



Glacier retreat, glacier lake outbursts and surging glaciers in Pamir, Tajikistan

J. F. Schneider

Institute of Applied Geology, University of Soil Sciences, Vienna

In 2002 and 2003, two missions have been carried out in the Pamir of Tajikistan, sponsored by SHA/SDC of Switzerland, to assess the remote geohazards (Glacial Lake Outburst Floods - GLOF's, mass movements and seismicity) in the Western Pamir Mountains, focused on the Vanch Valley as well as the Gunt, Shahdara and Pjanch Valleys. The utilized methodologies were:

- Interpretation of satellite images (Corona 1968, Landsat ETM+ 2000/01, Terra Aster 2002/03)
- Airborne survey with helicopters of specific areas with high potential hazards
- Terrestrial investigation of selected sites to confirm the hazards
- Meteorological and hydrological data interpretation concerning the glacier retreats
- Flood potential and debris flow calculation with estimation of impact zones
- Interpretation of seismic data concerning triggering of mass movements and GLOF's

355 lakes were classified within the investigation areas and ranked according to their outbreak potential, of which 133 are lakes with glacial dams situated on glaciers, 45 are lakes with morainic dams situated in the tongue basins, 12 lakes are dammed by large mass movements (rockslides or landslides), 16 lakes have composite dams (morains covered by rock debris)

After screening, areas with the highest hazard potential could be identified and specific sites determined: Sites with high potential for GLOF's, ranked according to lake type, size, maximal discharge and possible impact in the downstream area: Rivakkul/Rivakdara and Varshezdara in the Gunt Valley; Zardivkul/Sezhdara and Durumkul/Durumdara in the upper Shahdara; Khidorjevudara, Sharfdara and Dashtdara (where in 2002 a GLOF event occurred) in the lower Shahdara.

The Bear glacier and the RGO Glacier in the upper Vanch valley are prone to surging. They moved approx. 300m each at their tongues in 2 1/2 years. On the RGO glacier, a debris- or mudflow with a volume of nearly 8 Mio. m³, originating in a side valley (Glacier 96) was triggered with high certitude by an earthquake in March 2002. The flow stopped on the wide rugged surface of the main glacier, similar as the one observed on the Sherman Glacier in Alaska after the earthquake in 1964.

The retreat of the glacial tongues and forming of glacial lakes can clearly be observed by the multitemporal satellite image investigations. There are also signs of a rising permafrost boundary, giving way to loose debris formerly cemented by ice. Frozen retaining moraines are also partially melting.

The threat to the population and infrastructure in the lower valleys is considerable and growing. Flooding and debris flows are possible in the next future, but large events, such as occurred in the Caucasus (Kolka-Karmadon) have in Pamir a low recurrence rate.