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Research Article

RESULTS OF INTERPRETATION OF REMOTE SENSING DATA FOR GEOLOGICAL RESEARCH ON THE TERRITORY OF DERBEZ-KOKPATAS

***Khasanov Nomonjon Rakhmatovich[1] and Murotov Feruzjon Boboqulovich[1]**
[1]Institute of Mineral Resources State Institution, Tashkent, Uzbekistan
**Author for Correspondence: numon.raxmatovich@mail.ru*

ABSTRACT.
This article presents the results of automated and visual interpretation of Landsat and Aster satellite images in the Derbez-Kokpatas Mountains. As a result of processing Landsat and Aster images in the research area, fault structures were identified that play a major role in ore occurrence. The main one is the Derbez structure, where a zone of gold-sulfide mineralization was identified during processing of multispectral image ranges.

Keywords: *Derbez - Kokpatas, Landsat-8, Sentinel-2A, Aster, multispectral range, visual and automated interpretation, satellite image, Kirsch, Sobel.*

INTRODUCTION.

Many developed countries, namely the United States, Great Britain, China, Australia, Canada, and Russia, are carrying out geological exploration with the extensive use of space exploration materials. At the initial stage of geological research, remote bases - small, medium and large-scale Cosmo geological maps are being prepared. It should be noted that there are a lot of works to be done on geological research in the territory of the Republic of Uzbekistan, which requires the creation of a preliminary base map based on the technologies of the Geoinformation system using space research materials. Such a map is a remote basis - a Cosmo geological map, which effectively helps to study the areas, including closed areas covered with sedimentary-effusive deposits, in more depth.

Many literature sources present different opinions on the interpretation of space images. S.P. Alter interpretation is a method of determining the boundaries and the external reflection of the processes and phenomena manifested on the ground according to their photographic image in field conditions and emphasizes the real value of camera studies and studied objects. According to L.E. Smirnova, the interpretation of Figures is a complex process, as a result of which the information collected in the imaging materials about the studied object is collected and used.

From L.A. Bogomolov's point of view, decoding means obtaining information about the objects of a place (or, in a relatively broad sense, objects and phenomena of geographical appearance). According to L.A. Bogomolov, deciphering is based on the knowledge of the laws of reproduction of their optical and geometric properties by photography, as well as the determination of the organic relationships of the spatial location of objects, and obtaining information about objects on the globe (or in a broad sense, objects and phenomena of the geographical environment) from their photographic image. The general interpretation of the term "decryption" is reflected in the above definitions.

MATERIALS AND METHODS

Decoding of remote sensing images allows obtaining objective, thematic (mainly qualitative) information about the studied object or process, their relationship with the surrounding object. Visual decoding is based on the reading of photographs and understanding of their interpretation.

Knowing how to distinguish images in a photo by eye is based on the identification of signs of interpretation of objects and image characteristics. The accuracy of the results of the interpretation of photographs depends on the level of training of the specialist. The more thoroughly the interpreter understands the subject of his research, the more reliably he can extract information from the image (Nagevich and Shein, 2015).

Researchers should have a certain amount of subjective opinion of each interpreter (deciphering expert) when distinguishing the observed and reflected formations, objects and geological structures on the geological map.

A certain degree of subjectivity of the results of visual interpretation is not always a negative feature, that is, they are similar to the subjectivity of a map. In the process of interpretation, the specialist makes cartographic generalizations based on his personal opinion: he summarizes the boundaries, does not pay attention to small or insignificant objects (Labutina and Baldina, 2011).

Three main methodological approaches are used in the interpretation of space images: 1) comparison of images with photographs of geological objects; 2) comparison of objects within a single image; 3) logical interpretation of geological objects to be deciphered.

In the interpretation of geological objects and processes with the help of space images, their direct and indirect signs are used. According to E. Barrett and A. Curtis, there are 9 such signs (Barrett and Curtis, 1979): Form; size; photon; shade; tumulus; texture; location; detectability; stereo effect is considered.

