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New Geomorphologic Observation on Dating an Old Grand Landslide, Seimareh (Kabir-Kuh), Zagros Mountains, Southwest Iran

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Abstract

Landslides are among important mass movements of a great interest for earth scientists. This is due to their importance in land use and decision-making in rural and urban areas. Survey of old landslides to determine their behavior has important bearing on the study of new ones. Seimareh grand landslide is one of the oldest and the most attractive phenomenon that has been the subject of concern for Iranian as well as international scientists for decades.

There are two different opinions on the motivation factor and incidence date of the slide. This paper tries to investigate both geographic location and condition of the slide, with the geologic background of the Seimareh basin. By using hydro- climatic data, kinematics calculations, morphometeric measurements and remote sensing simulation, the dimension and extension of the landslide have been determined and a reasonable date of event has been estimated.

Geomorphologic field and documentary surveys and historical details have led to a new chronological conclusion that the event age was about 1100 years old instead of 10k.a. years as suggested by others. Also Hogback movement in limestones has been recognized as the trigger or motivation factor for the slide in the area rather a severe earthquake.

Keywords: **Mass Wasting, Seimareh Landslide, Zagros Mountains Morphology, Geomorphologic Dating.**

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Introduction

The giant landslide of Seimareh (Kabir-Kuh) is one of the great and well known landslides in the world that happened in Zagros Mountains, southwest of Iran (Figure 1).

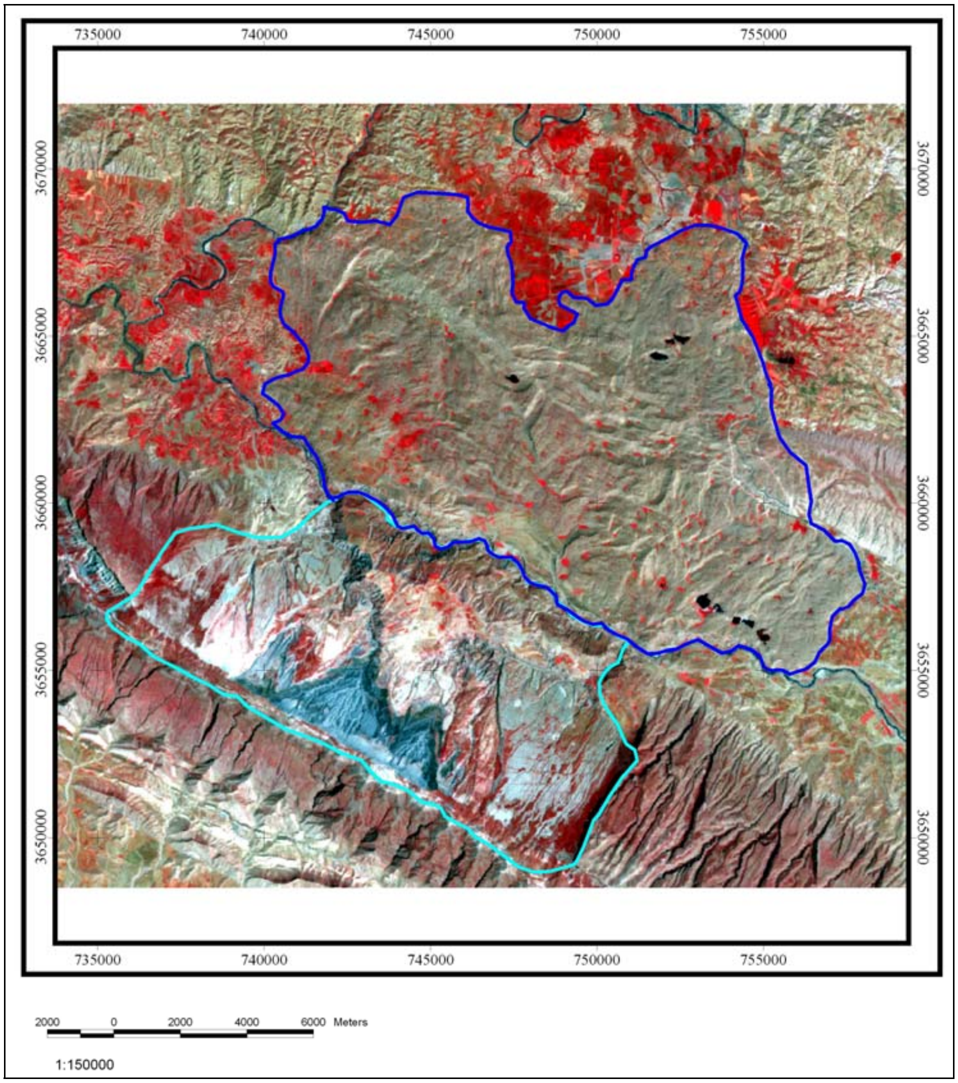

Figure 1 Seimareh landslide area on Landsat-7 (E.T.M) remotely sensed images.

The landslides' size and displacement is large enough to attract the attention of many scientists. It has been recognized as the greatest known to the world (Bloom, 1978, p182-183) and some call it the greatest landslide of it's kind in eastern hemisphere (Fisher, 1968 p190).

The geographic setting of Seimareh landslide is in the boundary between two Iranian provinces: Ilam and Luristan at 33, 00 N to 33, 15 N and 47, 30 E to 47, 40 E. The landslide starting point is the Kabir-kuh anticline crest line in Zagros range and slipped into the old Seimareh river valley and bed.

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The landslide debris has been spread on low opposite slop of Dofarsh-kuh anticline with a 700-meter elevation after damming the course old Seimareh river. The debris covered an area estimated about 80sq. km (Banihabib & Shoaei, 2000, p 2), or about 100 sq. Km (Bargrizan, 1995, 263) or even 166 km2 (Komakpanah, et all, 1995, p 311).

Geological setting of the landslide showed on a 1:100,000-scale geological map of southwest Iran published by N.I.O.C. Oil service Co. (Iran N.I.O.C., 1975) (Figure 2).

