STUDY OF STRESS-STRAIN STATE OF GEOLOGICAL ENVIRONMENT BY GRAVIMETRIC STUDIES OF THE FILIZCHAY PYRITE-POLYMETALLIC DEPOSIT

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The deposit we will inform about in the article is one of the largest deposits in Europe in terms of ore reserves, very rich polymetallic (Zn, Pb, Cu, Ag, Au, Co, etc.) reserves and is one of the largest projects in the Filizchay field prepared by "AzerGold" CJSC for operation. It is necessary to conduct complex preventive seismological and geophysical studies in the area in order to prevent adequate measures from the impact of any expected natural disaster factors on these facilities, sustainability of mining complexes and related infrastructures during operation in general, to minimize risk factors. For this purpose, a local gravimetric observation network has been established in this area to determine the activation dynamics and the gravimetric studies have been conducted.

A network of observation points has been established, taking into account the geomorphological features, relief, forest and impassable places with bushes of the field area and studies have been carried out to determine the relative gravity and the probable stress dynamics.

Isoanomal maps and 3D models reflecting the stress and depth dynamics of the gravitational field of both areas and characterizing these geodynamic stress changes have been created by the method of gravimetric exploration. The obtained data allowed to monitor tectonic disturbances in different depth intervals in the area and to assess the geodynamic regime of the area during the operation of the field.

Thus, the growth gradient of gravitational field stress detected as a result of discrete gravimetric observations in the deposit area in terms of space-time, stress situation in the exploitation field allows to get information about the relative gravity.

Gravimetric observations have been carried out at selected points established on a special network on foot by operators, with a high-precision gravimeter device CG-5 AutoGrav made in Canada in the area where "AzerGold" CJSC is preparing for operation in the Filizchay field located in Balakan region.

The studies have been carried out by the method of repeated measurement at the observation and support points in the 1st and 2nd areas of the Filizchay field, where "AzerGold" CJSC is preparing for operation (Fig. 1).

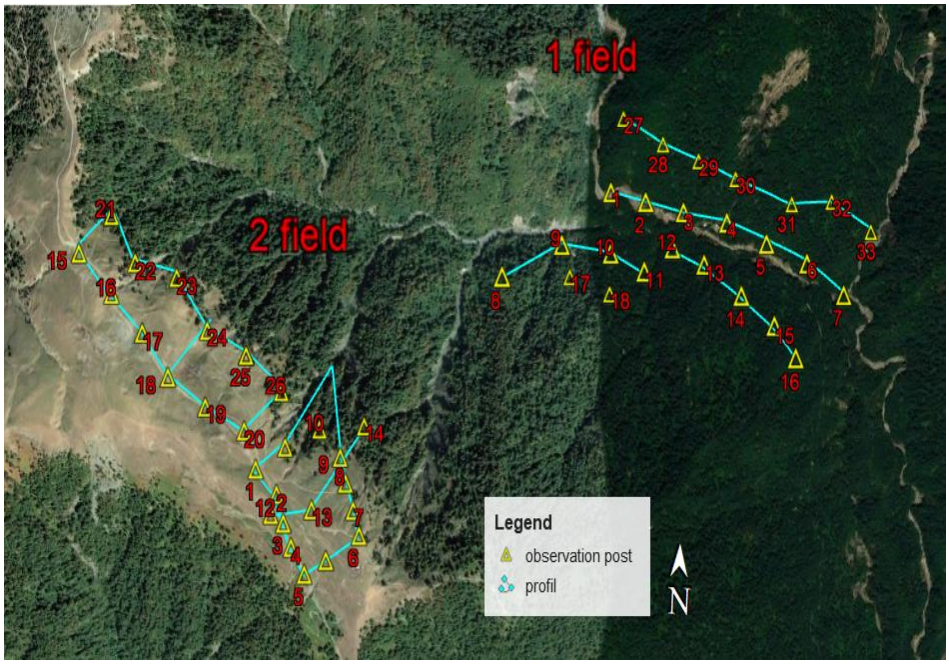

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Figure 1. The layout scheme of the gravimetric observation points in the Filizchay area

Based on the information obtained during the selection of gravimetric plofiles, the geological structure of the area, the location of tectonic faults, the dimensions, depth and contours of potential danger zones of the mass which may be the activity dynamics will be determined. Gravimetric measurements have been carried out in Filizchay area numbered 1 with profile IV of 25 physical point and Filizchay with 26 ph.p. The total volume of observation works have been 51 ph.p.