In addition to the important features listed above, terrain, vegetation cover, surface wettability, etc. are also very effective in interpreting space images. Automatic decoding is mainly done by processing known and reliable satellite images (Landsat 7 TM, Landsat 8 OLI, Aster) using the following methods: CC (color composition), ASR, Mincomp, Hydrocomp, ITS, Kirsch, Sobel, Laplace, Robert, and Index IV (Asadov and Tulyaganova 2020).

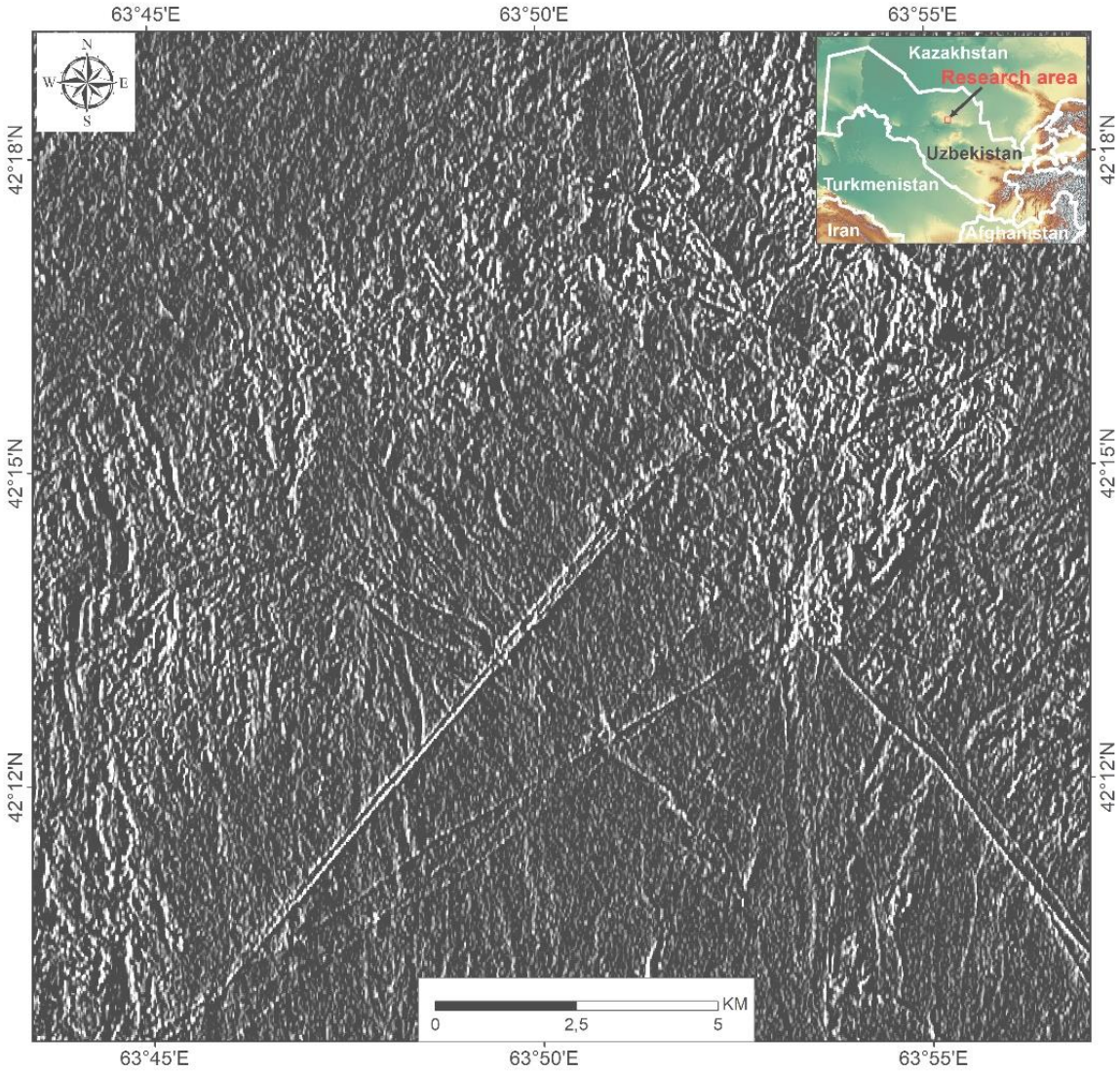

Figure 1: The result of processing the Derbez-Kokpatas area using the KIRSCH method.

