Advanced Engineering Days

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Application of the ratio of satellite image channels for mineral mapping using the example of Kokpatas-Okjetpes from the direction of the trend (Bukantau Mountains)

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Cite this study: Akrom, G., Arofat, K., & Navruzbek, J. (2023). Application of the ratio of satellite image channels for mineral mapping using the example of Kokpatas-Okjetpes from the direction of the trend (Bukantau Mountains). Advanced Engineering Days, 6, 187-189

Keywords
ASTER
Bukantau
Kokpatas-Okjetpes trend
Gold deposits
Mineralized zone

Abstract

Research using remote survey materials contributes to the improvement of existing and the creation of new research methods, the further study of the geological structure of large regions, and the identification of factors responsible for the localization of minerals. At the same time, the structural patterns of mineralization localization in individual areas are revealed, the connections of cosmo-geological objects with the distribution of minerals are studied. The object of research in this work is the perspective area of Derbez - the western flank of the Kokpatas deposit, Kokpatas-Okjetpes trend.

Introduction

The method of using the results of decoding satellite images and the images themselves is an integral part of geological research.

Cosmo-geological work on the object of research was carried out on the basis of digital space materials Landsat TM, Quick Bird, Aster, Radar using modern software products ENVI, ERDAS, ArcGIS. The use of mathematical and statistical apparatus embedded in software tools, in combination with the materials of geological, geophysical, geochemical, and other studies increases the objectivity of the results obtained.

Processing of digital materials of space surveys was carried out on the basis of methods of processing satellite images: CC (Color composition), PCA, Sobel, Kirsha, etc.

The results of processing by these methods made it possible to map all the structural units represented on the geological map on the studied area, as well as to record new and suspected discontinuous faults, fracture zones, ring structures, etc. Also, these methods made it possible to clarify the boundaries of structurally deciphered complexes.

Digital processing of satellite images of Landsat-7,8 ASTER and Quick Bird was carried out in 3 ways. MinComp, Kirsch, Sobel. As a result of the work, a variant of processed satellite images was prepared at a scale of 1:25000 per study area.

Determination of the main factors of localization of gold ore and other manifestations of minerals is a necessary condition for improving the efficiency of forecasting and prospecting.

To date, the identification of localization factors of gold deposits is based primarily on empirical data, on the search for patterns of deposit placement relative to the elements of the geological structure of the regions. Therefore, one of the main conditions for the successful identification of factors of localization of deposits is the study of the geological structure and history of geological development of territories with the determination of the place and time of formation of ore concentrations.

The range of varieties of geological and structural positions of mineralization is not so large: zones of crushing, fracturing, scarring zones, contacts of heterogeneous rocks, zones of hydrothermally altered rocks, and shale. As can be seen from this, the role of the fault recedes into the background, and the physical state of the fault zones, and contacts of dissimilar rocks come to the fore (Figure 1).

Among the geological and industrial types of deposits, the following are distinguished: gold-sulfide (Kokpatas), gold-quartz (Altyntau), gold-silver (Okjetpes), gold-sulfide-quartz (Bulutkan, Barkhannoe), tungsten scarn-skarnoid with superimposed gold (Southbay).

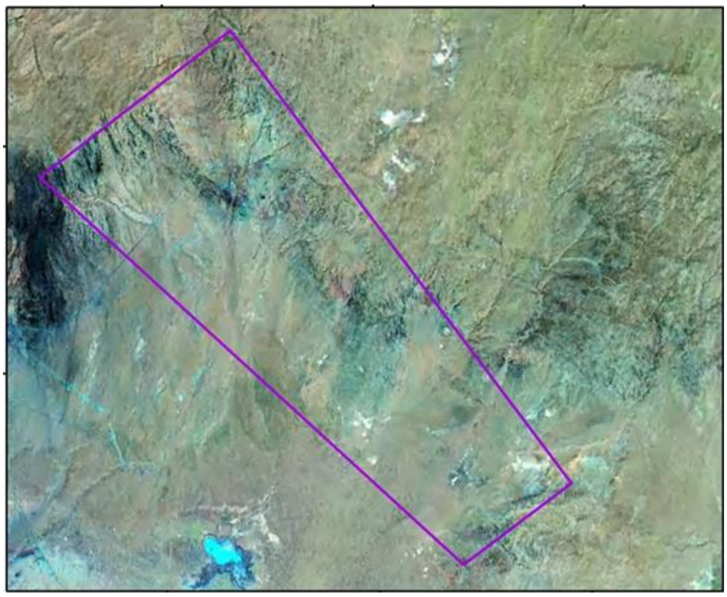

Figure1. Satellite image of the studied territory (Landsat-7)

Material and Method

When mineral deposits are formed and endogenous mineralization is placed in them, it occurs not only under the influence of certain geological factors, but also under the influence of physical fields of the areas of mineralization, under the influence of geodynamic conditions and tectonic deformation of rocks.

