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## Monitoring of areas undermined by subsurface mining

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### Abstract

With increasing depth of field depletion increased deformation of the array, which leads to the development of the surface displacement. In such a case, mined-out space gets to the zone of displacement underground, and on the surface-built-up areas.

To study the negative impact of geomechanical processes in built up areas, we carried out a research on the studying of deformation processes of rock formations and displacement of ground surface.

This article presents the results of researches of geomechanical processes on areas located one in the conservation of Mirgaliinsa deposit and other is under development of Zhezkazgan deposit.

### Key words

Deformation, massif, geomechanical processes

Field working off by underground way, especially development systems with open clearing space (leaving pillar of different function) changes character of technogenic loading in these areas, changing hydrogeological conditions, an intense and deformation condition, stability of rocks that leads formations of the broken sites, failures of a terrestrial surface which reach several hundred meters to massif deformation which are shown in the form of displacement of a surface, thus seizing the built-up territories of the cities, settlements, the railroads and various communications

Researches of geomechanical processes of a fulfilled Zhezkazgan field and the Mirgaliinsay field which was in preservation are actual today.

Let's consider the Mirgaliinsay field. The Mirgaliinsay range Karachik covers the territory of a valley of river. In upper courses of this valley, to interfluvium of the rivers Bayaldyr, Biresek and Kantagi forming the river Karashik, the mine field of Mirgaliinsay mine is located. Development of a field was conducted in the underground way by combine *Achpolimetal* (figure 1). The city is located on the southern border of a mine field of mine.

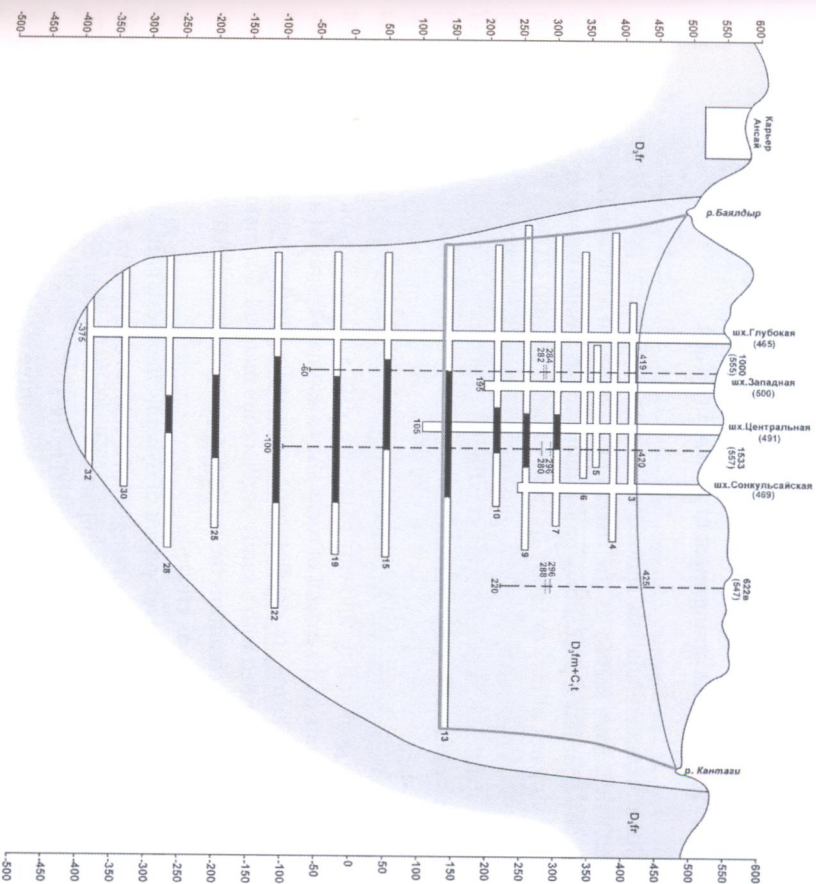
Since 1994 development of the Mirgaliinsay field is stopped because of unprofitability and stocks of polymetallic ores are translated in off-balance, and the field is preserved by a method of full flooding.

At elimination in 2004 underground waters rose to the initial level of the 40th years and reached a point of 438 m. Thus there was a flooding of Northern part of the city of Kentau.

In 2007 the special project passed a water drain adit 2504 m long and with a section of 3,14 m<sup>2</sup> from a trunk of Glubokoye mine (SZ) to the southwest area by Kentau

with the subsequent dumping of water in the Koshkurgansky reservoir the size 1,0x2,5 of the square kilometre of 5,2 million m<sup>3</sup>, located in 3 km to the south of Kentau (figure 2). The project provided control of level and quality of underground waters, control of deformations of a terrestrial surface.

During the subsequent period, on supervision, the maximum level of underground waters didn't rise above a mark of 427 m. Control of deformations was carried out by group of KAZNIMI. By them were recorded subsidence of a terrestrial surface on separate sites to 33 mm with the maximum speed of subsidence about 5 mm/month [1].



Picture 1: Scheme of an arrangement of developments

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corner of Dulatov St. (according to the hard currency catalog, № 15), on Zavodiskaya St. Yassavi St. corner, near the house № 13 (according to the hard currency catalog, № 23), on Auezov St. Panfilov St. corner, near the house № 17 (according to the hard currency catalog, № 27), on Shakarim St. Al-Farabi St. corner (according to the hard currency catalog, № 2), near the house № 65 (according to the hard currency catalog, № 3).