Visually the structure of the relief in the intersection scheme on profile, distance between observation points, at what height above sea level and etc. have been presented as an example (Fig. 2)

Based on the results of the initial calculations and change of gravity field on each profile in Balakan Filizchay 1 field, a 2-dimensional isoanomals map of the gravitational field (Fig. 3) and 3-dimensional models have been compiled (Fig. 4)

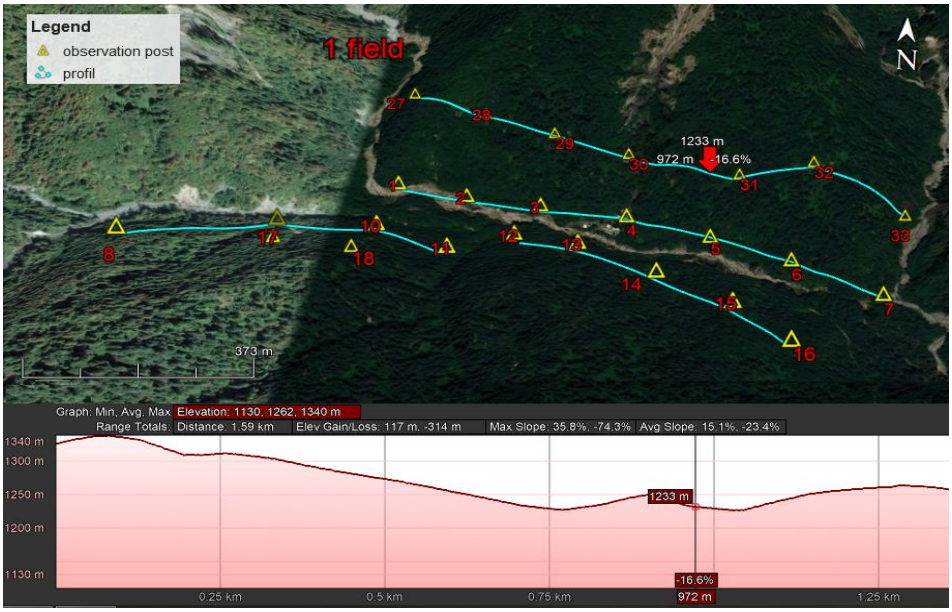

Figure 2. The scheme of intersection on profile I, where gravimetric observation points are located in Filizchay 1 area.

