Origin of Dislocated Limestone Blocks on the Slope Side of Baranan (Zirgoez) Homocline: An Attempt to Outlook the Development of Western Part of Sharazoor Plain.

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Abstract

The origin of huge dislocated limestone blocks on the southern part of Sharazoor plain and toe of Baranan Mountain (homocline) of are discussed. The homocline is elongate ridge, which is trending southeast- northwest at southern boundary of western part of Sharazoor plain at 20 km south of Sulaimaniya city. Field study showed that the blocks are slid from upper part of the homocline scarp. The thin section study showed the blocks belong to Sinjar Formation. This slide is proved to include both plane sliding, on the limestone of Sinjar Formation, and rotational sliding on Kolosh formation. This slide is the largest one recorded in Iraq.

The sliding and enlargement o f the plain is discussed and combined together through three stages. The main stage of enlargement of the plain is attributed to erosion by the stream and successive sliding of the cliff. The sliding is triggered by lateral and vertical erosion undercutting of the base of northeast side of the homocline by Tanjero stream during long time. These led to oversteepening of the paleoslope of scarp slope and consequently its failure and sliding. Both the sliding and the development of the Sharazoor plain are combined with northward and southward migration of the Tanjero stream during lateral and vertical erosion. The sliding failure is analyzed structurally and plotted on stereonet, which showed that the masses are dislocated mainly by plane sliding at upper part and by rotational siding at lower part on Kolosh Formation. The failure aided by low angle dipping of homocline and normal fault. This fault with two sets of conjugate hko joints might have act as release surfaces. The low dip angle of the homocline also promoted release of the blocks under the effect of the gravity.

Keywords: Baranan homocline, rockslide, Kurdistan geology, Tertiary stratigraphy, Sinjar formation, Stream erosion, Sharazoor plain

Introduction

The studied area located at northeastern Iraq, about 20km to the south of Sulaimaniya City (Fig.1). The area includes the western part of the famous Sharazoor plain and an elongate high ridge, which is called Baranan (Zirgoez) Mountain. This mountain has northwest-southeast trending between Darbandikhan dam and Dokan dam at southeastern and the northwest end of the studied area respectively. The mountain has many local names such as Shaffa Rash, Zirgoez Bakr Agha and Tasluja Mountain. Structurally the mountain is a homoclinal ridge and its strata dipping 25 degrees toward southwest.

The western part of the plain is located between toes of Goizha anticline and Baranan homocline (Fig.1). The plain is dissected longitudinally by Tanjero stream, nearly parallel to the homocline (Fig. 2). The stream divides the eastern part of the plain into two parts, southern and northern, both parts gently sloping toward the stream channel. The stream course is closer to Baranan Homocline and nearly parallel to the contact between Tanjero and Kolosh Formations (Fig. 3).

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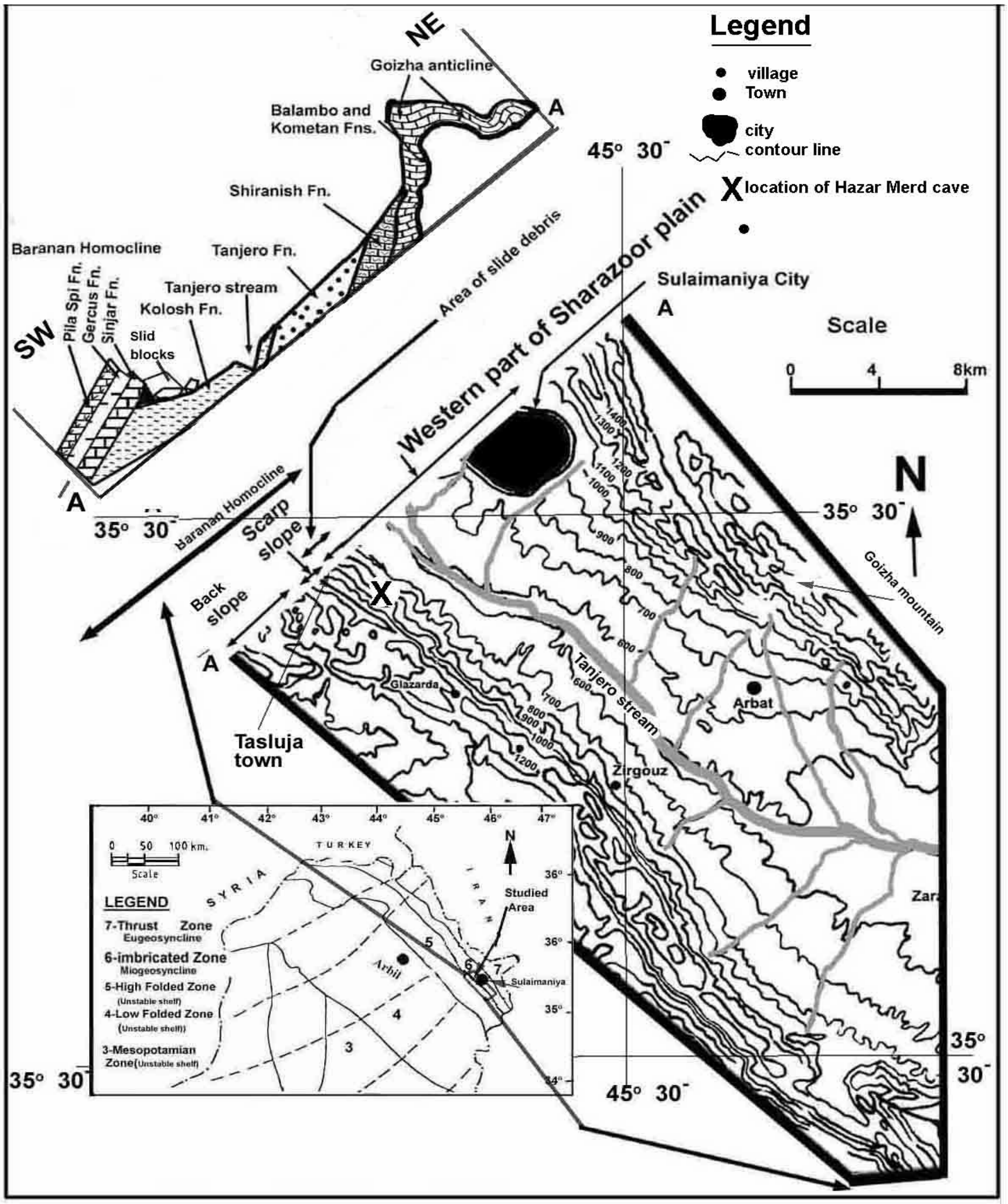


Fig.(1) Index map (lower left) and topographic map of the studied area including western part of sharazoor plain, Goizha anticline, Baranan homocline, area around Sulaimaniya city and simple cross section of the area (above left).

