STUDY OF INTRUSIVE MASSIFS OF THE NURATA MOUNTAINS BY LANDSAT 8 SATELLITE IMAGES

A.R.ALMORDONOV
Tashkent State Technical University named after I. Karimov, Tashkent, Uzbekistan
almordonov@gmail.com.
A.R.ASADOV
University of Geological Sciences, Tashkent, Uzbekistan
akmal73@gmail.com.

Abstract

The article presents the results of processing space images using PCA, ISODATA, K-Means and similar methods, as well as analysis based on GIS technologies. As a result of automatic and visual interpretation of the obtained images, intrusive complexes, linear and ring structures scattered throughout the Nurata region were identified. In particular, the result obtained by X-ray diffraction analysis proved that the composition of the 5R4G3B and 2R4G3B channels is one of the most effective methods for separating the intrusive massifs distributed in the region. Given that isolated intrusive massifs, linear and ring structures are directly related to gold mining zones in the Nurata region, the results obtained can be assessed as a cosmological criteria.

Keywords: satellite image, PCA (principal component analysis), phototone, Nurata mineral zones, spectral channel, classification, Isodata, K-means.

Introduction

The classical theory and methods of geological exploration from ancient times were based on the study of rocks in natural conditions. It has been repeatedly noted in the scientific literature that the mineral deposits of the Nurata Mountains are associated with intrusive rocks..

A number of researchers carried out observational work to determine gold production from space data in the structural-formational zones of Northern and Southern Nurata [1-2]. In particular, cosmogeological research in the region of Uzbekistan O.M. Borisov and A.K. Gluksom revealed ring structures of different levels in a number of separate areas of the Nurata region. L.I. Ivanov G.A. Aleshina N.I. and others. Special mention should be made of research work on the creation of geological maps based on deciphering materials of satellite images with a scale of M 1:200,000 in the region of the Karatau Mountains of South Nurata [3]. As a result, faults, linear and ring structures were identified on cosmogeological maps. It should be noted that most of them are not reflected on geological maps of different scales. In addition, it was found that the Nurata mining zones are bordered by intersections of lineaments in different directions.

As a result of special observational work on a scale of 1:200,000 and 1:50,000 in Nurata and adjacent areas, specialists from the Institute of Mineral Resources and the Earth Remote Sensing Department Sh.E.Ergashev, A.K.Glukh, A.R.Avezov, .A .Toychiev, M.Kh.Khodzhibekov, A.K.Nurkhodzhaev, A.R.Asadov based on space data developed the scientific foundations of cosmophotogeological mapping [1-2, 6]. In addition, geomorphological elements have been identified that reflect modern movements in the relief of this area. The mutual geodynamic conditions of the material composition of rocks and deposits, reflected in different channels of modern satellite images, are described, with the structure divided into photogeoblocks. It should also be noted the scientific research carried out in recent years by A.K. Nurkhodzhaev and I.S. Togaev in this area. At the same time, such tasks are solved as the creation of complexes for structural interpretation by color, structure and spectral clarity of images when various rocks and various tectonic structures are detected on satellite images and the selection of structural elements in open and closed areas by automatic and visual interpretation of images. [4-5, 7].

The study of the features of the geological development of the Nurata Mountains has not lost its relevance nowadays. This article presents some aspects of the results of cosmogeological studies of the Nurata Mountains in the southern part of the Tien Shan Range in Uzbekistan.

Materials And Methods

The following set of methods was used to study the features of intrusive rocks in Nurata mineral zones on Landsat 8 satellite images using modern geoinformation systems. The Landsat 8 satellite images were processed using ENVI software using the methods of basic component analysis (PCA), automatic classification (based on the ISODATA and K-Means algorithms), the results of these methods are discussed below.

Basic Component Analysis (Pca) is a method for analyzing multispectral cross-linked data. Related data shows that as the brightness of pixels in one spectral channel increases, the brightness of other spectral channels also increases. The result obtained by this method showed the features of the geological structure of the Nurata region. At the same time, rocks of different ages and compositions were separated on satellite images according to the signs of different photographic reflection [7-9]. Based on the combinations of RGB results obtained by the PCA method, deposits of different periods were distributed in the region. However, when expressing the multispectral properties of the Nurata region, a correlation was made between several channels of satellite images. As a result of the synthesis of the obtained images of the color space, it was found that the boundaries of coeval deposits and zones of intrusive massifs are reflected in the brightness values of several spectral channels (Fig. 1).

