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Review Article

SOME PROCESSES AND PHENOMENA AFFECTING THE ACTIVE WATER EXCHANGE OF GROUNDWATER (ON THE EXAMPLE OF THE KARAKALPAK USTYURT)

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ABSTRACT
In the article, the authors consider the area of the Karakalpak Ustyurt located on the second stage of the relief. Karakalpak Ustyurt, with its area and natural landscape, is a sagebrush-solyanka desert on the one hand and a clay-gravelly desert on the other, as well as towering over the surrounding plain to a height of one and a half to two hundred meters. Where the main types of processes are developed are due to the geological and structural features of the territory. The almost horizontal occurrence of surface rocks is associated with the shafts of Aktumsuk, Karabaur, where there is a relatively weak dissection of the relief. The authors have identified on the northern and southern slopes the dissection of relief with different stages of development of ravines, as well as positive and negative types and forms of relief corresponding to gentle anticlinal zones and deflections. Thus, the geological and hydrogeological processes and phenomena significantly affect the manifestation of the subsurface waters of the zones of active water exchange of the Karakalpak Ustyurt, the so-called karst valley - the northern slope of the Karabaur shaft is the area where takyrs are widespread. And the Miocene carbonate stratum is a natural reservoir of subsurface groundwater of the free water exchange zone.

Keywords*: Takyrs, Podtakyr Waters, Karst Valley, Fracturing, Natural Landscape, Chinks, Canyons, Tectonic Dislocations*

INTRODUCTION

In the western part of the Republic of the Uzbekistan, there is a unique plateau - the Karakalpak Ustyurt. As you know, it and the whole plateau with the adjacent territory is the bottom of the huge ancient Tethys Ocean, which existed more than fifty million years ago, which first turned into an inland sea (about two million years ago, when the waterway connecting the Black Caspian Sea dried up), and then finally dried up. The study of aerial photography materials of the territory revealed strange lines, obviously of non-natural origin. All lines that form arrow-shaped signs (almost 1.5 km long) have a direction «strictly north». The "arrows" laid out of huge boulders (currently heavily destroyed by time) the height of the shafts does not exceed a meter. In addition, ancient burial mounds, religious buildings, burials and numerous runic rock inscriptions have been found on the plateau. In short, in the research area, in addition to geological and hydrogeological processes, there are manifestations of engineering-geological processes related to human economic activity. The first thing that strikes the Karakalpak Ustyurt is its area, the natural landscape is a sagebrush-solyanka desert on the one hand and a clay-gravelly desert on the other, as well as towering over the surrounding plain to a height of one and a half to two hundred meters. In some places, the plateau turns into quite impressive gorges with vertical walls, and in other places it becomes mountain ranges, and chinks, canyons, tectonic dislocations are scattered all over Ustyurt, as if by someone's careless hand - almost inaccessible steep ledges up to three hundred meters high. Somewhere the chinks represent lonely peaks, aspiring upwards, and somewhere a bizarre rock or a series of rocks, some of them resemble castles erected by someone a very long time ago, and where they are huge boulders made up in a chaotic manner on top of each other of an incredible shape. Based on the above, the purpose of the research was geological and hydrogeological processes and phenomena

affecting the state of the sub-surface waters of the zones of active water exchange of the Karakalpak Ustyurt.

DISCUSSION

The Karakalpak Ustyurt is located within the second stage of the desert relief, and the main types of processes developed here are due to geological and structural features (Akramkhodjaev *et al.* 1967; Sadykov, 1970). Having the character of an almost horizontal occurrence composing the surface, the rocks are connected on the shafts (Aktumsuk, Karabaur, etc.) with relatively weak dissection, i.e. an almost flat surface is observed. Nevertheless, within the Karakalpak Ustyurt, the dissection of the relief (sharp ledges) and with various stages of development of ravines, as well as positive and negative types and forms of relief corresponding to gentle anticlinal zones and deflections are clearly distinguished on the northern and southern slopes.

In the north of the Karakalpak Ustyurt, there are drainless depressions of Sam, Karatyuli (in the area of Urdabai and Riapai wells), occupied mainly by sand massifs and salt marshes corresponding to the continuation of the shaft.

