THE AMERICAN JOURNAL OF INTERDISCIPLINARY INNOVATIONS AND RESEARCH
ISSN (e): 2642-7478
DOI: https://doi.org/10.37547/tajiir/Volume02Issue07-05

Cosmo structural Features of the Southwestern Spurs of the Gissar Mountains

Asadov Akmal Ruzimurodovich
Candidate Of Geological And Mineralogical Sciences, University Of Geological Sciences, Tashkent, Uzbekistan

Musakhonov Zayniddin Mukhtorhonovich
Leading Specialist Geologist, Institute Of Mineral Resources, Tashkent, Uzbekistan

Akhmadov Shokir Islomovich
Head Of Remote Sensing Center, Institute Of Mineral Resources, Tashkent, Uzbekistan

OPEN ACCESS
The American Journal of Interdisciplinary Innovations And Research
JULY 2020
Page No.: 26-33
Volume-II Issue-VII
PUBLISHED: 30 JULY 2020
www.usajournalshub.com/index.php/tajiir

Abstract

The article discusses the technique of automated lineament analysis based on Earth remote sensing data using the LESSA program. In the course of the work, methods were considered to increase the geological information content of the LANDSAT8 satellite image of the study area. A cosmostructural scheme and a map with tectonic elements of the investigated area have been compiled.

Keywords: Satellite imagery processing, digital elevation models, lineament analysis, LESSA, cosmostructural scheme,

Introduction

The availability of high-quality images of the Earth has made it possible to widely use them in various fields and to automate the analysis of these images. In most cases, the search for areas and structures is automated directly by brightness (color) and contrast. To the greatest extent, the proposed approach is similar to the traditional geological analysis of photolineaments, in which the expert identifies rectilinear fragments of the pattern associated with tectonics and then either statistically analyzes the distribution of these small lineaments in direction in a sliding window, or identifies extended lineaments. There are software's to varying degrees that automate the analysis of hand-drawn lineaments (for example, statistical analysis in the ER Mapped packages; tracing extended lineaments [2. 6-7]. There is another approach that allows you to directly analyze the drawing of images and automatically identify its linear-orientation characteristics [3. 8-10]. The LESSA method (Lineament Extraction and Stripe Statistical Analysis) as applied to various types of space images (including radar, thermal), digital elevation models and schemes, significantly differs from the usual lineament analysis both in the principle of identifying the original linear elements and the method of their analysis.

The purpose of this work is to study the cosmostructural features of the placement of gold and other mineralization on the Southwestern spurs of the Gissar ridge (Perspektivny area) based on lineament analysis in the "LESSA" program and compilation of a cosmostructural map of the Perspektivny area at a scale of 1: 10000. The study used digital satellite images ASTER, Sentinel-1, QickBird, as well as digital elevation models (DEM) and various maps of geological content. For digital processing and analysis of Earth remote sensing materials, software products Erdas, Envi, ArcGIS, etc. were used.

Main Part

The LESSA module is designed to detect an objective pattern in the selection of linear elements on distance materials, i.e. analysis of linear elements from pictures of images. DEM allows you to analyze only the relief elements, excluding the brightness anomalies of objects. Therefore, the automated lineament analysis of the investigated area was carried out on the basis of a digital elevation model.

The basis of automated lineament analysis is made up of linear image elements (strokes). LESSA automatically detects them and identifies them in 8 stroke directions. In a grayscale image, strokes are boundaries of homogeneous areas and / or lines, which should be sufficiently long and straight. Figure 1 (b) clearly shows that the program builds systems of strokes that are different in structure on images with different photomaps and reliefs.

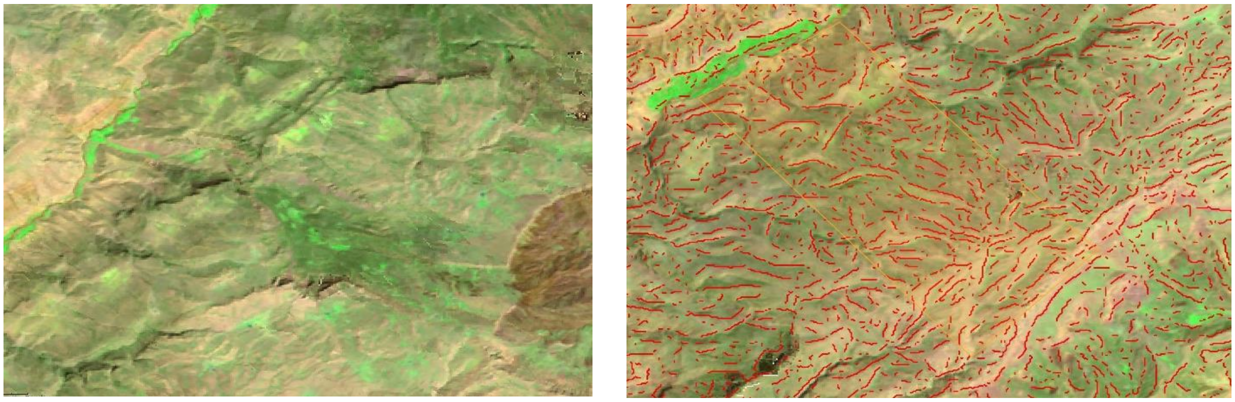
(a) (b)

