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Stability Causes of Ab-Ask landslide dam in Haraz river

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Abstract

So far so many landslide dams have developed along the steep slopes of Haraz valley, and the failure of some of them have claimed many lives and caused huge damages. Damavand eruption, the event of huge earthquakes and rapid snow-melting, are the most important causes of landslide dam development.

In 1999, along with rapid snow-melting in May, Ab-Ask landslide took place in the south of Damavand volcano. This landslide berried Pashang village, destroyed 450 m of Tehran-Amol main road and blocked Haraz river. This landslide dam is 20 m above the river level and its lake is at most of 700 m length, 300m width and 15m depth. Just like rapid-rock slide, this landslide occurred in the beddings of early Jurassic shale, sandstone and coals. The surface of the rupture formed along the bedding plane. Immediately after the main landslide and river's blockage there was a rock avalanche when a huge mass of big Travertine rocks fell on the northern part of the landslide. These boulders are haphazardly placed in the mud from the landslide and this has turned the northern landslide mass to be strongly firm. Following the landslide dam being filled, water overflew from the northern part of the landslide mass. Presence of Travertine boulders in this part has prevented the landslide dam from erosion during the past 17 years. The flow of Haraz river's overtopping water over the Ab-Ask landslide mass and water seepage through different parts have all created a dangerous situation. Nevertheless, Ab-Ask landslide dam's resistance in such hard a situation has made for a uniquely gorgeous instance of landslide dams.

Keywords: **Landslide dam, Rock slide, Geomorphometric parameters, Ab-Ask landslide, Haraz river.**

1. Introduction

Landslide dams usually form in mountainous areas of high terrain (Costa and Schuster, 1988), where there are proper conditions for preparation (high hills-slope gradients and discontinuities such as bedding, faults, joints) and triggering (precipitation, snowmelt, earthquakes) factors of slope failure (Korup, 2002). Most of the landslide-dammed lakes (about 90% of 390) examined worldwide relate to landslides triggered by either rainstorms/snowmelts or earthquakes (Schuster, 1993; Costa and Schuster, 1991). presented a data compilation for 436 historical landslide dams and associated landslide-dammed lakes that have been recorded throughout the world. In addition, some regional works attempting to collect and classify data on the present and historical landslide dams were carried out in different parts of the world (Casagli and Ermini 1999; Chai et al. 2000). Geomorphometric parameters of 15 large landslide dams were recently documented by (Hanisch and Söder, 2000; ICIMOD, 2000).

Failure of landslide dams usually resulted in catastrophic downstream flooding causing loss of life, housing and infrastructures. The Raikhot landslide dam of some 200-300 m in height which impounded a 65-km-long lake on the Indus River, Pakistan collapsed in 1841 (Mason 1929). This phenomenon is referred to be the largest damming by landslide and resulting catastrophic flood that has been documented in the world (Shroder 1998).

Landslide dams, which are both complex and composite (Korup 2002), are significant geomorphic forms due to their temporary existence in front of impoundment lakes. Geomorphic forms and processes related with landslide dam formation, stability and failure have been extensively explored. The grain size distribution of the debris material forming a dam influences the overall strength of a landslide dam due to the erosional processes that can cause to failures by overtopping or piping (Casagli and Ermini 1999). Casagli et al. (2003) applied different techniques to the analysis of landslide dams more than 60 cases in the Northern Apennines.

After the study of Costa and Schuster (1988), some statistical conclusions of landslide dams became a matter of primary importance. Korup (2002) reviewed the literature and focused recent findings on the geomorphic and hydrologic aspects of the formation, failure and geomorphic impacts of landslide dams. Ermini and Casagli (2002) and Korup (2004) proposed some indices for the prediction potential for landslide dam stability. They applied the indexes to the selected data from the Apennines in Italy, various worldwide sites and available New Zealand landslide dammed lakes, respectively. Weidinger (2004) suggested the Block Size Stability Diagram for classification for natural rock blockages and the life span of their dammed lakes due to work out the stability conditions of 20 landslide dams in the Indian and Nepal Himalayas as well as two in Chine. Temporary or permanent landslide dams gradually receive more attention and awareness with increasing population and land use pressure in steep terrains (Korup 2002). Landslide dams are quite rare in Iran and they have not been inclusively studied so far. Along the Haraz river, located in the south and east of Damavand volcano things are different. Along this river 3 dams have emerged so far, two of which have been destructed (Fig. 1). The first natural dam developed 40,000 years ago, when Damavand erupted and Lar river (a sub-branch of Haraz river) was blocked with the lava (Uromeihy 2000). This natural dam is 150 meters high and the deposits of which are visible on the river banks this dam was destructed after some time. The second natural dam is a landslide one, which formed 180 years ago near Mobarak-abad village (Pedrami 1987). This landslide dam developed when Damavand earthquake 0f 7.1 magnitude in Richter scale took place in 1830. The triggering earthquakes had probably been the starting point of this landslide dam. Mobarak-abad landslide dam was destructed after some time and caused some damages. Ab-ask landslide dam is the third natural dam in Haraz river which developed near Pashang village in May 1999, when there was a rapid snow-melting. This incident blocked the river and developed a natural dam in the river path. The damages this landslide caused were burying the Pashang village, destruction of 450 meters of Tehran-Amol main road, destruction of four stores, a restaurant and 15 electricity posts. This research studied the characteristics and the causes of Ab-ask landslide plus the relation between landslide mass and landslide-dammed lake as well as the threats resulting from the related failure.