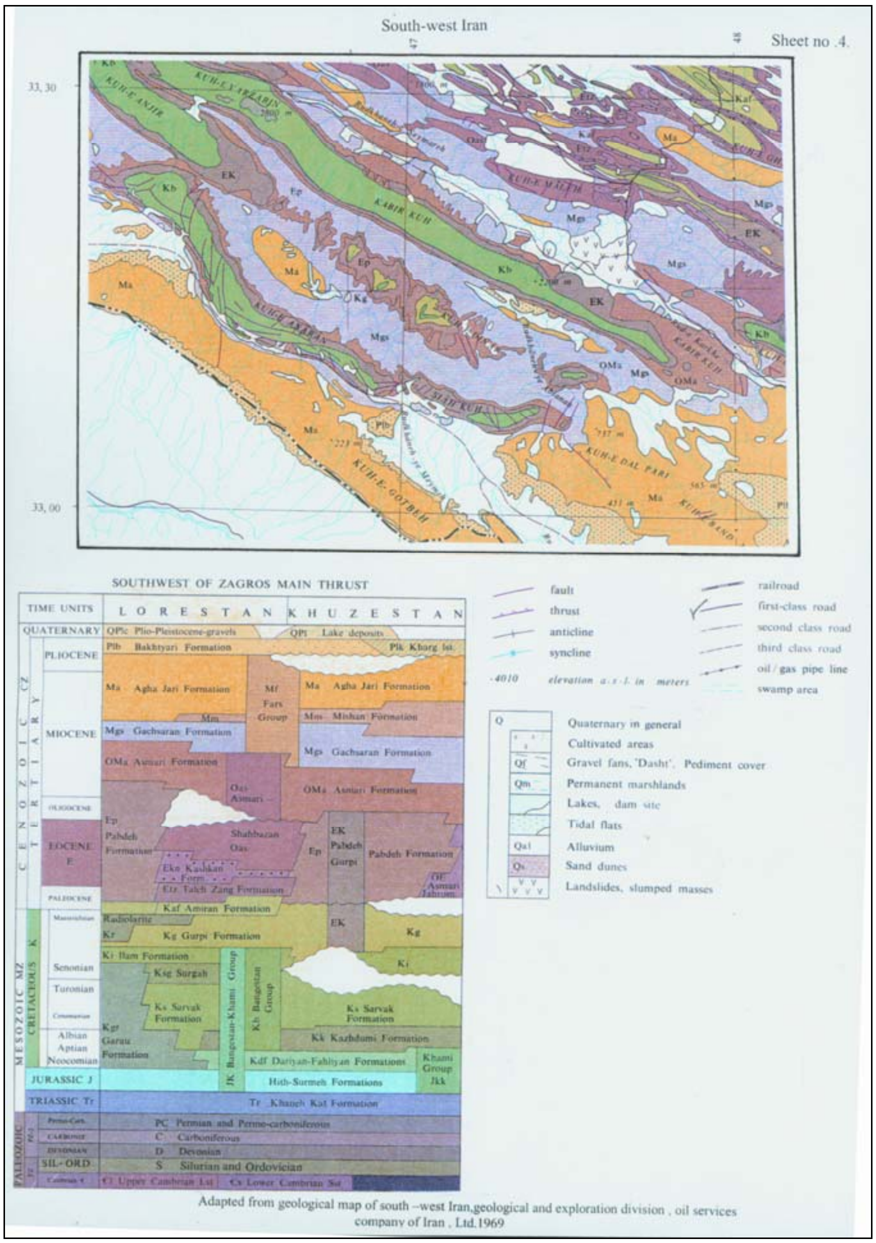

Figure 2 Geological map of Seimareh landslide area (N.I.O.C.Co.)

Geological investigations on the landslide documents and field surveys have shown that lithologicaly, the Kabir-kuh mainly consists of Asmarian Formation, which are combination of dolomites limestones, clay limestones and shale. The age of this formation dates backs to Oligocene epoch in Cenozoic era to Burdigalian of lower Miocene, and upper Asmarian, and beneath this formation lies evaporates of Gachsaran Formation.

Asmarian Formation divided into lower, middle and upper Asmarian based on fossils and sedimentation processes. Marlous limestons of upper Eocene age and Kajdomi Formation shale by Cenomanian age form some parts of the landslide realm and also Kabir-kuh, (Motiei, 1993, p 332).

Tectonically, the region has low seismicity and probably nearest active fault situated at about 20 km distance off the north west of Maleh-kuh, based on a seismic probability map of Iran. The landslide region showed as an area of low seismic risk region in this map (Barzegar, 1997, p 81) (Figure 3).