Geological setting

The studied area is located within the High Folded Zones near the boundary between Low and High Folded Zones of Buday (1980) [1]. In this area, Baranan (Zirgoez) homocline dips at 25 (back slope) toward southwest, which is nearly, equal to amount of the slope angles. While the scarp slope form high cliff, which has about 60 degrees of slope. The cliff is looking over the Sharazoor plain and Sulaimaniya city. Along its elongation many Tertiary units are exposed. These units are Kolosh), Sinjar Gercus and Pila Spi Formations from the bottom to the top of the cliff successively. These formations have the thickness of 1000, 120, 70 and 60 meters. Kolosh Formation is cropped out at an area extending from the base of the cliff to the right bank of the stream which covered sporadically by huge masses of thick bedded limestone (Fig. 2 and 4). The blocks are detached from the cliff and slid from the slope onto plain. Now they rested on southern boundary of Sharazoor plain on Kolosh Formation. Some of these blocks are far than three kilometers from the cliff. They have sporadic distribution some of them weighted more than 800 million tones. Their distribution can be seen clearly on map and at the field from Tasluja, at northwest to Zarayn town at southeast.

The study of origin of these limestone masses can unlock the development stages of the western part of Sharazoor plain (Fig.4 and 5). In the area of the study, both Kolosh and Sinjar Formations are closely related to dislocation of the limestone blocks and development of that part of Sharazoor plain included in this study.

The field and thin section studies showed that these blocks are belonging to Sinjar Formation as they are composed of well bedded to massive fossiliferous limestone, rich in nummulites (Plate 2.3) and miliolide forams with gastropod and pelecypods. The moderate weathering of the blocks probably proves that the sliding has occurred during Holocene (recent), which is no older than 8000 years.

In addition to the present slidings, the area around the plain contains many sliding masses. These masses located directly at northwestern boundary of the studied area such as a rockslide at the northern side of Charmaga valley and Qara-Chatan rockslide at the southwestern limb of Piramagroon Anticline. This latter slide is studied in detail by Hamasur (1999) [2] and Karim *et al*. (2000) [3].

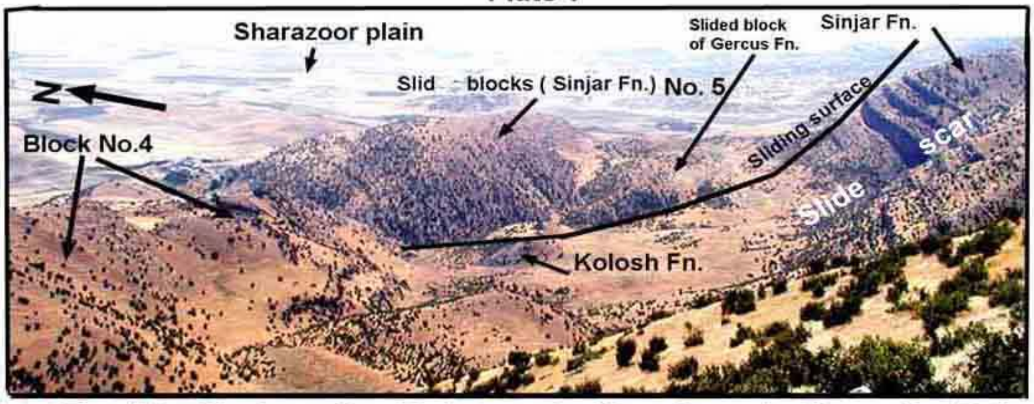
Sliding, joint and fault are participated in the shaping of cliffs. According to the slope classification of Al-Saadi 1981, in:(Al-Asade, 1996) [4] the scarp slope is called parallel slope. Because the angle between the slope trend and strike of the strata is deviated less than 20 degrees.

Development stages of the sliding

Stage 1 (Depositional Stage)

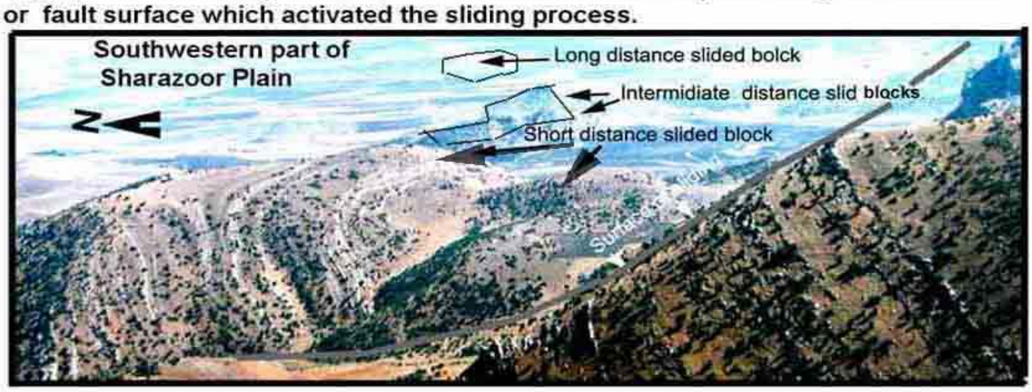
The most effective stage of the development of the plain is the deposition of the paleo-shoreline, which exactly located at the northern boundary of the plain, which nearly coincides, with the toe of the Azmir and Goizha anticlines (Fig. 5). During Paleocene and Eocene the limit of the deposition of the weathering resisting rocks (Sinjar Formation) was coinciding nearly with the paleo-shoreline (Fig.5). At the area between the toe of the anticlines and present position of the Baranan homocline the thickness of limestone of Sinjar and Pila Spi Formation was at the minimum due to coastal onlap phenomenon (termination). The thickness of the two formations is increased gradually toward southwest due to location of depocenter (core of the reef), which reach, at the location of sliding, 120m and 70m respectively. Karim (1999) [5] observed and studied this type of thickness change of Sinjar Formation from Sartak Bamo area (10km east of Darbandikhan town). He observed that at the distance of 2km and toward southwest, the thickness change from 20 m to 60m Al-Surdashy (1988) [6] studied the outcrop of Sinjar formation at the northeastern scarp of the homocline near Zirgoez village and he proved that the formation has shoal environment along present studied area.

Plate 1



(1.1) The slid blocks no. 4 and 5 photographed from the peak of homocline. Both the slid blocks and slide scar consist of Fossiliferous limestone of Sinjar Fn. Kolosh Fn. is exposed in valley between the scar and back of the blocks.

(1.2) A nearly vertical cliff about 30 m high at the northwest of Tasluja Cement factory below the cliff many slid blocks exist. The cliff is representing the slide scar or fault surface which activated the sliding process.



(1.3) The same bolck of the first photo, photographed from the summit of glazada mountain. The bolck is weighted more than 800 million tons of limestone materials of Sinjar Formation. At the back ground other blocks can be seen which are slid longer distance than the one in the foreground. All blocks are rested on Kolosh Fn. It is evidence that the block is moved downward by plane sliding because the dip angle of the slid blockd are changed from 25 to 45 degrees after sliding.

In the depositional time of these two formations the present Azmir-Goizha anticlines was at the initiation stage as a low positive paleo-high above the sea level. Sinjar and Pila Spi Formation were terminated against the Paleocene -Eocene low anticline of Azimr-Goizha.

