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Telceker Landslides; Mass Flow Morphology and Seismotectonic Influences on Hazard Mitigation. Dogubayazit. Agri, Eastern Turkey

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SUMMARY

Landslides, volcanic debris and mud flows are the most frequently occurred common geohazards in the Region of Great Ararat Volcano**.** Most geohazards are triggered or re-activated by earthquakes. This Region well known in literature as Turk-Iran High Volcanic Plateau (TIHVP) which located in front of Arabian-Eurasian Collision Suture. High seismicity and high relief due to young volcanism influenced mass movements. Landslides are frequently triggered by seismic shocks and developed by decreased slope stability due to active fault displacements. Telceker Landslide has been studied first by remote sensing and near surface geophysical techniques, by a joint research team from US-Los Alamos National Laboratory. Detailed geology, morphotectonic features and active tectonics of a landslide and surrounding area were studied. Telceker landslide subsidence started at the Turk-Iran border, water-divide line. Collapsed debris flowed northwards down along the valley and deposited near Telçeker Village at Doğubayazit Plain. The dominant character of the landslide mass is dominantly debris flow and currently active Mud Flow, at upper stages. The western margin is defined by a north-northeast striking left slip oblique Maşer Fault. Several ponds, swamp areas, longitudinal ridges, and transversal cracks, concave scarp structures have formed. Three segments of landslide are distinctly recognized along flow-direction. At the center, a Mud Flow continues through a narrow channel-like corridore, leaving lens-shaped huge fragments behind at the entrance to the corridor, 350 m wide and approximately 2.0 km long. A third segment is represented by deposition-accumulation of debris at the foot (toe) which crosses the Doğubeyazit Fault scarp where turns East (at sharp angle) resulted by right lateral displacement of the DB fault zone. Coarse debris spread down into the Doğubeyazit Plain in a fan-like geometry due to the high slope angle. Three stages of landslide activity are recongized, particularly at the lower part of corridor and at foot area. These stages are recognized by ground data based on textureal difference in topography, morphology, and degree of consolidation.

Introduction

Telceker Landslide and several other relatively short local landslides located at the uplifted (northwest) block of Dogubayazit Faults. This fault is a zone with N40W strike extending to Iran and combines North Tabriz Fault. Telceker Landslide caused complete destruction of agricultural area - as a valley with smooth surface of grass-fields. The whole valley filled by slope debris from both sides (from east and west) and flowed northwards down to Dogubayazit Plain, at about 1600 m altitude (Bayraktutan, 1987). To the South where the major collapse-subsidence occurred, at altitude of 2400 m. Three distinct segments of landslide developed with fantastic Mud Flows travers ridges, swamp areas, pools, domes etc. (Figure 1). Northward sloping topography before the 1949 Earthquake, had significant influence on the Whole Mass Flow, along the valley. Dogubayazit Fault zone is the major seismotectonic structure defines the SW margin of the Dogu Bayazit Basin (Karakhanyan et al, 2004).

Figure 1. Ark Shaped Mass in the Valley, oriented parallel to strike . Mud matrix debris Flow

There are several other landslides parallel to Telceker Landslide. Most of them ended by the uplifted SW block of Dogubayazit Fault Plane. Only Telceker Landslide crossed DB fault zone and with a sharp turn to southeast reflecting the slip sense of Right Lateral SS Faults (Strom and Abdrakhmatov,2018). The west margin of the valley controlled by N25E sinistral faults. This Fault namely Masher Fault surface lubricated by red clayey material and water springs at higher altitude section of the valley (Figure 2).

A local Earthquake that caused the landslide in August 1949 had an estimated magnitude of 5.5- 6.0. Mud flow is currently active at either side of the uplifted segment, but it is now laterally compressed and stuck in

place. The bottom topography (sliding surface) has three different geometrical properties. The South part has composite slide surfaces. The central part has a channel-like trough with a smooth base topography. The Northern part has steep sloping topography. The major geometry of the landslide is controlled by the Masher Fault along the Western margin and by the Telceker Faults to the North.

The close correlation of landslides and seismicity particularly in the Great Agri Region (Bayraktutan , 2019) requires serious analyses of landslide hazards under seismotectonic framework of NE Anatolia. Hummocky landforms are common on the northern most segment of active (stage III) mass flows.

