Modern information technologies in searching effective methods for stabilizing siya dara iron mine minerals Bamyan province

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Abstract: Computer technology helps to determine the geologic characteristics of ore deposits in greater detail and reliably. physical parameters of the objects and the host rocks. When analyzing physical properties of rocks, we also used methods of digital processing and obtaining statistical characteristics of physical properties of the of the host rocks and ore bodies. Therefore, the title of the article reflects the importance of modern information technology in the search for effective methods of mineral stabilization. The title of the article therefore reflects the importance of modern information technologies in the search for effective methods of mineral stabilization. The iron mine Siya Dara ore deposit covers an area of 42 square kilometers, among which several iron mining sites have been identified and investigated over an area of 17 square kilometers. On assignment from the Geological Survey of Afghanistan in 2018 a series of comprehensive geophysical surveys on a scale of 1:25,000 were carried out to determine mineral reserves in the Syadare area, Yaka Welang District. A series of comprehensive geophysical surveys on a scale of 1:25,000 were carried out to determine mineral reserves in the Siya Dara area, Yaka wlang District. The complex included magnetic reconnaissance, gravity reconnaissance. Canadian and Soviet equipment was used in the surveys: magnetometer G858, gravimeter CG-5. Canadian and Soviet equipment. The gravity method is based on differences in the density of rocks in the geologic section. Given that the density of iron ores varies dramatically with the density of the host rocks, gravity exploration is a very effective method of studying the field structure. No less effective magnetic reconnaissance is also an equally effective method, given the high level of magnetic recovery of iron ores.

Keywords: Siya Dara e iron mine, gravity, magnetic hollow, modeling

History of geological exploration and mining in Afghanistan

In the Middle Ages and early XX century, gold, silver, and emeralds were mined in Panjsher, as well as iron ore and ores of other metals in various parts of the country.

Coal mines have also been discovered in northern and central Afghanistan, oil and gas mines have been discovered in the northern provinces of Helmand, Kandahar and Khost over the last two centuries.

In 1919 a Russian delegation arrived in Kabul for the first time to work on the the subsurface. In 1920, American geologists participated in mineral exploration in Afghanistan. In 1937, Afghanistan granted a New York exploration company a license to explore for oil reserves throughout the country, but due to the outbreak of World War II the company withdrew its concession a year later. After the Second World War, geological exploration Exploration work was resumed under an agreement with France and coal exploration in southern Afghanistan by the Germans in 1950 and then in 1954 by Swedish geologists ware carried out.

A single airgeophysical survey of virtually the entire area of Afghanistan in 2011 г was carried out. and included aeromagnetic measurements, gravimetry, multichannel electrical survey and spectrometry. Videotaping was carried out using a fast flying aircraft "Orion from an altitude of 5,000 to 1,500 meters. The bulk of the country is developed by various exploration routes. The results of this survey show the state of deep geologic faults in the Earth's crust and are presented in Figure 1.(8)