2. General characteristics of the area

The study area is located in the central sector of the Alborz mountains. The Alborz range of northern Iran is a region of active deformation within the broad Arabia-Eurasia collision zone. The range is also an excellent example of coeval strike-slip and compressional deformation, and as such can be an analogue for inactive fold and thrust belts thought to involve a component of oblique shortening (transpressional deformation) (Allen et al. 2003; Zanchi et al. 2006; Hassanzadeh et al. 2006). It is roughly 600 km long and 100 km across, running along the southern side of the Caspian Sea. Several summits are .4000 m in altitude. Damavand, a dormant volcano, reaches 5671 m (Fig. 1).

The central Alborz constitute the highest peaks along the range. The region exposes a rough morphology with steep slopes and peaks. Main morphological units shaped under the control of the structural elements (main folds, faults) in the region trend to the NW-SE. The central Alborz are drained by the Haraz River, which is the most significant fluvial system in the region. Deep incision forms v-shaped valleys characterised by deep and steep slope in this drainage system. Large and deep-seated landslides are prevalent on these slopes. The relief along these slopes reaches up to 2400 m.

The climate of the study area is a transition of the Caspian Sea and the continental central Iranian climatic regions with warm summers (average daily July temperature 18.3 °C) and cold winters (average daily January temperature -11.8 °C). The annual average air temperature is 4.5°C, the precipitation is

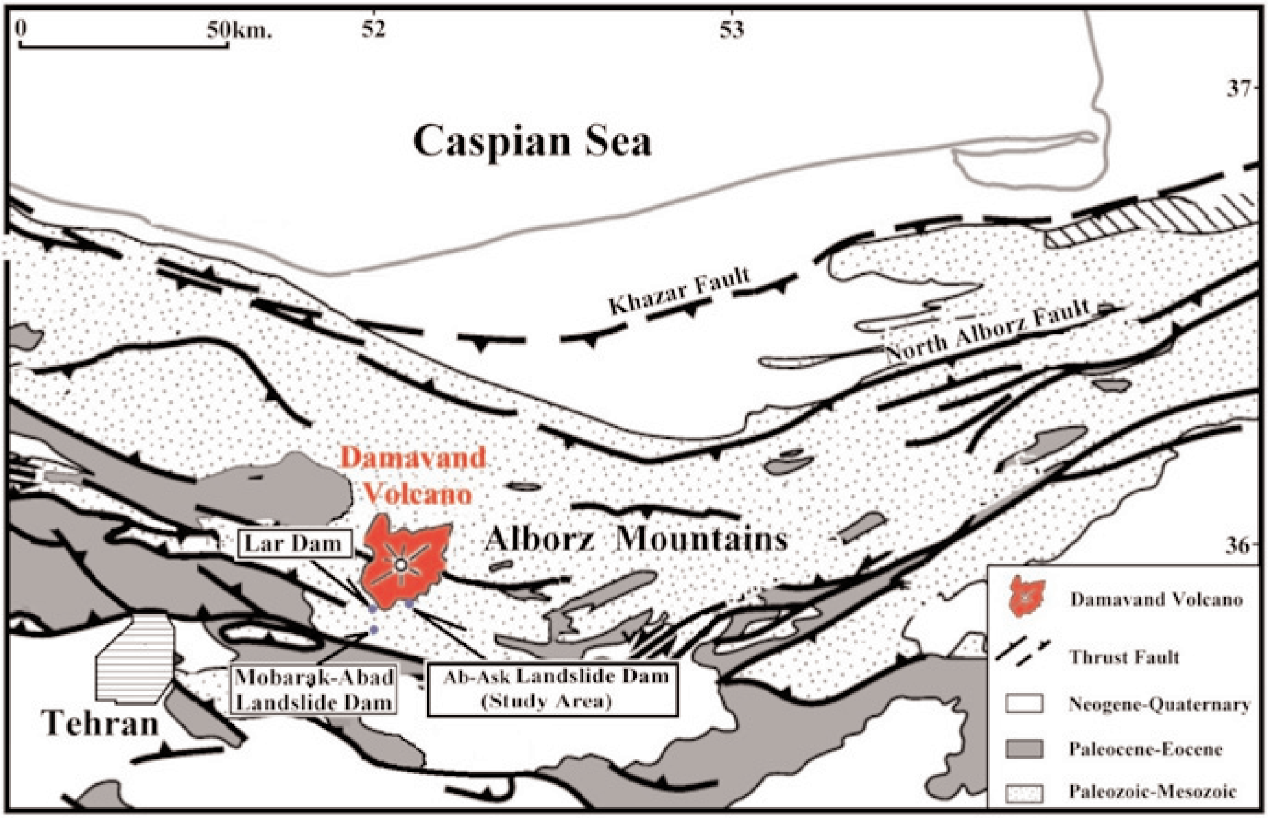

Figure 1. Location map of the 408 study area with distributions of landslide dams in Haraz river, modified from Allen et al. (2003).

