FEATURES OF CHANGE OF SEISMOMAGNETIC EFFECTS BEFORE THE STRONG IMISHLI EARTHQUAKE OCCURRED IN THE MIDDLE KURA DEPRESSION IN 2016

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Researchers know that the geomagnetic effects are observed with anomalous changes caused by strong earthquakes in the seismoactive areas. The collected information is regularly studied in geodynamic polygons of the world and in Azerbaijan with modern magnetometric devices.

Comparative analysis of available data and experience of previous researches in magnetometric polygons established in several regions of the world - China, Russia, Uzbekistan, Kazakhstan and Tajikistan have allowed the magnetometric observation method to be considered as one of the earthquake warning factors [1].

The accumulation of the stress-strain energy at different depths of the Earth's crust is related to both local and cosmogenic factors. Mechanical, physico-chemical and other features of the environment change with characteristic indicators in the source of the earthquakes which occurred in Middle and Lower Kura depression, the northern and southern slopes of the Greater Caucasus, the Azerbaijani sector of the Caspian Sea where the anomalous stress-strain energy is accumulated and effects of such active processes on the Earth's surface are studied in the seismic regions of the world as warning factors of geophysical fields: earthquakes, gravitational, electrical, magnetic and geochemical abnormal changes [1,2].

The epicenter map of the earthquakes occurred in the Middle Kura depression and adjacent areas during 2004-2016 years is given below.

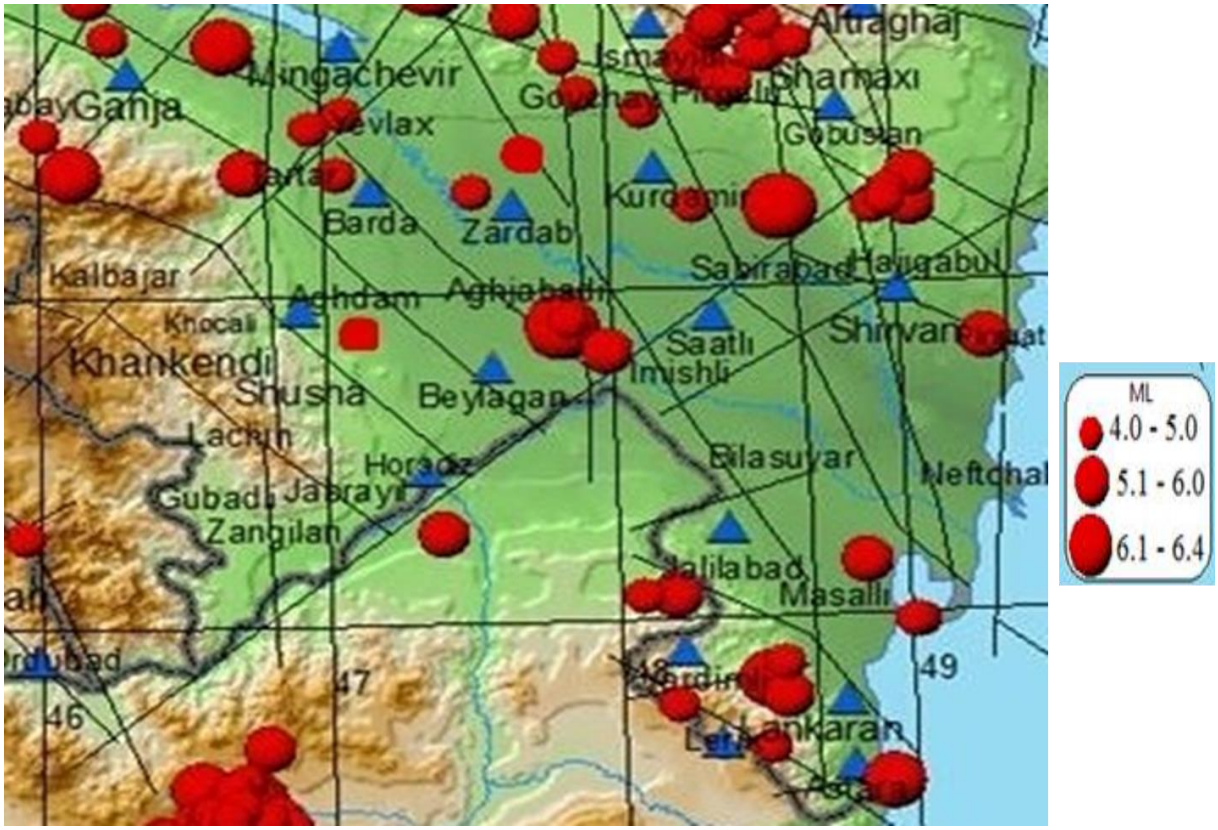

Figure 1. Epicenter map of earthquakes occurred in the Middle Kura and adjacent areas during 2004-2016 years.

