ANOMALOUS CHANGE IN THE GEOMAGNETIC FIELD BEFORE THE ZAGATALA EARTHQUAKE (ML=4.2) 01.03.2022

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The first information about earthquakes in the northwestern part of the Azerbaijani segment of the Greater Caucasus was received in 1850. Strong earthquakes in the region with magnitude ml>5 occurred in 1936 and 1948 (Agamirzayev, 1987). After the noted seismic events, the next strong earthquake in the Zagatala-Balakan zone occurred in 2012 on May 7th with magnitude ml>5.6 (h=9 km, φ=41.50°N, λ=46.58°E). After the main shock, aftershocks intensified in the region, which lasted for several days. Their number in the first day reached 170. After this event, 6 years later, a strong Zagatala earthquake with ml=5.5 (h=10 km, φ=41.5°N, λ=46.67°E) occurred in the same source on June 5, 2018. The coordinates of both sources of the Zagatala earthquakes coincide (Rzayev 2012).

As can be seen from Fig.2, the stress-strain state of the environment at the test site is characterized by local anomalies of stress zones in the Gabala-Sheki, Shamakhi-Ismayilli, and Zagatala-Balakan sections. A sharp change here in the increment of the geomagnetic field strength gradient in short sections of the profile indicates sharp changes and disturbances in the environment.

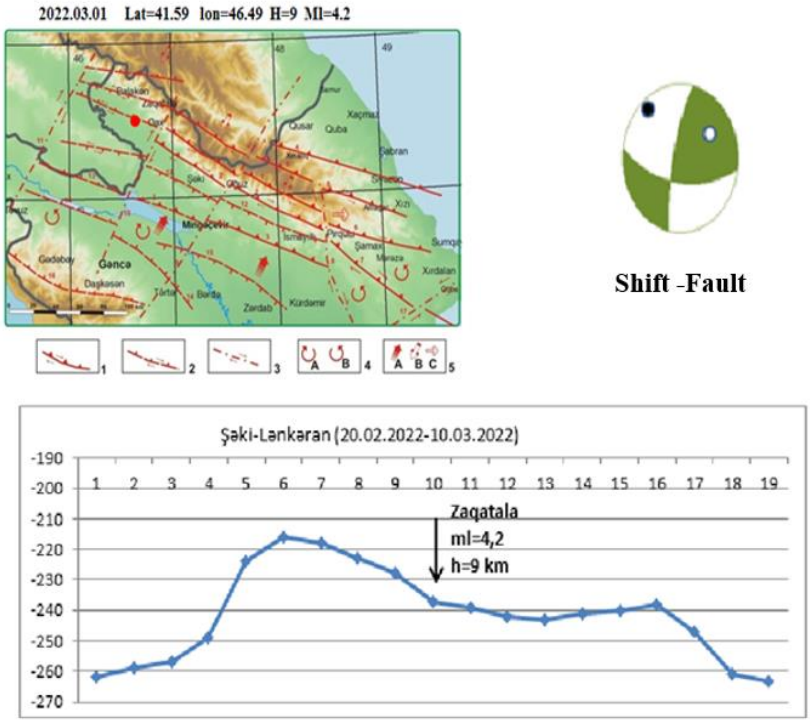

Figure 1. Seismomagnetic effect and source mechanism of the Zagatala earthquake (01/03/2022)

In the northwestern part of the polygon, at the Zagatala-Balakan section, a sharp drop in field strength by -300 nT is observed. Against the background of the formed closed local anomalies on the area of the polygon, in the northwestern part, namely in the Zagatala-Balakan region, a sharp

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change in the gradient ΔT~f(t) is observed and the formation of an extensive negative local anomaly of the geomagnetic field strength is observed here.

Monitoring of the geomagnetic field strength at the Shamakhi-Sheki-Zagatala-Balakan prognostic range is recorded around the clock by modern magnetic variation stations and transmitted online to the RSSC. Operational data processing allows timely detection of the seismomagnetic effect and its temporal changes. The data are presented as T~f(t) and ΔT~f(t) graphs.

In the case of the Zagatala earthquake on March 1, 2022, analyze the changes in tension before and after the seismic event in order to identify the SME and study its characteristics in connection with geodynamic processes in the earthquake source.

Analysis of magnetic variations ΔT~f(t) at m≥4 indicates that the seismomagnetic effect is determined by the parameters of the earthquake source mechanism (Rzayev, 2005, 2006, 2010, 2016). These data are in full agreement with the results of our analysis of the geomagnetic field during the Zagatala earthquake of 2022 (Fig. 1).