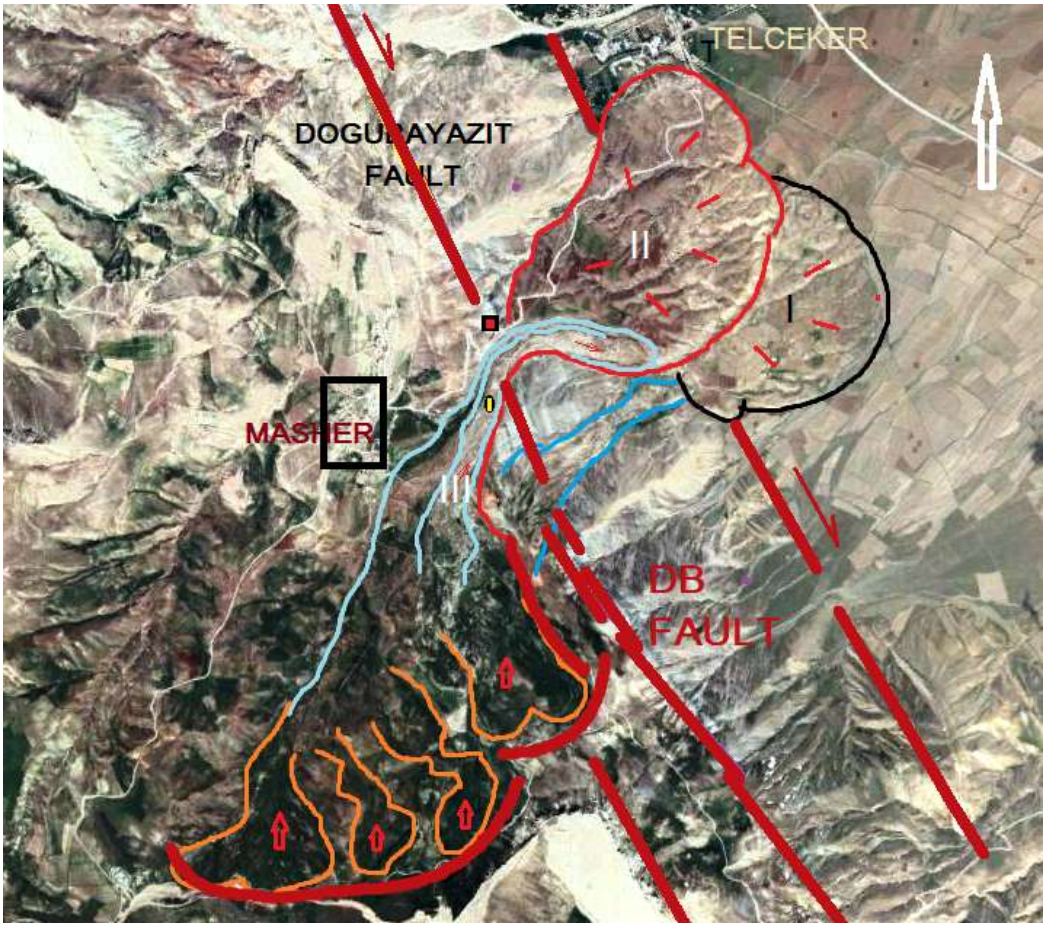

Figure 2. *Telceker Landslide; Dogubayazıt Faults and Three Stages of Debris Flows*

Methods

Major features of surface flow structures in the giant mass flow are studied by RS on Landsat-08 images, air photos and ground observations. Three geophysical methods applied in the central segment of Mud Flow include GPR- Ground Penetration Radar scanning, IP and Seismic Reflection by 24 channel Engineeering Seismograph. Cross-sections produced have been covaluated for basement topography, internal structure of flowing materials. An ark-shaped ground (Figure 1) uplifted by the 1949 earthquake, flowed northwards down the slope till entrance of the narrow channel, where it was stuck by the mud flow- dynamics patthern from both sides. Motion of this ark-shaped Mass was monitored by simple local geodetic network.

The ark-shaped mass had been scanned by SIR2 model ground penetration radar (GPR) using a 200 MHz antenna along transverse profiles at 2m intervals to investigate the internal structure. Additionally,24 channel engineering seismograph was used to obtain seismic reflection profiles. Geophysical data revealed two bottom topo-surfaces, as well as many vertical features and cracks. This work was the first GPR survey conducted in Turkey. Since 1987, several other GPR, near surface geophysical methods and two-dimensional ground resistivity measurements have been conducted.

Conclusions

Significant results of this research can be summarized as follows; 1) Geo- hazard risk sources are identified, 2) Mitigation of potential disasters- debris mud flows, floods, earthquakes- required ground data collected, measured in field, 3) Geotechnical safety of Village Telceker, at foot of giant Landslides, 4) Internal structure of Noahs Ark body determined in detail, 5) Geodetic measurements revealed that motion of the Ark Mass is not increasing by scale. 6) At the same time, this Landslide presents extraordinary fantastic features which is registered as Geo-Heritage Site, has gained conservation site statue, after this research as one final conclusion and the Site attracts big interests of Tourists.

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