Geophysical methods in forecasting and prospecting for deposits solve problems, the results of which give indirect signs of the presence or absence of hidden mineralization. Despite this, the results of magnetometry and gravimetry were used in this taxonomy in order to identify promising areas on a regional scale during prospecting, which, according to their geophysical parameters, correspond to the geophysical data of the areas of known deposits and ore occurrences.

Search signs are understood as factors indicating the presence or possibility of finding a particular mineral deposit in a certain place [1-10].

One of the main structures of the south of Bukantau, the authors consider the zone of the Kokpatas fault (structural-formation subzone) with a width of about 10-13 km, including the Okjetpes, Kokpatas, and Boztau mountains. The Kokpatas subzone south of Bukantau is divided into two large blocks – western and eastern. According to modern concepts, the Kokpatas subzone is an Okjetpes–Kokpatas antiform, i.e., a folded structure of the first order. The division of Southern Bukantau into western and eastern blocks is not justified (Figure 2).

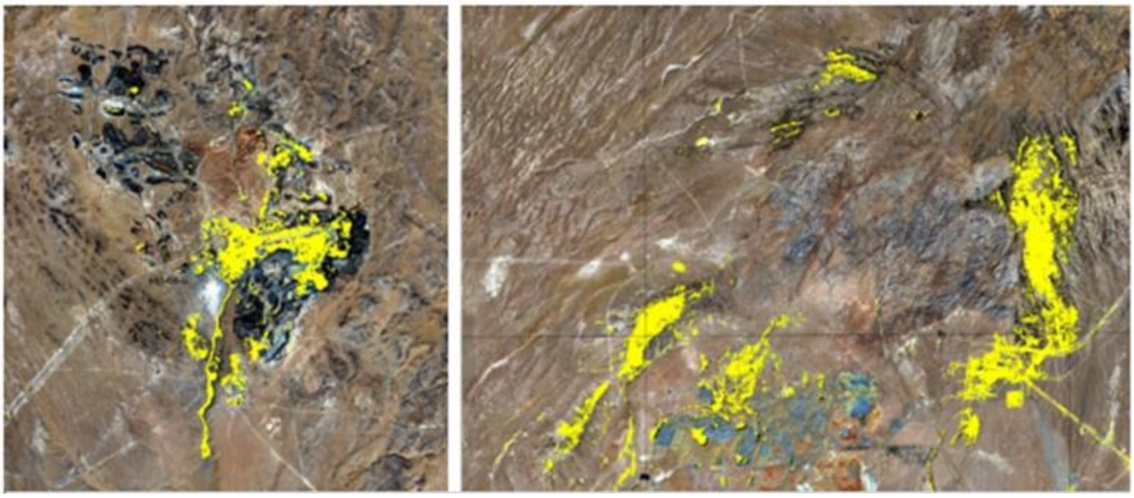

Figure 2. Manifestation of the iron index (yellow light). A – contour of the Kokpatas quarry; B – south-western flank of the Altyntau intrusive

Results

In 1993 and 1996. V.S. Korsakov, S.Ya. Lapidus conducted the GGK of the Altyntau mountains and the Kokpatas ore field. In 1999 M.U. Umarkhodzhaev, and G.A. Yusupov the assessment of the conditions for the placement of gold mineralization in the deposits of the Kokpatas formation (Central and Eastern Bukantau) has been completed. In 1964, the Bukantau party (N.I. Oransky, G.N. Korobeynikov) in the area of the Kokpatas ore field performed a ground-based magnetic survey at a scale of 1:25000 over a network of 250*50m, and in 1965, gravimetric survey at a scale of 1:50,000 was carried out by a gravimetric batch of DGFE (I.F Gaydamaka, Yu.S. Shmanenko) over a network of 1000 * 250m. This information report used these materials.

Based on the results of gravimetric work, maps of gravity anomalies in the Buge reduction at the density of the intermediate layer with σ p.s. 0.23 and 0.267 c/u, with corrections for relief and loss deposits on a geological basis, a map of local gravity anomalies was compiled.

Based on the obtained gravimagnetic data, a diagram of the elements of deep tectonics and magmatism of the Kokpatas ore region was drawn up, areas of development of hidden granitoid intrusions were identified, three systems of tectonic disturbances of deep laying-northwestern, northeastern and sub-latitudinal strike were identified, and areas of distribution of ultrabasic rocks-serpentinite rod-shaped bodies were identified.

Conclusion

The results of processing materials of remote sensing of the Earth using the ratio of channels of satellite images obtained from the ASTER satellite are presented. Mineral changes were mapped on the territory of the Bukantau-Kokpatas-Okjetpes trend: indices of iron, kaolinite, and quartz. The interrelation of mineral metasomatic changes with zones of ore mineralization, ore occurrences, and deposits, as well as with fault zones that control metasomatic mineral changes has been established. Structural, magmatic, and lithological factors of mineralization are substantiated.

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