

# PREDICTION OF SURFACE SUBSIDENCE DISPLACEMENT IN URBAN AREAS • F DONBASS ON THE BASIS OF THE SPECIAL- PURPOSE GEOINFORMATION SYSTEM

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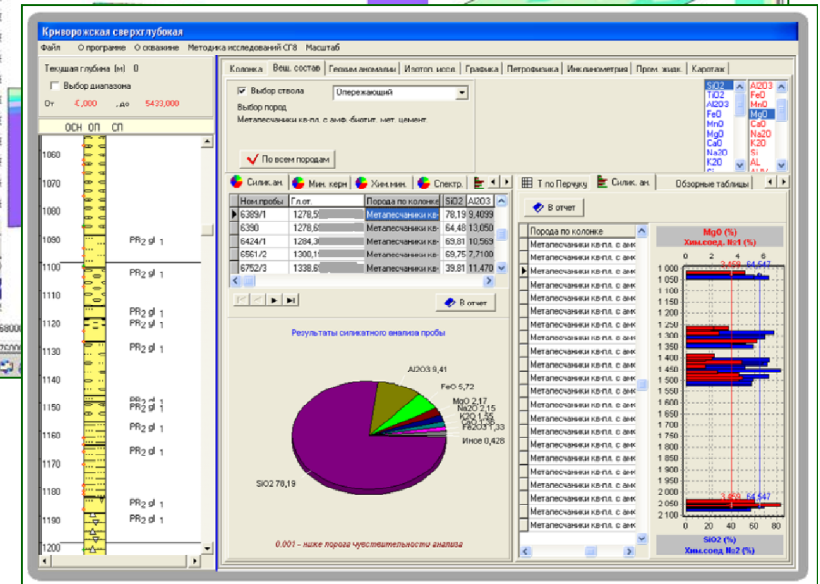
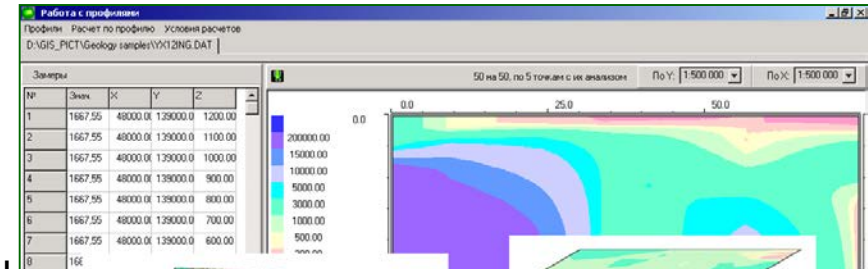
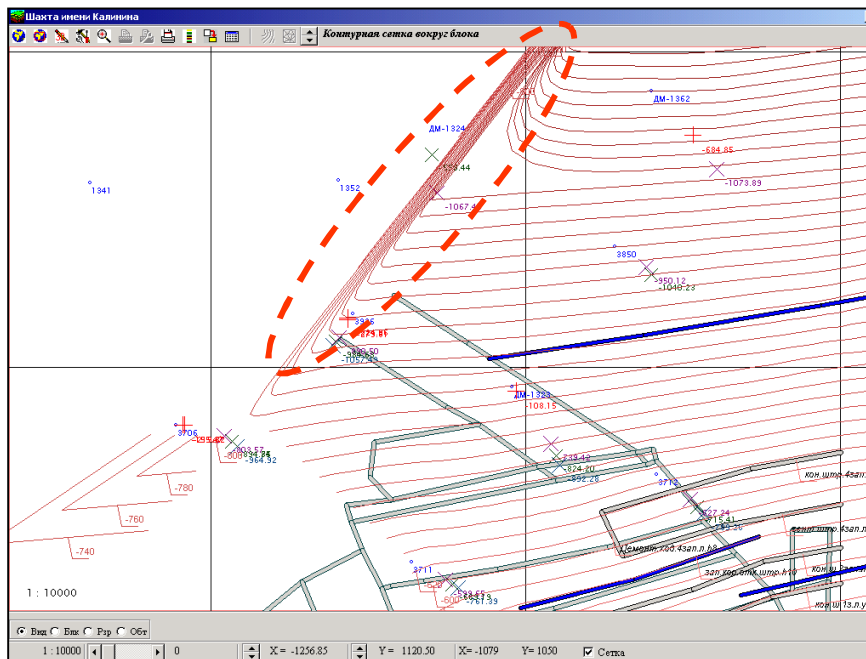


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# GeoMark targets are as follows:

