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ANTHROPOGENIC FACTORS OF THE MORPHOGENESIS OF THE ARID ZONE OF KAZAKHSTAN (CENTRAL KAZAKHSTAN)

In article the major anthropogenic factors, defining spatial distribution and dynamics of negative processes of a morphogenesis within a platform-denudational plains of the Central Kazakhstan which are characterized by aridity of climatic conditions are considered. Changes of processes of a morphogenesis and components of the environment is defined by type (engineering and economic, mining and mining processing industries, agricultural, town-planning, etc.) and character (direct and mediated) economic influence. The lands broken by economic activity occupy the huge spaces, catastrophically reducing territories of the equipped vital space of the population of the Central Kazakhstan.

Key words: platform-denudational plain, relief forming processes, geomorphological environment, morpholitogenic basis, environmental management type, relief environment, anthropogenic forms.

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Қазақстанның аридті зонасы морфогенезінің антропогендік факторлары (Орталық Қазақстан)

Табиғи-климаттық жағдайлары құрғақшылықпен сипатталатын Орталық Қазақстанның платформалық-денудациялық жазықтар шегінде морфогенездің негативті үдерістердің кеңістік таралуын және динамикасын белгілейтін негізгі антропогендік факторлары қарастырылған. Морфогенез үдерістерінің және табиғи орта компоненттерінің өзгерістері шаруашылық әрекеттіліктің тектүрімен (инженерлік-шаруашылық, тау-кен өндіруі, тау-кен өндеуі, ауылшаруашылығы, қалақұрылысы, т.с.с.) оның сипатымен (тура және жанама) негізделеді. Шаруашылық әрекеттілікпен бұзылған жерлер Орталық Қазақстан халқының ыңғайланған өмір сүру кеңістігін айтарлықтай қысқартып жатқан қомақты аудандарды алып жатыр.

Түйін сөздер: платформалық-денудациялық жазық, бедертүзуші үдерістер, геоморфологиялық орта, морфолитогендік негізі, табиғатты пайдалану тектүрі, бедер ортасы, антропогендік пішіндер.

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Антропогенные факторы морфогенеза аридной зоны Казахстана (Центральный Казахстан)

В статье рассматриваются основные антропогенные факторы, определяющие пространственное распределение и динамику негативных процессов морфогенеза в пределах платформенно-денудационных равнин Центрального Казахстана, характеризующихся аридностью природно-климатических условий. Изменения процессов морфогенеза и компонентов природной среды определяется типом (инженерно-хозяйственной, горнодобывающей и горноперерабатывающей, сельскохозяйственной, градостроительной и др.) и характером (прямое и опосредованное) хозяйственного воздействия. Нарушенные хозяйственной деятельностью земли занимают огромные площади, катастрофически сокращая территории обустроенного жизненного пространства населения Центрального Казахстана.

Ключевые слова: платформенно-денудационная равнина, рельефообразующие процессы, геоморфологическая среда, морфолитогенная основа, тип природопользования, рельефная среда, антропогенные формы.

Introduction

Now, in essence, there is a process of transformation of natural systems including geomorphological, in natural – anthropogenic. Degree of an anthropogenic transformation of geomorphological systems can be characterized by the comparative assessment having ball weight. Violations of natural functioning of the environment, their scales and the nature of manifestations depends on type of economic activity – engineering -economic, mining and mining processing industries, agricultural, town-planning, etc. The type of influence is understood as a complex of the actions, which are carried out by the person as a result of economic activity at the expense of various types and the sizes of designs, buildings, constructions, devices, the tool and substance [Gorshkov, 1982; Dzhanpeisov, 1977].

The problem of an anthropogenic transformation of lands in the Central Kazakhstan is especially relevant because the explored territory is in limits of subarid and arid natural zones, where any direct local economic influence causes the exaggerated mediated area influence, that is caused by noticeable decrease in a shock-absorbing role of moistening (insufficient in the territory of a research).

Territory and area of researches.

The Central Kazakhstan, known for the mining production, is located within the Kazakh board, where the basal structures of the base of the platform, including different types of minerals of the enriched contents, are open or located at small depths. The relief of the territory differs in the uniformity broken by separate low mountain – hills raisings and being result of manifestations of the latest tectonic raisings.

The territory of a research is rather poor by surface water. Here it is possible to note the Sarysu and Nura rivers with their shallow inflows and the small lakes located in the west and the northeast of the area. For support of mining production and the residential industry, mainly, underground waters which level and quality for the last decades have considerably decreased are used.

Basic data and methods of researches.