Fig.1. Fragments of a satellite image of the investigated area with various photographic drawings (a) and their strokes (b)

A rose diagram was constructed along the strokes, which reflects the orientational characteristics of the texture (Fig. 2a). Further, the strokes were statistically processed in a sliding window, the size of which was set interactively (64x64 pixels), and various statistical characteristics were obtained, from which the most informative ones were selected for analyzing the image structure. Based on the results of measurements in a sliding window, pseudo-color images are obtained, which show the density of strokes in different directions. Figure 2b shows individual fragments of the territory and their characteristic line densities.

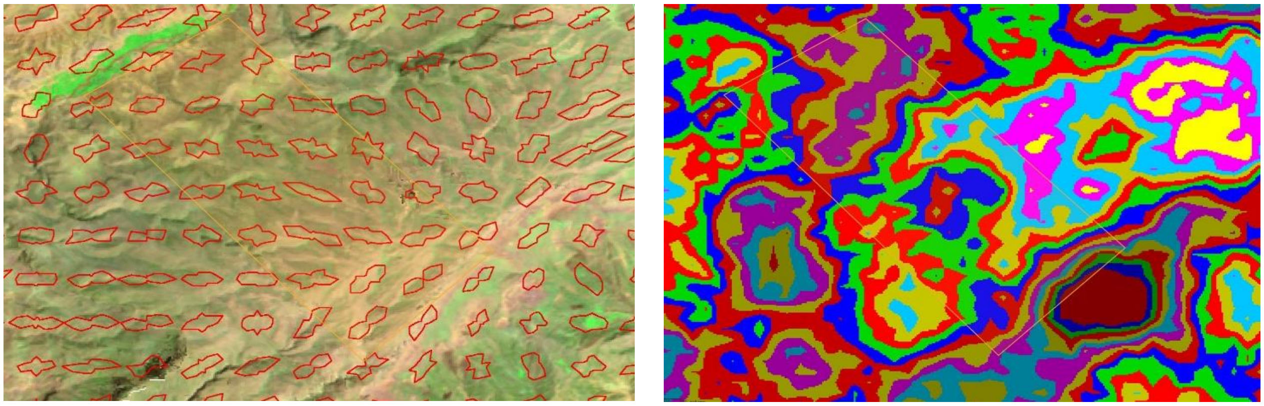
(a) (b)

Fig.2. Rose diagram (a) in direction and density of lineaments (b).

All rose diagrams and vector fields indicate the direction and degree of elongation of the lineaments. LESSA presents data on the prevailing directions of the texture in the form of a network of elongation lines (Fig. 3, a) and the properties of strokes along the elongation vector (Fig. 3, b).

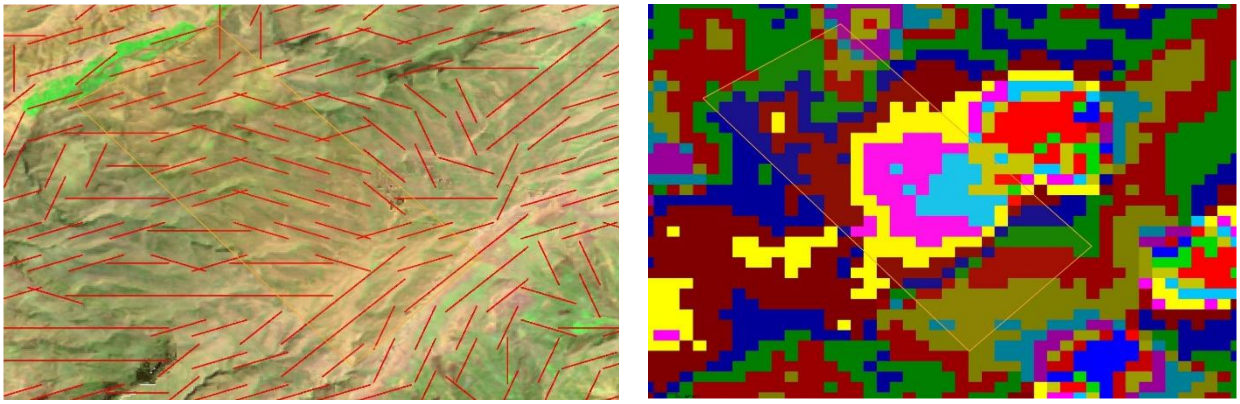
(a) (b)