Stage 2 (deformational stage)

This stage includes the longest time span of Tertiary and began after deposition of the Sinjar, Gercus, and Pila Spi Formations. It starts with deep burial and subsequent uplift. Simultaneously with these, the horizontal tectonic stresses were exerted on the deposited rock units. The main force in the area was appeared during the orogenic movement of continent-continent colliding between Iranian and Arabian plate. According to Karim, 2004[7], this collision is started during Upper Cretaceous and continued during Tertiary. In this stage the deposited formations are folded, fractured and faulted. Many minor synclines and anticlines are formed. All these minor structures are superimposed on gently dipping homocline and Sharazoor plain (Fig. 5).

Stage 3 (erosional stage)

After the burial and uplift, the deformed area was undergoing gradual extensive erosion. The maximum erosion is happened at the thinnest portion of the homocline, which in our estimate, it happened at the area of coastal onlapping of the Sinjar and Pila Spi Formations. This is happened before exposing of Sinjar and Pila Spi Formations. This is because these formations were at their minimum thickness at the coastal area (Fig.5). The erosion is aided by more or less jointing and fracturing due to bending.

So the erosion was progressed from the southwestern limb of Azmir-Goizha anticline toward the present scarp of Baranan (Zirgoez) Homocline. At end of this stage and with erosion, the previous positions of the Tanjero stream were migrated southward continuously toward the present position. The underlying soft rocks of Kolosh Formations aided the erosion. (Fig.5) This shifting is possibly associated with some minor sliding.

Stage 4 (sliding stage)

Emery and Myers (1996, p.179) [8] defined sliding as shear failure along discrete shear planes subparallel to underlying beds. Slide may behave elastically at top, plastically at the base and thin at lateral margin. This stage characterized by occurrence of the main and the last slidings. The slid mass (in few places transformed to slide debris) now spread on the southern part of the plain at the toe of Baranan mountain (Plate 1.1 and 1.2) and (Fig. 4). Before the last sliding the Tanjero stream had been shifted (migrated) southwestward beyond its present location (Fig.5). So that it was reached the present position of the slid mass. Bloom (1998, p.263) [9] showed by diagram and mentioned lateral migration of a stream down dip on soft rocks (Kolosh Formation in the case of present paper). He called this process "homoclinal shifting".

When the channel stream reached the closest position to the monocline, the cliff had been oversteepened and remained without support. Consequently the cliff masses slid toward the existed slope toe and some masses reached the plain. The sliding of these huge limestone blocks caused the stream to retreat backward (migrate toward northeast). This backward migration of stream is analogous to a new road excavated by inexperienced engineer in mountainous area. When the road makes unstable high side, the side rocks may slide and change the route of the road (migrate). In this example the excavation of the road and sliding can be

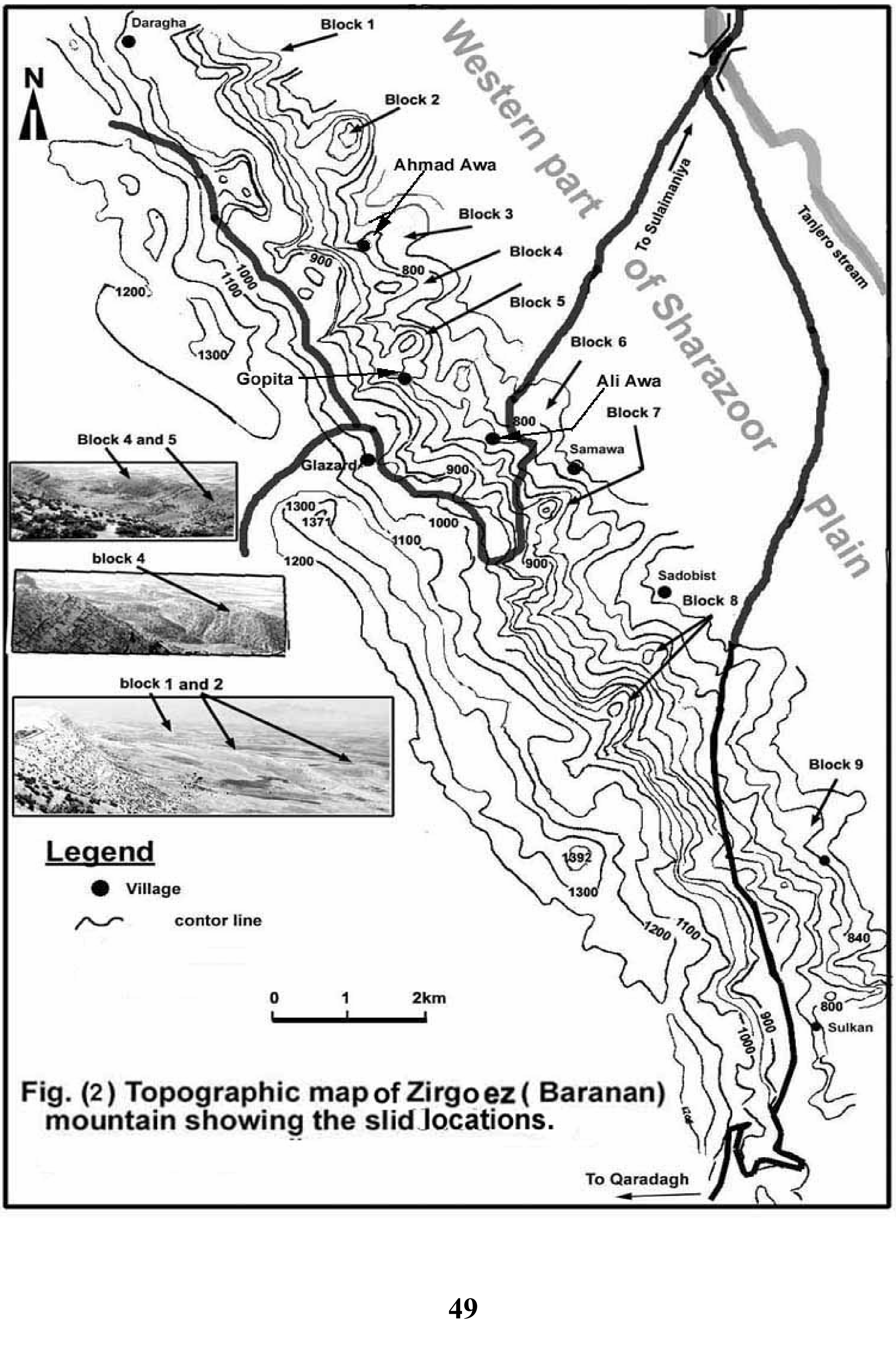


Fig. (2) Topographic map of Zirgoez (Baranan) mountain showing the slid locations.

compared with southwest and northeast migration of the channel respectively. The present slide is similar to Viont slide in Italy which changed the position of the channel of Viont river away from slide (see Boom [9]).

The occurrence of Kolosh Formation promoted the processes of sliding due to softness of the lithology of the formation (mostly marl and calcareous shale). The measured angle of internal friction is no more than 25 degrees.

