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CONTROL ID: 1201993

TITLE: Crustal weakening and transgressive melt penetrative intrusion across the Kunlun Shan inferred from INDEPTH Phase III and Phase IV magnetotelluric data

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Tectonophysics (T)

CURRENT SESSION: T04. 20 Years in Tibet- The INDEPTH Transect

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ABSTRACT BODY: Determining the nature of the transition between weak Tibetan Plateau lithosphere and the surrounding rigid blocks is a key issue for understanding the ongoing India-Eurasia collision. The overall goal of Phase IV of the INDEPTH (International Deep Profiling of Tibet and Himalaya) project is to develop a better model of the structure and evolution of the northern margins of the Tibetan Plateau. Between May and July 2010, long-period magnetotelluric (MT) data were acquired as part of INDEPTH Phase IV, including the new 6000 profile crossing the Kunlun Shan east of the 600 line, to complement broadband MT data already acquired in the area. In association with these new Phase IV MT surveys, existing MT 600 line data, collected during INDEPTH Phase III across the Kunlun Shan, were re-analyzed and re-modeled using more modern approaches. Both Phase III and IV profiles were investigated using 2D isotropic and anisotropic inversions, as well as 3D modeling.

The new evidence for electrical anisotropy observed in the 600 line resistivity model at the northern edge of the Plateau compromises the prior characterization of the Kunlun Fault as a significant rheological boundary between weak, warm Tibetan crust and the rigid Eastern Kunlun-Qaidam block. Moreover, south of the Kunlun fault, the middle to lower crustal conductive features of the new model of the 600 line data exhibit compelling spatial correlations with major regional tectonic features, implying structural control of crustal melt distribution – the presumed cause of the high conductivity – leading to localized decoupling of the deformation in time and space.

Preliminary 2D isotropic, anisotropic and 3D models of the INDEPTH Phase IV new 6000 profile confirm the presence of a conductive anomaly in the lower crust of the Kunlun Shan. The 2D anisotropic models highlight a preferred “along profile” orientation of this conductive feature, which agrees with the 600 line results.

The crustal anisotropic conductive anomaly observed in the Kunlun Shan may characterize transgressive penetrative intrusion of melt from the Tibetan crust to the north, weakening the crust beneath the Kunlun Shan and accommodating the actual ongoing crustal shortening between India and the Qaidam basin.

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INDEX TERMS: [8110] TECTONOPHYSICS / Continental tectonics: general, [8108] TECTONOPHYSICS / Continental tectonics: compressional.