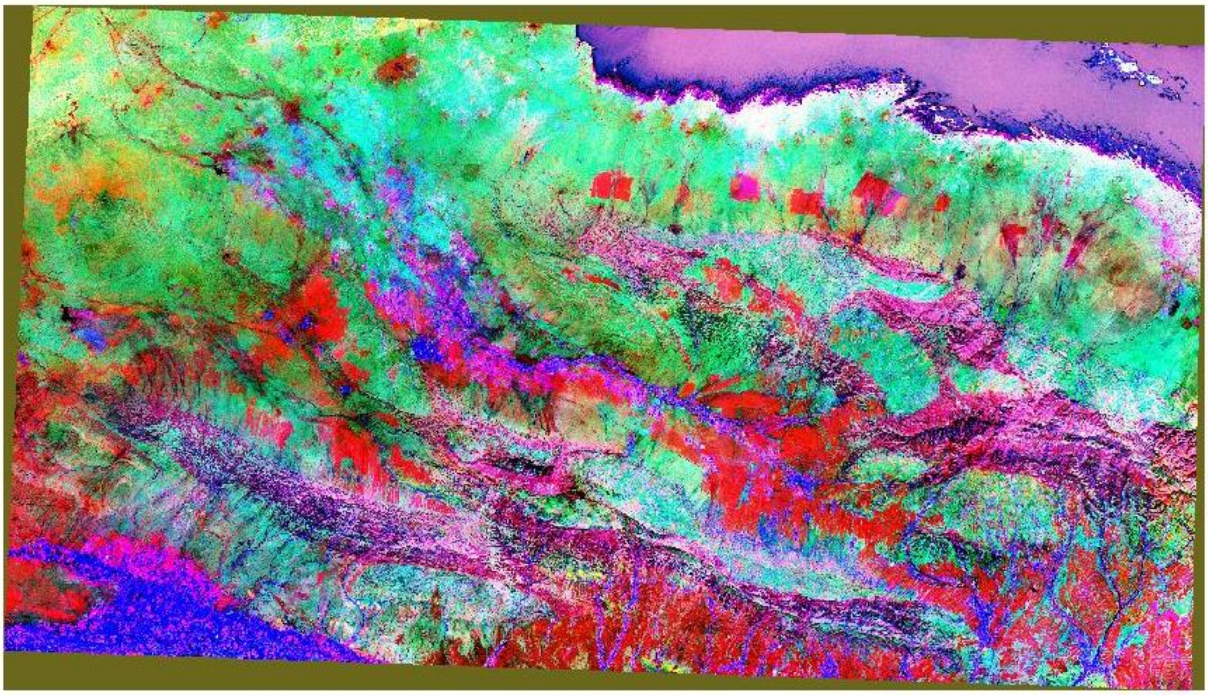

Fig.1 Satellite image of the Nurata processed by the PCA method (RGB-PC5, PC4, PC3)

Results And Discussions

Let us dwell on some aspects of the study of the morphological formation of the intrusive massifs of the Nurata Mountains.

The Temirkabuk intrusion is located in the northwestern part of the northern Nurata mountains. In the western part of this intrusion, granadioritic and granitic intrusive rocks are formed. The intrusion belongs to the Upper Carboniferous with granadiorite, adamellitic and granitic rocks in the north and granadiorite, adamellitic-granite and gabbro-diorite rocks in the west. Madavat intrusive complexes also consist mainly of granadioritic and granitic rocks. The age of the isolated complex belongs to the Carboniferous Age. In the PCA combination 2R4G3B of these two intrusive complexes, the northwestern parts of the Temirkabuk intrusion are depicted in very light green, the central and southern parts in purple, and the eastern part in green. In the western part of Northern Nurata there is the Madavat intrusion. At the same time, on different channels of satellite imagery, the southwestern and adjacent areas of the intrusive massif were reflected in blue photons by the PCA method. The northeastern areas were bright red. In addition, the Ustuk intrusive complex in the central part of Northern Nurata is also composed of granites and granidiorites. Here, these rocks are associated with a high-carbon age. However, in the central part of the intrusive, granites are found, mainly related to the Permian period. At the same time, these complexes are well represented on satellite images; the southeastern flanks of the Ustuk intrusion are colored light green and purple, and the northeastern flanks are purple-red (Fig. 2).