The plain between the anticline and homocline can be regarded as natural large channel whose southwestern bank (homocline) was unstable. Thorne (1990) [10] studied small channels of these types and showed that high banks fail by rotational slip along curved surface when their slopes are less than 60 degrees. He observed that slip surface passes just above the toe of the bank. The sliding of the limestone block of Baranan Homocline is nearly similar to that mentioned above channel because the sliding on the lower slope on the Kolosh Formation was included clear rotational slide.

Fischenich (1989) [11] claimed that nank failures in river system occur through one of the three modes:

1) Hydraulic force that remove erodible bed (Kolosh Formation in the present
2) study) or bank material.Geotechnical instabilities.A combination of hydraulic & geotechnical factors.

Situation of slided blocks

The existence of joints and faults in the rock of Sinjar Formation may be acted as release surface for sliding. At the upper part of the slope the masses slid on Sinjar Formation while at the lower part, they moved on soft marl of Kolosh Formation. This Formation, in the area, has soft lithology, which consists mainly of marl and calcareous shale. Now the sliding surfaces are slightly weathered and dissected by ravines and even small valleys. Most of the remained parts of slid blocks show the original bedding plane (Plate 1.1 and 1.2) with some disintegration and deformation.

In some place the direction of dip shows prominent changes. So that original S50W dip direction of the bedding plane of homocline is changes, in some place, to east or west. The amount of dip of the slided masses also increased, from 25 to more than 70degrees for some blocks. Therefore the dislocation of the blocks is happened by sliding not faulting. This agrees with what is given by Sparks (1974,p.56) [12] who cited and illustrated by diagrams that sliding blocks suffer from increase of dip angle while the faulted blocks do not (Fig.4 and plate1).

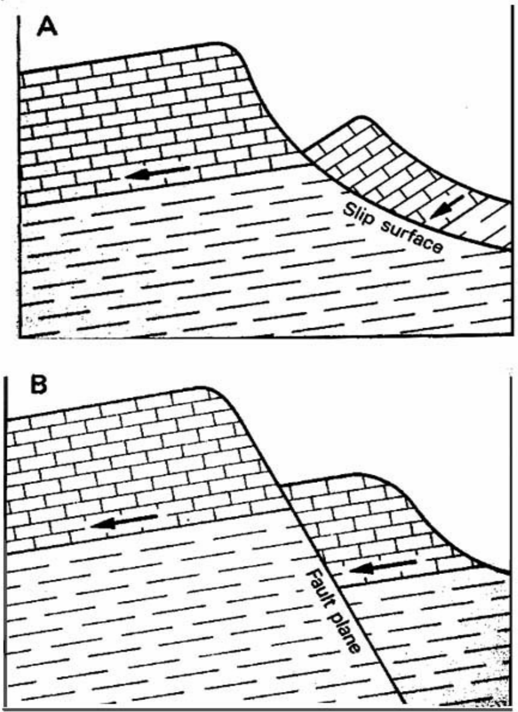


Fig.(2a) difference between slipped (slided) blocks (upper one) and faulted blocks (lower one) which shows change of dip angle and discontinuty of former dislocation(Spark,1974) [11]

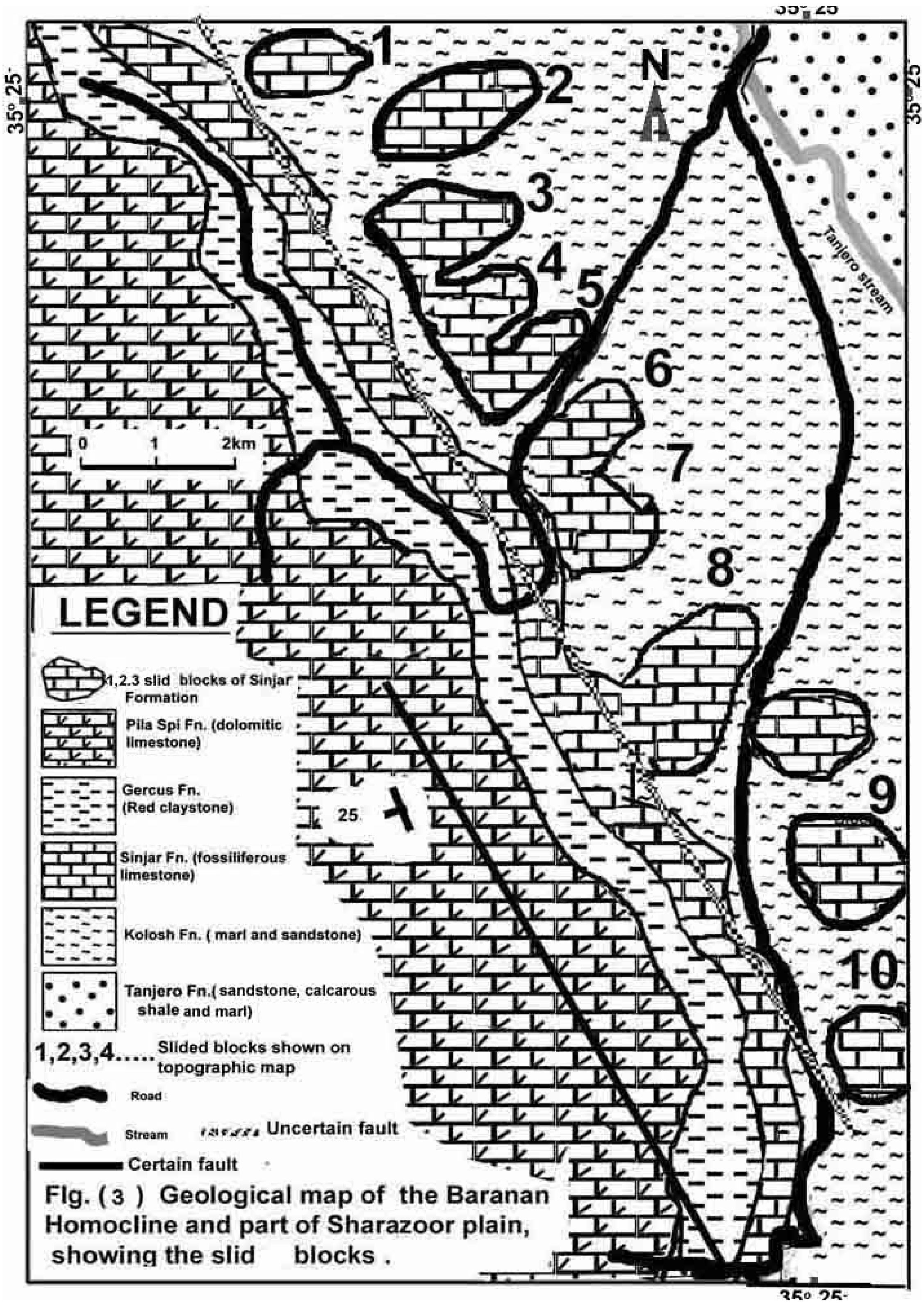


Fig. (3) Geological map of the Baranan Homocline and part of Sharazoor plain, showing the slid blocks.