1967 shocks have been recorded in the 3rd quarter of 2016 year in the Middle Kura depression. The amount of seismic energy was E=55•1011 C. The amount of seismic energy during

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the quarter of 2016 was higher than in the previous quarters. The reason of this was the strong earthquake occurred (ml=5.6) in the Imishli region on 01.08.2016 year.[6]

The earthquake has been felt at 5 point in the epicenter and up to 5-3 point in the surrounding areas. This earthquake has been accompanied by a small number of aftershocks. Three of these earthquakes have been felt.

Seismicity in the Middle Kura depression was higher than the background level. Epicenter of Imishli earthquake and its aftershocks are located in the Kura-Caucasus and Gabala-Chakhirli orthogonal tension zones.

Imishli and Sabirabad earthquakes sources are known in these parts of the Middle Kura depression. In 2016, the geodynamic activity of the Imishli zone has been greater than that of the other regions.

In previous years, earthquakes with magnitude 4 have been recorded in the Imishli source zone on the map of strong historical earthquakes (427-2016 years). Two of these are earthquakes of magnitude 6 in the 1862 and 1934 years. [6]

The parameters of historical earthquakes in Imishli region have been shown in Table 1.

Table 1

№	Year	Month	Day	Time	lat	lon	H	ml	Point	Note
1	1862	12	19	02-30±1	39,70	47,90	25	6,4	7	Imishli
2	1911	6	23	12-30-19	40,00	48,00	18	5,6	6-7	Imishli
3	1916	5	14	12-11±1	40,00	48,10	30	5,6	5	Imishli
4	1934	10	29	16-15-45	39,90	47,80	30	6,3	6-7	Imishli
5	1959	8	13	00-33-11	39,90	48,20	12	5,3	6-7	Imishli
6	1964	11	9	08-05-48.0	39,80	48,20	14	5,3	6	Imishli
7	1965	5	15	18-43-05.0	39,90	48,00	10	4,6	6	Imishli
8	1968	6	24	18-28-44.0	40,00	48,10	15	4,6	5	Imishli
9	1975	12	16	07-42-50.0	39,70	48,10		4,5		Imishli
10	1976	2	3	16-40-40.5	40,00	48,10	7	5,4		Imishli
11	1999	6	4	11-56-58.2	40,02	48,22	37	4,2		Imishli
12	2016	8	1	4:46:35.799	39,91	47,85	28	5,6	5	Imishli
13	2016	8	1	7:51:01.571	39,92	47,87	25	4,1	3	Imishli
14	2016	10	16	7:52:20.874	39,83	48,00	21	4,4	4	Imishli

The compressive strain of the earthquake magnitude of 5.6, occurred in Imishli area in the 01.08.2016 year is north-east(AZM=47°) oriented, close to the horizon(PL_P=18°-70°) and tension strain is south-west oriented (AZM=254°), (PL_P=70°). The displacement element of the type of movement for both sharp flatness (DP_1=65°, DP_2=28°) is reverse fault. For NP1 modal flatness (STK_1=324°), the movement is with the north-west direction and for NP2 modal flatness (STK_2=123°), it is with the south-east direction. The earthquake source is located in the Kura and Chakhirli-Gabala orthogonal faults zone (Fig.2).

Seismo-magnetic effect created by Imishli earthquake has been observed by modern magnetometers installed at seismological stations operating in the Middle Kura depression. The character of the observed seismo-magnetic effect shows that the compressive action is the leading process in the earthquake source and as a result, there has been a reverse deformation and the tension gradient of the geodynamic field has been reduced to positive, but not negative. However, there is an increase of 15-20nT in the seismo-magnetic effect of the magnitometer operating in the Lankaran station 7-8 days before the Imishli earthquake. Analogical situation has been recorded at the Sheki magnetometric variation station. It is also observed that the effect is formed by an increase of 15-20 nT before the earthquake 7-8 days with the same. It is recorded that the seismomagnetic effects were observed with decreases earthquake time and after earthquake at both

stations. Also a detectable seismo-magnetic effect is considered as a key factor in the defining criteria of dependence of the parameters and mechanism of the earthquake sources (Fig. 3) [3].

