THE UNIVERSITY OF HONG KONG

DEPARTMENT OF CIVIL ENGINEERING

SEMINAR

The shape of the Himalayan "Arc": an ellipse pinned by syntaxial strike-slip fault tips

Dr. Liqing JIAO
Researcher, SinoProbe Lab, Chinese Academy of Geological Sciences, Beijing, China

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Time: 10:00 a.m. – 11:00 a.m.
Venue: Room 632C, 6/F Haking Wong Building, The University of Hong Kong

ABSTRACT
Trans-Himalayan GPS data confirms that, between both syntaxes, India/Asia convergence is steadily oriented ≈ N20°E, perpendicular to the range trend. However, measurements of co-seismic and Holocene surface faulting near both syntaxes, along the 2005 and 1950 earthquake ruptures, imply long-term thrusting directed ≈ 130° apart, and post-LGM shortening rates of only ≈ 5-6 mm/yr, ≈ 2 to 3 times slower than in Nepal (≈ 15-20 mm/yr). Syntaxial earthquakes' return-times are also ≈ 3 times longer (> 2000 yrs) than those in Nepal (≈ 700 yrs). In a structural frame centered halfway between the syntaxial cusps, the tectonic features of the range show remarkable symmetry. In map view, the overall shapes of the Main Frontal Thrust (MFT) and the Main Central Thrust (MCT) closely fit ellipses, with major-to-minor axis ratios of ≈ 2.5 to 3. This suggests that the range growth atop subducting India was "pinned" by the strike-slip faults that bound it to the east and west. 3D Discrete Element Modelling corroborates a late-Tertiary elliptical range growth. This accounts for the ≈ 65° angles and 2-3-fold decrease in active thrusting between Nepal and the syntaxis, for the maximum Himalayan heights (≥ 8000 m), larger magnitudes (≥ 8), and shorter return times (≈ 700 years) of great earthquakes in Nepal, for the existence of two 500 to 600 km-long, south-concave mountain ranges north of both syntaxes and for the ≈ 9 mm/yr, N100-110°E extension across southern Tibet. It also suggests that predictions of impending or frequent great earthquakes in the eastern- and westernmost Himalayas may be overstated. In this talk, Dr Jiao will analyze geometry/kinematics of the entire range and of its two main megathrusts (MFT and MCT), in keeping with broad-scale, along-strike geodetic measurements, earthquake's focal mechanisms and field-studies of thrust faulting. She will show by using a simple, planar, laterally bounded Discrete Element Modelling (DEM) simulation, that, as predicted by solid mechanics, the range's shape and growth best fit those of ellipses pinned at both syntaxes by ≈ NS, nearly orthogonal, conjugate strike-slip fault tips. Dr. Jiao will also discuss the mechanisms behind the formation of the Himalayan Arc.

ABOUT THE SPEAKER
Liqing is a researcher at the Chinese Academy of Geological Science (CAGS) in Beijing, China. She graduated from the China University of Mining and Technology with a BEng in Xuzhou in 2003 and a MSc in Beijing in 2007. She went to Singapore in January 2008 as a project officer in Civil and Environmental Engineering at Nanyang Technological University (NTU). In 2010, she joined the Tectonic group at the Earth Observatory of Singapore (EOS) after her former supervisor left NTU. In 2016, she obtained her PhD degree from EOS, NTU. She spent about three more years at EOS as a Research Fellow before moving to Institut de Physique du Globe de Paris (IPGP) in Paris in May 2019. Three years later, she obtained a faculty position and moved to CASG in Beijing. Her main focus is on the mechanism of large-scale continental deformation, the formation of the Himalayan arc and earthquake/earthquake cycling rupture simulation. Part of her research findings have been published in various academic journals, such as PNAS, EPSL, GRL, JGR solid earth, Acta Geologica Sinica, Tectonophysics, and others.

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