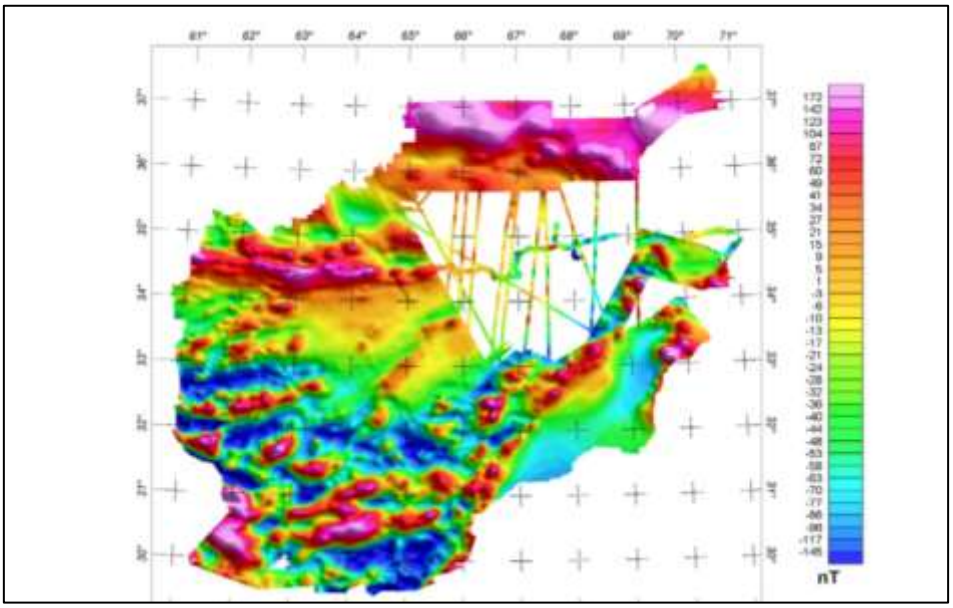

Figure 1. Results of aeromagnetic survey of Afghanistan: physiographic characterization

The Siya Dara area is located 360 km northeast of Kabul and 160 km southwest of Bamyan province Its coordinates are presented in Table1.

Coordinates of the study area

No	Y	X
1	34° 37″17 .5′	66° 51″18.55′
2	34° 35″45.9′	66° 51″59 58′
3	34° 30″54.1′	66° 44″10 .00′
4	34° 31″58.2′	66° 43″14 .75′

Geophysical surveys play an important role in solving geological problems at ore The results of these studies are used at all stages of geological prospecting and exploration.

The magnetometer method was used as the main method in the study of the Siya Dara deposit. which was used to identify blocks with high magnetic properties, area iron ore deposits, etc. Indirectly, it was used to investigate the rocks around the mine This method is performed on the ground and in the air to locate mineral blocks of a geologic structure. So, compared to other geophysical methods. it can be noted that it is simpler and cheaper. To detect the magnetism of iron ore magnetometry is used as the best exploration method.

The gravity method is based on differences in the density of rocks in the geologic section. Given that the density of iron ores differs dramatically from that of the host rocks, gravity exploration is also a very effective method of studying the field structure [1].

Geology of the region

According to previous research conducted by the Precious stones team In the year 2019 in the study area, most of the stones are of the Paleozoic group. These are mainly black shales (C3) of ash-black color, small plates of quartz (SiO) and granite are marked, sericite limonite that have been fragmented by tectonic movements. In some thin layers are observed in some areas, and on others, very thin layers. In the area of Siya Dara. blocks of iron ore can be seen in the form of outcrops.