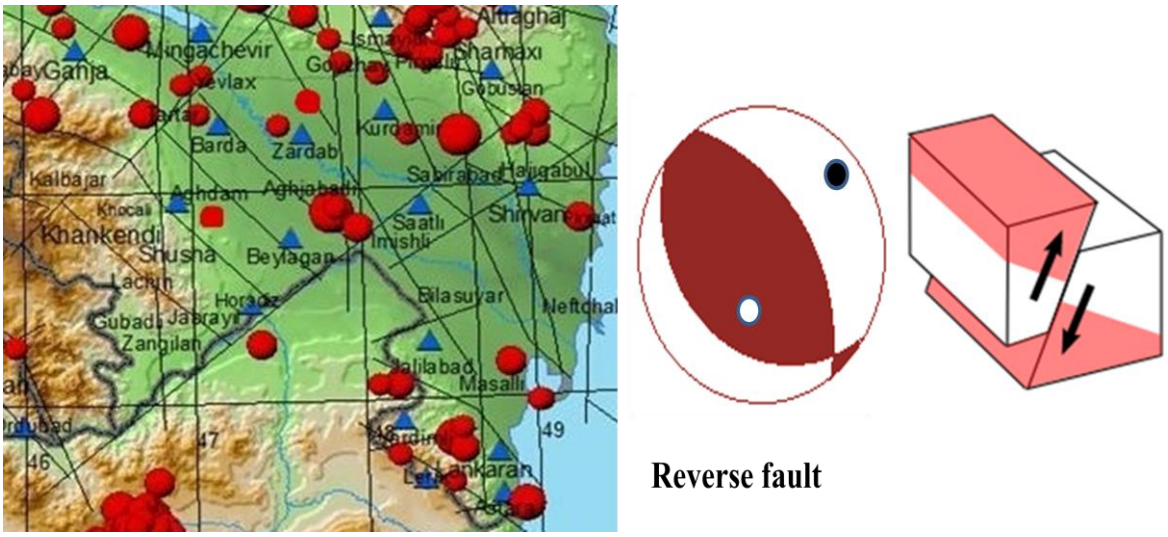

Figure 2. Block-scheme of the displacement and source mechanism of earthquakes occurred in Imishli on 01.08.2016. (compiled by S.E. Kazimova)

