Geophysical Research Abstracts
Vol. 12, EGU2010-10350, 2010
EGU General Assembly 2010

The long runout of the Heart Mountain landslide: A chemo-thermo-poro-elastic mechanism

Liran Goren (1), Einat Aharonov (2), and Mark H. Anders (3)

(1) Weizmann Institute of Science, Environmental Sciences and Energy Research, Rehovot, Israel (liran.goren@weizmann.ac.il), (2) Institute of Earth Sciences, Hebrew University, Givat Ram, Jerusalem, Israel. (einatah@cc.huji.ac.il), (3) Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, USA. (manders@ldeo.columbia.edu)

The Eocene age Heart Mountain landslide in northwestern Wyoming is the largest subaerial landslide known. This slide is an extreme example of a long runout with upper plate blocks that slid up to 50 km along a slope with an average dip of 2°. The emplacement mechanism of this unique structure has long been an enigma. Here we suggest that a combination of a thermo-poro-elastic (TPE) feedback operating along the slide base, and thermal decomposition of carbonates on the sliding surface, may explain the Heart Mountain landslide via a catastrophic emplacement mechanism. TPE effects arise when a porous, fluid-filled, shear zone undergoes frictional heating during sliding. If the shear zone is confined, heating will cause pore pressure to rise, which in turn will reduce frictional resistance to sliding. Pore pressure diffusion from the shear zone (via porous flow) opposes this process. The shear zone of the Heart Mountain slide is located within a confined dolomite layer, ideal location for the TPE mechanism. Due to high heating rates the temperature along the slide base is expected to rise rapidly and reach the temperature of thermal decomposition of carbonates. This endothermic reaction further complicates the TPE feedback by consuming heat, increasing porosity, and releasing CO_2. Simulation of the sliding dynamics of the Heart Mountain block, accounting both for the TPE feedback and for thermal decomposition of carbonates, successfully reproduces the travel distance of the Heart Mountain block. This simulation also predicts that the maximum sliding velocity was 113 m/s, and sliding duration was 26 minutes.