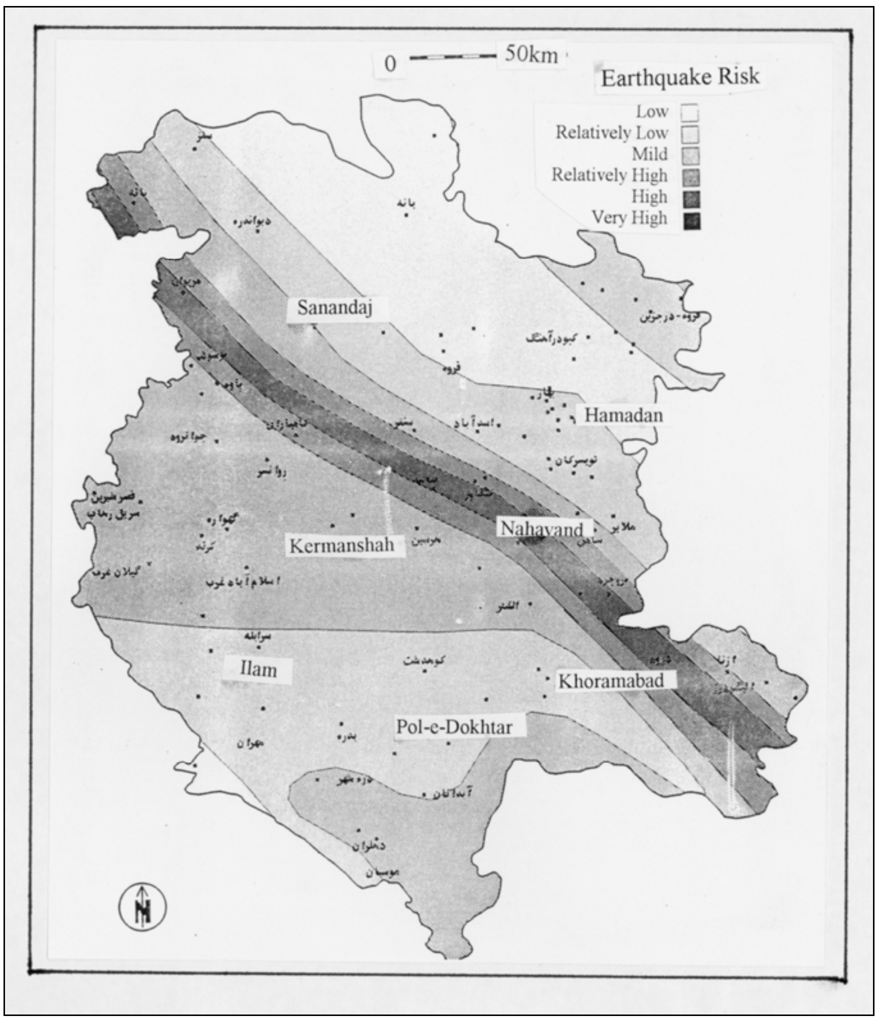

Figure 3 Seimareh risk map of the Zagros region, South-west Iran (after Urban Planning Centre of Iran)

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Although the map shows that the Seimareh region has a low risk of seismic probability, however the historical documents highlight that severe earthquakes shocked the region during historical periods (Ambraseys and Melville, 1991, Komakpanah and Montazerghaem, 1995, Bargrizan, 1995; Rahnemei, 1996).

Many landslide researchers have paid attention to the causes of the phenomenon such as gravitational forces (Chorley, Schumm & Sugden, 1984), gravitational slips (Oberlander, 1993), saturation and swelling of susceptible layers by water (Komakpanah, 1994) or a mixed structural and saturation condition of stratigraphic layers (Alaei, 2002, p 179).

Different dates have been suggested for the landslide, attributing to 10 k. years, the time when late Pleistocene pluvial periods dominated the region (Bloom, 1978; Chorley, Schumm and Sugden, 1984; Darvishzadeh, 1991; Komakpanah, 1994; Banihabib & Shoaei, 2000) or 2000 years ago and 872 A.D. (, Ambraseys and Melville, 1991; Bargrizan, 1995).

Since different approaches for the causes and a considerable range of date on the landslide have been given, geomorphologic investigations carried out to find evidence for relatively accurate date based on the field surveys and interrelationship among the hydro-climatic, geomorphic and geological findings .The work has been completed through the following stages:

- **a)** Document investigations, including historical records;
- **b)** Morphometric and geomorphic field surveys.

Investigations based on theories that:

1) Undercutting in Asmarian limestone layers and masses and forming a hogback in the limestone masses, have been main factor for releasing layers and motivation in the Seimareh landslide at the region;

2) An earthquake motivated weathered limestone on the slip plain and triggered them to move toward Seimareh river valley, and;

3) The date of the event is new, confirmed by geomorphologic evidences and kinematics measurements.

The first suggestion was presented because of high dissolution rate of limestone marls, shale and chalks and considerable erosion power of the Seimareh river at the base of the layers and undercutting by the river action and erosion force create a hogback in Asmarian limestones, marl and shale. To test this suggestion, geologic structure and lithologic investigations carried out either on the documents or on the field observations. Reconstruction of the premier environment has been completed by a digital elevation model (DEM) based on 1:50,000 topographic maps of the region (Iranian Army Geographic Bureau, 1976).

We tried to reconstruct a drainage system before incidence of the landslide by omitting landslides' debris in our minds and on our DEM based on the topographic maps and remotely sensed data (Figures 4 & 5).