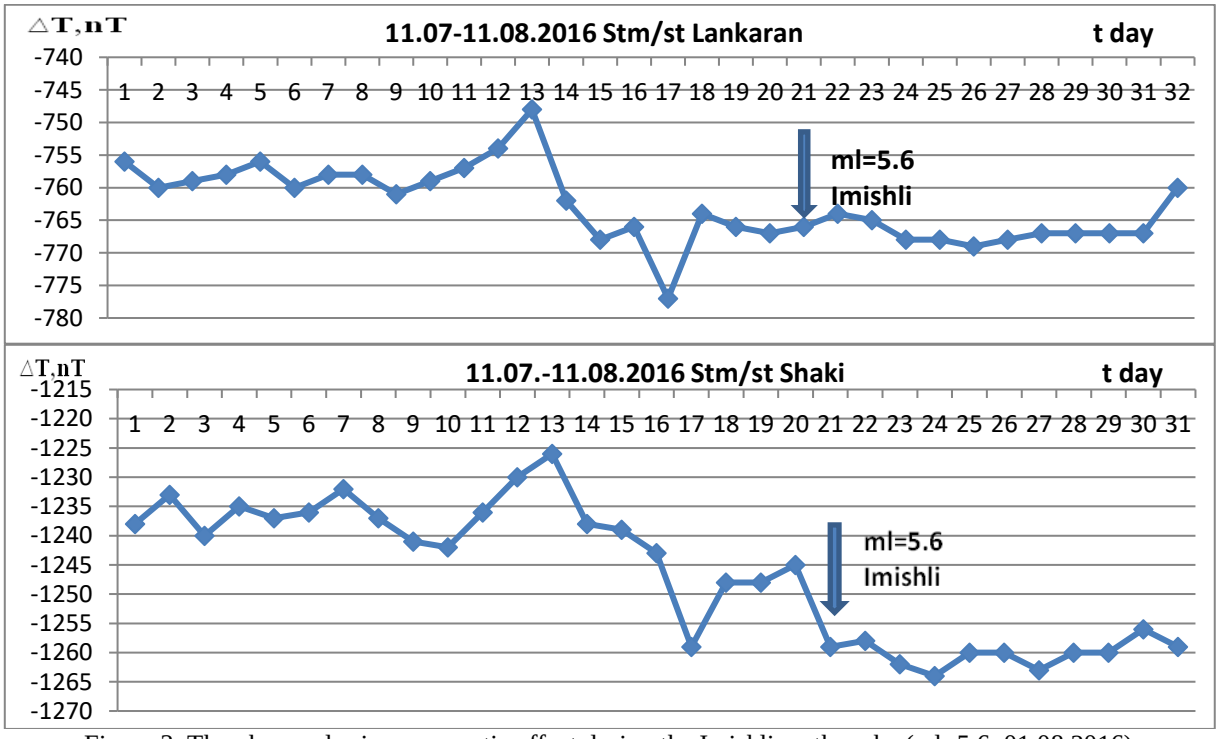

Figure 3. The observed seismomagnetic effect during the Imishli earthquake (ml=5.6, 01.08.2016)

As can be seen from the comparative analysis of the earthquake mechanism and parameters with the curves for the change of seismomagnetic effect, the regularity formed by increases of seismic effect did not justify itself in this episode if the energy of stress-strain in the earthquake source obtained by statistical data for many years is compressive. A similar situation has been reflected during the comparative analysis of the earthquake mechanism and parameters (H=48 km, ml=5.3) occurred in Saatly on 11.05.2017 with the variation for the change of seismomagnetic effect. Even though the stress-strain condition is compressive here too, it is noted that the seismomagnetic effect is observed by the decreaseduring earthquake.

An analysis of the variations of geomagnetic site tension and gradient increases has been allowed us to detect the stress-strain zones in the Middle-Kura depression and adjacent areas. These

are Saatly, Barda, Aghdam, Ujar and Zardab long-term stress-strain zones. In these areas, strong earthquakes are not always present, but are considered as seismic hazard zones and the seismomagnetic effect is observed by anomalous changes [4].

If you look at the map in 2D and 3D format which reflects the stress-strain condition of the geological environment based on magnetic data at the NearKura-Talish geodynamic polygon in 2016 year, the magnetic maximums are recorded in the regional plan (Fig.4).