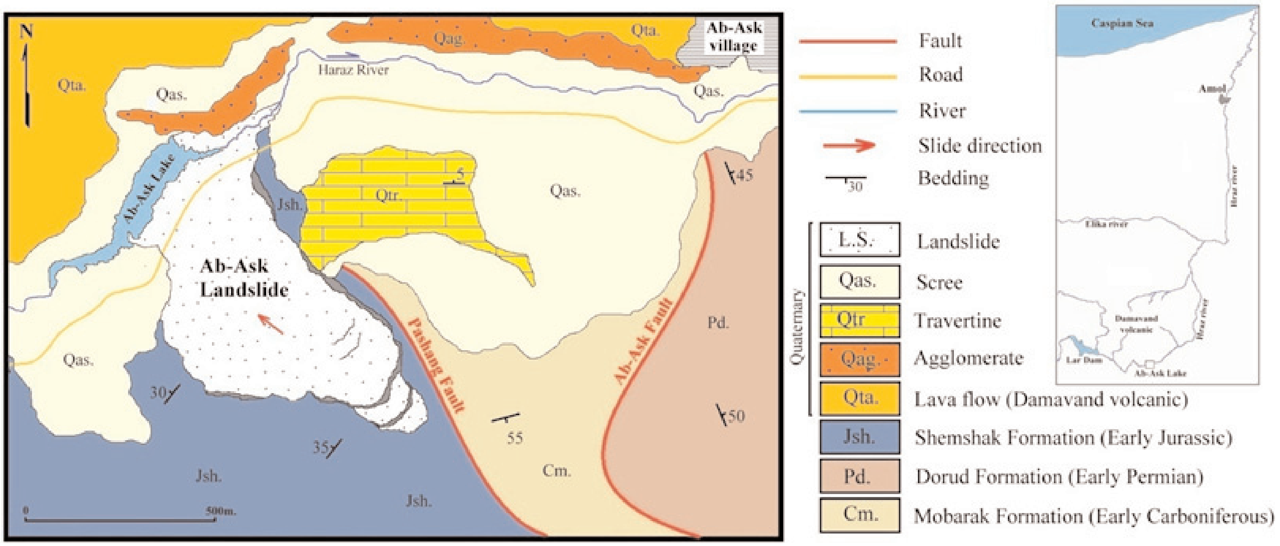

Figure 2. Simplified geological map and landslide inventory map of the study area.

553 mm during the year (SMLD 2005). The Reyneh-Larigan meteorological station is located at 5 km the northeast of the Ab-Ask landslide

Ab-Ask landslide region consists of two Early Jurassic and Quaternary sedimentary collections. From Stratigraphic view point, these deposits include Shemshak Formation and Quaternary travertine. Shemshak Formation (Jsh.), which is related to Early Jurassic, is composed of extremely folded alternating coal shale and sandstone. travertine collections (Qt.) from around the Ab-Ask village were created under the influence of spas activities during Quaternary period. Formation of travertine in the region's spas is ongoing. These travertine collections are 3-10 m thick and have been horizontally placed 100-150 m from the Haraz river level as an unconformity on the deposits of Shemshak Formation (Fig. 2).

3. Assessment of Ab-Ask landslide

Most of Haraz river landslides have occurred along the steep slopes and on the deposits of Shemshak Formation. These landslides have taken place on alternating coal shale and sandstone. Moreover, the presence of active faults next to landslide masses proves the role of tectonic crushing's in magnifying the landslide potential. Ab-Ask landslide and the associated lake, 70 km northeast of Tehran and 68 km south of Amol, is a typical case of landslide in the region (Pourghasemi et al. 2003) (Fig. 3).

The Ab-Ask landslide occurred in the Shemshak formation (Jsh.) that dip moderately downslope. Detail lithological descriptions of this sequence with 1025 m thickens are made by (Assereto 1966). It consists of alternating thick and thin bedded, poorly sorted, gray quartzose sandstone and immature, ammonite bearing graywackes inter-bedded with fossil shales, siltstone, and thin limestones, that have coal seams up to 1.5 m Thick as a characteristic feature. The lower part of the shemshak Formation is characterised by plant fragments which are of central Asiatic type. Cross-bedding and ripple-marks are numerous and indicate a very shallow-water to lagoonal environment of sedimentation. The upper parts contain features characteristic of deltaic environment (Stocklin 1968).

Ab-Ask landslide has accumulated as a rock slide and slide mass on the valley floor of the Haraz river. The mass has blocked 450 m of Haraz river path. Here, the landslide mass is 20 m in the tallest part, from the valley floor of the Haraz river. After filling the landslide dam, water overflew the northern part which is made of large travertine segments.

3.1. Ab-Ask landslide movements

The Ab-Ask landslide initially occurred as a translational slide or stepped translational slide. The failure surface was controlled by bedding that dips moder-

Figure 3. Ab-Ask landslide-dammed lake and landslide dam (foreground), view to the north.

