Geophysical Research Abstracts
Vol. 12, EGU2010-15617, 2010
EGU General Assembly 2010

Geophysical investigation of moraine dam seepage

Jeffrey Moore (1,4), Alexandre Boleve (2), Johnny Sanders (3), and Steven Glaser (1)

(1) Department of Civil and Environmental Engineering, University of California, Berkeley, (2) CNRS-LGIT, Université de Savoie, Equipe Volcan, Le Bourget-du-Lac, France , (3) Department of Earth and Planetary Science, University of California, Berkeley, (4) Geological Institute, Swiss Federal Institute of Technology, Zürich, Switzerland

Self-potential (SP) and electrical resistivity measurements are used to investigate seepage at a remote moraine dam in the Sierra Nevada of California. The site is a small terminal moraine, pre-dating the LIA advance, which impounds roughly 300,000 m3 of water at around 3400 m a.s.l. Suspicious fine sediment in an adjacent downstream toe lake prompted initial concerns that anomalous seepage may be eroding matrix material from the moraine dam. 235 individual SP measurements covering the surface of the moraine were collected in order to investigate electrokinetic current sources resulting from seepage, while resistivity soundings revealed that the till contains a small fraction of interstitial ice. The contoured SP data reveal a non-uniform voltage distribution over the moraine dam, and two distinct negative SP anomalies can be distinguished. The first, located in the central area of the moraine, shows a large negative SP zone around the crest and increasingly positive SP moving downhill towards the upstream and downstream toes. This anomaly is interpreted to result from shallow gravitational groundwater flow in the near-subsurface, similar to the "negative summit" phenomenon observed in SP surveys over steep terrain. When the influence of upward groundwater flux by evaporation is also included, the combined effect matches the SP field data well. The second SP anomaly has a distinct "bulls-eye" appearance where the most negative SP is tightly constrained. Different sources for this anomaly include concentrated seepage, lateral resistivity contrasts, and electrochemical reactions, and the most likely are discussed. Positive SP anomalies at the boundaries of the survey area result from groundwater inflow from adjacent hillslopes. The dam matrix material was evaluated for internal stability using the concepts of filter criteria and was found to be only marginally resistant to seepage erosion.