The method of Kirsch. The method of Kirsch is to work with targeted directional mask operators in each direction. It allows the rotation of the operator's base. In the photo, the benchmarks of the regions are linear, concentric, arcuate and isometric structures, mountain slope planes at the border of folded structures, and

depressions within the mountain are well visible (1-Figure). Their borders are observed in the form of black, white sometimes double lines of different lengths (Glukh *et al.*, 2003). A fairly thick network of lineaments represents its unique reflection on the exposed boundaries of the Paleozoic foundation, in semi-closed and open conditions on the surface of the earth, and in plain sections. As you move away from the mountain, the accuracy decreases and decreases dramatically in the amount of structural units.

The method of Sobel. The "Sobel" method is considered an enhanced version of the "Kirsch" method, which creates a sharp difference, especially for closed areas, non-homogeneous structures in the image, but it is more convenient to distinguish the indicator of the index coefficient. These method records discontinuous objects away from the fold structures. Analyzing the photo (Figure. 2), mainly the boundaries of the concentric structure of different sizes and its internal structure are clearly visible. The hidden cracks on the surface of the earth are represented by the double white and black lines. The image of deep faults is extremely interesting: these are not solid lines, as previously drawn, but a narrow zone of short arcs connecting to each other, sometimes the zones do not cross each other in the same way as they do in width.

