



University  
of Victoria

Graduate Studies

Notice of the Final Oral Examination  
for the Degree of Master of Science

of

**TREVOR GEORGE MEARCE**

BSc (Humboldt State University, 2015)

**“Along-Strike Changes in the Active Tectonic Configuration of the  
Northwestern Himalaya: Insights from landscape Morphology, Erosion  
Rates, and River Profiles”**

School of Earth and Ocean Sciences

Thursday, November 30<sup>th</sup>, 2017

11:00 A.M.

Bob Wright Centre

Room A319

Supervisory Committee:

Dr. Kristin Morell, School of Earth and Ocean Sciences, University of Victoria (Supervisor)

Dr. Lucinda Leonard, School of Earth and Ocean Sciences, UVic (Member)

Dr. Tom Gleeson, Department of Civil Engineering, UVic (Outside Member)

External Examiner:

Dr. Lindsay Schoenbohm, Department of Chemical and Physical Sciences, University of Toronto  
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Chair of Oral Examination:

Dr. Bryson Robertson, Department of Mechanical Engineering, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## **Abstract**

Geodetic models suggest that much of the convergence across the Himalaya (~20 mm yr<sup>-1</sup>) is taken up on the Main Himalayan Thrust, the main decollement beneath the Himalayan wedge. In Central Nepal and the majority of Northwest India, several geomorphic, geophysical and seismological datasets indicate that this decollement has a mid-crustal ramp geometry in cross section and continues uninterrupted for 100's of km along-strike. In this study, we use spatial analyses of elevation, relief, channel steepness indices, and basin-wide erosion rates from cosmogenic <sup>10</sup>Be concentrations to outline a potential large-scale change in the active fault arrangement near longitude 77°E. The physiography in the areas to the east of 77°E appear similar to that observed along much of the Himalaya where topographic relief, erosion rates, and river channel steepness ( $k_{sn} < 200$ ) remain relatively low in the areas to the south of the Physiographic Transition<sup>2</sup>. North of the Physiographic Transition<sup>2</sup>, these metrics increase sharply within a 30-km-zone due to higher rock uplift rates above a mid-crustal ramp on the decollement or unidentified out-of-sequence thrust fault that soles to the decollement. Either of these models may also contain a duplex growing by underplating of the Indian plate into the Himalayan orogenic wedge contributing to higher rock uplift rates north of the Physiographic Transition<sup>2</sup>. To the west of 77°E, however, the landscape morphology indicates the Main Boundary Thrust makes a northward bend coinciding with the along-strike termination of the Physiographic Transition<sup>2</sup> and an arc-perpendicular Bouguer gravity anomaly reflecting a trough on the Indian plate west of longitude 77°E. These data suggest that the Main Boundary Thrust merges along-strike with the ramp or emergent fault soling onto the Main Himalayan Thrust at this location, potentially marking a significant change in tectonic configuration along the Himalayan arc.