Environmental changes after Kabirkuh landslide and its impact in formation of archaeological sites in Jaydar Lake area

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Received: October 30, 2014 Accepted: February 29, 2015

Extended Abstract

Introduction
Geographical and natural potentials of Zagros and archaeological findings from the studies suggest that this cultural area has been used for human societies from pre-history to the present days. Many devastating earthquakes (872 AD Saymareh) and a lot of landslides in the Zagros caused severe environmental changes in this region: Landslide occurrence in Kabirkuh, blocking the Kashkan and Seymareh River. The subsequently formation of the Jaydar and Saymareh Lake are among the most important environmental changes in this region.

Kashkan River is one of the environments that provides a suitable environment to settlement in this area from past to the present. But environmental changes, especially Kashkan river redirections and formation of the Jaydar Lake had significant effects on the settlement pattern of archaeological environments in the past. Therefore, the aim of this study is to investigate changes in settlement patterns of archaeological sites in the area of the Jaydar Lake after occurrence of Kabirkuh landslide.

Materials and Methods
The Jaydar Lake located in the western parts of Pole-Dokhtar, considered as studied area. Field and descriptive-analytical research methods along with tools such as topographic maps, geologic, satellite images, GPS and other software like Arc GIS and Global Mapper are used to assess the changing process of the settlement patterns of archaeological sites. Then, extensive field studies have been done in the area and with observing the lake deposits at several points on the periphery of Khorramabad- Poldokhtar road; then recording their heights, Lakes area has been drawn based on 740 meter contour.

In the next stage, the position and period of archaeological sites on the lake area have been overlapped. Using investigation of the height and thickness changes of sediments in the lake, the settlement pattern changes of the archaeological sites after formation of Jaydar Lake during the different periods have been analyzed. Finally, at the end of this study the results are presented.

Results and Discussion
Kabirkuh Landslide is the world's largest landslide. Based on Thermoluminescence dating method on deep lake sediments ample of Saymareh Lake, Kabirkuh Landslide time has been determined about 15700 ± 2500 years. After the occurrence of landslides and blocking Kashkan River, Jaydar Lake has been formed behind a pile of sediments slide. Its formation has coincided with the formation of the first stage of Saymareh Lake. Because only in the first step, landslides had the
most volume and vastness so that it blocked the Kashkan River path. Based on field studies, Jaydar Lake area is calculated around 88 square kilometers.

Chronologically, 27 archaeological sites have been identified in the area showing archaeological sites have been created in the prehistoric, historic and Islamic period. The distribution pattern of the identified 27 Archaeological sites shows that all the ancients are located in adjacent too rat a distance of less than 1000 meters far from the Kashkan River. Proximity to the water and flatness of its surface has been the most important factors affecting the formation and distribution of archaeological sites adjacent to the lake. Other factors such as topography and fertile land are important in the formation of archaeological sites. They have been affected by the water level of the lake and then by the river. So that the rise in water level is directly related to the height of archaeological site and the fertile lands in the margin of river.

Investigating changes in the height and thickness of the lake sediments show that in the Bronze period we can observe the formation of a permanent establishment (or perhaps semi-permanent establishment) and adjacent cemetery for the first time. In addition, during this period we can see the formation of archaeological site on these dimentary terraces at the end of these dimentation basin of Jaydar lakes.

**Conclusion**

The study of 27 archaeological sites from the EpiPaleolithic period to the late of the Islamic period in the Jaydar Lake sedimentation area showed that during this period, major changes in the settlement pattern of archaeological sites in the lake area have been occurred. All of these changes are directly related to the occurrence of Kabirkuh Landslides and the subsequent formation of Jaydar Lake and its remaining sediments. Gradual rise in water level brought about loss of 6 human kind settlements in the late period of Epipaleolithic with average height of 695 meters from the open waters in the lake margin and for cible migration to more elevated areas. It looks like that water in the Neolithic period reach to its highest level, 740 meters, and up to the end of this period remains at the same level. With beginning of the Chalcolithic period the height of the archaeological site area is reduced and areas that have already been buried under the water, in this period once they become residential.

Formation of the first permanent settlement with in the Jaydar Lake coincides with the Bronze Age. In addition, residents of this area in this period of time for the first time build graves on lake and river sediments. Two periods of drought during the Iron Age cause the formation of Iron Age sites in the alluvium mountain path and near the river Kashkan. In the historical period (Achaemenid, Parthianand, Sasanian), much of the lake sediments (probably up to the entrance of Poldokhtar) have been dried. In historical period, archaeological sites to access the river have been formed in the closest parts to the river. The pattern of settlement in the early Islamic period is not much different from the previous period. But at the end of the Islamic period and after over 5000 years, the basin sediments of Jaydar Lake are dried and conditions for the formation of new settlements especially in the Jaydar plain area are provided.

**Keywords:** archaeological site, environmental determinism, geoarchaeology, Jaydar Lake.