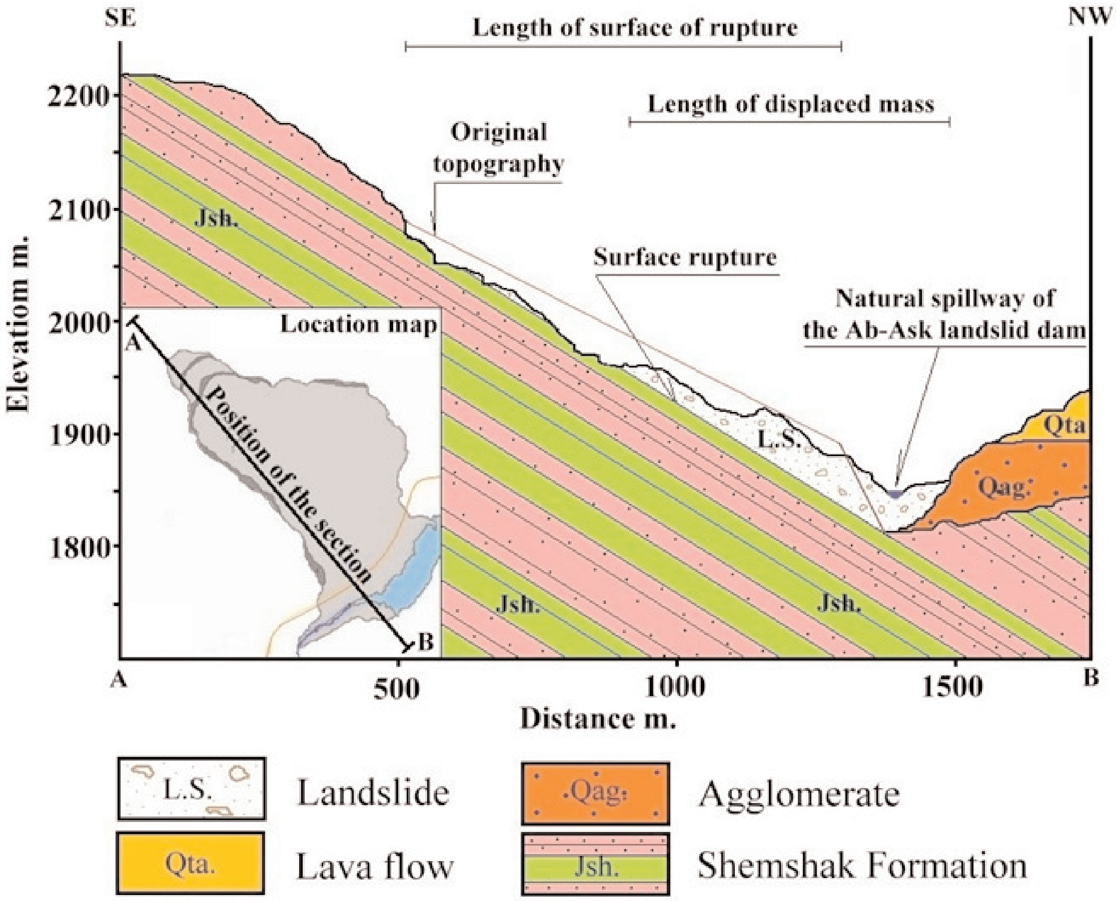

Figure 4. Longitudinal cross-section of Tortum landslide with the dimensions. (a) Shows location of the cross-section.

ately out-slope to the NW (Fig. 4). The sliding surface day-lighted close to the lower sector of the canyon. The landslide probably started as a rock slide on the failure surface but soon evolved into a rock avalanche as it accelerated down the steep slope. In addition to the bedding plane, 3 joint systems are evident in the vicinity of the landslide (Fig. 5). The bedding plane trends N58E and dips a 28-37° NW (set 1 in Fig. 5). Joint set 2 forms the acute angle with the bedding plane and trends N77W, but dips towards 62°SW. Joint set 3 trends N10E and dips 66°SW. Joint set 4 trends N12W and dips 79°SW. The right and left flanks of the Ab-Ask landslide were accompanied by joint set 2 and joint sets 4, respectively.

3.2. Features and geometry of Ab-Ask landslide

In Ab-Ask landslide, the scarp to the northwest of the landslide mass, which is next to Haraz river, has been omitted. The scarp to the left flank of landslide, which is 1-3 m tall, is sloped toward north. The scarp to the right flank of the landslide, which reaches 7-10 meters in the tallest parts, is sloped toward southwest. These two branches are united on the landslide mass. The main scarp to the southeast of the landslide mass is of a slope toward northwest and 10-12 m height (Fig. 6). The secondary scarps indicate the inclination of the landslide mass toward north. This may have occurred soon after the major slide. Back-tilting on

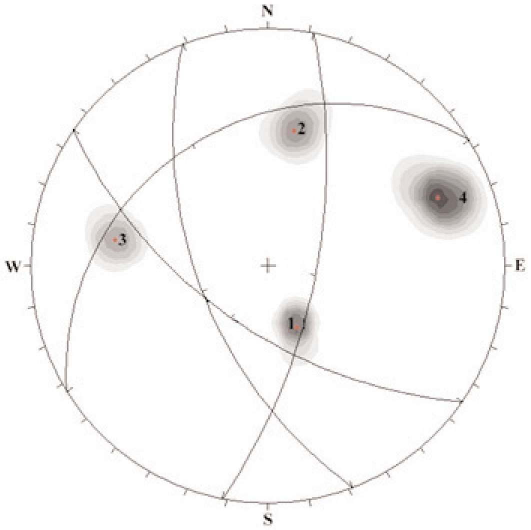

Figure 5. Contour plot of poles to discontinuities and related great circles. Stereonets are lower hemisphere equal area nets. Numbers inside stereonets correspond to discontinuity sets described in the text.

the secondary slide indicates that the mechanism was formed as types of a rotational slide. Concurrent to the second slide, a huge mass of travertine rocks fell over the landslide mass. Each rock is as big as 3 to 5 square meters. Presently the lake overflows in this part.

The surface of the rupture along the bedding is covered by striated by slickensides and exposed in the upper sectors of the slide. The accumulation zone is typical with a hummocky morphology having mounds up to 3-4 m in height and depressions of 2-3 m depth and 10-20 m width. The front of the disintegrated rock mass located on the opposite north side of the Landslide dammed lake, reaching to an elevation of 1854 m.a.s.l., a height of about 20 m above the valley floor. The mass is split and diverted upstream and downstream in the valley floor. The material that diverted downstream progressed almost 200 m from the axis of the rock avalanche. The landslide lake covered the mass diverted upstream (Fig. 7).