Identifications of types of economic activity and results of their impact on the environment generally and on the geomorphological environment in particular, it has been based on the analysis cartographical, the space film-making, literary, and reporting – fund materials and also these field researches and mapping. Selection of the cartographic materials including large-scale topographical and survey-topographic maps of 1982 and 2008 of the edition, was made taking into account type and the nature of economic activity. For obtaining representative data space pictures of Landsat with the resolution no more than 30 m as they yield good results at decryption were used.

The used reporting-fund materials across the territory of a research are connected with the 40th years of last century – with the period of intensive development of mineral-raw material resources of the region. With this time and also over time complications of an ecological situation in the 60-70th years, are connected all planned researches of a natural and resource basis of the region, his ecological potential and remediation opportunities.

The data of field researches, including field mapping of types and the nature of economic activity, results of their manifestation in the geomorphological environment, descriptions of spatial distribution, morphology and a morphometry of again formed forms of a relief and their interrelation with anthropogenic activity, population poll for identification of changes in the environment and dynamics of a morphogenesis for the last 50-60 years have been received in the period of 1988-2014, including during implementation of the grant project in 2011-2014. Natural components (litogenny basis of a relief, their types and processes of a morphogenesis) and their complexes or landscapes belong to transforming a relief of natural character. From indicators of anthropogenic character were the resource basis of managing, including land and water resources and also a condition of the society, which is partly a consequence of the developing geomorphological environment is chosen. By the specified criteria the general comparative assessment of the geomorphological environment of the region is carried out (tab. 1).

Results and discussion.

Practically all types of impact of society on the nature belong to the category of purposeful. The city and industrial agglomerations [Баймырзаев, 2000], creating thermal, gravitauionnye radioactive and electromagnetic fields, are large sources of leveling of a relief, concentration of technogenic deposits, pollution of a soil and vegetable cover, the atmosphere of air, natural waters. Changes of the environment, natural physical fields in the cities belong to the complicating factors for accommodation of the person and, so, effective functioning of all economy of the city. Practically all types of economic activity anyway lead to chemical pollution (wide range) surrounding including relief environment.

The Central Kazakhstan is one of the regions of the republic, experiencing powerful anthropogenic

pressure. High rates of development of mineral – raw, fuel – energy and agricultural resources have led to emergence of large city and industrial agglomerations (Karagandy, Zhezkazgan, Balkhash) and sets of urban-type settlements (Aksuat, Konyrat, Satpayev, Kayrakty, Zhezdy, Topar and nany other). On significant areas of lands of the Central Kazakhstan there is an essential transformation of components of the environment: natural relief and relief forming processes, soil – vegetable cover, water and air environment and, in general, geosystems.

The Central Kazakhstan, differing in dryness of climate, weak efficiency of a soil – vegetable cover, strong limitation of water resources, possesses, at the same time, mineral deposits, unique on structure and stocks, which, as well as other components of the natural -resource environment, intensively accustom. Besides, in connection with complexity of development of the region, the accompanying types of environmental management or anthropogenic production with the corresponding types of transformation of lands and extent of violation of the geomorphological environment (tab. 1) have development.

The analysis of environmental management and, respectively, influence and, as a result, violation of the geomorphological environment of the territory of the Central Kazakhstan is reflected by the table (tab. 2) below. 5 types and 11 subtypes of environmental management both the related types of transformation of lands and various degree of a violation of the geomorphological environment are reflected in her. The allocated taxons of environmental management consider the following criteria: the type – reflects genetically uniform environmental management; the subtype reflects the nature of environmental management (anthropogenic production); a look – concrete forms of use and transformation of lands. Baymyrzayev K.M. is absolutely right [Slastunov, Koroleva et. al, 2001: 148-153], noting, that all types of impact on natural (including and on geomorphological – R.B.) environment in the region have intensive character.

The dominating environmental management in the territory of a research are mining (production of ore and nonmetallic deposits, their processing) and hydrotechnical types of anthropogenic production. Mining developments are connected with coal mining, black, color polymetallic and rare metal ores, their enrichment and are the leading branches in development of natural – resource capacity of the Karaganda region.

The greatest violations of the relief environment are connected with a driving of open excavations, overburden works and extraction of mineral in pits; by underground minings – with the dredging of minerals, accompanied with the collapse of overlying breeds and deformation of the earned additionally surface; by open-cast and underground mining – with an arrangement on a surface of dumps of the breeds given from excavations. The changes, caused by violation of a surface, have an adverse effect on biological, erosive, esthetic characteristics of the territory. Main types of violations of the geomorphological environment, when is connected with developent of mineral deposits of area, are noted in table 2.