Fig.3. Vector (a) and direction of elongation of strokes (b)

Results And Discussion

The results of the lineament analysis were verified in the field by the methods of field interpretation. When decoding, direct and indirect (landscape-indication) signs were used [4-7]. Direct deciphering signs of faults are identical in space survey materials of all types and scales, and in exposed areas they are manifested both by particular signs of a fault, and by their combination. The faults are clearly deciphered in a situation when rocks of different types in composition, structure, color, genesis are brought into contact along the fault, or there is a sharp change in the picture of the photographic image of the contacting objects, and in layered rocks the sign of a fault is the displacement of the members. A comprehensive analysis of the results of field research and processing of various types of space images, as well as the results of previously carried out geological survey work, made it possible to create a cosmostructural scheme and a cosmogeological map with tectonic elements of the investigated area (Figs. 4 and 5).

Most of the faults within the Gissar region are represented by thrusts, reverse thrusts, forming structures of the scaly type. Low ridges of the northern, northeastern strike, characteristic of the southwestern spurs of the Gissar, border in the east with the Surkhan Valley. West of the Surkhan Valley, in the northern block of mountains, from east to west, the mountain ranges of Surkhantau, Baysuntau, and Chakchar are manifested. Within these ridges (at high altitudes), Precambrian and Paleozoic formations are exposed, overlapped on the wings (at the base of the mountains), on the western slopes of the mountains, by a cover of Mesozoic deposits, with the formation of wide and gentle cuesta landforms and slope wasps. The eastern slopes of the ridges are steep, cut by an arc shape by uplift-navigations: Surkhantau, Baysuntau, Chakchar. The dip of the thrust faults to the west at angles of 60^0 - 70^0. The arc shape of upthrust-thrusts is conformal on the multispectral Gissar ring structure, a characteristic feature of which is the appearance in the relief of its semi-circular elements curved to the east, expressed by the ridges of Surkhantau, Baysuntau, Chakchar [1]. The faults of the Hercynian age, in most cases, were renewed in the Alpine time, they are characterized by a submeridional orientation, upthrust, fault-thrust nature.

In most cases, tectonic faults develop at the contacts of rocks of different composition and age, represented by sublatitudinal thrust faults, faults and reverse faults of northeastern striking, right lateral strike-slip faults of northwestern striking. The maximum displacements are noted along the fractures of sublatitudinal strike, the minimum - along the meridional faults.

The presence of contrasting unconformities, tectonic contacts, faults, reverse faults, thrusts, blocks, gives the territory a scaly-block structure. The complexes are manifested in the form of narrow sublatitudinally oriented bands (horsts and grabens), which is noted in the central (Kyzylimchak-Marguzor) and southern (Tashkurgan-river Kshtut) mountainous parts. Within the grabens, separate blocks are recorded, emphasized by short (up to 2 km) ridges (Khazret-Sultan, Chulinura, Khoja-Kiyikkalon, etc.), composed of Devonian carbonate deposits and overlying limestones of the Jurassic and Cretaceous systems with the development of landslides in recent gravitational faults occurring at NQ time). The faults, especially in the western half of the named sheet, within the development field of the Devonian carbonate structural-material complex, are fan-shaped with the formation of wedge-shaped structures (blocks), favorable for the localization of mineralization. Within the development of granitoids, ring structures (RS) of magmatic genesis of various radii are actively manifested, which play an ore-concentrating value.