3.3. Dimensions

The landslide dimensions WP/WLI (1990) are useful to estimate the volume of a typical landslide. However, the Ab-Ask landslide does not satisfy a typical landslide model. Blocking the valley by the landslide mass and the absence of the after-failure topographic map has caused some uncertainties when calculating the depth of the displaced mass. Therefore, a valley profile to approximate the depth of the displaced mass and the topographical recon-

Figure 6. the former sliding surface due to the retrogressive slide.

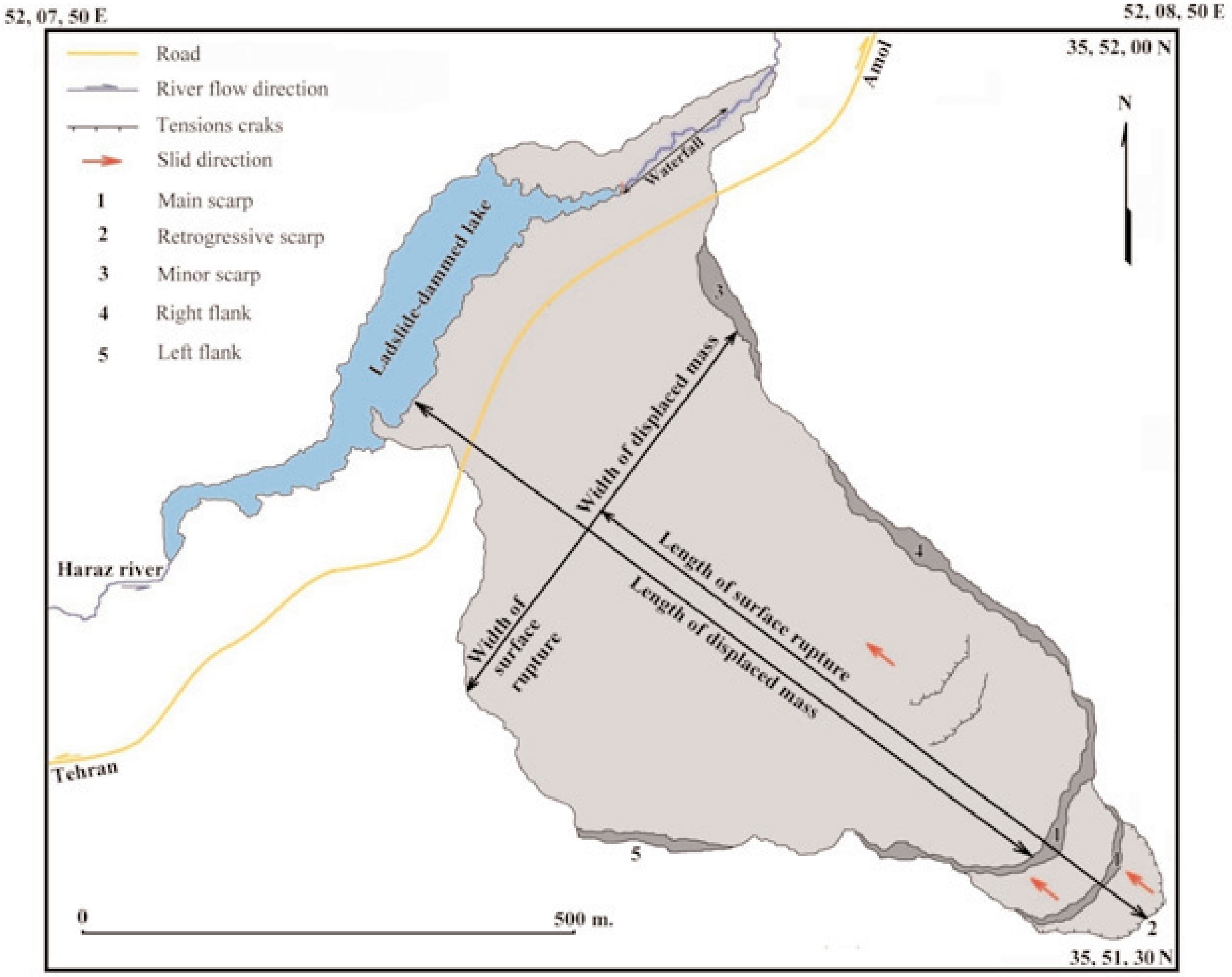

Figure 7. Geomorphological map of Ab-Ask landslide showing related landslide-dammed lake,water fall, and natural diversion channel of the lake.

struction after the failure were performed to estimate the landslide volume.

The dimensions of the Ab-Ask landslide according to the IAEG Commission on Landslide WP/WLI (1990) are tabulated in Table 1. The parameters of the length and the width of the landslide were obtained from the cross-sections (Fig. 4) and the geomorphological map that was acquired from the 1/50,000 scale topographic maps with a contour interval of 10 m. Because the landslide mass filled the valley floor, the depth of the displaced mass could not be estimated. Based on the cross-sections (see Fig. 4), the depth of the sliding surface is about 10 mat the upper part of the landslide. In contrast, the depth of the rupture surface toward the valley floor, where the main landslide mass accumulated, reached 20 m (Fig. 8).