He gave another difference, which manifested by the fact that the dislocation by fault continues into the underlying incompetent rocks (Fig.2a). The sliding is not only included Sinjar Formation, but included both overlying Gercus and Pila

Spi Formations (Fig.5). As these two formations have softer lithologies and thinner beds than Sinjar Formation, so they removed by erosion after sliding. Till now some slided blocks partially covered by Gercus Formation (Plate 1.1 and 1.2) and (Fig. 4).

The weight of some blocks are measured to be more than 800 million tones, these huge masses exerted high pressure on the underlying rocks during sliding so that some brecciated rocks can be seen on the sliding surfaces (Plate 2.2).

The distinguishing of the bedding plane along surface of the blocks is attributed to two factors; the first one is relatively low sliding elevation (no more than 250m) and slope angle of 50 degrees. This low elevation of sliding gave the masses low velocity of sliding. The second one is the resting carpet of the slided masses, is composed of soft marl. This carpet of marl possibly absorbed nearly all-dynamic force of blocks during sliding. Dennis (1987) [13] mentioned that the slid slabs are transported rapidly and usually disintegrated down slope during movement and finally come to rest as jumbled and brecciated masses. According to Hamasur (1999) [2] and (Karim *et al*. (2000) [3] these processes are happened for Qara-Chattan (at southwestern limb of Piramagroon anticline) rockslide which slided from elevation of about 1000m and rested on hard rock (mainly Kometan Formation).

The second factor is returned to constituents of the original slid masses, which is composed of competent fossiliferous limestone Sinjar Formation (Plate 2.3). It is possible that brecciated blocks (if existed) of Sinjar Formation are removed by weathering.

Graphical representation of the data

Before graphical representation of the sliding processes on stereonet, the field study of the area is conducted for measuring; all the structural discontinuity associated and promoted the sliding. According to Zhou (2000) [14] the ruptures (fractures) and joints make up main discontinuities for rock sliding. In this study, fractures, joints, faults and bedding are measured in the field.

For the plotting of the structural data as rose diagram, a Windows based software (named Rock Ware) is used as following:

1. The original data for joints were taken in the field as compass quadrant reading. For convenient, they are converted to their equivalent azimuthal reading before entered into the PC.

2. The effect of tectonic tilt is corrected when the tectonic tilting is more than 30 degrees (Tucker, 1988) [15].

3.The attitude of structural geomorphological elements (fault, slope, sliding masses) are plotted on the Schmidt stereonet by careful treating of the data and their arrangement because they must be formatted either according to *Dip Direction* or according to *Right Hand Rule* (see help file in the Rockware Software). In the present study, the compass readings are arranged (or converted) to azimuthal data by using Dip Direction Format for drawing of the stereonet diagrams (Fig. 6).

The effect of the structures on the sliding are as following:

1.The main joint sets are two conjugated sets of hko which nearly dipping vertical and striking 45^o and 305^o (Fig.6). They are striking obliquely on the axis of homocline. These joints are possibly acted as lateral release surfaces for the sliding blocks.

2. The normal longitudinal fault (dip slip fault) is distinguished which nearly run parallel to the crest of the ridge (Baranan mountain It strikes 320^o dips 50 towards northeast (Plate2.1). The role of this fault, as release surface for the later sliding is not known. This is because the position of the fault is more than 500m far from the sliding scar. But if it had been associated with parallel faults or en echelon faults they may had played main role for sliding of the blocks. Therefore these possible parallel faults treated as main factor for sliding in

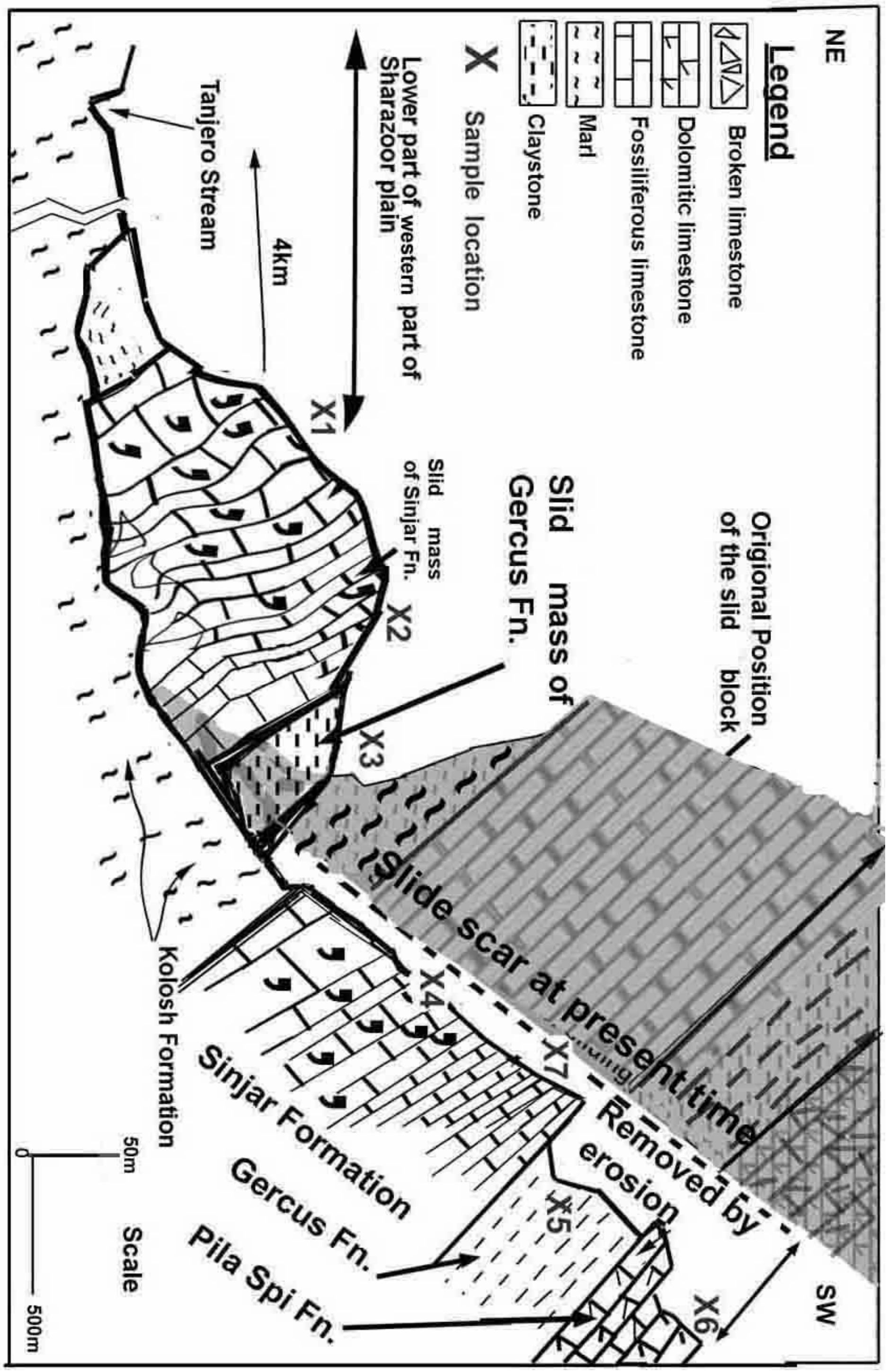
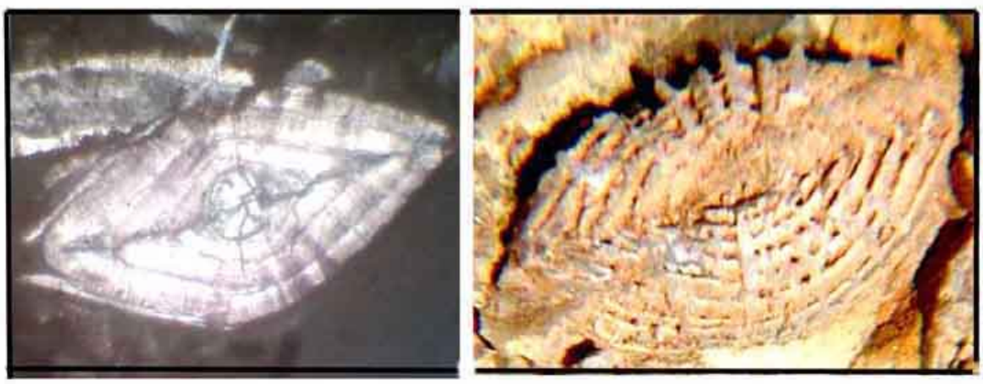


