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A reconstruction of a former rockslide-dammed lake: the case of the Kokomeren River valley (Tien Shan, Kyrgyzstan)

F. Hartvich (1), F. Mugnai (2), C. Proietti (2), V. Smolková (3) and A. Strom (4)

(1) Department of Engineering Geology, Institute of Rock Structure and Mechanics, Czech Academy of Sciences, Prague, Czech Republic, (2) Earth Sciences Department, University of Firenze, Firenze, Italy, (3) Department of Physical Geography and Geoecology, Faculty of Sciences, University of Ostrava, Ostrava, Czech Republic, (4) Institute of Geospheres Dynamics, Russian Academy of Sciences, Moscow, Russia

(veronika.smolkova@osu.cz / Fax: +420-597-092-323 / Phone: +420-724-875-256)

Typical aspect of a large-scale rockslide event is a creation of a more or less stable natural dam. Landslide dams, especially those barring deep, narrow fluvial valleys in active orogens, pose a significant danger for the upstream and downstream areas. As such large phenomena are not very frequent, the study of past events is useful for understanding the present-day ones.

Among the largest and most spectacular known rockslides in the western Tien Shan (Kyrgyzstan) is the Kokomeren rockslide (volume at least 10^9 m^3). Approximately in the late Pleistocene, the Kokomeren rockslide blocked the Kokomeren River valley and caused a temporary lake formation. Although the lake no longer exists and the landslide dam topography was significantly changed by later erosion, there is still relevant sedimentary and morphological evidence allowing us to reconstruct this prehistoric event.

Outcrops of corresponding sediments found on both sides of the valley illustrate well the character of the former lake: its narrow shape and steep surrounding slopes determined a significant input of slope material from valley sides and lead to a formation of typical deluvio-lacustrine sedimentary sequences.

Based on the outcrops position, GPS-assisted field mapping, laser clinometer profile measurements, morphology of the dam remnants and former valley bottom altitude, we were able to determine the minimum effective height of the dam. During the following work, we used a digital elevation model for reconstruction of the possible lake extent and calculate its volume and time of filling. Using parameters obtained in previous steps, we assessed the dam volume to about 10^9 m^3 by the calculation of the Dimensionless Blockage Index.

Total amount of lacustrine sediments accumulated in the dammed Kokomeren River valley can be roughly estimated to 10^8 m^3. Present-day mean sediment yield of the Kokomeren River is approximately 10^5 m^3/year. Thus, assuming approximately the same rate of sediment load at the end of Pleistocene when river damming took place, we obtained time period necessary for accumulation of the above-mentioned amount of sediments: around 1000 years. Additional argument for a long-term damming of the Kokomeren River is a natural obstacle at the dam location – an epigenetic meander formed in the left-bank bedrock. As the lowest dam point was situated asymmetrically, the river was forced to cut its way through the bedrock. The bypass gorge incision could only have occurred during rather a long time, which rules out the possibility of sudden outburst of the lake.

Further research will include both absolute and relative dating analyses to estimate the ages and pin-point the sequence of events on the time scale.