Accurate estimation of the landslide mass volume needs pre-failure and post-failure maps as well as maps to landslide mass under water. In case of Ab-Ask landslide, there are no topographic maps, thus it is impossible to estimate the volume of the landslide mass accurately. Still, based on the approximations resulting from filed measurements through GPS and comparing them to pre-failure topographic maps, the volume of the landslide mass has been estimated with a high error of measurement. The landslide mass vol-

Table 1. Dimensions of the Ab-Ask landslide.

Dimensions Value, m	Value, m
Width of displaced mass, Wd	460
Width of surface of rupture, Wr	460
Length of displaced mass, Ld	780
Length of surface rupture, Lr	700
Depth of displaced mass, Dd	25
Depth of surface of rupture, Dr	10
Total length, L	930

ume is estimated to be 5.7 million cubic meter.

3.4. Ab-Ask landslide Activity

Tehran-Amol road is 180 km and one of the main roads between Tehran and Mazandaran provinces. This road has been used since 1963. Ab-Ask landslide is located next to this main road. Thus, all Ab-Ask landslide movements have been carefully recorded. As the records indicate, Ab-Ask landslide has had activities in 1973 and 1990. But the most pervasive activity of this landslide has been in 1999. It blocked Tehran-Amol main road in addition to creating Ab-Ask landslide dam. According to the local reports, Ab-Ask landslide activity started on May 19, 1999 at 4:30 pm with rocks falling into the road. Considering the exacerbation of the situation the road was blocked by the local officials at 10:00 pm and Pashang village was evacuated. It made for Ab-Ask landslide to have zero death tolls. At 12:00 am slight movements in the slopes overlooking the road started. The main landslide took place 4 hours later the resulting failure of which created a dam over Haraz river in a short while and destructed the road and some of the buildings along the road in the process. This landslide buried pashing village, destructed about 450 m of Tehran-Amol road and brought down a couple of power towers. Tehran-Amol, which is one of the most important connecting roads in the northern part of Iran, was blocked for 45 days (Karimnegad and Gayomian 2001).

The surface of the rupture of the Ab-Ask landslide occurred along a bedding plane and flanks were accompanied by joint sets. Repeated movements of the same type along the bedding surface and the ensuring enlargement of the surface of rupture were observed towards the upslope directions in the landslide. Based on these observations, the state, distributions and the style of the activity of the Ab-Ask landslide are reactivated, retrogressive and multiple, respectively.

3.5. The landslide dam and related lake

The Ab-Ask landslide mass impounds a 650 m long, 120 m wide lake with a surface area of 72400 m2 and a total volume of 651600 m3. The average March-April river discharge at the landslide site is approximately 12 m3/s. The base of the blockage varies between 10 and 12 m in width (parallel to the direction of the flow of the river). The length of the landslide dam is about 560 m along the cross-valley, but 300 m of this length belongs to the toe and has no significant thickness.

A delta with a length of 200m and a width of 20m formed upstream of the landslide dam. The delta has an average gradient of about 2.3°. The maximum thickness of the deltaic sediments is estimated rough-

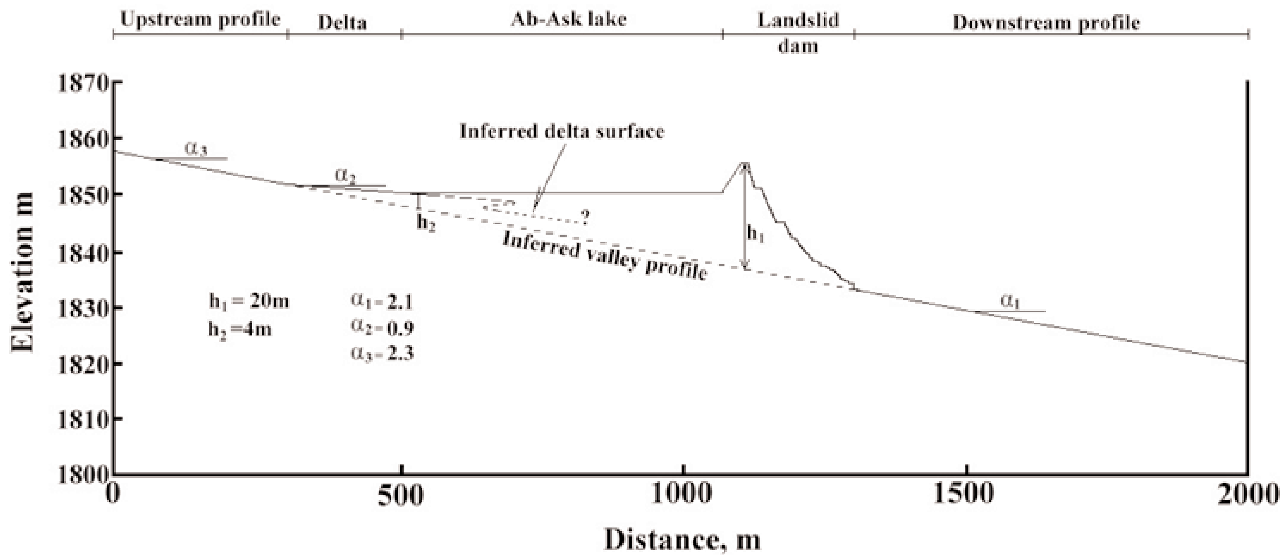

Figure 8. Longitudinal profile along the Hraz River. The profile extends toward 700 and 300 m downstream and upstream from the Ab-Ask landslide mass, respectively. Note landslide dam, related lake and delta formed at the upstream were crossed along the profile.

