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The results of physical modeling experiments with the close dry suffosion.

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Introduction.

Presented are the results of physical modeling experiments with the close dry suffosion. The goal of the experiments was to find new geophysical methods to control the origin and development of the suffosion. The experiments were made at the experimental equipment of the **STATE ENTERPRISE "ANTIKARST AND COASTAL PROTECTION",** Dzershinsk, Nizhny Novgorod Region, Russia. The experimental equipment was designed by Dr. Victor P. Khomenko

Summary

The working camera of the experimental equipment (95 x 74 x 30 sm^3) was filled by sand. In the process of the experiment, an opening appeared in the bottom of the camera. Thickness of the sand of 200 cm, 400 cm and 600 cm was used. The method of the geoelectrical monitoring was used. On the surface of the model, two mutually orthogonal pairs of measuring electrodes $M_X N_X$ and $M_Y N_Y$ were installed. These electrodes were placed on the equipotential line near emitting electrode A (the equipotential installation). The first pair of electrodes, $M_X N_X$, was oriented towards AB which is the direction toward suffosion (axis Õ, along the model); the second pair $M_Y N_Y$ was oriented across the model (axis Y). Generator connected to the model through AB electrodes produced electrical signal of 1 kHz. The AB distance = 64 sm, $M_{XY} N_{XY}$ = 15-16 sm. The measuring electrodes were connected to the analog-digital converter. The experiment was controlled by computer.

The above method was chosen for the following reasons:

1. The necessity to measure small variations of geoelectrical parameters in time and space instead of the absolute values. The initial difference of potentials between electrodes MN (co-phased interference) is close to zero for this equipotential installation; therefore, the signal/noise ratio increases tens of times.

2. The signal appears after the equipotential line changes its form, i.e., after the initial field changes its vector, which reflects the processes of the origin and development of non–homogeneity.

Field experiments in seismic and landslide areas (A. N Bogolubov, A.N. Kamshilin, E.N. Volkova , 2002) have shown that this method allows to decrease the co-phased electrical interference by three orders of magnitude. Influence of variations of conductivity of near-surface layers caused by temperature changes was decreased by two orders and more. No direct effect of precipitation has been detected.

Results of the Experiments.

Formation of the closed cavity was accompanied by deformation of the initial field, i.e. by change of configuration of the equipotential lines. This was registered in all experiments (there were seven experiments total). The greatest signal was generated by pair $M_X N_X$ positioned toward the cavity (which was not a result of the change of current of generator). A signal generated by $M_Y N_Y$ pair was considerably smaller, if generated, or absent at all, which evidences a possibility of determining the location of the emerging suffosion by this method. This confirms by results of our field experiments with seismic vibrators and other sources of non–homogeneity. It appears that deformation of the surface of the model before formation of the suffosion was registered, as well. It will be checked in the process of further experiments.

A preliminary experiment with self-oscillations based on mechano-electrical transformations in sand was conducted. The results are currently being reviewed.

Conclusion.

The results of the experiments show a possibility that the method of “equipotential installation ” (method of geodynamic electrics) developed by us to research geodynamic processes will allow to control the dynamic of karst-suffosion processes.

We presented the results of experiments with three-electrode device. Obviously, this is not the only possible model of “equipotential measuring”. Several more models were tried as well. Currently, we are working on choosing an optimal type of device for monitoring of karst-suffosion processes.

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References.

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