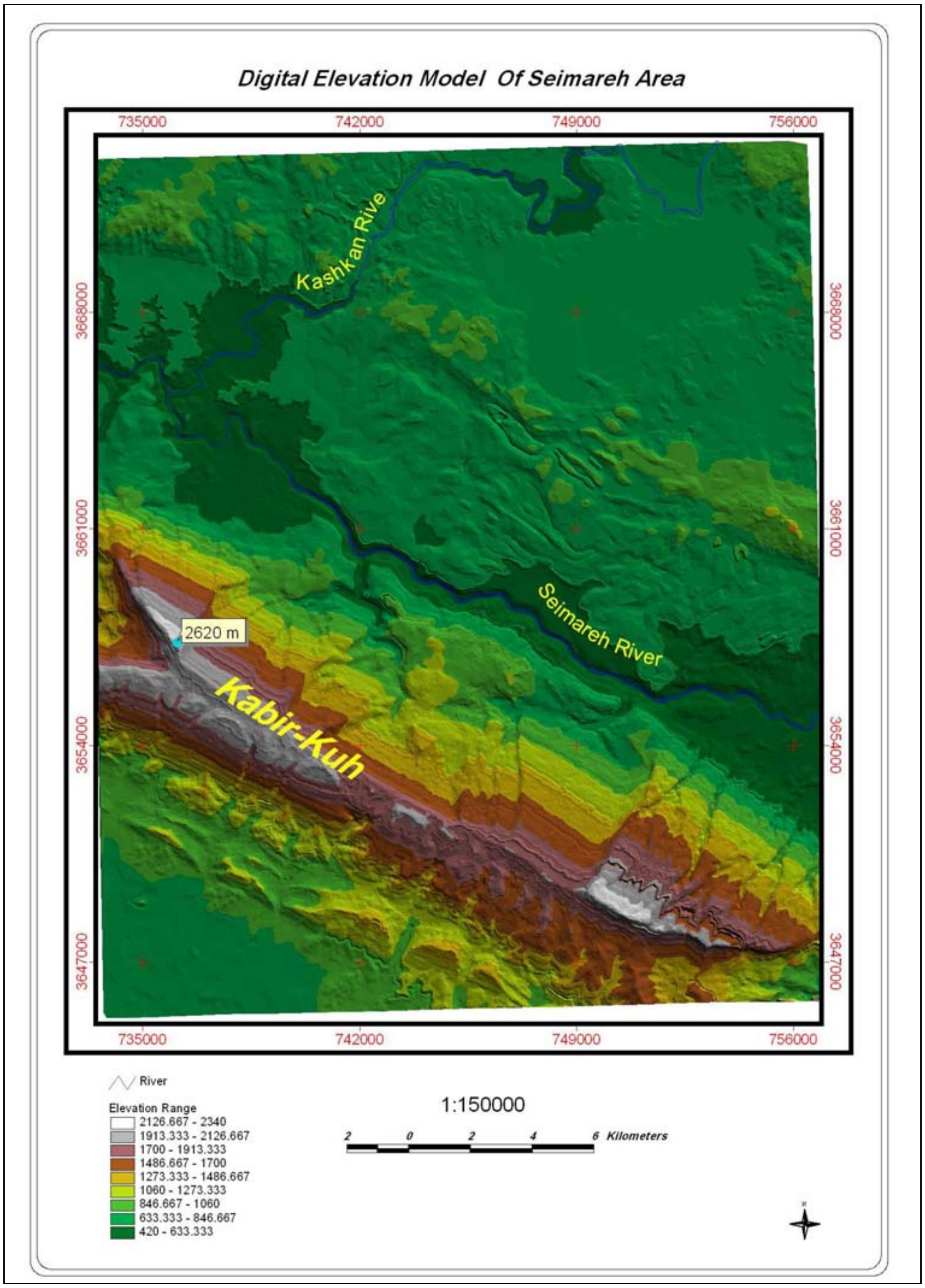

Figure 4 Digital Elevation Model (D.E.M.) of Seimareh landslide area based on topographic maps and remotely sensed data

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Figure 5 General perspective of Kabir – kuh and the landslide, showing west direction.

Because of the publication of reports on a trigger effect of an earthquake on the landslide and differences in mechanical characteristics of the phenomenon, and for testing the second theory, new mechanical calculations were accomplished and simulation of the dynamism of landslide appeared to approve the third suggested theory for the date of the landslide. Field observation on hydrologic network of the region, investigations and measurements of soil thickness formed after the landslide, the roughness rate of the debris blocks, shifts in channels and watersheds with different rates, rates of displacement and deposition of new material after flashfloods at the region and it's relation to the discharge volume of Seimareh river and, local climate effects on the debris landforms were studied and samples were collected. Analysis of these data and geomorphologic relations between landforms, soils and drainage pattern, along with stimulation programs led us to conclude the main cause as well as the date of the landslide (Figure 6).

2. Study Area

2.1 Climate and Hydrology

The Kabir – Kuh region has a semi- arid climate with cold winters and dry summers in mountainous areas. During winter seasons Mediterranean rain - bearing cyclones influence the region but in summers the temperature is high and relative humidity is low and continental conditions is dominant, so maximum temperature reaches to about 36º C (Rahnemaei, 1996). Because of steep slopes of mountains and of regions mild rains and flash showers at the Kabir- Kuh area, run-offs destroy slopes and weaken points of unconsolidated material and carry a high volume of loads into Seimareh riverbed. The erosion power

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of running waters on the steep slopes is high enough, cutting deep channels through rock masses. Melted snow waters on steep slopes of Kabir- Kuh have rapid movements with high erosional in channels and a high volume of eroded material into the Seimareh riverbed and depressions formed inside the debris' material. Pediments of the Kabir-Kuh with unconsolidated and weak material are exposed to erosion, so there are many landforms at the region, such as alluvial fans, taluses and other related features at the landslide area. Annual average rainfall of the region is about 400mm (Rahnemaei, 1996, p 33).