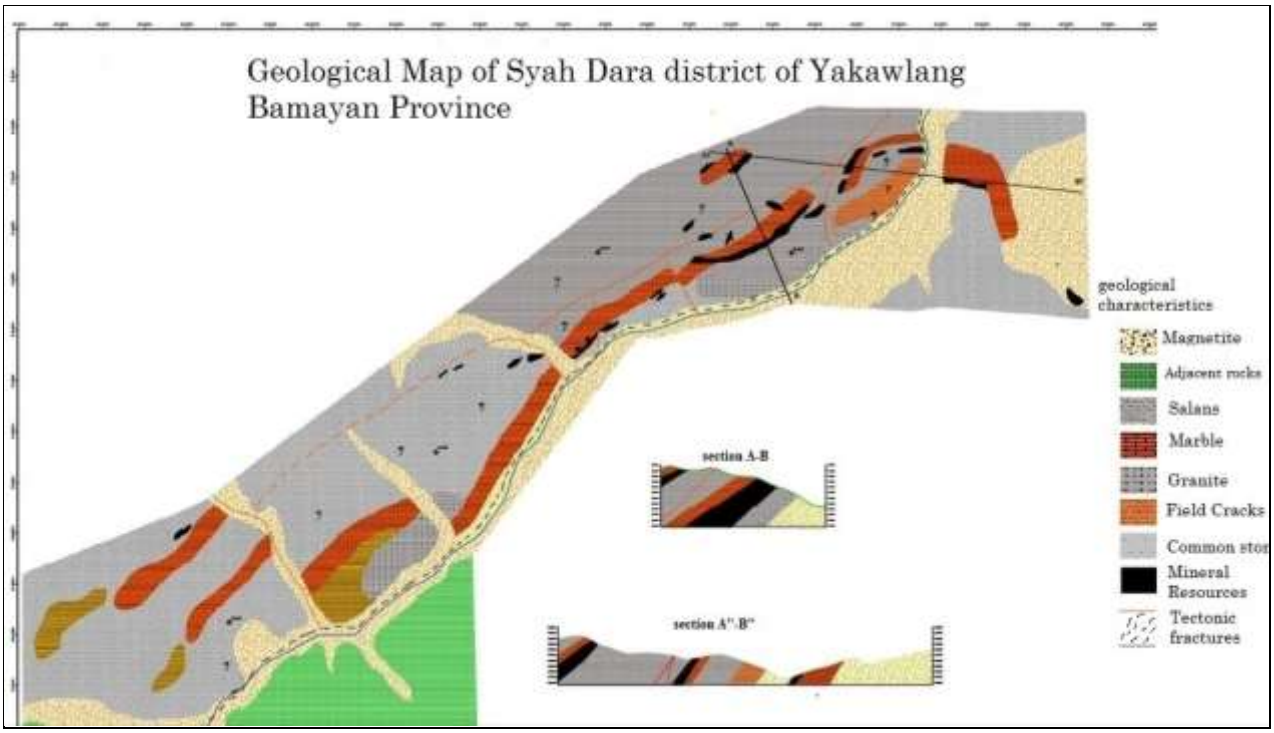

Figure 2. Geologic map of Siya Dara district, Yakawalang province, Bamyan province (digitized in GIS program)

Iron ore mineral blocks No. 1, 2, 3 ... 17

Based on work conducted by the gemstone team in 2019, The study area has an area of 42 square kilometers and is divided into 17 mineral blocks at a scale of 1:25,000 and 1:2,000 for category C2. It was calculated that approx. (5.63E+08) tons of iron. Among the dolomitic marble stones and black and chlorite blocks, containing iron blocks, both the largest iron blocks and the smallest mineral blocks are common.

Figure 3. Iron ore outcrops in the village of Sirk Siya Dara

Iron ore blocks composed of minerals (magnetite, hematite, martite, pyrite and cedrite) are widespread in the area. They first run eastward, then extend westward to the Caf-Col valley. The slurry rocks and sediments at the studied sites were subjected to various transformations during contact with magmatic rocks.

Magnetic method

In magnetic exploration, the physical basis is the distinction of rocks by magnetic properties. Magnetic method is one of the most important methods of geophysical exploration, which has many applications and includes small studies, such as locating underground pipes and electrical cables to large facilities, such as mineral reserves, and the study of large geologic and petroleum structures. One of the advantages of this method is the ease of measurement and its lower cost compared to other geophysical methods (exploration geophysics). The magnetic field was measured at the investigated area by a vapor cesium magnetometer G-858 manufactured by Geometrika company with an accuracy of 0.01 ntl (unit of magnetic field strength), this device records one value (reading) per second [4].

Interpretation of magnetometer data

After making the necessary corrections to the terrain anomaly maps by the program (Geo soft) it was decided that the figure below shows the changes in the strength of the of the magnetic field in the area of Siya Dara. The magnetic field difference in this area is very large minimum limit of 18,902, and a maximum of 57,324 ntl according to the high value map the intensity. of the magnetic field extends from east to southwest, which is due to the southwestward expansion of the magnetite blocks to the southwest. What's important about the anomalies in this region is the continuity between them, that appears in the depths of their union.