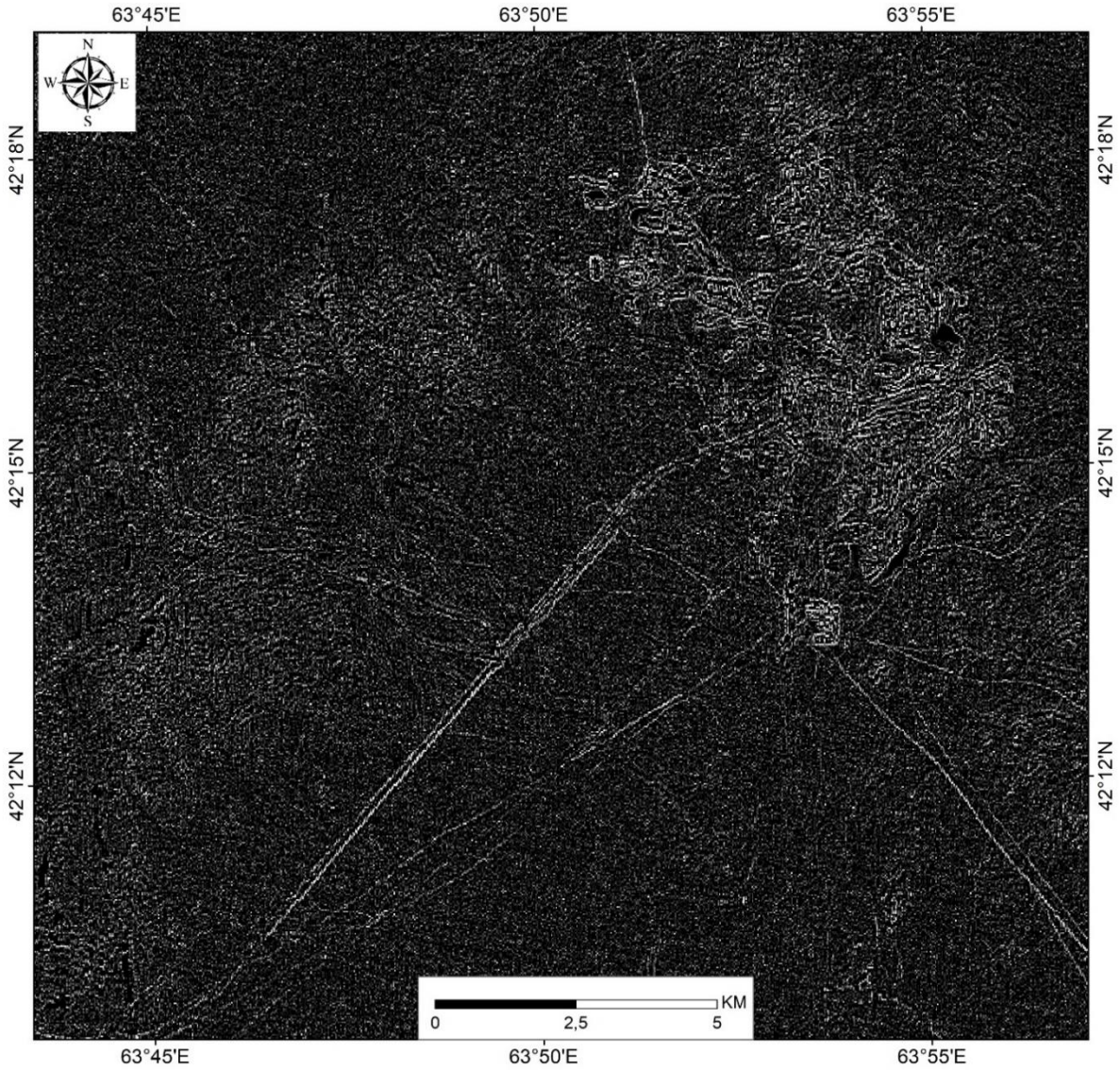

Figure 2: The result of processing the Derbez-Kokpatas area using the Sobel method

RESULTS AND DISCUSSION

Visual and automated methods of lineament analysis were widely used as a result of the research. Visual analysis methods are considered to be traditional methods in the field of cosmogeology, and started with the