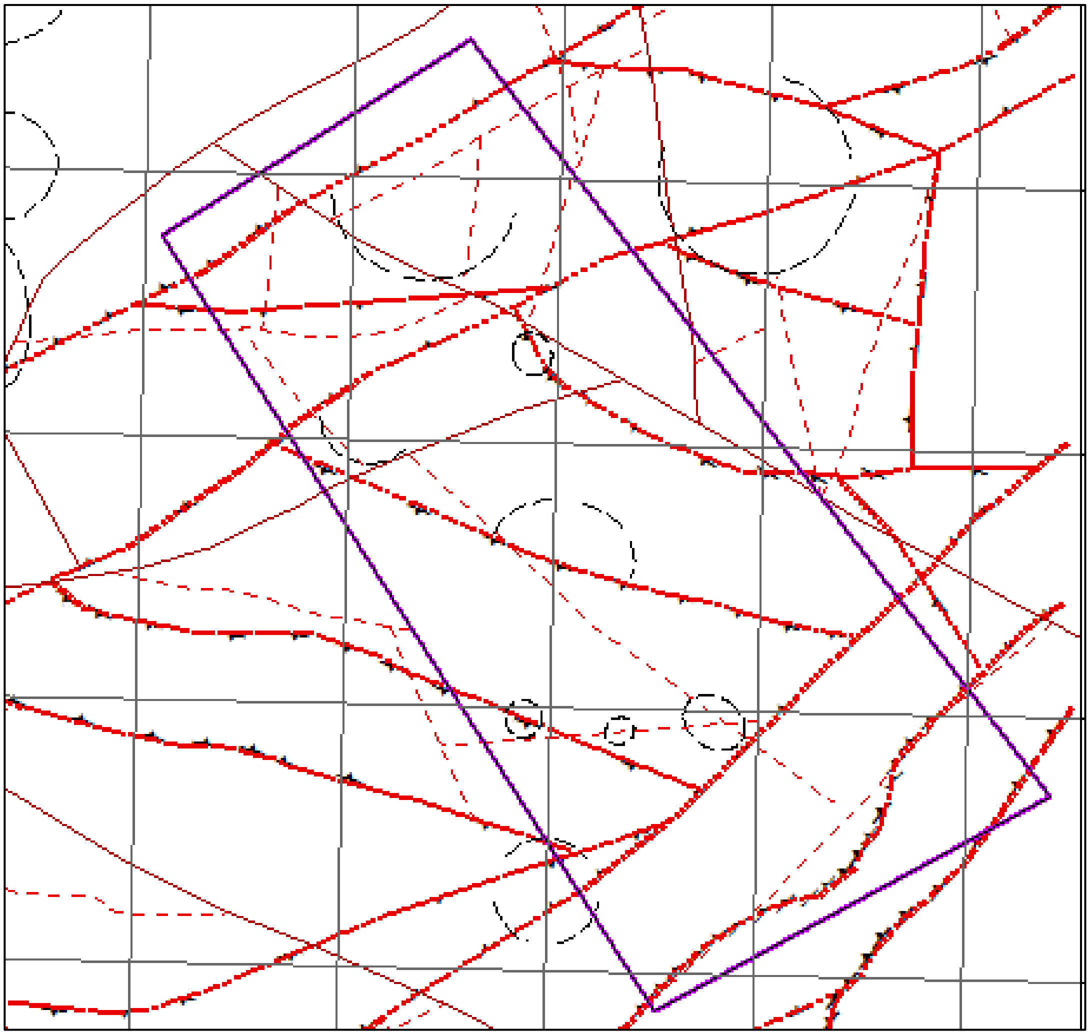

Fig. 4. Cosmostructural scheme of the study area

Within the limits of moderate dissection of the relief in the area of the southwestern spurs of the Gissar, the degree of decoding on the materials of space images of Cretaceous, Paleogene and Jurassic rocks is quite high, and allows for detailed geological mapping. The eastern bordering of the south-western spurs of the Gissar is expressed by a strip of narrow compressed anticlines (Kelif-Sarykamyshsak ridge, etc.), consisting of separate, folded deposits of the Cretaceous-Paleogene, anticlinal folds, (Maidan, Lyaylyakan, Gajak, Bangorin, etc.), “Substituting” each other along the strike. The vaults of these folds are displaced relative to the buried fold vaults in the subsalt Jurassic from the center of the Baysun ring structure.

Within the northern block of the southwestern spurs of the Gissar Range (north of the Effusive Fault), Precambrian rocks (PR?) are represented by extremely poorly deciphered gneisses. The Paleozoic rocks in their lower part are represented by carbonates, and in the middle (lower - middle Carboniferous) - by volcanics of basic, intermediate and felsic composition, broken by later granitoids. Most of the faults developed within the Paleozoic and Precambrian rocks are represented by reverse faults, which form, as already noted, scaly structures.