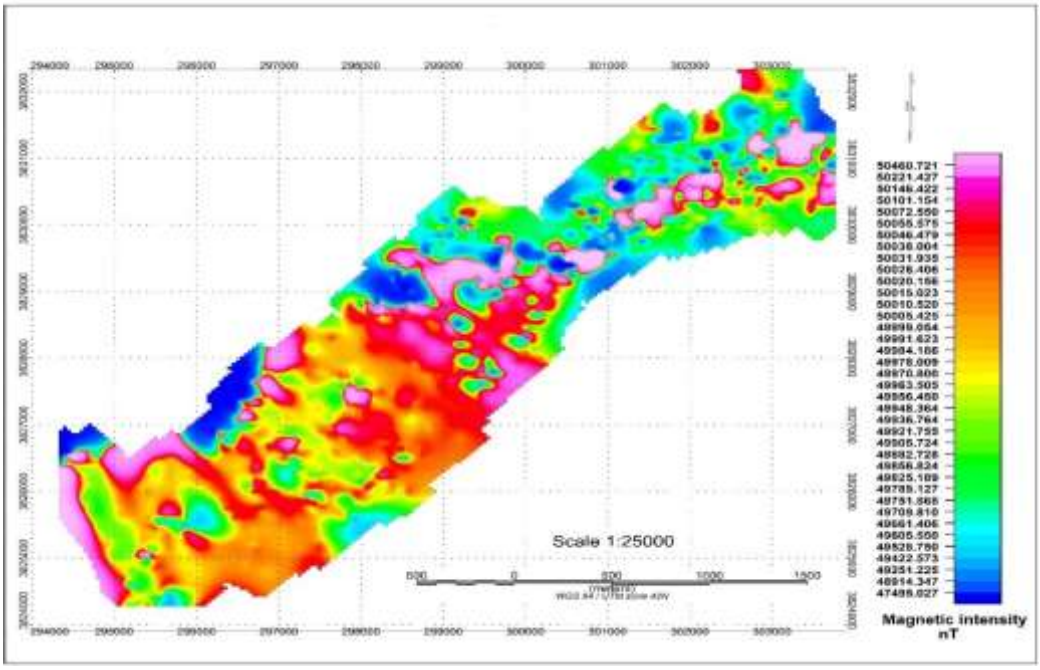

Figure 4. Map of magnetometer anomalies of Siya Dara district, Yakawlang district, Bamyan province

Analysis and interpretation of magnetometric data

The results of the magnetic survey are presented in Figure 5 in absolute units. The magnetic field anomalies were transformed by a method of reduction to vertical magnetization and recalculation to the upper half-space in order to justify obtaining depth characteristics the sources of these anomalies. Figure 5 shows the transformants of these fields. Magnetic data transformants of the Siya Dara district in the study area at horizons of 100, 20 and 50 meters an upward expansion filter was applied to determine the depth of expansion of the iron deposit. As you can see from the map extending upwards to a height of 20 meters, part of the anomaly on the magnetic field strength map disappeared, and a number of anomalies, that were larger in size are still is still present. Analyzing the nature of the magnetic field change, two areas can be distinguished, characterized by- characterized by different geometric types of magnetic anomalies [3].

Northeastern section with local positive anomalies of small intensity with elongated shape. intensity of elongated shape. Comparing the location of these anomalies with the map of iron ore bed outcrops in Figure 3, it can be concluded that these anomalies reflect exactly the formation iron ore bodies coming to the surface. Magnetic field modeling from models reservoirs, calculating magnetic anomalies, that is, solving the direct problem of magnetic exploration, using Magmodel computer program, Figure 4 confirms our assumption.