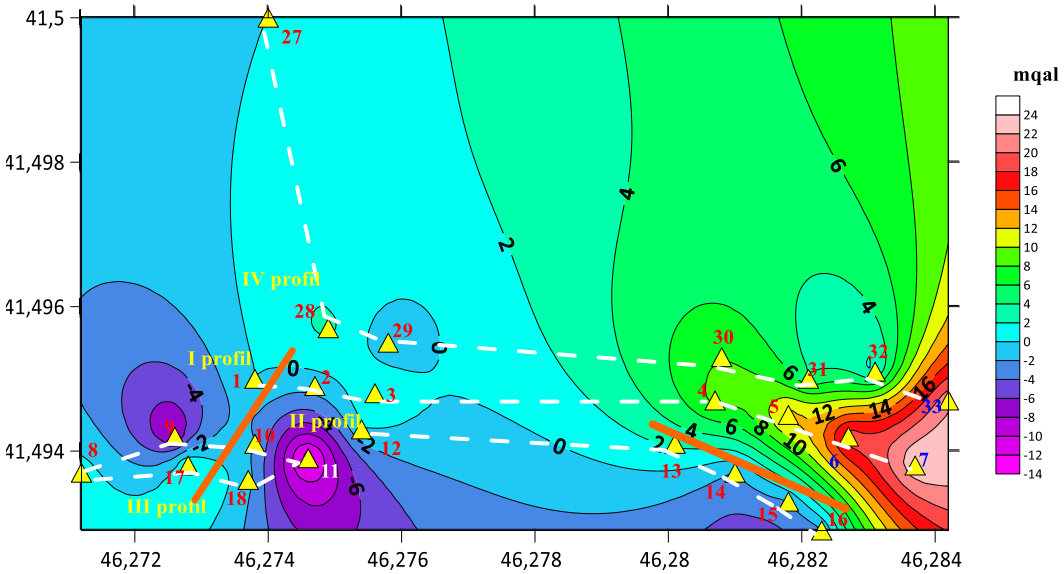

Figure3. Isoanomals map of the gravitational field reflecting the stress-strain state of the Filizchay 1 area.

Symbols:

△ observation points — — — profiles ——— violation zone

As can be seen from the isoanomal map of the gravitational field, the anomalous zones accompanied by a variable value of relative gravity have been accurately covered in this map. Thus, the relative gravity varies from the north of the study area to the south-west and relatively south-east with a minimum value - from 1,179 mg to 13,364 mg. This anomaly is spread from north to south and southwest and remains closed in the north and open in the south.

In the south-eastern wing of the map, there is another complication in the gravitational field, which is the exact opposite of the anomaly in the south-west direction, with an increase in the gravitational field from 2,466 mg to 21,488 mg at the maximum value. These anomalies are from the first observation point of profile IV from north to south, from 1,2,3 m/m of profile I, and in the form of completely stretched of profiles II and III.

If we pay attention to the 3D model of the stress-strain state of the geological environment based on gravitational field data, according to field numbered 1 of Filizchay deposit, the results of the interpretation which mentioned above is noticeable with precision (Fig. 4).

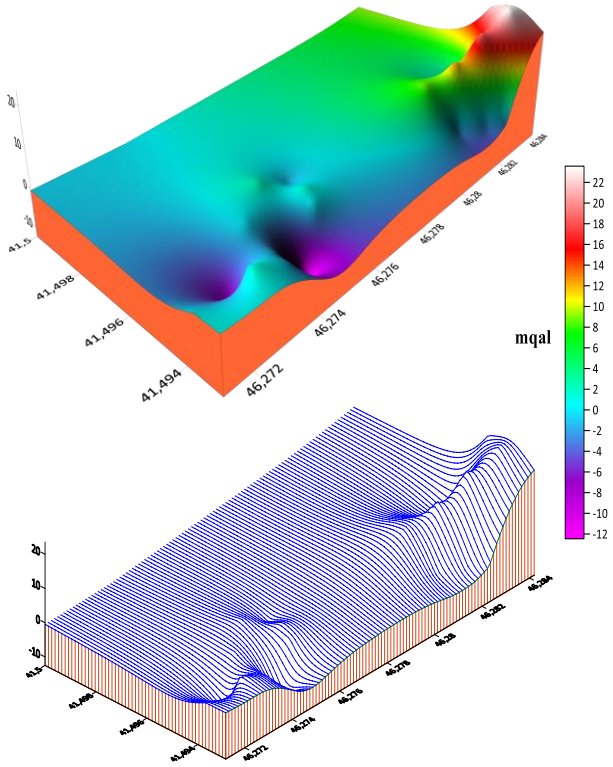

Figure 4. 3D model reflecting the stress-strain condition of Filizchay 1 area.

Gravimetric measurements in Balakan Filizchay 2 have been carried out in the same way as in field 1, taking into account the repeated and auxiliary measurements in the amount of 26 ph.p.

Based on the gravimetric observation data developed in the Filizchay field numbered, change maps of the gravitional field have been compiled. Here we pay attention to the schematic map of the stress-strain state of the geological environment in 2D format (fig.5.).

Glancing at the map, it is clear that there is anomaly varies from 0.138 mgal to -9.813 mgal of the relative gravitation of isoanomals, characterized by minimums in a diagonal shape from southwest to northeast.

On the contrary, there is an increase in the gravitational field from 2,526 mgal to 7,321 mgal in the south-east and from 2,203 mgal to 4,149 mgal in the northwest of the diagonal that divides the map into two minimum values.