The carbonate, combined (J) complex, phototagging, includes well-deciphered objects

ISSN (e): 2642-7478 DOI: https://doi.org/10.37547/tajiir/Volume02Issue07-05

by color and relief. The complex occupies a high hypsometric position and has a linear development. Structural landforms develop along it. The complex is characterized by a light tone on the consequent slope and violet and light lilac on the observational slope (Fig. 5).

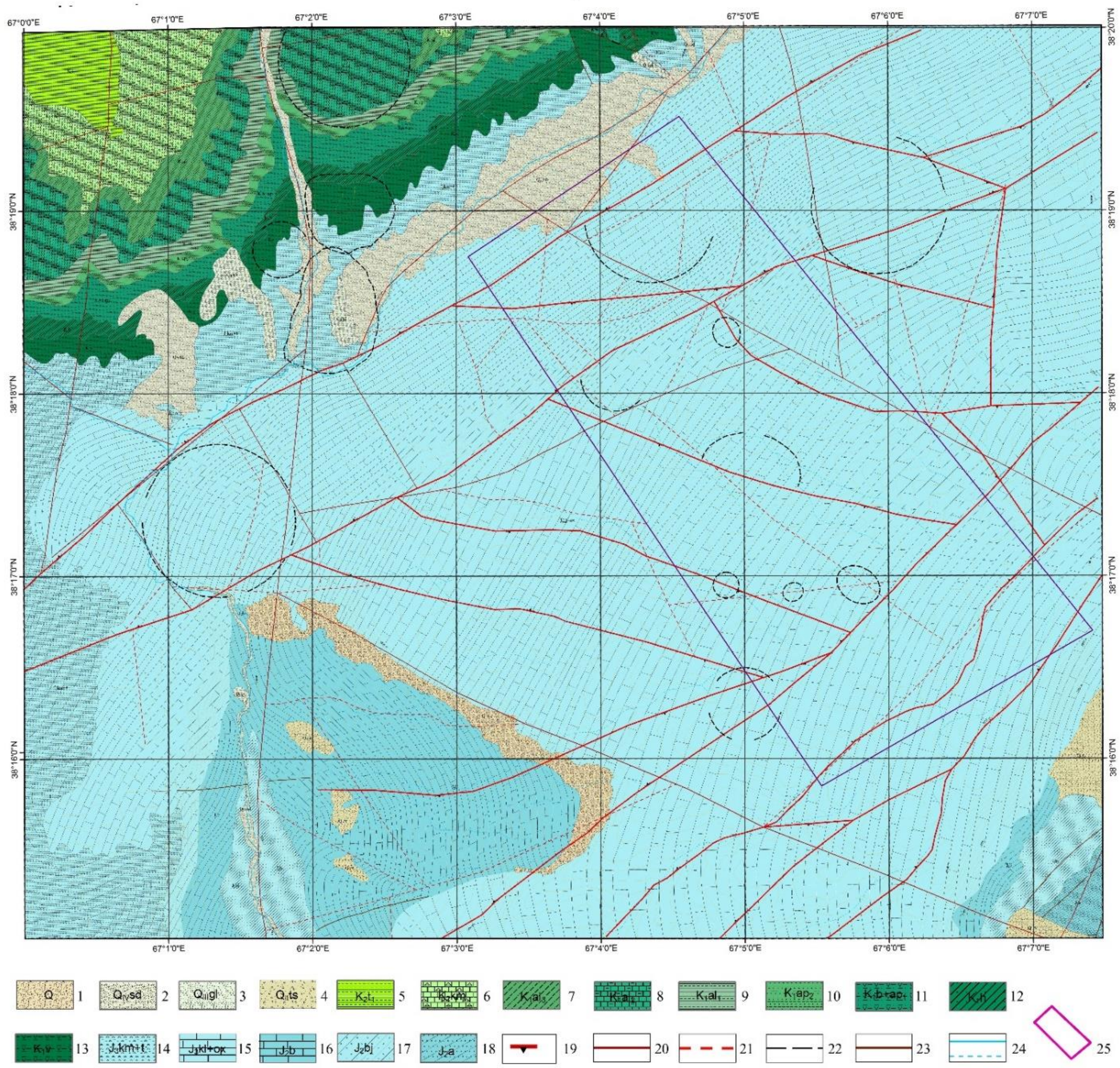

Fig.5. Cosmogeological map with tectonic elements, compiled on the basis of remote sensing data processing