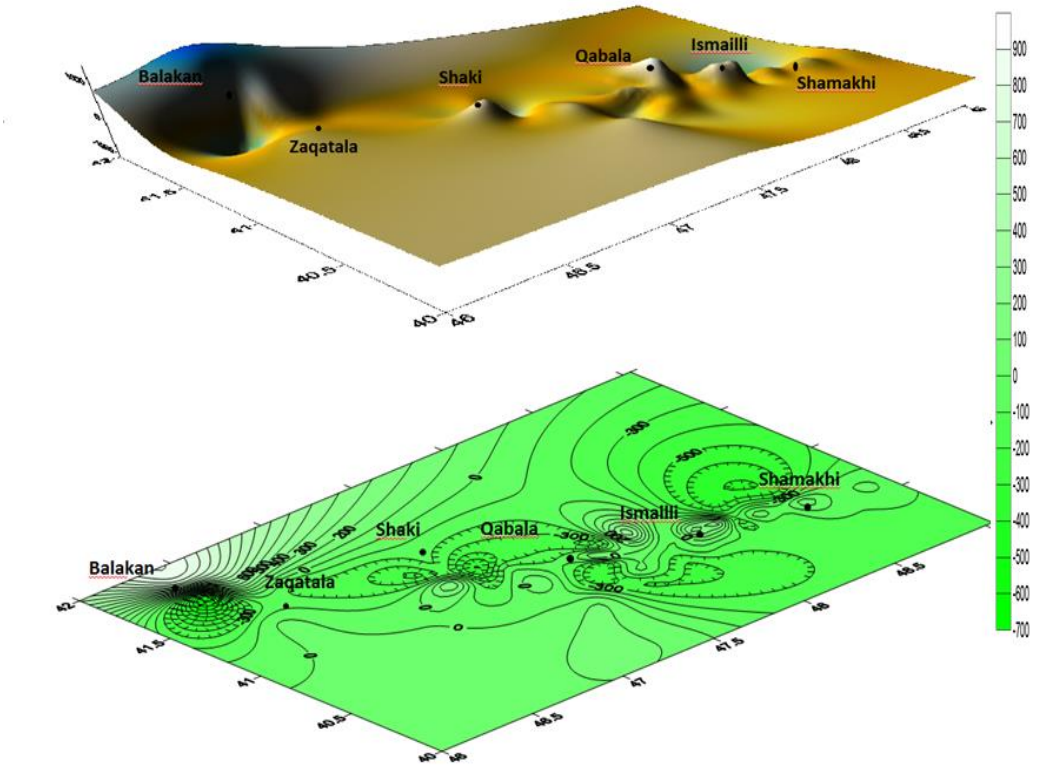

Figure 2. Stress-strain state of the geological environment of the Shamakhi-Zagatala-Balakan polygon according to magnetic data in 2D and 3D formats

As can be seen from Fig.1, the seismomagnetic effect reflects the geodynamic situation in the earthquake source, located in a mobile block of the earth's crust and expressed in shear-thrust deformation. Shear-thrust deformation in the source is clearly reflected in the positive local anomaly of the field strength increment, which forms the seismomagnetic effect (SME).

An analysis of the results of studies of the seismomagnetic effect available in the literature shows that with the mechanism of compression in the source, the seismomagnetic effect is formed with positive dynamics of the increase in the geomagnetic field strength. In cases where tensile

stresses predominate in the source, the seismomagnetic effect has a negative increment in the geomagnetic field strength (Rzayev, 2005, 2006, 2010, 2016).

In the case of the Zagatala earthquake on March 1, 2022, as noted above, the geodynamics of the source is characterized by shear-thrust deformation with the predominance of compressive stresses in the source. At the same time, for 3-5 days at the magnetic variation stations of Sheki and Lankaran, an increase in the intensity of the geomagnetic field was observed. The seismomagnetic effect in this case reached 25–30 nT. After the earthquake, for 5-6 days, a decrease in the intensity of the geomagnetic field was observed with its complete relaxation to the level of intensity on February 20, 2022.

In 2021, a discrete magnetic survey was carried out on the area of the Shamakhi-Balakan test site. An analysis was made of spatiotemporal increments of the geomagnetic field strength gradient $\Delta T \sim f(t)$. The stress-strain state of the geological environment at the site was presented in the form of maps $\Delta T \sim f(t)$ in 2D and 3D formats (Fig. 2).

The earthquake on March 1, 2022 occurred within the Zagatala-Balakan zone of excess stresses identified by us in 2021, was characterized by a sharply differentiated increment gradient $\Delta T \sim f(t)$ (Fig. 2).

Conclusion:

1. The analysis of magnetometric data made it possible to identify the seismomagnetic effect, which was formed 3-5 days before the Zagatala earthquake on March 1, 2022. The nature of the SME fully corresponds to the mechanism of the earthquake source, where the predominance of compressive stresses with the "shear-thrust" source mechanism was observed. As a consequence, we have a positive local increase in the geomagnetic field strength and the formation of a seismomagnetic effect (SME) with positive dynamics.
2. Identified by magnetic data in 2021, the Zagatala-Balakan zone of the stress-strain state of the environment with a sharp differentiation of the geomagnetic field strength gradient, was the zone of formation of the source of the Zagatala earthquake on 01/03/2022 and is well reflected on 3D maps $\Delta T \sim f(t)$.

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