The above-mentioned anomalous zones are more clearly visible on the map created in 3D format (Fig. 6). The intensity of the gravitational field is almost at the background level, except for small increases in the right and left wings of the map. Along the diagonal, in the north-east of the

direction, on the contrary, there are complex anomalous zones characterized by a minimal value of the intensity of the gravitational field.

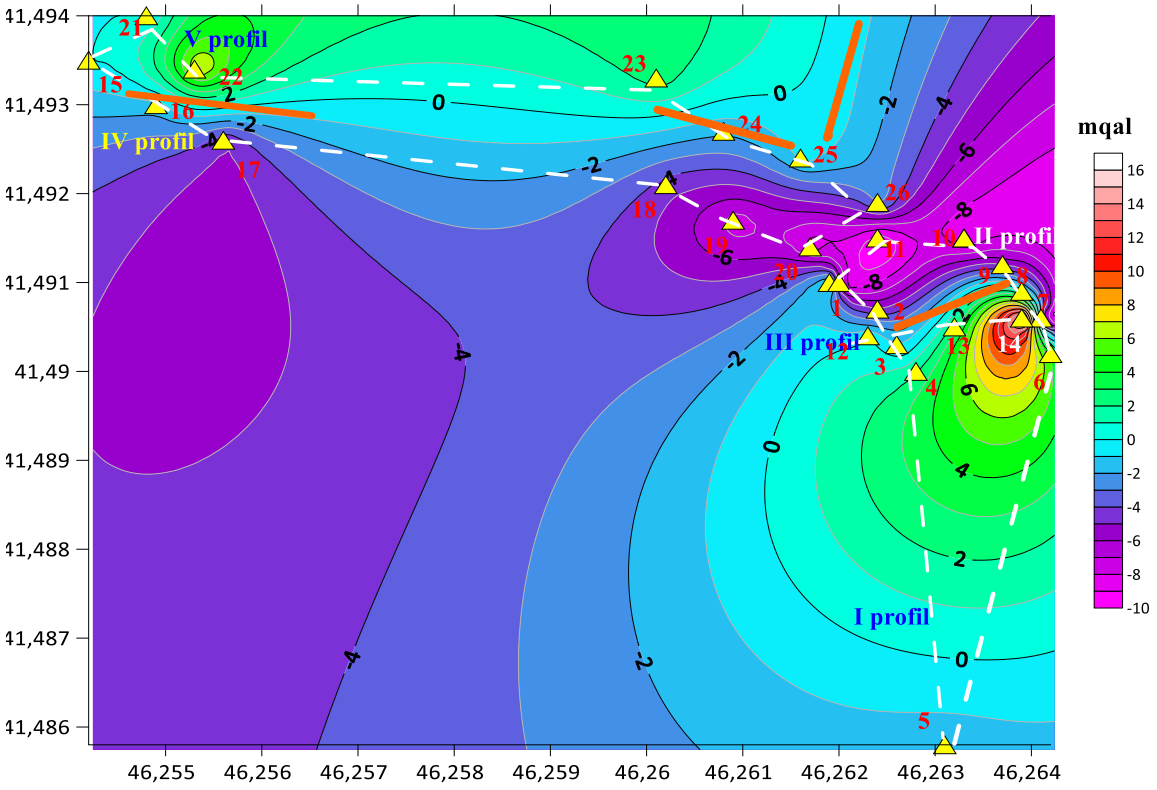

Figure 5. Isoanomals map of the gravitational field reflecting the stress-strain state of the Filizchay 2 area (around Gubek mountain).

