Land degradation due to diapirs in Iran, case study: Hableh Rood drainage basin, east of Tehran

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ABSTRACT

Different geological characteristics play role in Land degradation in Iran which are:

1-The abundance of Neogene evaporitic marly formations around and in desertic depression. These units have had important role in the formation of present landforms, are saline, alkaline and erodible and degrade the quality of water resources as diffuse and widespread sources and are endless sources for sand dunes.

2- The presence of numerous diapirs, some of which are salt domes consisting of halite. Due to diapirism, salts are now exposed at the surface of many parts of Iran and cause soil, surface and underground water and vegetation degradation as point sources. The importance of diapirism in geology of Iran has been emphasized previously. This paper intends to investigate the effect of salt domes in land degradation and propose restoration measures.

Salt dome or diapire is a dome or anticlinal fold which due to the fact that salt has been intruded, the overlying rocks have been pierced and fractured. The process of movement and reaching of salt to the surface is called diapirism.

Salt domes can be classified into active and inactive ones. Active diapirs are the ones which are still incorporating salt into the surrounding environment. They are usually young and play important role in degradation of natural resources. Solution of salt is continued. From the view point of geomorphology, they show irregular topography. One example of this kind of diapire is Kamaraj Salt Dome in Shahpour. Dalaki- Heleh Drainage Basin, Zagros Mountain Ranges, Iran. In this area, surface water resources are in constant contact with the salt. In inactive salt domes, diapirism has been terminated and most of the salt has been dissolved away. These diapirs are usually older in age and do not have important role in degradation of natural resources.

In this research, diapirs of north of Great Kavir, in Central Iran Geological Zone, Hableh-Rood Drainage Basin, between Arzagh Bridge and Shahzadeh Hossein, northeast of Garmsar, southeast of Tehran, located in 35,15' to 35, 25' north latitude and 52, 20' to 52, 30' east longitude were investigated in detail. From the view point of structural geology, the studied area is located between Alborz Zone (soutern part) and and Central Iran Zone(northern part). Hableh Rood originates from mountains of northwest of Firooz-Kuh, drains Firruz-Kuh Plain and then reaches the studied area. Here, it receives Shor-Darreh whose watershed contains many active diapirs of Oligocene Age.

Keywords: Degradation, salinization, Hableh Rood Drainage Basin, Iran

INTRODUCTION

Salt dome or diapire is a dome or anticlinal fold which due to the fact that salt has been intruded, the overlying rocks have been pierced and fractured. In relation to the external cover and internal pressure, diapirs have different shapes which are : Salt anticlines, salt rollers, salt pillows, salt ridges, salt waves, salt stocks and namakier which is the flowage of salt downslope. The process of movement and reaching of salt to the surface is called diapirism. Diapirs along with other evaporitic units p;ay important role in water salinization and desertification in arid regions of the world (Szabolcs,1992, Nat, et al.1997).

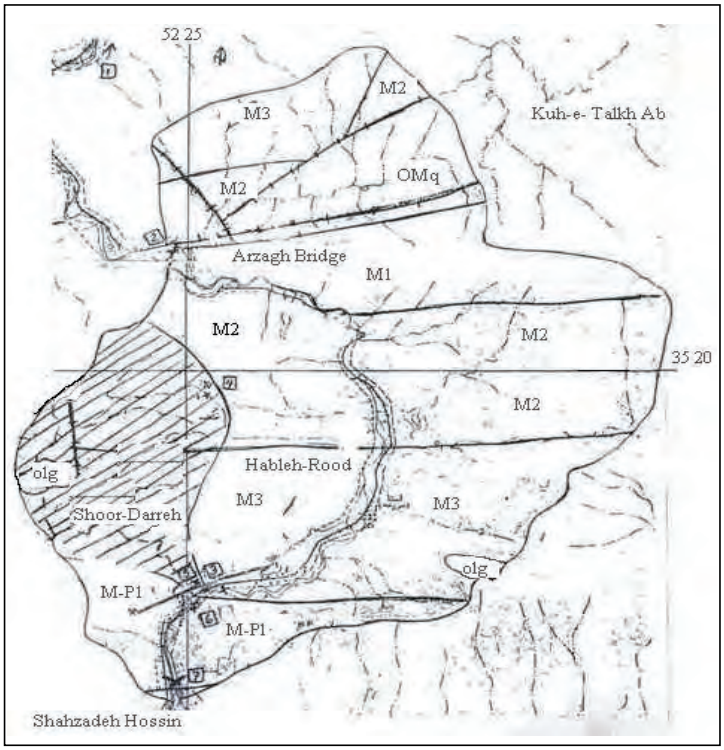
Salt domes can be classified into active and inactive ones. Active diapirs are the ones which are still incorporating salt into the surrounding environment. They are usually young and play important role in degradation of natural resources. Solution of salt is continued in these types. From the view point of geomorphology, they show irregular topography. One example of this kind of diapire is Kamaraj Salt Dome in Shahpour-Dalaki- Heleh Drainage Basin, Zagros Mountain Ranges, Iran. In this area, surface water resources are in constant contact with the salt. In inactive salt domes, diapirism has been terminated and most of the salt has been dissolved away. These diapirs are usually older in age and do not have important role in degradation of natural resources. Iranian diapirs are present in most parts of Iran, especially in Zagros and Central Iran Geological Zones.