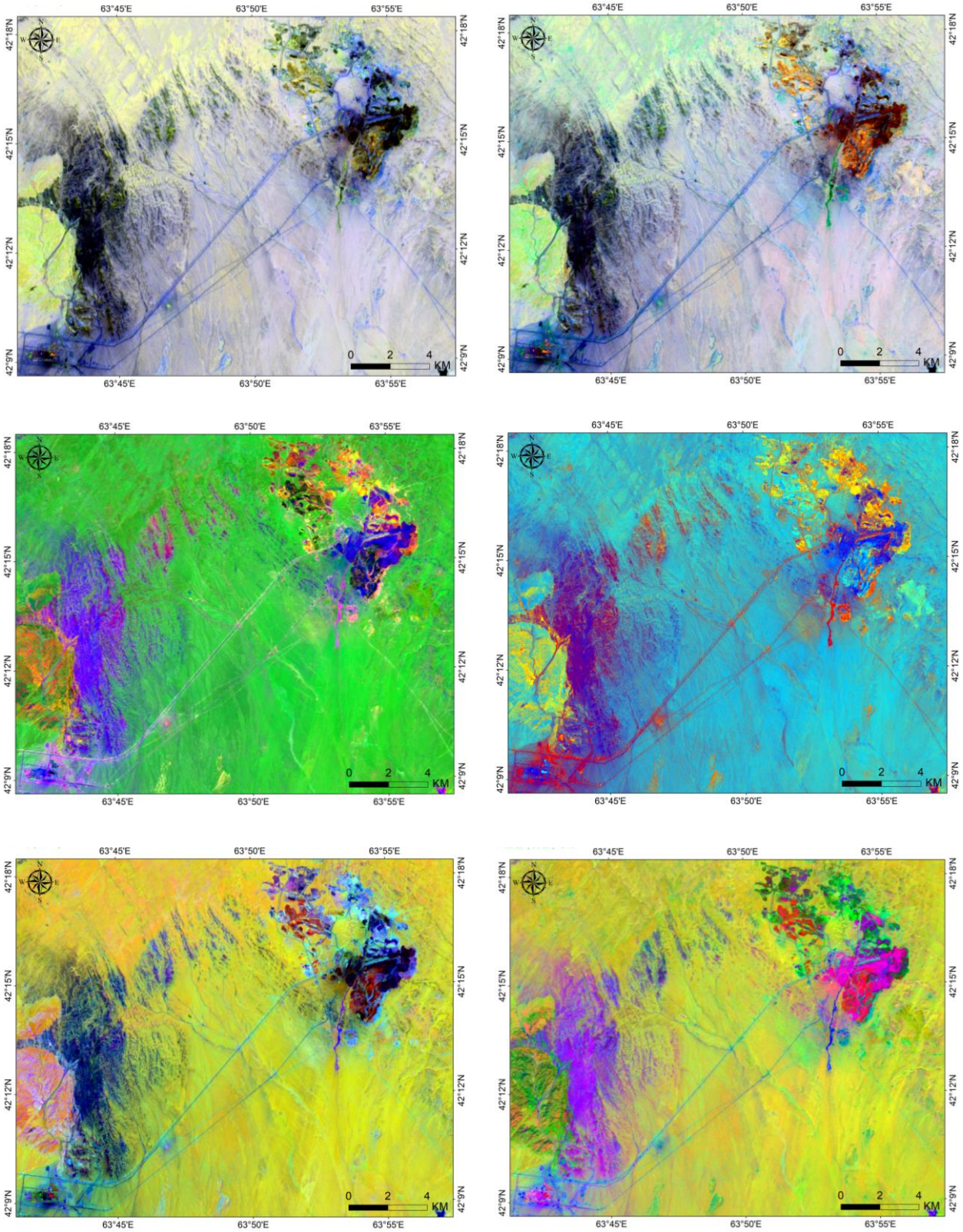

Figure 3: Created new combinations that allow mapping of hydrothermally altered zones. 1). LC8. 7/4, 6/4, 4/2; 2). LC 8. 7/5, 6/4, 4/3; 3). LC 8. 6/7, 4/2, 5/6; 4). LC 8. 6/7, 6/5, 7/6; 5). LC 8. 7/4, 4/3, 6/7; 6). LC 8. 7/6, 4/3, 5/6; (N.R. Khasanov 2023)

separation of geological structures in the first black and white space images taken with the help of space images, and these studies are continued consistently today. In this research work, using direct and indirect methods of interpretation, visual decoding was performed through three different scales: regional, local, detailed generalization level.

Processing of multispectral space images with more than 40 channels of spectral processing was carried out as part of practical cosmogeological research conducted in the research area, which is the basis for the preparation of the dissertation research work. As a result, 6 new combinations were created that allow mapping of ore and mineralization zones (Figure. 3).

Mapping of Hydrothermal altered zones associated with ore mineralization using medium and high-resolution Landsat-8 and Sentinel-2A multispectral satellite imagery for mapping altered rocks on the western slopes of Derbez, Kokpatas, Kokpatas-Oqjetpes routes for geological prospecting on ore mineralization was used.

Morphological signs of geological formations distributed in the area ring and arc forms are of interest in deciphering ring structures and assessing their metallogenic significance (Nurkhodjaev *et. al.*, 2017).

Recently, the world experience of foreign countries with advanced space technology has shown that the results of remote methods in geology are the most reliable and cost-effective. Automated methods of processing space images (SI) in various multi-spectral ranges play a special role in remote sensing of the earth (Glukh 1983). The human eye cannot see all the radiation of the electromagnetic ranges of nature's spectrum, but multispectral sensors installed in Earth remote sensing instruments have the opportunity to see these electromagnetic ranges (Goipov *et al*., 2020).

Tectonic and structural decoding is carried out in the detection of linear and annular structures on the basis of space images in the prediction and exploration of minerals. Most of the well-known mineral deposits appear in nodes at the intersection of earth faults, where the structural factor plays a key role in folded regions, separation of linear and ridged structures is carried out by visual and automatic decoding of digital materials of remote sensing of the earth.

CONCLUSION

As a result of visual and automatic processing of Earth remote sensing data obtained from Landsat-8, Sentinel-2A and ASTER satellite images, a zone of gold-sulfide mineralization was identified in the area. Also, as a result of Cosmo geological research and visual and automatic decoding of space images and rock processing, tectonic earth faults, which play a key role in the formation of ore in the area, were identified, as well as 6 new combinations were created that allow mapping of ore and mineralization zones.

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