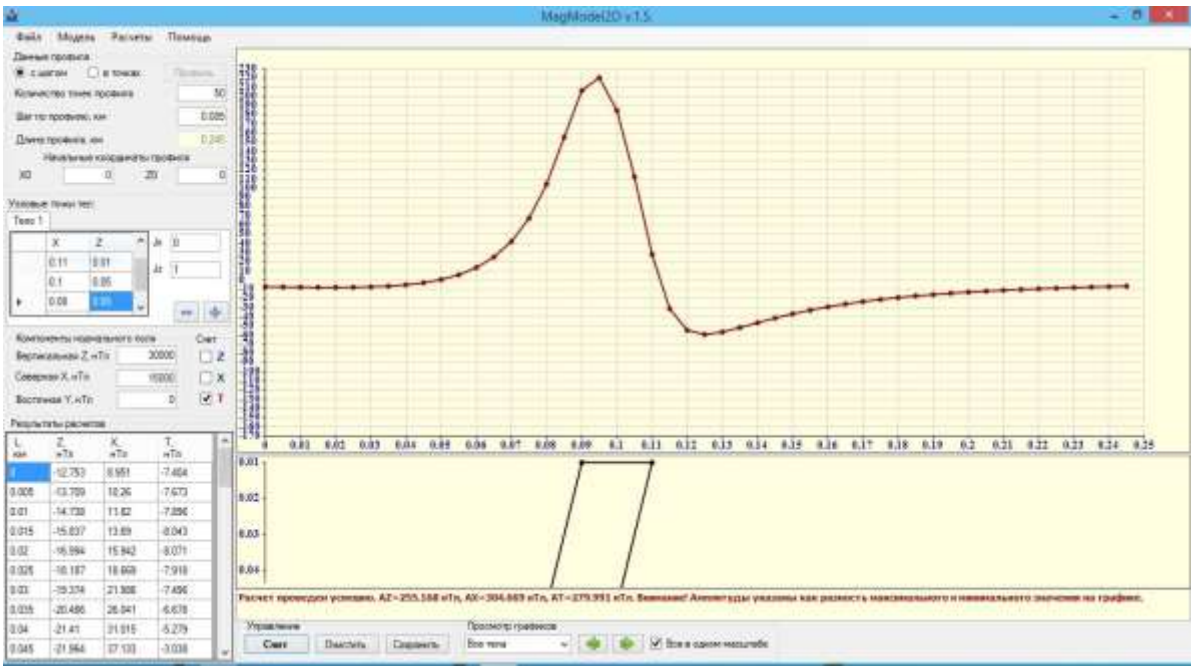

Figure 5. Results of calculations of magnetic anomalies for ore body models

Gravimetric method

The physical basis of the gravimetric method of exploration is the distinction between rocks of a geologic section by density value, which create excess (or defective) masses relative to the host rocks.

Analyzing the values of the densities of rock (host) rocks and ore minerals (Fig. 4), We see that the ore objects have excess density relative to the host rocks on average of by 2 g/cm. Based on geological studies conducted by a team of precious stone specialists in 2009 Siya Dara district of Yakawelang of Bamiyan province was surveyed, which showed, that an area of 42 square kilometers contains 60-70% iron. It was revealed, that this area includes all types of metamorphic and igneous sedimentary rocks, including the most extensive iron ore mineral zones, which are mostly composed of blocks of magnetite. (and in some places sedimentary rocks, blocks of hematite, martite formed by sedimentary rocks, as well as minerals of manganese (Mn), magnesium (Mg), zircon (Zr), titanium (Ti), molybdenum (Mo), barium (Ba), uranium (U) and titanium (Th).

Gravity field analysis

If the gravimeter is moved upward (away from the ground), the magnitude of g or gravity measured by the device will decrease. The measured values must be corrected for this effect, and these gravity data after anomaly correction are called free gravity.

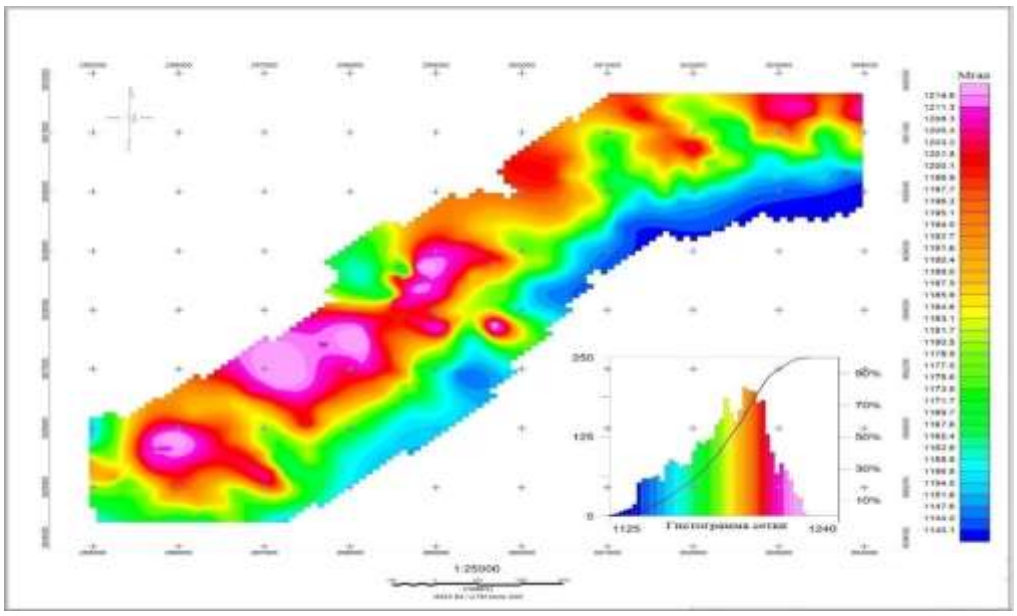

Figure 6. Map of the observed gravity field relative to the WGS-84 Earth model

Results of gravimetric field analysis at Siya Dara

Taking into account the brand of the instrument and how the daily variations of the magnetic field were accounted for, the map of the gravitational field of Siya Dara was analyzed after bringing the gravitational field to the pole (vertical magnetization) and coincidence of such anomalies with gravity anomalies. The GravModel program outputs the following parameters.