In recent years, in the course of mass development of the solid minerals (SM) there were cardinal shifts of the negative plan in a condition of the environment. The complex of works on production of SM leads to change of geological, geomorphological, hydrological, hydrogeological and weather conditions in areas of production and border lands. It is established that decrease in piezometric level of underground waters by each 10 m of water-bearing thickness increases load of overlying layers on average of 1 kg/cm^2 [Alpysbayev, Karatorgaev, 2001]. Violations of the land surface, as a rule, don't disappear and become steady technogenic formations.

The mining enterprises of the Central Kazakhstan are located compactly and connected, as a rule, with development of one or groups of fields, for example, of ferromanganese ores (the Western Karazhal, Zhezdy, Kentobe), copper-ore (Zhezkazgan, Kounrat, Sayaksky group), zinc-lead (Zhairem, Ushkatyn, Karagaily, Alaygyr, Akzhal, Zhezkazgan), rare metals (Koktemkol, Kayrakty, Akchatau) which are permanent factors both the direct, and mediated negative impact on the geomorphological environment.

One of powerful consequences of open land-underground and underground minings are dumps – production wastes, which in the explored territory about 7 billion t. have collected., not only tear away considerable land grounds, but also give rise to notable negative ecological and social consequences. According to calculations, in 2009 accumulation of all types of solid waste have made about 24 billion tons. A considerable part of this saved-up waste is stored in the Karaganda region (29,4%) [Baimyrzaev, 2000: 149-151].

Deformations of integumentary thicknesses are connected with underground minings and formation of troughs of subsidence, subsidence of layers under the influence of a body weight, shift of breeds on the bedding planes, the collapse of a roof over the produced layers (that takes place over the old fulfilled mines within the ore field in Satpayev), the formation of a zone of cracks and intensive crushing of breeds, leading to change of a superficial drain,

flooding and bogging of the sunk sites of the land surface over underground developments.

With increase in depth of working off of ore bodies, that is observed, for example, in Akchi-Spassky and Annensky ore areas (with very difficult tectonics) of Zhezkazgan ore field, increases pressure, processes of peeling of a roof of mine emptiness amplify [Alpysbayev, Karatorgaev, 2001]. Besides, dredging and accumulation of huge mass of rocks is followed by emergence of considerable territories of the neogenic ground (especially near the cities), which doesn't have a fertile layer and a dense vegetable cover, that completely natural changes of environment exomorphodynamic. Artificial grounds – disintegration rocks, finished goods warehouses, which, along with cuts of deep laying of open-cast minings, form positive (like waste heaps) and negative (careers) forms of a relief.

Table 1 – Criteria of comparative assessment of a geomorphological situation of mining areas of the Central Kazakhstan

General assessment of a geomorphological situation	Groups of indicators			Main directions of improvement of a geomorphological situation
	Nature and relief	Econimy	Society	
Satisfactory	Norm	Norm	Norm	Improvements without essential expenses are possible. Stabilization of structure of economy
Adverse	Signs of change separate relief forming processes	Separate changes in use of land resources	Understanding of environmental problems begins	Monitoring of land resources. Improvement of technologies of use of land resources – agrotechnical actions
Extremely adverse	Degradation of separate landscapes, destruction of a morpholitogenic basis	Decrease in efficiency of land use	Manifestation of the social tension, caused by deterioration in an ecological situation	Monitoring of geodynamic processes at all types of extraction of solid minerals. Introduction of new technologies of developments and improvement of conservation
Critical	Formation of new natural – anthropogenic forms and types of a relief	Deterioration in efficiency of use of land and water resources	Ecological situation as factor of social tension of society	Large material inputs for reorganization of separate parts of structure of mining economy
Crisis	Profound and irreversible changes of a relief, degradation of landscapes	Strengthening of economic losses. Violations of structure of economy	The crisis ecological situation, defining social development	The radical reorganization of economy, demanding huge capital material inputs

Table 2 – Main forms of geomorphological violations

Operation	Type of violation	Relief forms	The processes defining emergence of a technogenic relief
Open	Channels	The extended horizontal or inclined dredging of rectangular, trapezoid or step section	Drainage works, protections of industrial sites from flooding
	Trenches	The extended, horizontal or inclined dredging of trapezoid or step section	Driving of preparatory excavations
	Dumps	Swell-like triangular, trapezoid and segment form	Driving of auxiliary excavations and formation of dumps at a driving of excavations by scrapers, bulldozers and excavators
		Hilly	Formation of single-tier dumps when transporting rock
		In the form of the plateau	Transfer of the rocks excavators, by machines forming dumps
		Pectineal, plateau, terassa similar	Formation of many-tier dumps when transporting rocks