In this research, diapirs of north of Great Kavir, in Central Iran Geological Zone, Hableh-Rood Drainage Basin, between Arzagh Bridge and Shahzadeh Hossein, northeast of Garmsar, southeast of Tehran, located in 35^0,$15^/$ to 35^0, $25^/$ north latitude and 52^0, $20^/$ to 52^0, $30^/$ east longitude (Figure 1) were investigated in detail. From the view point of structural geology, the studied area is located between Alborz Zone (soutern part) and and Central Iran Zone(northern part). Hableh Rood originates from mountains of northwest of Firooz-Kuh, drains Firruz-Kuh Plain and then reaches the studied area. Here, it receives Shor-Darreh whose watershed contains many active diapirs of Oligocene Age.

MATERIALS AND METHODS

In this study, geological map of the area with the scale of 1:100,000 was used, it was changed to 1:50,000 scale and was completed by air-photo interpretation and field checks. The following formations are present from the older to the younger ones: Salt domes (OL^s) and gypsum layer (OL^g) of Lower Red Formation(OLr) belonging to lower Oligocene; Qom Formation (OMq) consisting of limestone and marly limestone, belonging to Oligo-Miocene; Upper Red Formation (Mur) consisting of marl and siltstone having gypsum and halite and belonging to Miocene; Mio-Pliocene conglomerate ($M\text{-}P_1$) and Alluvial Deposits (Q) (Figure1).

To investigate the effect of diapirs on degradation of water resources, soil and vegetation, diapirs of the studied area were investigated in the field. Samples were taken from soil, water and vegetation. The water samples were taken from Hable-Rood and Shor-Darreh. Samples 1 and 2 were taken from Hable-Rood before entering the salt domes, sample 3 from Hableh-Rood very close to Shoor-Darreh, sample 4 from the headwater of Shoor-Darreh, sample 5 from the outlet of Shoor-Darreh, sample 6 from Hableh-Rood after receiving Shoor-Darreh and sample 7 from Hableh Rood before reaching Garmsar Alluvial Fan. Water samples were analyzed for PH, EC, gypsum, SO_4^{--}, $Ca^{++}+Mg^{++}$, $CO3^{--}$ and Cl^-(Table1).



Age	Sign		Litological characteristics	Formation
Quaternary	Q		Alluvium	Upper Red
Miopliocene	M-Pl		Conglomerate(including Hezar-Dareh Formation)	
Miocene	M	M_3	M: Claystone, sandstone,shale, undivided evaporitic rocks	
		M_2	M_3: Gypsiferous mudstone	
		M_1	M_2: Sandstone, mudstone	
			Shale, siltstone, evaporitic rocks	
Oligocene	OMq		Limestone and marl	Lower Red
	Ol	Olg	Sandstone, shale, marl, conglomerate, volcanic rocks	
			Olg: Gypsum	
		Ols	Salt as diapirs	

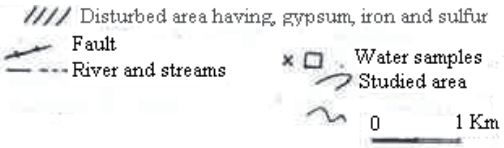


Figure 1: Location of the studied area and its geological characteristics.

Table 1: Chemical characteristics of water samples in Hableh Rood Drainage Basin

No.	pH	EC micromohs/cm	Gypsum m.e./l	$SO4^-$ m.e./l	$Ca^{++}+Mg^{++}$ m.e./l	$CO3^{--}$ m.e./l	$HCO3^-$ m.e./l	Cl^- m.e./l
1	7.2	850	2.4	23	9	0	4	2
2	7.6	800	2	21.5	9	0	4	1.4
3	7.4	5685	2.4	14.5	12	4	4	160
4	6.5	89585	40	43	148	0	2	2300
5	6.7	141450	60	12	137	0	2	5000
6	7.4	5280	6.4	12.5	15	4	4	140
7	7.4	1020	2.4	12.5	10.5	0	3	2.3

The results have shown that the water samples of the vicinity of diapirs are highly saline and alkaline.The soils of the area are of saline soils and relatively to highly saline solonchalk. Vegetation cover of the area consists of Anabasis which is characteristic of gypsic soils and Siedlitzia which is characteristic of saline and solonchalk soils. Therefore, vegetation cover is also affected.

DISCUSION AND CONCLUSION

Diapirs are present in different parts of the world and Iran. They are important in degradation of natural resources and desertification (Natir, etal., 1997, Szaboles, 1992). For restoration of the studied area and the similar areas, the following measures are proposed : Preparation of the inventory map of diapirs in each drainage basin, determination of the extent of the effect of diapirs in land degradation by sampling and analyses of soil, water resources and vegetation cover, establishing different controlling measures for prevention of salinization and land degradation such as diverting saline drainage into local depressions and conducting other drainages through covered and concrete canals.

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