Figure 9. water fall and natural water overflew from the northern part of the landslide mass.

ly as 4 m by projecting the gradient to the longitudinal profile of the valley (Fig. 8).

After filling the reservoir, the lake was overtopped from a terrace, where is located at right hand abutment and the landslide mass accumulated, and a natural spillway was cut by the river. overtopping water created a marvellous water-fall at the tip of the landslide dam (see Fig. 9). The water-fall is 12-m wide and 20-m high, having a discharge of 12 m3/s in the spring time.

4. Environmental impacts of Ab-Ask landslide

Some landslide dams have positive environmental impacts. As an instance, Tortum landslide-dammed lake in Turkey is a tourist attraction, works as a fishing zone, generates electricity, and has changed the local climate as well (Duman 2009). Taking into consideration the fact that Ab-Ask landslide dam has not been utilized a lot, due to the specific topographic conditions and the lake's dimensions. The deep valley of Haraz river makes it very difficult to reach different parts of the landslide dam, like the lake or the downstream waterfall. Moreover, nothing has been done so far to grow fish artificially or generate electricity. Limited area of the dam lake has made very little changes to the local climate as well.

The busy road of Tehran-Amol being located next to Haraz river and all those many villages being built along the river sharply increase the damages and death toll of the landslide dam's breaking. So the lake failing will certainly bare a huge death toll. Most unfortunately, with no regard to the characteristics of Ab-Ask landslide dam, the local officials opened the floodgates of Laar dam in the upstream of landslide. It increased the pressure on landslide mass and might break it. Most fortunately indeed, despite the large over topping over the landslide mass, Ab-Ask landslide mass endured the pressure and did not fail. Undoubtedly failure of Ab-Ask landslide dam will bring about the destruction in the toe of the landslide in addition to damages and death toll resulting from the flood. Presently, the bottom of the landslide mass is on the left flank of Haraz valley. This acts as a natural obstacle and prevents the landslide mass from moving again. Moreover, considering the large volume of Haraz river deposit, the basin of landslide-dammed lake will be filled with deposits in a few years. An increase in the amount of deposits in the dam lake will increase the perseverance of the toe of the landslide. Thus, the accumulated deposit in landslide-dammed lake has turned to be a preserving factor for the landslide mass. This way, the most important environmental impact of Ab-Ask landslide dam is to strengthen the toe of the landslide.

Regarding its age, Ab-Ask landslide activity started after the construction of Tehran-Amol road. The excavations in the toe of the landslide in order to construct the road and resulted vibrations from the moving vehicles have led to Ab-Ask landslide mass activity. Thus the domain of Ab-Ask landslide-dammed lake is the centre of attention as a high risk region. In the case of a rupture in the landslide dam and erosion of the deposits, the toe of the landslide would be emptied and this would set for its moving again. When a landslide recurs, besides road destruction, there are chances of having a bigger landslide dam the failure of which can bring about worse damages.

5. Discussion

Korup (2004) has gathered the information on land-

slide dams volume and landslide-dammed lake volumes of 184 examples of worldwide data in a graph. Based on this graph, Ab-Ask landslide-dammed lake is of 65100 cubic meters landslide-dammed lake volume and 5700000 cubic meters of landslide-dammed mass and thus among small landslide dams. (Fig. 10)
For the prediction potential for landslide dam stability, Korup (2004) proposed six indices that are the Blockage Index, the dimensionless Blockage Index, the Impoundment Index, the Backstow Index, the Basin Index and the Relief Index (Table 6). Casagli and Ermini, (1999) applied the Blockage Index and the Impoundment Index to the cases in the Apennines, Italy. Ermini and Casagli, (2002) examined 83 worldwide sites for the dimensionless Blockage Index. Korup (2004) presented results from the Blockage Index, the Impoundment Index, the Backstow Index, the Basin Index and the Relief Index based on available data from New Zealand landslide-dammed lakes. Weidinger (2004) suggested the Block Size Stability Diagram. The diagram correlates the grain, boulder and block size of landslide material and the stability of a dam, with the result that the greater the average diameter of the components, the longer the life of the dam and lake. Davies and McSaveney (2005) pointed out the implications of the presence of fragmented rock material for the stability of landslide dams. Dunning (2004) discussed the sedimentology of rock avalanche deposits and its application to dam breach-development.
The indices introduced by Korup (2004), present precious information about landslide dams. Moreover, they enable us to predict the future conditions of landslide mass. The blockage index of Ab-Ask landslide dam is 6.8 and above the threshold ration of

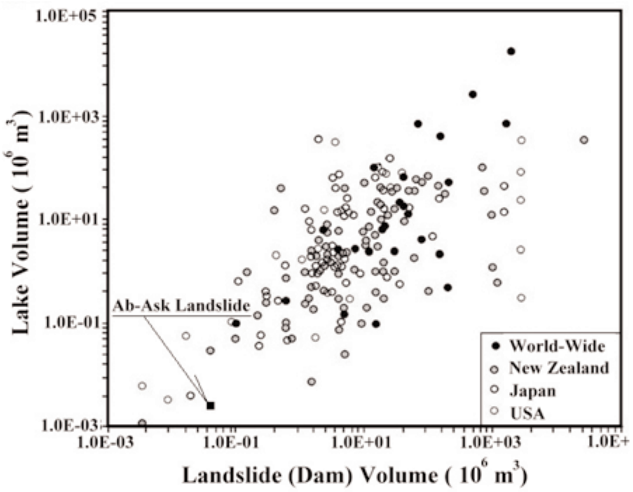

Figure 10. Bivariate plot of landslide-dammed lake volumes versus landslide dam volume derived from a worldwide data set (n=184), highlighting occurrences in New Zealand, Japan, and the USA according to Korup [13] and data from Ab-Ask landslide dam and landslide-dammed lake.