- For gravity exploration - high density, of the order of 4.8-5.8 g/cm.cu. density of host rocks is estimated in the range of 2.7-2.9 g/cm.cu.

Taking into account the gravitational field density of the body and the adjacent rocks, we graph it below.

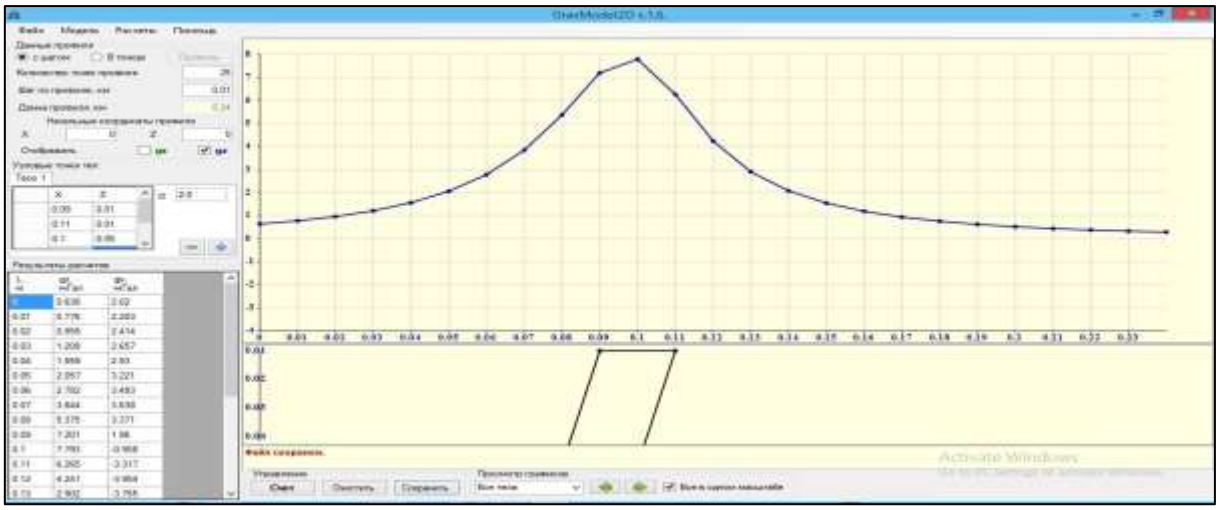

Figure 7. Results of anomaly calculations for the first model

CONCLUSION

In 2018, a series of geophysical surveys were conducted over iron mine in the Siya Dara area, YakaWelang District, Bamyan Province, with a scale of 1:25,000. Geophysical surveys in the Siya Dara area play an important role in solving geologic

problems and are used in all phases of exploration geology. In this study we used the magnetictometric method of G-856 and G-858 gravimetric method of the device‹ CG-5 for stabilizing iron ore ingots, which is commonly used in geophysical surveys, and petrophysical sampling. The magnetometric method is the main method in the study of the Siya Dara deposit, directly to identify blocks with high magnetic properties, iron mineral deposits. It is used to scout for materials around the mine. This method is conducted on the ground and in the air to detect the mineral blocks of a geologic structure. Therefore, compared to other geophysical methods, it can be noted that it is simpler and less costly. To determine the magnetism in iron ore, the magnetometry method is used as the best exploration method.

Based on the studies performed, the block structure of the deposit was established, ore areas have been identified for development. A critical comment on the completed filming: field work has been carried out in a limited area and there is no correlation of the survey results to regional gravity and magnetic fields.

Based on the studies performed, it was found that, that the Schiadare deposit consists of two different areas:

1) Northeastern, which is represented by formation bodies, several meters thick and up to 100 meters deep.

2) South-western, represented by massive ores. The total mass of ore bodies can be can be determined from gravimetric data.

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