Now the range for monitoring is a little expanded, are established in addition soil a reference point on dangerous sites, by further repeated supervision it is possible to supervise collecting deformations, regularly to study characteristics of their development in time. On the basis of these data it will be possible to predict displacement process on all lines of all planned route with consecutive development of a network that will give the chance of a timely assessment of a condition of process displacement of a terrestrial surface and the prevention of catastrophic consequences.

The same problems considered above, accompany also to working off of some fields on which there is a revision of stocks according to the contents, transfer of off-balance stocks to category active balance and development of the left stocks in difficult mining-and-geological conditions (increase in depth of development, a zone of flexures, repeated overlapping, etc.). As a result of such repeated development, there is a formation of a new secondary force field of tension which can lead to increase of negative manifestations of mountain pressure: to emergence of the centers of mass collapses, development of the planes of displacement in leaning thickness, to increase of expenses for maintenance of collapsing developments, emergence of hollows-muld of displacement on a surface and to violation of problems of airing because of formation of zones of a collapse.

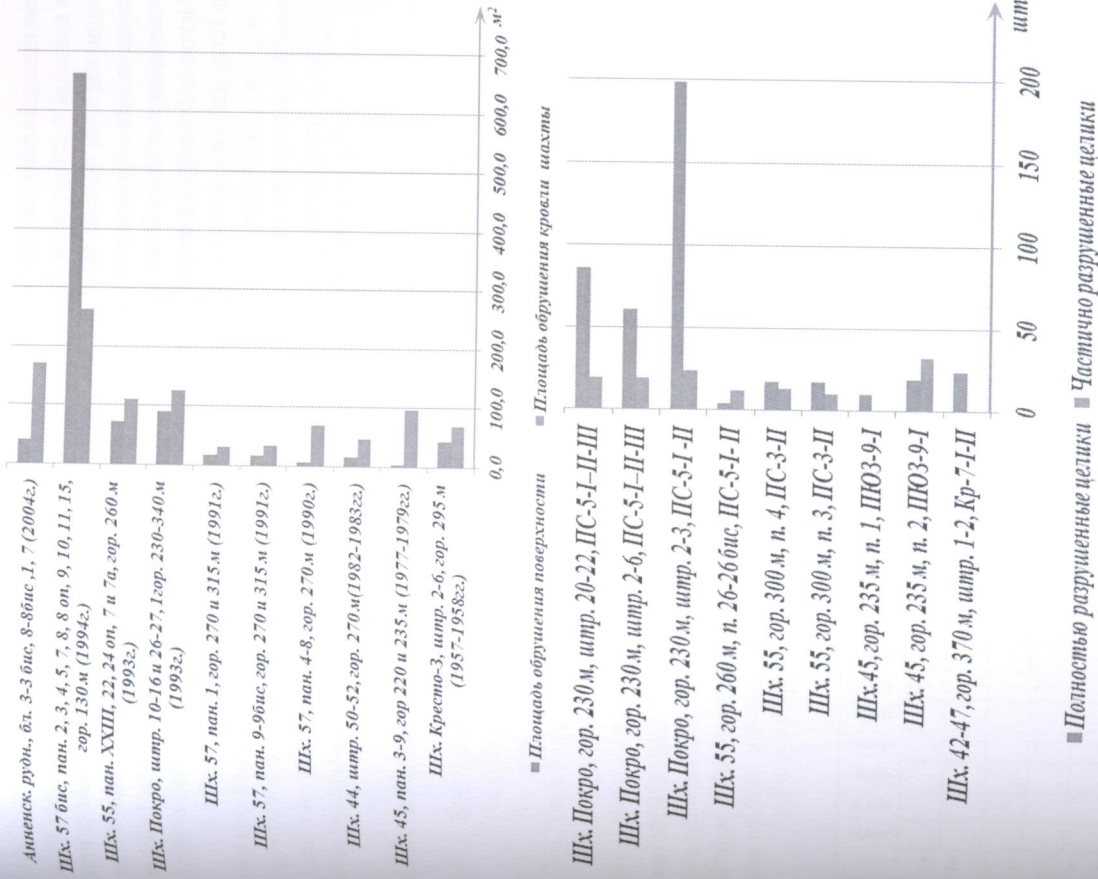
One of such powerful fields is the Zhezkazgan field of the medisty sandstones which working off is conducted more than 80 years.

By results of monitoring on a field some large collapses with an exit to a surface, to territories of Zhezkazgan mines in a zone of collapses and displacement are recorded there were settlements of 4 km, *Komsomol*, a field of mines 42 and 51, Annensky mine. More than 30 cases of a mass collapse of the developed space (figure 5) are recorded.

According to acts of inspections and the conclusions of the commissions of Kazhmys corporation of a collapse resulted from the various reasons caused by discrepancy of the actual sizes pillar by a design, not coaxial arrangement pillar and their partial side job, a fracture of breeds, a many-tier of deposits, large volume of the emptiness maintained collapsing of a pillars.

Now degree of a side job of a field makes 41% (volume of emptiness). Thus it should be noted that the main emptiness are formed last century.

The gain of emptiness is absent today, on the contrary there is a gradual repayment of emptiness by a self-collapse, a compulsory collapse, a bookmark (figure 6). Thus, works on stabilization of a geometrical situation are conducted.



Picture 5: Distribution of the area of a collapse to surfaces and in mine (and), quantity brought down pillar at collapses with an exit and without an exit to a surface

Gradual destruction of MKC and achievement of limit flight of an exposure of breeds of a roof leads to an immersion border pillar and to the subsequent their collapse. Thus the roof from breeds of a red-color complex is less steady, than a roof from gray sandstone.

Process of a collapse of leaning thickness, having arisen, develops further deep into the mass of height and stops at achievement of a powerful layer of gray sandstone. In this case, there is a localization of process of a collapse and lag of overlying