Symbols:

△ observation points — — — profiles ——— violation zone

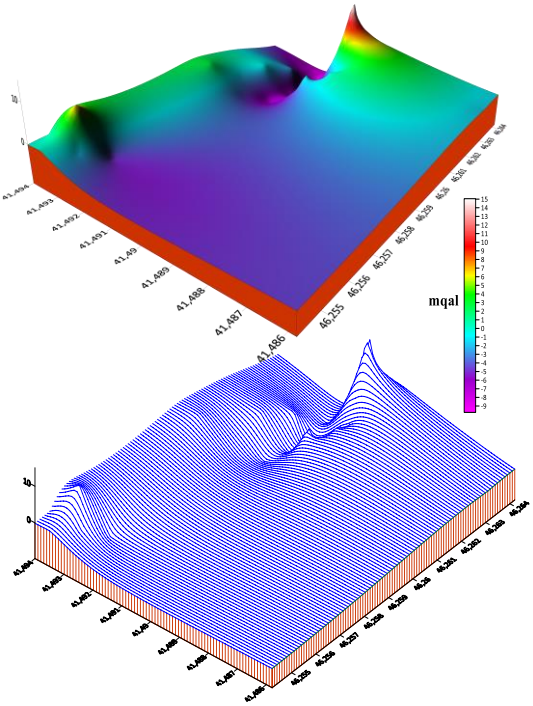

Figure 6. 3D model reflecting the stress-strain state of the gravitational field in the Filizchay 2 area (Mount Gubek).

In addition, based on observations conducted in both areas of the Filizchay field, spectral analysis was provided along with the construction of 2D format isoanomal maps and 3D models reflecting the stress-strain state of the geological environment.

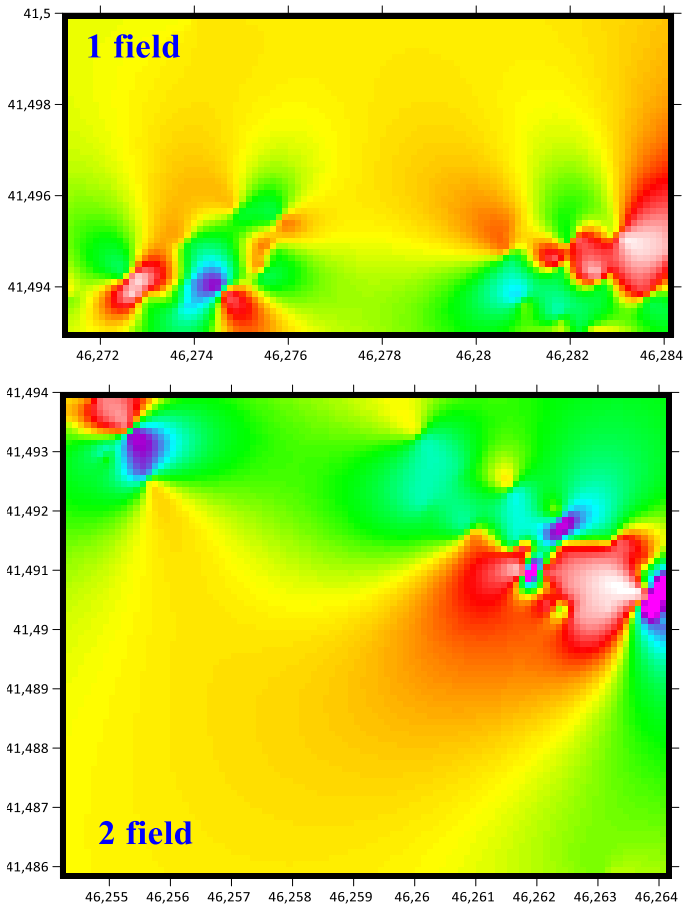

Figure 7. Spectral analysis reflecting the stress-strain state of the gravitational field in Filizchay fields numbered 1 and 2

Symbols:

- stable areas - intensive areas (min-max)
- an intensive area accompanied by minimums

The result

1. The geodynamic regime of the area to be exploited in the Filizchay field has been assessed and the stress dynamics of the gravitational field has been studied and a potential tectonic fault zone has been identified in each of the fields 1 and 2.
2. On the map of isoanomalities of the gravitational field, the anomalous zones accompanied by a variable value of Δg and dynamics of the mass characterizing the anomalous areas are shown to be active and these areas are tend to landslides.
3. Isoanomal maps, 3D models and shadow maps of spectral analysis reflecting the stress-strain state of the geological environment have been created by gravimetric method, based on observations in the field, anomalous areas have been separated accompanied by gradient increase and decrease of tension in local areas.

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