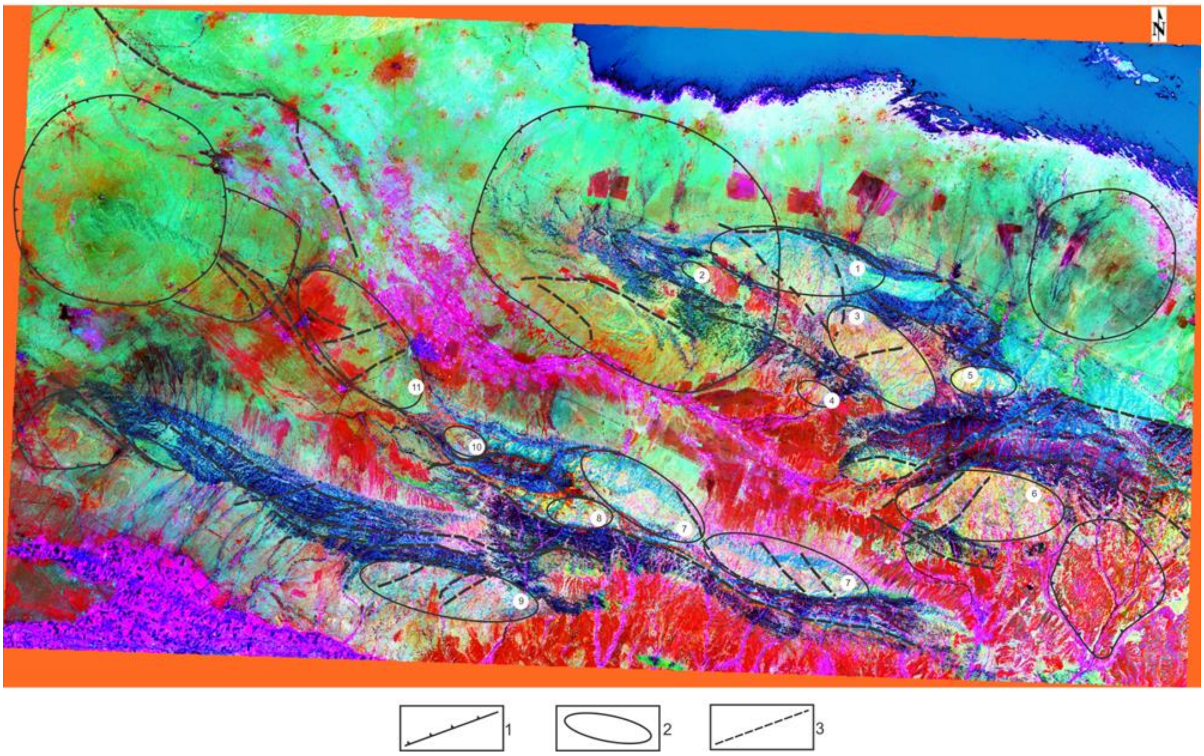

Fig. 2. Map of mineralized zones of the Nurata region on satellite images

1-ring structures; 2-intrusive arrays; 3 cracks;

Also, granites and granodiorites belonging to the Sentobsky intrusive are expressed in brightness in different channels of the classification result obtained by the ISODATA algorithm. At the same time, in the northeastern part of the Koshrabat intrusion, dacite-diorite intrusive rocks were well manifested in light phylolitic photon shades.

In general, the location of some intrusive bodies is distinguished by its protruding shape to the surface and spectral brightness in satellite images. Such bodies have a classic appearance in the northern and southern parts of the Nurata Mountains. The manifestations of the Akchop and Snt Ob intrusions in the North Nuratinsky Mountains are deciphered with high accuracy on large-scale satellite images.

In the Akchop intrusion, granites (C3) are composed of leucocratic granites (C3) in the body. Since granites are composed of large granular crystals, their spectral brightness was more pronounced than that of other rocks.

In the 2R4G1B combination of the resulting Aktau Intrusion PCA image, the northwestern portions are colored purple and reddish, while the southern and northeastern portions are shown as purplish light yellow photon markers. The Nurata intrusion and the Yangaklik intrusion are purple-light green, in combination 2R4G1B the northwestern part is dark red, the northern and southwestern parts are blue-yellow, the Karatovskaya intrusion is light yellow.

Conclusion

Processing of space images by PCA, ISODATA, K-Means and similar methods and analysis based on GIS technologies gives a reliable result when identifying intrusive massifs in the Nurata ore zones. When identifying several intrusive massive zones and boundaries in the North and South Nurata region, the photon in combinations 2R4G1B and 2R4G3B is characterized by a clear separation of bluish-yellow and light purple hues. It has also been established that existing sections correspond to different levels of lineaments, ring structures and soil cracks in the selected zones. These criteria can be assessed as a new approach to identifying and mapping gold mining zones in the Northern and Southern Nurata region.

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