Underground	Hollows and failures	In the form of troughs (a subsidence trough, deflections)	Driving of horizontal excavations
		Troughs in a look terasses (subsidence troughs)	Driving of inclined excavations
	Dumps	Tape, semi-ring	Dumping of breed at a driving of holes drilling
		Tape rectilinear	Dumping of breed from holes and other auxiliary developments the simplest means
		Fan	Dumping of breed by the bulldozer
		Conic	Dumping of breed with application of skips and trolleys
		Pectineal, in the form of the plateau	Dumping of single-layer dumps with use of vehicles

Loading on natural including on the geomorphological environment at the expense of coal-mining branch are noted within all Karaganda basin, which total area is more than 4 thousand sq.km. The basin consists of 4 carboniferous areas: Verkhnesokursky, Karagandy, Sherubay-Nurinsky and Tenteksky. By underground minings the big environmental risk is connected with sudden emissions of coal and the gasdynamic phenomena. Sudden emissions of coal, according to A.S. Saginov, in the Karaganda basin reach from several meters to 550 m. The special danger is constituted by sour gases, which considerable volume is allocated during hurling back and transportation of coal [Saginov, 1995]. Sudden explosions of gases lead to failures of treatment facilities, that, in turn, leads to considerable deformations of the land surface.

Underground horizontal and inclined productions of coal layers on certain sites of city line became the reason of a flash of the land surface, sometimes with formation of failure funnels. The dangerous situation with failures of a roof of underground emptiness has developed on certain sites of the Zhezkazgan industrial zone, owing to resettlement of the population of industrial settlements is made (the settlement Rudnik, the settlement of ChKM, etc.) in Zhezkazgan and Satpayev.

Features of change of hydrogeological conditions, violations of a relief and natural process of modern exogenous processes, questions of stability of ledges and boards of pits are considered in Bochkaryov V. P. works, etc. [Bochkaryov, 1990], Zhaparkhanova S.Zh. [Zhaparkhanova et. al, 1985; Zhaparkhanov, 1970], Baymyrzayev K. M. [Baymyrzayev, 2000: 148-156], etc. According to these authors, cumulative influence of the processes, accompanying mining, on the natural and geomorphological environment for decades is led to a number of the undesirable phenomena. Radical reorganization of a near-surface and superficial part of a lithogenic basis happens especially at career dredging of ore weight, which in total with dumps of technological processing at mining plants in the conditions of the semi-desert stimulates formation of lifeless territories – technological bad lands.

In the conditions of the desert and the semi-desert of the Central Kazakhstan treat especially negative consequences of mining changes of a hydrogeological situation on the operating mines belong. Mines also became the education reason the depression of funnels which area reaches hundreds of square kilometers. To increase in depth and area of working off there is growth of a depression funnel and simultaneous deterioration of water. So, in the first years of development of Zhezkazgan with a depth of mine working off up to 100 m miner waters were fresh and poorly saltish, had hydrocarbonate and hydrocarbonate-sulfate structure. With deepening of working off of the field to 200-300 m sulfate-chloride waters with the raised mineralization of 2,5-3,5 g/l have begun to come to a zone of active water exchange. After opening by excavations of zones of tectonic violations (300-400 m) chloride waters with the size of the dry rest of 10-15 g/l have appeared. At the same time miner waters often incorporate the considerable maintenance of harmful minerals: lead, zinc, copper, iron, mercury, arsenic, etc., which do them unsuitable for use. Utilization of miner waters is a big problem for many mining objects. They in areas of mining production pollute ground waters, waterlog settlements, bring significant areas of lands out of a turn, exert impact on flood of soil of tailings dams of concentrating factories, become the reason of bogging and salinization of lands (Zhezkazgan, Karaganda, Zhairem, the settlement of Aksu, etc.), in a final case – to anthropogenic desertification of lands of the Central Kazakhstan.

Conclusions:

1. Functioning of the mining enterprises of the Central Kazakhstan causes intensive exhaustion of reserves of underground waters under the influence of powerful drainage effect of mines.

2. Exhaustion and, respectively, lowering of the level of underground waters affects the impoverishment of specific structure of vegetation, violation of structure of a soil cover, leading to strengthening of a wind and water erosion.

3. Change of components of the environment directly is expressed also in direct violations of a relief and activization of natural – anthropogenic processes, including development of gravitational and erosive processes on slopes of pits and various dumps. Besides, also the mediated influence of mining on character and intensity of the relief forming processes through changes of structural components of geosystems is observed (through pollution of atmospheric air, pollution and increases in aggression of surface, ground and underground water, change of structure to the soil and a transformation of specific structure of a vegetable cover).

Broken by geological exploration and mining and the enterprises of the earth occupy the huge spaces, catastrophically reducing the areas of the equipped vital space of the population of the Central Kazakhstan.

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