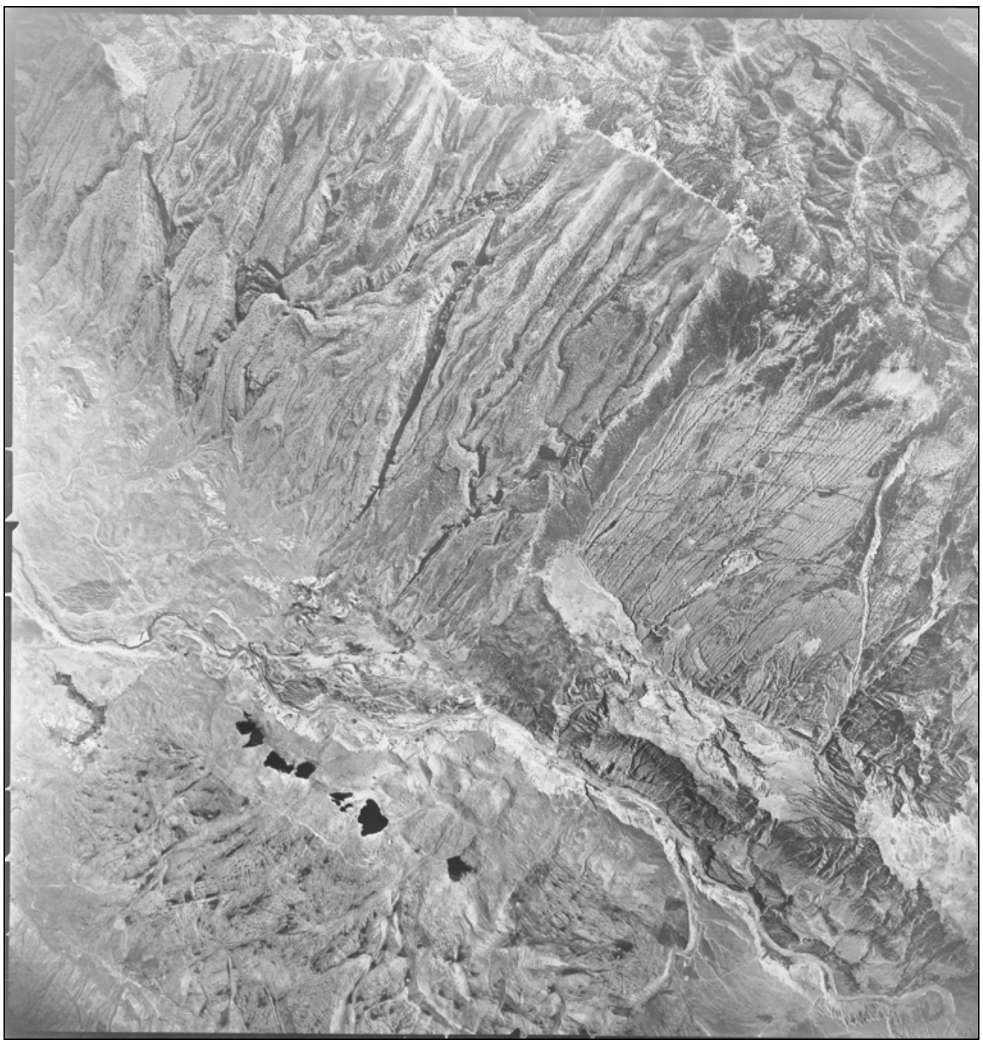

Figure 6 General view of Kabir– kuh, and slipped lime stones of Asmarian Formation through aerial photo of the region. Dark dots are remained lakes.

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From the oro-hydrographic network point of view, the study area is one of the main components of Seimareh –Karkheh river system that makes Seimareh system. This area is one of the main parts of drainage systems that formed after conjunction of Gamasiab & Ghara-su Rivers by Kashgan River at the study area. The direction of flow at the base of Kabir-Kuh is in north-west to south-east The length of main Seimareh river valley is 235 Km and waters that discharge from upper rivers, drains an area about 28,454.5 Km and pass through the base of Kabir-kuh slopes. If we consider characteristics of rain showers and flashfloods at the region after passing rain-bearing Mediterranean cyclones, and weak lithologic formations at the region, it is obvious that erosional and destructive potential of the Seimareh waters are considerably high in the region. Annual average discharged waters of Seimareh at the region is 109 cum/s and average maximum of discharge is about 217 cum/s, and we can calculate expected flashfloods at the region based on the statistical methods: average flood discharge of the Seimareh river at Cham-zab hydrometery station is 894.5 Cum/s based on Gambles distribution, and is 780 Cum/s based on parametric normal log distributions (D.W.P.I., Co. 1999). We can conclude from these records and estimations that the potential of flashflood for carrying the debris and unconsolidated eroded material off the region is considerably high. Probability of incidence flashfloods in Seimareh river basin at Cham-Zab station during 2 to 10,000- years periods presented in Table 1.

Table 1 Characteristics of Max. discharge and return periods of flashfloods during 2 to 10k-years in Seimareh River at Cham-zab hydrologic station

Flood Special Disch-arge (M3/sec /Km^2)	**Drain-age Area (Km^2)**	**10'000**	**1000**	**100**	**50**	**20**	**10**	**5**	**2**	**Return Period Max.disch.[1]**		**Station**
0.24	28454.5	5361.5	3686.6	2371.9	2000.0	1582.4	1273.1	980.0	594.7	*	One Day	Seimareh Cham-Zab
		6600.0	4200.0	2500.0	2100.0	1600.0	1300.0	990.0	595.0	**		
		9691.7	4711.5	2936.5	2500.0	1945.3	1591.8	1130.0	715.3	*	Momentum	
0.29+		8300.0	5300.0	3100.0	2600.0	2000.0	1600.0	1140.0	715.3	**		

* Calculation based on standard skewness.
** Calculation based on standard skewness and corrections.
+Calculation based on one- day & momentum discharge, relations.
1 discharge in m3/s
(**Source**: D.W.P.I. Co.1999)

The sediment yield discharge volume has been calculated at Saz-bon hydrologic station on Seimareh near the Cham-zab station. The volumes at two stations are approximately the same and the sediment yield is about 353.6 metric ton/km2/year (D.W.P.I., Co., 1999). Considering the annual yield we may conclude that total sediment yield at the entire region is 10, 061,581/ton/year, or about 10 million metric tons of sediment pass through the Seimareh river at the landslide area, and has a considerable erosional and depositional potential power to make a hogback in soluble Asmarian limestones and all of debris, resulted by the landslide. We should pay attention to climatic changes over time and drier conditions after the occurrence of the slide. During the landslide the region would have been wet, with more rains and powerful rivers than now.

2.2 Seimareh Landslide Characteristics

Northern slopes of Kabir- Kuh in Zagros range have northwest- southeast directions at landslides' start plane. The Asmarian limestone departed from Kabir –Kuh anticline crest and moved by a northwest direction toward Seimareh river valley. Maximum height of the slip region in northeast of the mountain which is the root of slide, is 2353 m and in southwest about 2339 (Figures 7 & 8).

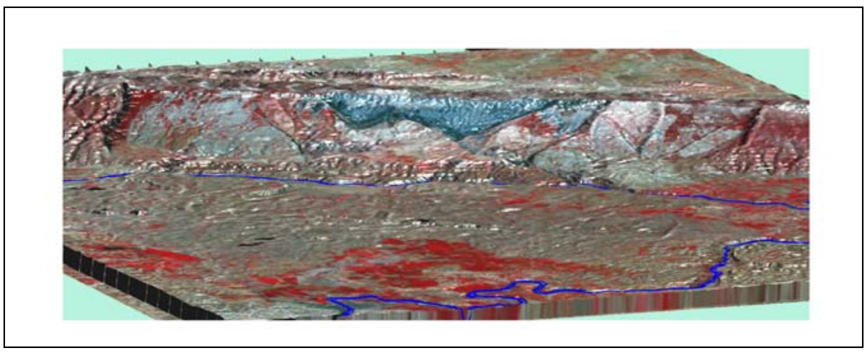

Figure 7 Southern perspective of the landslide area, with looking toward South.