Aktumsuk. Deflationary processes are quite widespread in this territory and form, respectively, the same-named forms of relief. The length of the sand massif is about 6 km from southwest to northeast with a width of up to 4 km (Akramkhodjaev *et al.* 1967; Sadykov 1970). Weakly anchored sands form ridge and cellular-ridge relief and a relative excess of up to 5-10 m. In all depressions, sand masses of smaller sizes are observed along the outskirts.

The northern slope of the shaft is everywhere covered with small incisions of temporary stream. Ravine formation of the second and third stages is observed dryly directed from the central part of the Aktumsuk shaft to the west, northwest, as well as on the northern slope of the Karabaur shaft. The slopes are relatively gentle, and cut through by temporary streams, forming ravines in places. On the sides of ravines under a small (0.5-1.5 m) thickness of quaternary sandy loam rocks with inclusions of small and medium poorly rounded limestone and marl gravel, deposits of the Sarmatian tier are observed represented by fractured, slightly carded limestones and loose marls. The sediment capacity is not opened. Physical weathering is observed to a depth of 1.5 m. The sides of the ravines have a vertical depression to the bottom. Intensive development of bottom and tank erosion observed (Akramkhodjaev *et al.* 1967; Sadykov, 1970; Zakirov and Shin, 2018; Dzhaksymuratov, 2021; Zakirov *et al.*, 2022). Along the sides of the ravines, fracturing, cavernous and in places karst cavities with traces of physical weathering are observed. The southern slope of the Karabaur shaft is characterized by steep reliefs, a wide spread of gully-beam systems with a depth of cuts from 10-15 to 30-35 m. In general, the southern and southeastern chinks of the Karakalpak Ustyurt have smaller ledges within 60-80 m. As well as a distinctive feature of the south, there is a sharp and dense dissection of the relief by temporary surface layers, forming a deeply embedded 10-15 rarely up to 20 m and a widely branched developing gully network, and ravines transformed into a beam network.

The impact of various weathering agents, desert denudation, mainly surface and groundwater on the Chinka ledge, depending on geological and structural conditions, landslide and landslide processes are observed to develop over a considerable length, dividing the marginal parts of the Karakalpak Ustyurt into strips 2-2.5 km wide. In these areas, the impression of mountainous relief is created, especially in the presence of large landslide blocks and huge boulders of Miocene rocks. Such processes are facilitated by the height of chinks above the edge of the Aral Sea, reaching within 200-250 m.

In the central part of the research area, it was characterized by the presence of approximately 5000 m^2 of the Barsakelmes drainage basin and in the southern part of the research area, Assekeaudan (Zakirov *et al.*, 2022; and Dzhaksymuratov *et al.*, 2020). In these areas, the minimum relief marks are fixed: Barsakelmes -62; Assakeaudan - within 45 m. The bottom of which is filled with salt marsh, salts and in places arrays of sand. In this part of the district, territories with internal evaporation of groundwater are allocated. These are mainly territories with a sandy massif and a saline surface. They are mainly isolated along the outer border of the Barsakelmes and Assakeaudan depressions. These depressions are located in the

central parts of the tectonic depression, and drainless basins such as Shakhpakhty, Aksaymak, Shordzha, etc. have a hydrogeological role for the water supply of geological exploration enterprises.
The formation of large relief forms and micro relief was the result of tectonics, depressions, surface leaching funnels, seepage funnels (steppe saucers), karst and suffusion processes, and subsequently deflationary processes took place. Analysis of previously conducted and in the process of conducting personal research has established the impact on geological and hydrogeological conditions.
In the Karakalpak Ustyurt, the karstiness, cavernousness and fracturing of the deposits of the carbonate strata of the Sarmatian tier have been established. In addition, on the territory of the northern slope of the Karabaur, the karstiness, cavernousness and fracturing of the Miocene carbonate strata are widespread.
Thus, the geological and hydrogeological processes and phenomena significantly affect the manifestation of the subsurface waters of the zones of active water exchange of the Karakalpak Ustyurt, the so-called karst valley - the northern slope of the Karabaur shaft is the area where takyrs are widespread. Moreover, the Miocene carbonate stratum is a natural reservoir of subsurface groundwater of the free water exchange zone.

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