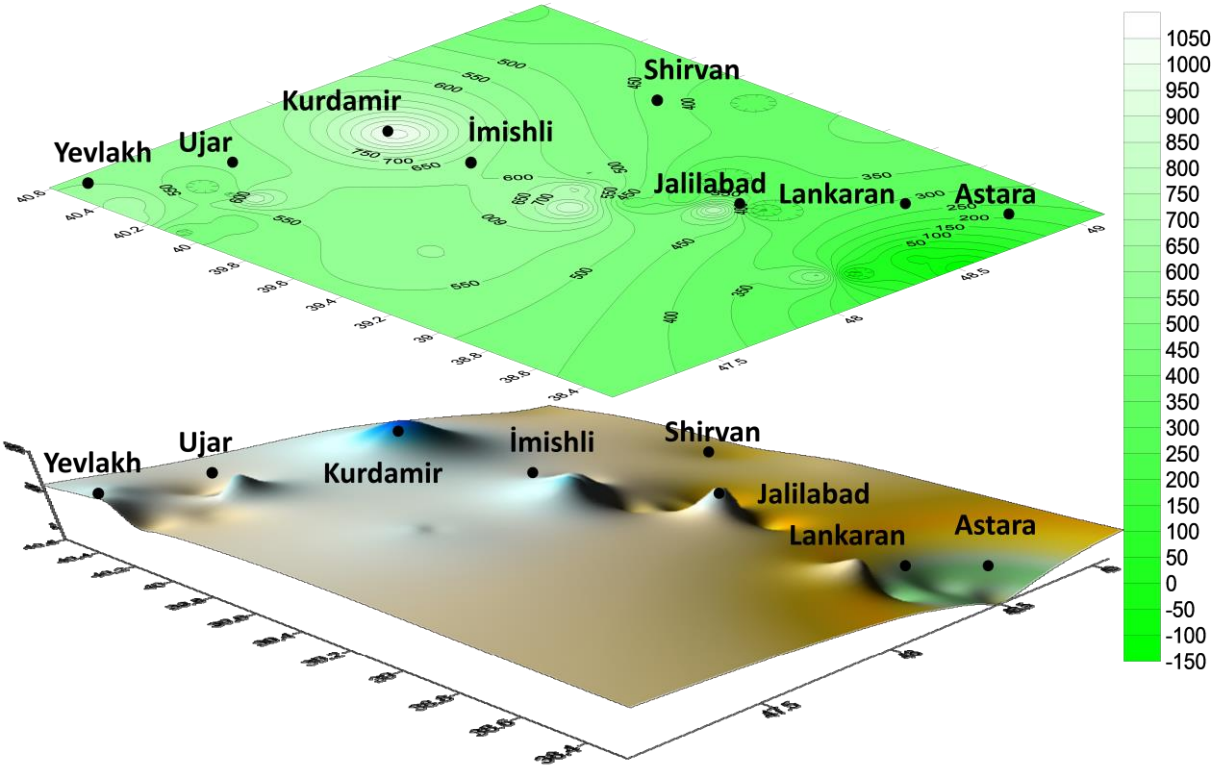

Figure 4. The stress-strain condition of the geological environment on the basis of magnetic data at the Near Kura-Talish polygon (2D, 3D format)

However, in the local area Jalilabad-Imishli and Imishli-Kurdamir maximums are being to the south-east and north-west directions, intensity is 800 in the izolines reflecting the geomagnetic field in the center of the first maximum but to the edges it is 650nT and in the second maximum, these numerals are recorded in the closed form with the intensity 950-650 nT.This situation is reflected in the more complete map in 3D format [5].

The seismoanomal effect in the magnetic field of the Imishli earthquake source zone is determined by the geodynamic regime of the area. It is noted that, geodynamic regime of the Middle Kura depression is related mainly to passed to the bottom of the main blocks of Kura depression to Great Caucasus structure,which is observed by the movement with the south direction of the Great Caucasus structures mentioned in the upper part of the Earth's crust.For this reason, compression deformation occurs in the environment and the seismicity of the area is clarified.[3] The formation of a positive seismomagnetic effect in the Imishli earthquake source zone confirms once again the above mentioned facts.

REFERENCES

1. Yetirmişli Q.C. Aşağı Kür çökəkliyinin seysmotektonik şəraiti və onun neftlilik-qazlılıqla əlaqələri. Azərbaycanda Geofizika Yenilikləri Jurnalı. 2000. Bakı.3-4. Səh. 45-49.

2. Велиев Г.О. 1989. Вариации геофизических и геохимических полей в Шемаха-Исмаиллинской сейсмоактивной зоне. Газо-геохимические методы поисков полезных

ископаемых в Южно-Каспийской впадине и обрамляющих горных системах /ГГМ-III/ 15-17 ноября. 1989 г., Баку, с. 143-144.

3. Рзаев А.Г., Етирмишли Г.Д., Казымова С.Э. 2013. Bakı. Отражение геодинамического режима в вариациях напряженности геомагнитного поля. Xəbərlər. Yer Elmləri, N4, page 3-15.

4. Рзаев А.Г. Связь аномальных изменений в напряженности геомагнитного поля с сейсмотектоническими процессами в литосфере Земли. AMEA xəbərlər Yer Elmləri, №32006c, 58-63(рус).

5. Дадашев Ф.Г., Метакса Х.П., Велиев Г.О. 1985. Изучение связи пространственно-временных вариаций геомагнитного поля с сейсмичностью в Исмаиллинской очаговой зоне. Изв. АН Азерб. СССЗ, Наук о Земле, №4, с. 107-112.

6. AMEA-nın nəzdində RSXM-nin Seysmoloji bölməsinin 2016-cı il hesabatı. AMEA-nın nəzdində RSXM-nin fond materialları, Bakı 2016.