1 - Landslide formations, 2 - Syrdarya complex: pebbles, gravel, sand, loams, 3 - Golodstep complex: conglomerates, pebbles, sands, loess-like loams, 4 - Tashkent complex: breccias, pebbles, sands, loess-like loams, 5 - lower substage: clays, sandstones, limestones, 6 - Cenomanian stage: clays, siltstones, sandstones sandy limestones and limestones - shells, 7 - Upper substage: clays, 8 - Middle substage: clays, limestones - shells, 9 - Lower substage: clays, siltstones, gravelstones, 10 - Upper substage of the Aptian stage: clays, sandstones, 11 - Baremian stage and lower substage of the Aptian stage: clays, sandstones, gypsum, limestones-shell rocks, 12 - Gogerivsky stage: siltstones, sandstones, 13 - Valazhinsky stage: clays, siltstones, sandstones, limestones, sands, 14 - Cimmerian and

Tithonian stages undivided: clays, siltstones, gypsum-anhydrites with interlayers of clays and limestones, 15 - Callovian and Oxfordian stages undivided: massive and fine-crystalline limestones, 16 - Baty stage: calcareous clays, sandstones, limestones - Bayo Stage: mudstone-like clays, siltstones and sandstones, 18 - Aalenian stage: interbedded mudstones, clays with interlayers of coal, siltstones and sandstones, 19 - Thermolineaments (according to the results of the distribution of changes in the surface temperature of the infrared range, Aster satellite image), 20 - Faults, 21 - Prospective faults, 22 - Ring structures, 23 - Geological faults, 24 - Temporary streams, 25 - Survey area outline.

Conclusion

The method of lineament analysis established the wide development of structures of the thrust (reverse-thrust) type and faults of various strikes, the position of which was not reflected on the geological map. Image analysis results obtained by the LESSA method can be used to confirm, clarify faults in the study area, they can show anomalous areas, lines that can serve as a clue for finding a deposit. For example, the identified lineaments can serve as channels for migration and concentration of fluid flow values, which is important in studying the patterns of distribution of known deposits, ore occurrences, zones of fluid supply channels, analysis of the structure of the lineament zone and ore-controlling direction, and other favorable conditions.

When carrying out prospecting work, in order to study the patterns of distribution of minerals in the region, it is recommended to pay special attention to thrust and strike-slip structures.

References

1. Glukh A.K; Avezov A.R. Maps of the density field of tectonic disturbance and providing a wide range of geological problems. Geology and Mineral Resources. № 4. IMR. 2005. -p. 3-5.
2. Gonzalez R; Woods R. Digital image processing. Moscow: Technosphere, 2005.
3. Zlatopolsky A.A. New possibilities of LESSA technology and analysis of digital elevation model. Methodological aspect // Modern problems of remote sensing of the Earth from space. 2011. T. 8. Number 3. -p. 38-46.
4. Katz Ya.G; Poletaev A.I; Rumyantseva E.F. Fundamentals of Lineament Tectonics. Moscow: Nedra. 1986 .-p. 144.
5. Ryabukhin A.G; Makarova N.V; Makarov V.I. Space methods in geology / Moscow: Publishing house of Moscow State University, 1988. –p. 146.
6. Kronberg P. Remote study of the Earth. Basics and methods of remote sensing in geology. Moscow: Mir, 1998.
7. Robert A. Shovengerdt. Remote sensing. Models and methods of image processing. Moscow: Tekhnosfera, 2010 .-p. 560.
8. Zlatopolsky A.A. Multiscale analysis of the orientation of the texture of the Earth's surface. Special scales. Vtoraja time.(Multyscale Earth surface texture orientation analysis. Special scales. Part two.), Modern problem remote sensing of the Earth from space, 2013, Vol. 10, No. 2, - pp. 295–304.

ISSN (e): 2642-7478 DOI: https://doi.org/10.37547/tajiir/Volume02Issue07-05

9. Zlatopolsky A.A. Effective spatial resolution of data and instrument. On the example of multiscale analysis of DTM (Effective data and instrument spatial resolution. By the example of the multiscale DTM analysis), Modern problems of remote sensing of the Earth from space, 2014, Vol. 11, No. 2, -pp. 18–25.
10. Zlatopolsky A.A. New technology opportunities LESSA and analysis cifrovoj models rel'efa. Methodical aspect. (New LESSA technology resources and digital terrain map analysis. Methodology), Modern problems remote sensing of the Earth from space 2011, Vol. 8, No. 3, -pp. 38-46.