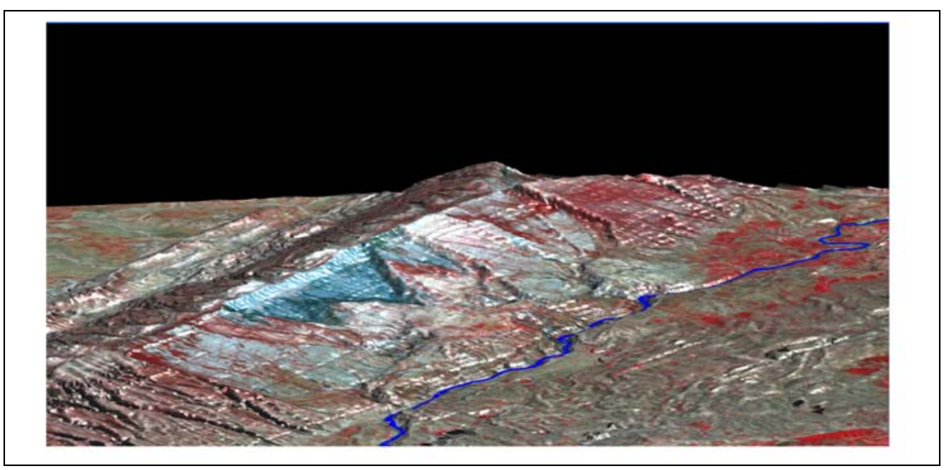

Figure 8 Northern perspective of the landslide area.

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Depth and length of the Asmarian limestone layers which was moved during the slide are respectively 305m and 14 km. Mechanical calculation shows that the material moved about 902.5 m from Kabir-kuh crest to Seimareh riverbed. The steepness of slopes that the slide moved over is about 20 degrees and bed layer was used for the slip is made of chalk of Gachsaran Formation. Calculations implies that the speed of movement has been about 5m/s2 and about 20 km of material with a volume of 56 billion cum3 displaced at a height of about 1800m.The slide debris discharged into the Seimareh riverbed, crossed it and accumulation of material made several barrier lakes behind the closed river course until the volume and power of accumulated waters and loads enable to cut river course through a narrow gorge inside the debris and all the collected waters have been emptied by a flash flow. Geomorphologic evidences show that max. and min. of water marks on the banks and inside the lakes are at 912m and 801 m above sea level and can conclude that the depth of Seimareh lake has been at least 111m. After crossing Seimareh riverbed, the debris mass continued its' way toward the opposite slope and has moved up to about 9km! Width of debris accumulation area is about 8 to 12 km.

The first section of movement or slip is from Kabir-kuh crest to Seimareh river bed (Slip plane) with 902.5×14000m = 12.6km2 and second part is accumulation area with 135km2, which totally covers an area about 147.6 km2.

It is estimated that the length of Seimareh Lake has been about 15km, covered an area of about 85km. In some published documents on the landslide, deepness of the lake has been estimated to be 180m (Oberlander, 1993). Remainders of former lake may be found in three places around the area now: Jaidar, Seimareh and, Chah-Javal lakes.

Since there are many remained debris blocks of landslide all over the region with different sizes, from small ones to even about 20 m3, Shreve (1966) calculated that speed of slip has been about 300km/h and it had enough power to displace the material on to opposite anticline by a height about 600m above the base level of region and travel about 18 km, while our calculations lead to a figure of about 192 km/h (Table 2).

Equations used for Kinematics calculation of Seimareh landslide dimensions in the table are as follow:

Movement Speed:

Eq no 1: $V^2 - V_o^2 = 2\alpha\Delta x$

Eq no 2: $mg \sin\alpha - fk = m\alpha$

Eq no 3: $\Delta x = \frac{1}{2} \alpha t^2 + V_o t$

Eq no 4: $\Delta P = m\Delta v$

Eq no 5: $Ft = m\Delta v$

Eq no 6: $\Delta d\beta = 10 \log (I/I_o)$

Noise intensity:

Eq no 7: $W = fd \cos\theta$

Compressed air:

Eq no 8: W (Air) = Wt (Total) – Wf (Friction)

Eq no 9 : $(Fd \cos\theta) = (F' d' \cos\theta)$ $\quad \underline{F = p \times s}$

$F' = m\alpha$

$(psd \cos\theta) = (m\alpha d' \cos\theta)$

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Table 2 General characteristics and cinematic calculation results of Seimareh Grand Landslide

	Definition (Parameter)	***Size, or Dimension***	***Unit***
1	Length of Landslide, Crest line of kabir- kuh	14	Km
2	Width of Spreaded material (debris),on slide plane	902.5*	M
3	Affected area by Landslide: a) Slide area b) Debris deposition area	 12.6 135.0	 Km^2 Km^2
4	Asmarian Limestone Layer thickness slide	305	M
5	Slide slip angle (average)	20	Degree (°)
6	Total debris′ volume	20	Km^3
7	Debris ′mass	$56x10^9$	$Mton/t^3$
8	Equal triangle height (gravity centre)	1800*	M
9	Distance of material movement after passing Seimareh riverbed valley a) Max. b)Min.	 12 8	 Km Km
10	Seimareh Lake area	85*	Km^2
11	Seimareh Lake depth: a)Max. b)Min.	 180 111*	 M M
12	Max. volume of debris	20	M3
13	Slip velocity on kabir- kuh slope	190*	Km/h
14	Accelerated velocity on slope	5*	M/s^2
15	Front compressed air force during the slide	10^5*	N/m^2 Or $100KN/_m{}^2$
16	Released energy during the landslide (Surface friction supposed to be 0)	64890*	N/m^2 Or J/m^2
17	Sound Intensity level during Landslide (Noise)	105*	Db
18	Length of accumulated debris area	12165	M
19	Length of debris displacement	902.5*	M

*Measured & calculated by the author**.**

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3. Geomorphological considerations

Some of kinematics findings, resulted by physical and mechanical relationships which presented in Table 2, help us to understand geometric characteristics of the slide, such as volume, mass, speed, exceeded speed, slip and accumulated area, lakes' areas and so on. A brief look at the table shows that we are encountered with a grand landslide with a giant scale.