Fig. (4) A geological cross section of one of the slided blocks (block no. 5) at the northeastern side of Baranan Homocline.

Plate 2

(2.1) Normal fault (dip slip fault) at the crest of the homocline which nearly strikes parallel to slide scar.
The photo is taken at the left side of the main road between Sulaimanbiya City and Qaradagh Town.

(2.2) Solution breccia on the slide scar consisting of angular clast of limestone of Sinjar Formation. This breccia formed by effbect of partial solution and susequent crashing by weight of huge slid blocks.



(2.3) Thin section photo of nummulite foram of Sinjar Formation at the left while that at the right shows same type of forams as seen in hand specimen in which the weathering outlined the scalptures..The samples are taken from the slid blocks east of Zirgoez village and enlarged nearly 10 times. Sample no. 1 and 5.(see Fig.4)

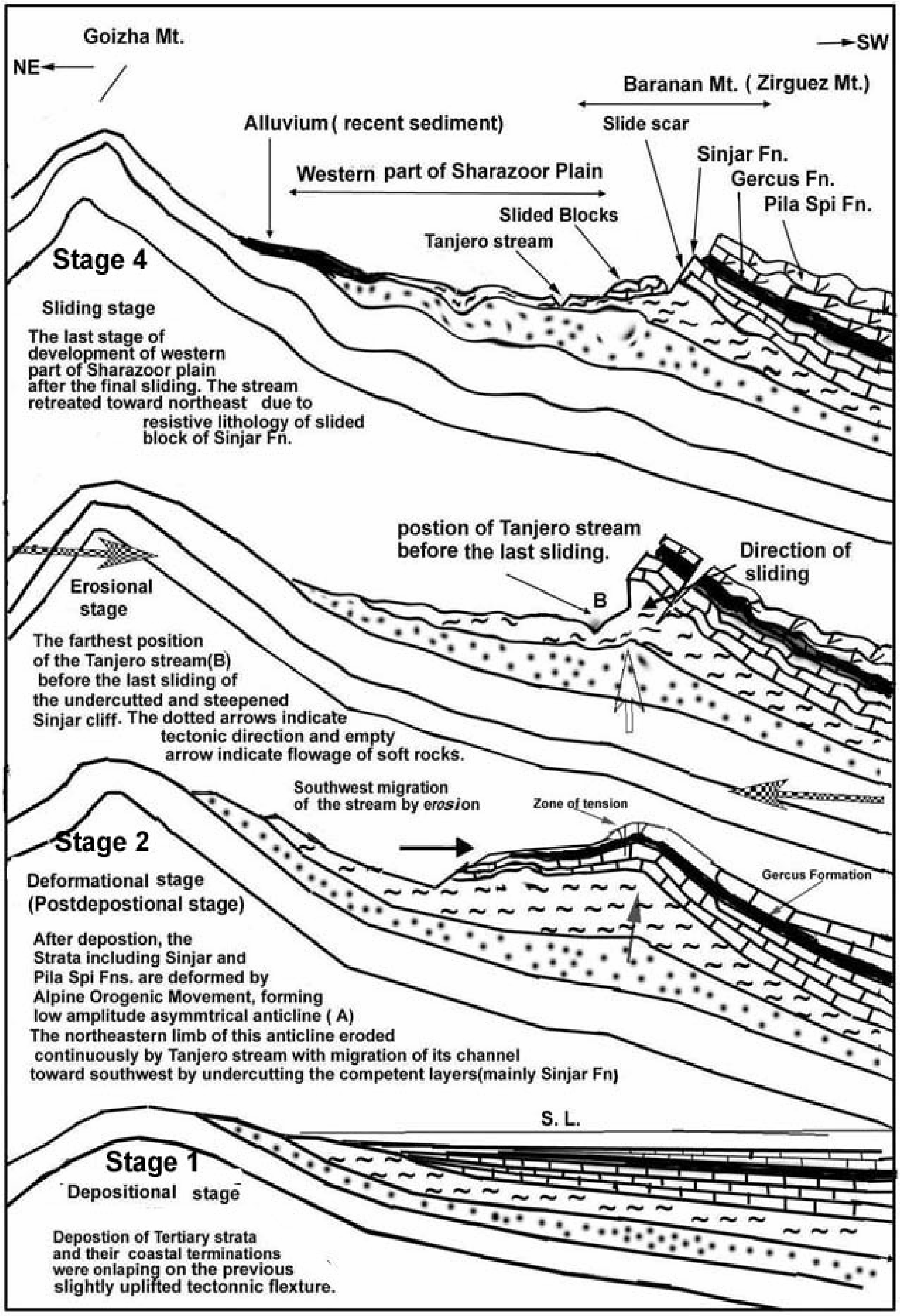


Fig.(5) Development stages of Sharazoor plain by tectonic deformation, stream erosion and sliding of the scrap of Baranan Homocline.

