



Exploration of iron and chromite by geological and geophysical studies in Shovin area, Sistan and Baluchestan Province

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Extended Abstract

Summary

The study area is geologically and potentially capable of mineralization of iron and chromite, and thus, there are many mines and ore deposits of such ore minerals at short distances in the area. This area is located nearby ophiolite and ultramafic assemblages in which considerable mines of iron and basic metals are observed and explored. Considering the economical concentration potential of iron and chromite in this area, some studies on a regional scale have previously been performed. Here, we have investigated Shovin mineralized area for further exploratory studies. Our magnetometric studies reveal that no iron-rich ore deposit is observed in this area and the high magnetic intensities indicate the presence of magnetic minerals in ultramafic rocks. High magnetic intensities are due to the presence of a dyke and the existence of ultramafic rocks. The presence of a buried mass with a density of about 4.4 g/cm³ is proved based on modeling of the gravity data obtained

from the area. Thus, the presumption of the presence of a chromite mass in the study area is highly possible.

Introduction

Geophysical methods are applied approximately in all exploration steps as cheap and reliable ways, which reduce the risk of large investments in many cases (Telford et al., 1990). Similarly, using geophysical methods alongside geological studies increases the efficiency and interpretation of the results more accurately, and hence, can improve the possibility of exploration and feasibility of achieving to promising areas.

Magnetometric and gravimetric methods are some of the oldest geophysical methods used for exploration of iron and chromite deposits. Correct interpretation of field magnetometric and gravimetric data integrated with other exploratory data can reduce the exploration cost and provide valuable information about the location, depth, and dimensions of the concealed iron ore deposits (Carlson and Ripley, 1997; Ganiya et al, 2012; Amobi Adebisi, 2018; Sampaio, 2021).

The gravimetric and magnetometric methods consider primitive exploratory tools for detecting minerals (Sott and Geo, 2014). The majority of chromite ore deposits have been discovered in the recent decade (Yaghoobpur, 2005). Gravimetric and electrical methods are the most important geophysical approaches used to explore chromite lenses in chromite ore deposits that are complex targets to explore due to the influence of tectonic conditions and their irregular shapes (Kogel et al., 2006). Although ophiolite rocks have a pretty high specific gravity, the density of chromite ores makes them recognizable from the host rock (Hornicka et al., 2020). Therefore, gravimetry is a common method to explore chromite resources (Aghajani, 2012; Moazam, et al., 2019; John, 1997). Kamkar Rouhani (2008) and Azad, et al. (1392) could detect the anomalies of chromite deposits in the Faryab mine area by processing the gravimetric data collected from the area.

Methodology and Approaches

To perform exploration operations in the Shovin mineralized area, first, the area was visited, and then, all data, reports, and maps of the area were collected, and by incorporating these two sources (field studies and previous documentation), a relatively adequate knowledge of the geological characteristics in the area was attained. These data were used to plan future exploration operation. In the second step, several operative groups with different aims were equipped to

commence the exploratory operation in collaboration with the mapping group. Many activities such as field geological studies, geophysical surveys, and sampling of the favorable areas were carried out. In the third step, the data collected from various geological and geophysical studies were possessed, and the results were obtained.

To conduct magnetometric surveys in the Shovin area, G856 model proton magnetometer with the sensitivity of 0.01 nT was applied to acquire magnetometric data at the points considered along 11 survey lines with 50 meters intervals passing all the suspicious ultramafic outcrops and faults in the study area. Using a theodolite instrument, the designed points have been marked on the ground. As a result, a survey network with the density of 25*50 or 50*50, depending on the proximity of ultramafic outcrops and the main faults was considered. Overall, total magnetic field measurements in 264 points were made and magnetic map of the area was obtained after performing all of the corrections on the magnetic data.

Similarly, gravimetric surveys were conducted in the area, and totally, gravimetric surveys were made in 209 points with a grid of 20 meters by 20 meters along 11 survey lines in four days. For the gravimetric surveys, the Lacoste-Romberg device with the resolution of 0.01 mGal was used. After performing all corrections and calculations on the raw gravimetric data, the residual anomaly map was obtained.

Finally, after processing and interpretation of the magnetometric and gravimetric data, and integration of the geophysical results with geological information, possible iron and chromite mineralized zones were recognized.

Results and Conclusions

Shovin iron and chromite deposit is observed along with ultramafic and mafic rocks (harzburgite to gabbro) and the iron ore found in this deposit in the form of hematite, although magnetite can be scattered in the ultramafic rocks and or as a filling within the joints and cracks that is economically valuable .

Magnetometric investigations in the area reveal that no accumulation of rich iron masses exists in the subsurface, and high magnetic intensities are the results of the presence of a dyke and ultramafic rocks .

The residual gravity anomaly and modeling applied on the gravity data indicate the presence of a buried mass with a density of about 4.4 gr/cm³ that can indicate high possibility of the existence of a chromatic mass in the study area.