Hydrologic & geomorphologic surveys for testing hypothesize at the region, led us to conclude that:

A) Undercutting and a hogback were main factors in instability of Asmarian limestone mass (at least with a layer of 305 m thickness) created by the Seimareh river erosion power. Based on this theory, mass weight of the Asmarian limestone, undercutting & creation of a hogback, lead to instability of material at the region and gravitational force made cracks in rock masses caused more instability within the limestone mass.

Thus, because of the movement of the mass the grand landslide occurred. We can reject the theories based on saturation of under layers by waters collected by continuous rainfalls after or during pluvial periods of Pleistocene as a trigger factor of the landslide; therefore there wasn't needs to have a heaved elastic clay layer.

Underneath Asmarian layer is a trigger factor and saturation of clays, because the slipped layer is Gachsaran chalk, not a clay layer. The huge dimensions of moved debris during the slide approve the gravitation force due to undercutting and instability of underneath layer by a slope angle of about 20 degrees. From the kinematics points of view, a huge mass of material with- out a reliance plane, under gravitational force (9.81) could be a factor of movement alone. These rules approve the Oberlander theory for the landslide that saturation of underlayer and a severe earthquake were not necessary for the landslide and, reject other theories (Oberlander, 2000). Also the mass movement based on under cutting and hogback, rejects the Harrison and Falcons-first presenters of the Seimareh landslide-theory that saturation factor was as trigger factor of the slide after Pleistocen about 10,000 years ago (Harrison, Falcon 1936, 1937, Harrison, 1964).

B) Mechanical calculations based on the measurement of the landslide dimensions and it's debris shows that the slide mass by itself has enough mass, weight, and energy that could create a huge noise at the area and adjacent regions. A detailed survey of historical documents about the phenomenon in the region shows the indication of a great noise in the region, but the recent authors take the noise as a sound made by an earthquake. In a conclusion made in one of the documents, the authors says: "in all of the documents, the Arabic term of " Hedah " stands to explain the quake which means a great noise of collapsing buildings or debris, this term don't point to the collapsing factor, an earthquake or similar phenomenon (Ambraseys & Melville, 1991) so, it seems that all of the researchers made carelessness on historical quotations .We conclude from all of mechanical and kinematics calculations that the grand landslide of the Seimareh has enough energy and power to create a grand noise and seismic shock on the region resulting of collapsing a bout 56 billion tones of debris during a 3 - minute movement only. Some historians, like Tabary in his "History of Tabary" mentioned a seismic shock at the time of the landslide in *Waset* and *Basra* (two towns in Iraq, at distance of about 290 km from the Seimareh region). Therefore the second theory that a severe earthquake made the landslide, rejected. It seems that the situation was vice-verse!

c) Geomorphologic evidences shows that the date of the landslide is recent one and the slide cannot be as old as 10k years. The evidences areas follow:

1) **Limited development in drainage system:** field surveys, remotely sensed date, aerial photos of the region show that the runoff system hasn't developed enough to create 3rd order river and channel system on the debris resulted of the landslide. Since the annual average of rainfall in the region is about 400mm, and as flash rains, the lime stones have not enough resistance against the erosional power of these rains, and the chalks of Gachsaran Formation layers are very susceptible to erosional forces of run-off, if there were longer time- such as 10k years should have been appeared a developed network of drainage system in the region. But lack of such a system is the effect of short duration of erosional factors, thus we can conclude that the time of the slide has not been enough to develop drainage system.

2) **Limited development in regolith formation:** field measurements and observations shows that the development of regolith at the base of rock debris is small and limited because of lack of enough times for development of such a materials.

The climatic conditions, weathering rate in the region after fluctuations in annual, seasonal and daily temperatures and gravitation force in the region are enough to develop a considerable regolith layer in the case of the availability of longer time. Lack of considerable regolith layer could be attributed to lack of time. Thus we can conclude that the slide is new. The thickness of regolith layers at the base of the rocks is about 3-8mm only (Figure 9).

Figure 9 Regolith layer development is not considerable, and blocks keep their primitive forms (S-W of Gavmishan village).

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Figure 10 Lapies made on the landslides' limestones are shallow.

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4) Low Roughness rate in debris: Erosional factors such as wind, temperature fluctuations; chemical and mechanical weathering can lead to roughness in granular rocks and material. This makes rough angles in the sharp pointed or jagged material. Field observations on the landslide debris shows sharp angles on the limestones and other material that indicates that the time wasn't enough to fade away the sharp edges on the rocks (Figure 11).

Figure 11 Roughness on Asmarian limestone block has low development. The picture shows the biggest block of debris in entire landslide area.

5) Limited alteration in crack and fissures in debris: Field measurements and observations on the landslide debris shows that the cracks and fissures created after the landslide in the debris are limited and large debris blocks are intact and massive yet. Only some limited cavities can be seen on the rocks due to the solution processes. We can conclude that despite the fact that weathering conditions are suitable; the limitation of time span is effective factor on under development of the cracks and fissures in debris (Figure 12).

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Figure 12 Developments of fissures and cracks on the landslide blocks aren’t considerable. Note to man as scale.

6) Limited development of the soil horizon: The development of soil horizons have a direct retaliation to time span over the soil formation; the greater soil thickness, the longest the time span involved. Field observations and measurements of soil horizons of debris and the landslide area shows that only in limited depressions are among the debris turned to patches of land used for vegetable cultivations by the *Gavmishan* village people. The patches of lands are very limited, and even the size of patches are less than one or tow acres. The soil horizon is limited to development of about 10cm. If there was about 10k year's time for the soil to develop, we could have find at least a developed humus horizon in the region and developed soil layer beneath it. It should be mentioned that the rural people of *Gavmishan* should collect the coarse debris material to create a limited patch of land for vegetable cultivation and preparation of the lands is a difficult task (Figure 13).