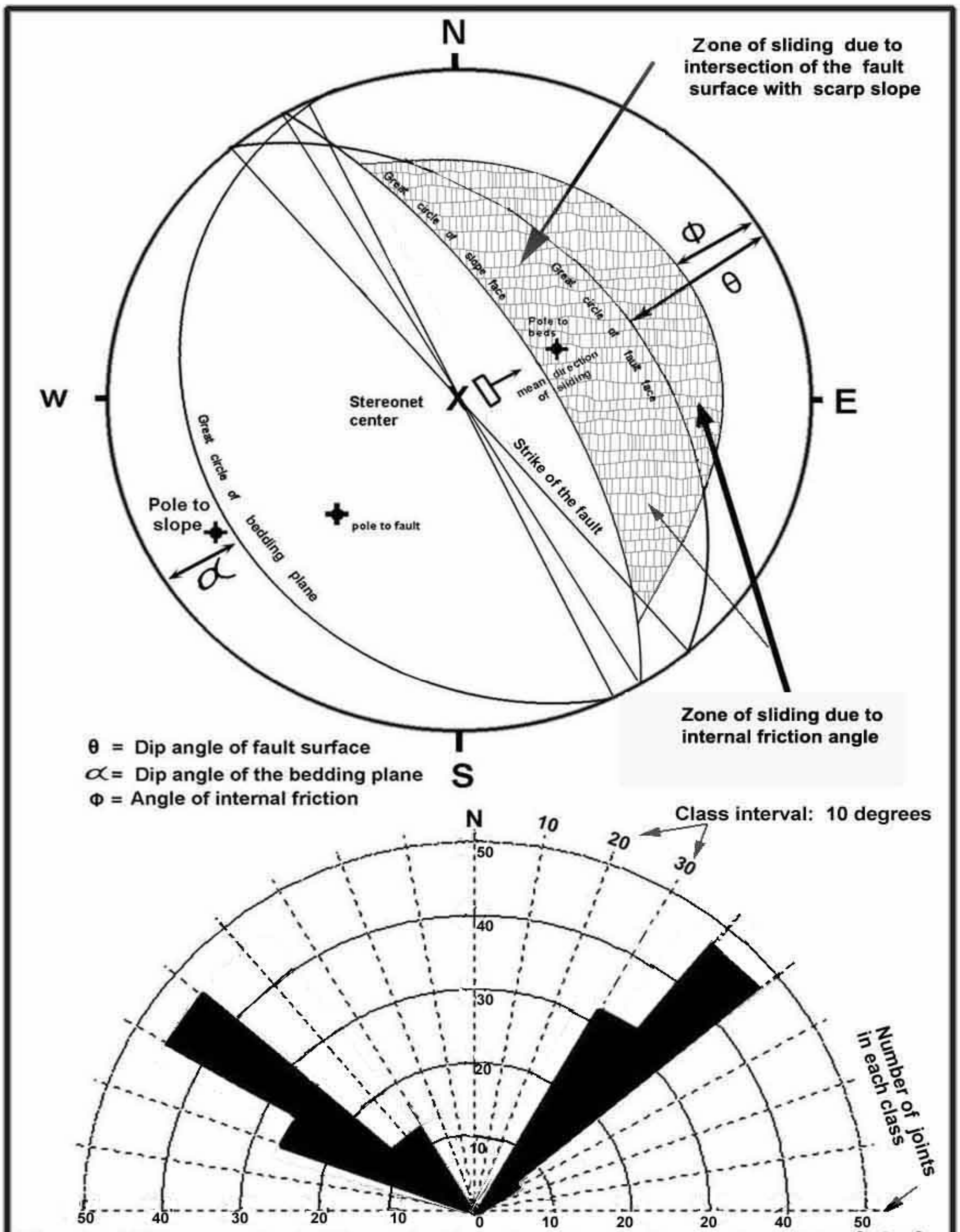


Fig. (6) Stereonet plotting of the structural elements associated with the sliding of blocks (above) and rose diagrams of the main dirctions of the joint sets in the Sinjar Formation. The number of joints are 170.

stereonet analysis. At the extreme eastern end of the studied (homocline) area, near Darbandikhan Dam site, Jassim *et al*. (1975)[16] recorded a normal fault but they regarded as syn-depostional fault not as post-depostional one as assumed in this study.

3. After the stream erosion (under cutting of the slope scarp of homocline), the most important structural factor for the sliding is the dipping angle of homocline. It is dipping at 25° degrees toward 243° (S63W). This type of dipping creates suitable unstable condition for that part of the homocline that is looking over the Tanjero stream (looking northeastward). The effect of the low angle dipping is as following:

A. The stream might have eroded the soft marl and calcareous shale of Kolosh Formation easily vertically and laterally (towards southwest) without any obstacle. This scored the support below the scarp slope of the homocline and cause detaching of large blocks from scarp slope. geomorphologically the ridge can be regarded as large cuesta, because it has gentle slope (equal nearly to dip angle) on one side (southwestern side) and steep slope on the other (scarp slope). So the removing of the support led to successive sliding of the cuesta (Baranan ridge).

B. The low dipping angle of the homocline makes the undercut blocks to be unstable. The masses may be supported partially by weathered marl; it was most possibly that part of the masses is located outside the fresh marl and inside the weathered marl (or calcareous shale) of the Kolosh Formation. In this study the internal friction of the weathered (or deformed marl) is specified to be 25 degrees for plotting on the stereonet (Fig.6). The sliding is proved to be plane sliding at the upper part of the slope and rotational sliding at the lower part on Kolosh Formation. Blyth and de Freitas (1974, p.372) [17] showed the difference between plane and rotational sliding.

4. The effect of the paleo-hydrological setting (It was nearly similar to present one) cannot be excluded in promoting sliding. Like at the present time, the discharge of groundwater existed as spring between the contact of the Kolosh and Sinjar Formations eroded and undercut the scarp slope. The ancient discharge between the two formations now can be seen as famous Hazard Merd caves which can be seen from Sulaimaniya city by small binocular. (Fig.1). According to Jiao et al. (1999) [18], the saturated slope materials, after rainstorm, accelerate their failure. The present slide is also might be aided by groundwater due to increasing the weight and decreasing the internal friction.

Conclusion

This study has reached the following conclusions:

1.The development of western part of the Sharazoor plain is attributed to Tanjero stream erosion and sliding of huge block from the Baranan Homocline.

2. More than 9 slid blocks are recorded and mapped for the first time.

3. The development of the plain is discussed through four stages they are depostional, deformational, erosional and sliding stages successively.

4. The slid blocks are belonging to Sinjar Formation, slide for more than 3km, and descended 300m from crest of homocline to the plain.

5. During time, Tanjero stream has changed its course. It was assumed that the streambed was closer to the homocline than the present. But retreated northeastward after the sliding.

6. The sliding is proved to be plane sliding at the upper part of the slope and rotational sliding at the lower part on Kolosh Formation.

7. The underlying Kolosh Formation has great effect on both sliding and development of the plain by its low angle of internal friction and easiness of erosion both laterally and vertically.

8. The sliding is occurred during recent (Holocene) times (no older than 8000 years).

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بنەچەی تلە بەردە کلسی یە جووڵاوەکانی بەشی باکووری خۆرهەڵاتی شاخی بەرانان (زرگۆیز)ی هاولار : تێروانینیك بۆ دروست بوونی بەشی باکووری خۆرئاوای دەشتی شارەزوور.