Table 2. Geomorphometric indices distinction of discrete domains of landslide dam stability results based on available data of landslide-dammed lakes from New Zealand Korup [13] and indices values for the Ab-Ask landslide dam and landslide-dammed lake.

Index	Landslide dam stability	Index values for Ab-Asklandslide dam
Blockage Index Korup (2004)	I_b>2 threshold ratio for formation lakes I_b<4 threshold ratio unstable lake I_b>7 threshold ratio stable and existing lakes	Ib = 6.8
Dimensionless Blockage Korup (2004)	$I_{b'}$ 3 lower threshold ratio for stable $I_{b'}$ 5 upper threshold ratio for unstable	Ib' = 2.8
Impoundment Index Korup (2004)	I_i=1 threshold ratio stable from unstable	Ii=-0.7
Backstow Index Korup (2004)	I_s<-3 upper threshold ratio for unstable I_s>0 lower threshold ratio for stable Data between these threshold remain inconclusive	Is= -2.1
Basin Index Korup (2004)	I_a>3 threshold ratio stable from unstable	Ia= 2.5
Relief Index Korup (2004)	I_a>3 threshold ratio stable from unstable	Ia=1.2

unstable lakes (Table 2). The rest of Ab-Ask landslide dam indices are either lower than the threshold ratio of stable lakes or in the inconclusive domains. Therefore, according to the indices, Ab-Ask landslide dam is in unstable or inconclusive domain. Regarding the fact that Ab-Ask landslide dam has endured for 16 years, it is assumed that there is an inconsistency between the calculated indices and the observations.

Ab-Ask landslide dam is of unique characteristics. Water overtopping the landslide mass which forms waterfalls on the body of landslide dam creates a dangerous situation. Moreover, water seepage from the landslide mass and the formation of three springs in different parts of it have created an undesirable situation. In most cases, such landslide dams quickly break. But Ab-Ask landslide dam is still stable after 16 years and in spite of several floods and the pressure resulting from opening upstream Lar dam floodgates. Most probably, the main reason for the landslide dam stability is the difference between the component material of landslide mass and the blocking part. The main part of Ab-Ask landslide dam mass is made of Shemshak formation coal shale and sandstone. But the northern part of the landslide mass, where the lake spillway is located, is made of big Quaternary travertine rocks. These travertine rocks were located as an unconformity on Shemshak formation deposits. Immediately after the main landslide, travertine rocks fell on the landslide mass from the height of 100-150 meters from the river level and located in a mass of mud. This has sharply increased the stability of the northern part of the landslide mass. In a way that river overtopping on the body of landslide mass has not led to its erosion.

From the point of view of hazard assessment, the danger of landslide dam failure is always present. As a result, this is probable for Ab-Ask landslide dam to face a decrease of height due to large floods in the future and the landslide mass to be destructed. Certainly destruction of the landslide dam and the reservoir being emptied in Haraz river path will cause huge damages to the road and downstream villages.

During the past 50 years no major earthquake has hit Ab-Ask landslide dam region. Moreover, during 1973, 1990 and 1999 when the landslide was active, no earthquake has been documented in the region. Thus triggering factor resulting from the event of earthquake has played no role in Ab-Ask landslide activity. But in May 1999, after rapid snow-melting in a short while, the most important activity of Ab-Ask landslide has taken place. Thus, triggering factor can be considered as the most confidently related factor to rapid snow-melting in the region.

6. Conclusion

Here, the Ab-Ask landslide dam and its characteristics, age, causal factors and environmental impacts, geomorphometric parameters of the related landslide dam and its impoundment lake, were investigated. Ab-Ask landslide is a large plane slide along the slope of Haraz valley. This landslide has occurred in the southern part of Damavand volcano and in altitude of 2000 m.a.s.l. in the hillside of Zardlaash Mount. Ab-Ask landslide is accompanied with formation of steep-wall on the surface of landslide mass and downfall of big rocks in the northern parts.

Considering the topographic situation and Ab-Ask landslide-dammed lake dimensions, it has brought about none of the positive environmental impacts like, climate changes, development of tourism, growing fish, development of agriculture, and hydropower generation. Besides burying Pashang village and causing heavy damages to Tehran-Amol main road, Ab-Ask landslide-dammed lake is an active threat to this road. Moreover, overtopping on the landslide mass has created an undesirable situation. Yet, in an amazingly unique way, the landslide dam is stable and has not been destructed. This shows that the stability of a landslide dam is not solely determined by the ratio of dimensions of landslide mass and dam lake. And the dimensions of the rocks in the spillway region, is of outmost importance in stability of landslide mass or lack of it as well. However, erosion of spillway region in Ab-Ask landslide mass increases the destruction potential of the landslide dam. The landslide dam's failure would lead to erosion of the accumulated deposits in Haraz riverbed. This way, the toe of the landslide would be emptied and grounds would be set for another slide. The successive filling of the lake with deposits would increase the stability of the landslide mass.

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