

Formation of the Sary-Chelek landslide dam - Contribution by the Chatkal Earthquake 1946

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In the tectonically active Tian-Shan mountains numerous mass movements such as landslides occur with sometimes disastrous consequences.

The documentation and analysis of landslides is restricted to the last 150 years and informations of large events especially are lacking. Well described prehistoric events therefore contribute to a better understanding of how seismic activity and earthquake induced landslides correspond and play an important role in generating future scenarios on both, regional and global scale.

In this work we present the results of a case study from a giant paleo-landslide located at the western spurs of the Chatkal Range in Kyrgyzstan. The active Talas-Fergana strike slip fault stretches along approximately 5 km north-east of the study area. The estimated deposit volume of 5-6km³ and the covered area of approximately 40km² shows the exceptional spatial dimension of the Sary-Chelek landslide dam, which is one of the largest known in the Tian-Shan.

It can be assumed that a paleo-earthquake with a magnitude comparable to the Chatkal Earthquake in 1946 (M 7,5) triggered a giant prehistoric landslide which dammed the Karasu River and formed the Sary-Chelek lake. In our study we assume that after this initial event several subsequent mass movements must have contributed to the landslide dam. To verify if the area is prevailed by multiple failure conditions ever since and if the Chatkal earthquake from 1946 triggered a larger event, we first of all generated a landslide inventory map. Therefore, we used remote data such as SRTM and high resolution orthoimages [world view 2] as well as data from the field. With the geomorphological map and further calculations [ArcGis] we distinguished a rough division of the deposits and observed two significantly different areas. To assign the landslide deposits depending on the definite event we used Schmidt-Hammer rebound values from 25 boulders and took three tree cores at a deposit ridge. The result of the rebound values shows that there is a correlation within the samples of the preliminary younger deposits and it is possible to delineate them from the assumed older ones. The significant higher rebound values compared to the other deposit segment indicates that the landslide dam results from at least two different mega-events. After the dendrogeomorphological analysis of the tree cores, which show minimum age of 160yrs, the contribution of the Chatkal earthquake as a trigger for a giant landslide at the Sary-Chelek can be excluded.