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کـــورتـــە

شاخی بەرانان (زرگوێز) ی هاولار کە 20کم باشووری سلیمانی کەوتووە وەك شاخە براویکی تیژ (کەناریکی تیژلار)دەردەکەویت , لە باشووری خۆرهەڵاتەوە دریژ دەبێتەوە تا باکووری خۆرئاوا لەسەر لیواری باشوور و خۆرهەڵاتی دەشتی شارەزوور .لە بەشی باشووری خۆرئاوای ئەم هاولارەدا , لاری چینە بەردەکان یەکسانە بە (25) پلە وە جووتە لەگەل لاری شاخەکەدا , بەڵام بەشی باکووری خۆرهەڵاتی بریتی یە لە کەناریکی تیژلاری سەخت بە لاری (60)پلە وە دەروانیت بە سەر بە شی رۆژئاوای دەشتی شارەزووردا. رووباری تانجەرۆ بە تەریبی ئە م شاخە هاولارەدا دەروات لە ناو دەشتیك دا کە داپۆشراوە بە تلە بەردی کلسی چین چینی گەورە کە ئەوانیش بە شیوەی تلە بەردی پەڵە پەڵە لە سەر پیکهاتەی کۆلۆش ئارامیان گرتووە. هە ندیك لە و تلانە کیشی یان دەگاتە 800 ملیۆن تەن . دەتوانریت پەڵەی ئەم تلە جووڵاوانە بە ئاسانی لەسەر نەخشەو لە کیلگەدا ببینریت هەر لە تاسلوجەوە لە باکووری خۆرئاوا هەتا دەگاتە ناوچەی زەرایان لە باشووری خۆرهەڵات. لیکۆلینەوەی کیلگەیی و خویندنەوەی برگە تەنکی بەردەکان دەری خست کە ئەم تلانە سەر بە پیکهاتەی سنجاری کلسین , کە لە بەشی سەرەوەی کەنارە تیژلارەکەوە خزاون پاش ئەوەی بنکی کەنارەکەی بریوەو لە دەشتەکەدا جیگیر بووە . ئەم تویزینەوەیە دەری خست کە ئەم خزانە لە جۆری (خزانی رووتەختی)یە و گەورەترین خزانە کە تا ئیستا لە عیراق دا تۆمار کرابیت .
هەر لەم تویژینەوەیەدا فراوان بوون و دروست بوونی دەشتی شاروزوور لیکۆلینەوەی لەسەر کراو ئەم فراوان بوونە بە سێ قۆناغ خرایە بەرچاو: سەرەکی ترین قۆناغی فراوان بوونە کە گەرینرایەوە بۆ ئەو خزانەی لەو هاولارەدا روویداوە لەگەڵ ئەو کاری داخوورانەی رووباری تانجەرۆ ئە نجام داوە .ئەویش بە داخوورانی ئەستوونی و تەنیشتی بۆ بنکی کەنارە تیژلارەکە لەلایەن رووباری تانجەرۆ وە بۆ ماوەیەکی دوور و دریژ کە بووە هۆی لابردنی تلە پاڵپشتەکانو زیاد بوونی لاری لاپاڵە کۆنەکە و شوێنەوارەکەی وە ڕوودانی خزان و ڕووخان .
هەردوو ڕووداروی خزانەکە و فراوان بوونی دەشتی شارەزوور هاو ڕووداو بووە لەگەڵ شوێن گۆڕکێی رووباری تانجەرۆ جارێك بۆ باکور جارێك بۆ باشور بە هۆی داخورانەکەوە.
خزانەکە لە ڕوانگەی پێکهاتەیی جیۆلۆجییەوە شی کرایەوە وە زانیاریەکانیشی لەسەر (Stereonet) نەخشەکران , ئەمەش دەریخست کە تلەکان بە شێوازی خزانی رووتەختی بووە لە بەشی سەرەوەیدا و ئەگەر بوونی خزانی سووڕاوەیی لەبەشی خوارەوەیدا و لەسەر پێکهاتەی کۆلۆش .

أصل الكتل المنقولة من الحجر الجيري على جانب الشمالي الشرقي من جبل برانان المتجانس الميل : نظرة على تطور الجزء الشمالي الغربي من سهل شهرزور .

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المستخلص

يظهر جبل برانان (زرطويز)ألمتجانس الميل كبروز طولي تمتد شمال غرب- جنوب شرق على الحدود الجنوبية م للجزء الشرقي لسهل شهرزور (20) كم جنوب مدينة السليمانية .

الجزء الجنوب الغربي لهذا الجبل(في بعض أماكن) يتطابق فيه ميل الطبقات مع ميل المنحدر الذي يساوى (25^0) بينما الجانب الشمالي الشرقي عبارة عن منحدر حاد ذات ميل أكبر من (60 درجة) مكونة بروزاً مطلة على الجانبي الغربي من سهل شهرزور .

يجري نهر تـا نجرو موازياً لهذا البروز داخل السهل , حيث أن السهل مغطى بكتل كبيرة من الحجر الجيري المتطبق مستقرة و موزعة بشكل بقع على تكوين كولوش . تزن بعض هذه الكتل أكثر من (800) مليون طن . يمكن ملاحظة هذا التوزيع ألبقعى للكتل بوضوح على الخارطة و على الأرض من طاسلوجة شمال غرب لحد مدينة زراين جنوب شرق . أثبتت الدراسات الحقلية و دراسة الشرائح الرقيقة , بأن هذه الكتل تعود إلى تكوين سنجار الجيري , و التي انزلقت من على الجزء العلوي و قمة النحدر ألمتجانس الميل حيث قطعت قاعدة المنحدر و استقرت على السهل .

كما أثبتت الدراسة بأن هذا الانزلاق على سطح الفالق هو من نوع المستوى و ضمن هذه الدراسة أيضاً تم تفسير مراحل تطور و تكوين السهل عل ثلاث مراحل :

المرحلة الرئيسية للتوسع أعيدت إلى إنزلاق جزء من المنحدر و ما رافقها من التعرية النهرية . التعرية العمودية و الأفقية (التي أدت إلى الحت السفلي و إزالة الكتل الداعمة الواقعة في قدم ألمنحدر) لنهر تـا نجرو ساعدت الانزلاق بشكل كبير , حيث أسفرت هذه التعرية إلى زيادة ميل المنحدر القديم و من ثم حدوث الانزلاق و الانهيار. تطور كل من سهل شهرزور و الانزلاق رافقتهما تغيراً لموقع النهر با تجاه الشمال تـارة و جنوب تـارة أخرى خلال التعرية العمودية و الجانبية .

تم تحليل الانزلاق تركيبياً و رسمت البيانات على مخطط (steorenet) و التي أظهرت بأن الكتل تحركت بفعل الانزلاق المستوى في جزء –العلوي و احتمالية حدوث انزلاق دورانى في الجزء – السفلي على تكوين كولوش . كان للفالق الميلي الاعتيادي و الزاوية القليلة لطبقات المتجانس الميل دوراً مهماً في حدوث الانزلاق حيث أسهم الفالق كسطح الانزلاق (Slip surface) مع مجموعتين من الفواصل (hko) , و ساعد الميل القليل للطبقات على حدوث الحركة تحت تـأثير الجاذبية نحو أسفل المنحدر .

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