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THE IMPACT OF MINERALS IN MOUNTAIN AND FOOTLAND AREAS ON LANDSCAPES AND THEIR CLASSIFICATION

Nazarov Maksud Geldiyorovich
Associate Professor of Karshi State University,
Doctor of Philosophy in Geographical Sciences (PhD),
E-mail: mgnkd@mail.ru

Fayzullaev Maksud Abdullaevich
Associate Professor of Shahrisabz State Pedagogical Institute,
Doctor of Geographical Sciences (DSc),
E-mail: fayzullaevmaqsud08@gmail.com

Sultanov Shukhrat Adkhamovich
Associate Professor of the Shakhrisabz State Pedagogical Institute,
E-mail: sultonovshuxrat87@gmail.com

Navotova Dilnoza Ibragimovna
Associate Professor of the Shakhrisabz State Pedagogical Institute,
Doctor of Philosophy in Geographical Sciences (PhD)
E-mail: dnavotova@gmail.com

ABSTRACT

This article briefly analyzes the impact of mineral resources in mountain and foothill areas on landscapes. The impact of minerals in mountain and foothill areas on landscapes was also studied and their classification was developed.

KEYWORDS

Igneous rocks, landscape, geological conditions, sedimentary rocks, effusive, karst, intrusive.

Introduction

Mountain and foothill regions are distinguished by complex relief, altitudinal zoning, rapid climate change, dense river network, and unique vegetation cover. In the territory of Uzbekistan, such regions include the Gisar, Zarafshan, Nuratau, Turkestan, Chatkal mountain ranges and their foothill zones. In these areas, igneous, metamorphic, and sedimentary rocks intersect, which leads to the formation of various minerals. Minerals play an important role not only as an economic resource, but also as a landscape-forming factor.

Main Part

The landscapes of mountainous and foothill regions are directly related to the minerals of the rocks that make up them, their structure and texture, physical and mechanical properties, and how they have changed under geological conditions. Minerals in magmatic, sedimentary, and metamorphic rocks are the main geological factors determining the strength of the Earth's crust, the activity of erosion processes, the rate of relief formation, and the stability of landscapes. In the process of mountain system development, the specificity of minerals leads to the differential formation of landscapes.

Minerals of igneous rocks, especially those crystallized under intrusive conditions, create the basis for the stability and massiveness of mountain landscapes. Rocks such as granite, syenite, or diorite, formed as a result of the slow cooling of deep magma, are distinguished by a fully crystalline, dense, and coarse-grained structure. Their composition is dominated by strong minerals such as feldspar, quartz, mica, amphibole, and they have a high degree of erosion resistance. For this reason, high mountain ranges, steep cliffs, thick mountain slopes, and sharp relief forms develop over massifs rich in such minerals. Intrusive rocks with fluidal or strip texture cause the development of faults in certain directions, increasing the direction of the erosion process. In such areas, the splitting of mountain slopes, the formation of ravines, and the development of a network of valleys are determined by the structural features of the minerals.

Vitreous, vesicular, or microlitic structures, characteristic of effusive igneous rocks, lead to the changeability and instability of landscapes. Minerals such as basalt, andesite, obsidian, or pumice, found among volcanic debris, are prone to rapid deterioration due to their porous or glassy structure. Therefore, volcanic mountain ranges are characterized by rapid fragmentation, gentle slopes, and numerous canyon, ravine, and quarry forms. Pumice and glassy lavas saturated with gas bubbles undergo rapid changes under the influence of water, resulting in unstable volcanic cones and rapid development of erosion processes. The main composition of the lava consists of semi-crystalline minerals, the formation of which in the relief is manifested in the form of lava plateaus, rock flows, and lava plains.

The structure and texture of sedimentary rocks cause the differential development of mountain and foothill landscapes. Carbonate rocks, such as hard-cemented sandstone, limestone, or dolomite, are resistant to erosion due to their strong mineral composition - calcite, dolomite, quartz - on which rocky massifs, karst relief, high ridges, and steep ravines are formed. On the contrary, in areas with a lightly cemented sand, clay, marl, or gravel mineral composition, soft, gentle, and rapidly changing landforms - river valleys, alluvial plains, and sandy-plastic deposits - are formed. The stratified structural feature of sedimentary rocks leads to the formation of anticlinal and synclinal ranges in the foothills, which intensifies the anisotropic development of the relief.