Figure 13 Limited patches of cultivation land, which has been developed on the debris from the landslide, (South of Gavmishan village).

7) Limited deposition through fluvial and runoff processes: The Seimareh River should have enough strength to deposit its eroded material on its' banks and bed in the landslide region if it passes about 10k years time. A field observation shows that within the landslide area and banks of the Seimareh river, extension and thickness of deposited material has no relations to the sedimentation rate of the river. Only, we can find some evidences of the former Seimareh lakes on the region and new deposition could not be easily recognized. The lack of time may be responsible for limited deposition of material in the Seimareh riverbanks and the landslide area (Figure 14).

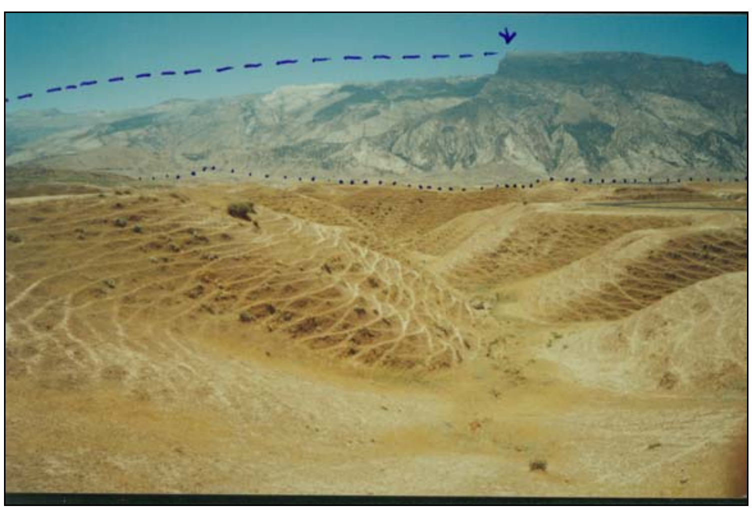

Figure 14 Lacustrine deposits of former Seimareh Lake and terracettes created by soil creep on it.

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4. Concluding remarks

a) Different sources for the grand Seimareh landslide has been suggested by scientists which needs corrections. Here one should aware the fact that when presenting such points, we need a new geomorphologic evaluation and review approach with new techniques for measuring the dimensions and characteristics of the landslide to reach a precise simulations of the phenomenon.

b) Nearly all of the literature on the landslide have repeated reports of former scientists findings and therefore we couldn't rely on the frequently repeated historical documents. Environmental documents and records are needed for geomorphological inferences and reasonable geomorphic relationship among and evidences.

Field surveys and new measurement and observations and, establishment relationship between findings and evidences are the base for a reasonable research in geomorphology and every other environmental inference.

Geomorphological survey on the giant landslide of Seimareh shows that the date of the event is recent and thus the date of 10k/y can be rejected.

We can conclude with Tabarys' narration where he shows the 22nd of June 872 A.D. as the date when great shock and noise heard from the Seimareh area (Tabary, 996) and we can take this date as a probable time of landslide occurrence in Seimareh area and must say that the landslide made a great seismic shock which is about 1100 years old, and existing geomorphologic evidences approve the idea of recent time.

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مشاهدات تازه ژئومورفولوژیکی درباره یک زمین لغزهٔ بزرگ,
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سیاوش شایان[۱]

زمین لغزهٔ سیمره(کبیر کوه) یکی از بزرگترین لغزشهای دنیاست که از گذشته توجه بسیاری از دانشمندان داخلی و خارجی را به خود جلب کرده است. در تعیین علت و زمان وقوع آن بین دانشمندان اختلاف نظر وجود دارد. در این مقاله ضمن بررسی وضعیت مکانی و ویژگیهای دینامیکی و ژئومورفولوژیکی لغزش بزرگ کبیر کوه، فرضیه‌هایی برای چگونگی وقوع و زمان آن ارائه و به آزمون گذاشته شده‌اند. همچنین نظریات دانشمندان مختلف داخلی و خارجی مورد بحث قرار گرفته و سپس با استفاده از داده‌های سنجش از دور، کارتوگرافی، هیدرو- اقلیمی و محاسبات دینامیک لغزش، مشخصات عمومی و جزیی لغزش سیمره ارائه شده است. یافته‌های حاصل از شواهد ژئومورفولوژیکی همچون نرخ گسترش شبکهٔ آبهای سطحی بر روی لایه زیرین یا سطح لغزش، چگونگی گسترش رگولیت، میزان انجام فرایندهای انحلالی (ایجاد لاپیه، حفره‌ها، درزها و شکافها)در سنگهای آهکی ریزشی، گردواری اندک در دانه‌ها و قطعات لغزش یافته، گسترش جزیی افقهای خاک در پهنهٔ ریزش و محدودیت نهشته‌گذاریهای رود سیمره بر کناره‌های منطقهٔ لغزش سبب شده سن زمین لغزهٔ سیمره جدید تشخیص داده شود. همچنین با بررسی اسناد و مدارک تاریخی، زمان وقوع لغزش در سال ۸۷۲ میلادی (مطابق ۲۵۸هجری قمری) تشخیص داده شده و نظریات وقوع آن در حدود۱۰۰۰۰سال قبل، رد شده است.

لغزش سیمره به هنگام وقوع با صدای عظیم همراه بوده وسبب ایجاد لرزش در منطقه و نواحی دوردست شده است. از این رو برخی از دانشمندان محرک وقوع آن را زمین لرزه دانسته‌اند. در این مقاله با بحث در خصوص لرزه خیزی منطقه، نتیجه گرفته شده که منطقه از لرزه خیزی اندک برخوردار است و وقوع لغزش عظیم سیمره باعث ایجاد زمین لرزه شده است نه برعکس.

واژگان کلیدی: لغزش سیمره(کبیر کوه)، سن سنجی ژئومورفولوژیکی، زمین لغزه‌های زاگرس، حرکات دامنه‌ای، ژئومورفولوژی کاربردی.

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