile occurred. Riedel shears are also associated with a few of the E-W trending faults.

The Kohistan Island arc forms the hangingwall of the Main Mantle Thrust. E-W trending normal faults occurring in the ultramafic rocks can be divided into two groups according to their movement: topside to the south, similar to the footwall and topside to the north. The latter are developed parallel or sub-parallel to the shear fabric of the hangingwall rocks. This is not as well developed as the fabric of the footwall sequence but implies clear north-verging extension. Many minor extensional faults are associated with the larger scale faults in the Kohistan ultramafics.

A second set of normal faults, striking N-S, are associated with the late deformation which folded the Main Mantle Thrust into a minor syntaxis producing an antiform in the Besham region. This east-west directed extension was more pronounced in the hangingwall of the Main Mantle Thrust than in the footwall and is attributed to outer-arc extension of the developing fold.

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