The biomorphic structure of organogenic carbonate rocks leads to the development of karst processes in mountainous and foothill areas. Due to the shell structure, the abundance of cavities, and the composition of chemically soluble minerals, karst funnels, caves, underground rivers, suffusion, and karst relief forms are formed. Such landscapes are usually characterized by uneven, hollow, and multi-tiered relief.

Minerals of metamorphic rocks have an even more complex influence on the formation of landscapes. Minerals in gneiss, crystalline schists, marble, and quartzites are recrystallized, dense, and hard, creating massifs highly resistant to erosion. Mountain ranges composed of such minerals form large,

steep, very stable, and long-lasting relief forms. Leucoplastic structure, like mica schists, leads to the development of fracturing in specific directions, accelerating the formation of stepped slopes, inclined surfaces, and residual mountain formations. The orientation of metamorphic zones intensifies the directional development of relief in mountain ranges and foothill landscapes, which leads to the formation of the core of mountain systems by large gneiss massifs.

In general, the composition of minerals in mountainous and foothill areas, their degree of crystallinity, granularity, porosity, and chemical stability are decisive factors in the formation of landscapes. Minerals determine the strength and degree of weathering of rocks, which determines the rate of formation of relief forms, their shape, size, and direction of development. As a result, various geomorphological structures are formed, such as mountain ranges, valley-like relief, karst forms, volcanic landscapes, or semi-level surfaces. Thus, minerals are important not only as a geological component determining the composition of rocks, but also as one of the main forces of nature regulating the morphological and dynamic development of landscapes.

During the research, the influence of mineral resources in mountainous and foothill areas on landscapes was studied. Based on the data obtained, their properties and role in the formation of landscapes were determined and classified as follows (Table 1).

Types of rocks and mineral resources and their impact on landscapes

Table 1.

Type of mineral	Physical state	Mineral resource	Specifications	Impacts on landscapes
Magmatic rocks	Crystalline solid	Quartz, feldspar, amphibole, pyroxene	Dense, stable, and erosion-resistant	Steep and stable mountain massifs, non-porous rocks
Magmatic rocks	Porous and glassy	Obsidian, pumice, and volcanic tuffs	Very porous, light, and easily eroded	Volcanic landscapes, zones of lava flows, relaxed relief
Sedimentary rocks	Fine-grained and coarse-grained	Sand, sandstone, gravel, and conglomerate	Granular, medium strength, varying degrees of cementation	Alluvial plains, deltas, and foothill valleys
Sedimentary rocks	Carbonated	Limestone, dolomite, calcite	Chemically soluble, soft or moderately durable	Karst landscapes: caves, sinkholes, karst valleys
Sedimentary rocks	Sulfuric	Gypsum and anhydrite	Very soluble and soft	As a result of dissolution, cavities, caves, and rapidly changing areas form
Metamorphic rocks	Metamorphic layers	Slanets, fillit, gneys	Layered, directional fracturing, medium or high strength	Terraced mountain slopes, landscapes with directional erosion
Sedimentary rocks	Soil-forming	Feldspar, calcite, and caustobiolites	Prone to crumbling, granular in texture	Soil and the distribution of vegetation cover form the ecological landscape in foothill areas.

The table has been compiled by the authors.

Conclusion

The formation and development of landscapes in mountainous and foothill areas are directly related to the properties of the minerals that constitute their geological composition. Minerals found in igneous, sedimentary, and metamorphic rocks determine the stability or rapid erosion of the relief based on their strength, porosity, solubility, and degree of crystallinity. While solid crystalline minerals form high

mountain massifs and steep relief features, porous and easily decomposing rocks create dynamic, changing landscapes. Carbonate and other sedimentary mineral resources shape karst processes, enhancing the uniqueness of the foothill relief. Metamorphic minerals form the supporting structure of large mountain systems. Consequently, mineral composition is the primary factor determining the geomorphological, hydrological, and ecological characteristics of mountain and foothill landscapes.

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