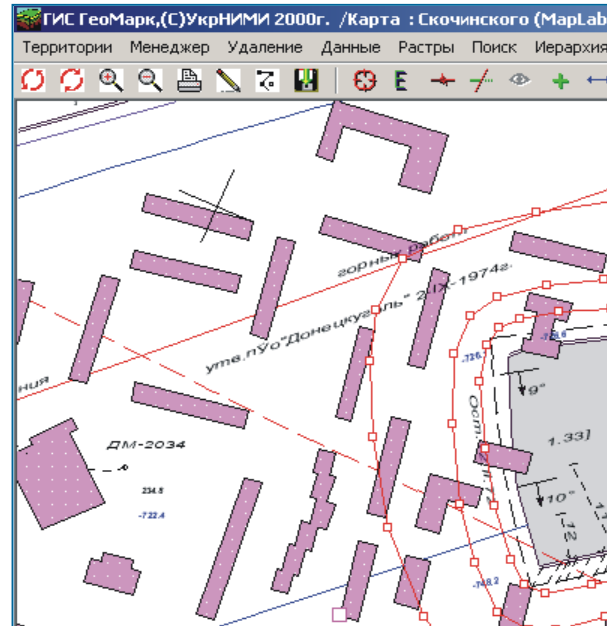
- to predict or calculate state, composition and properties of rock mass in any point of the Earth's slice within mine field on the basis of in situ geological, geophysical, geochemical observations and other types of observations;



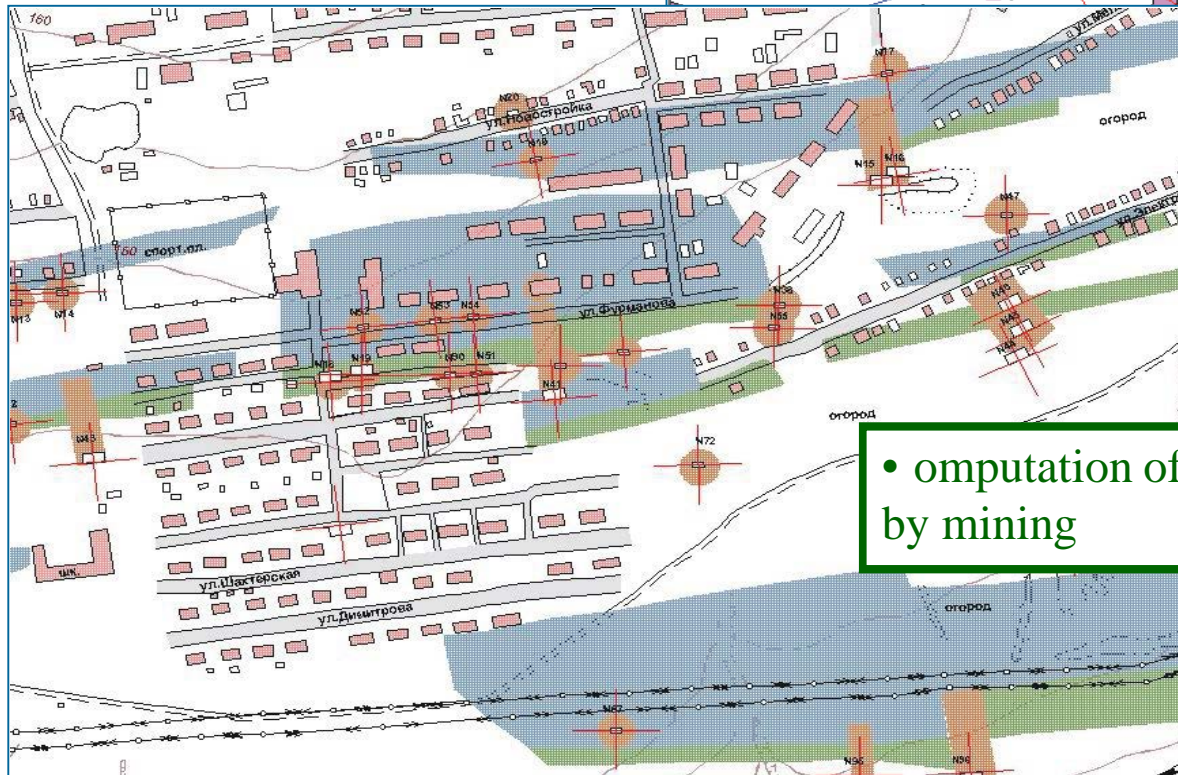
- to solve a wide range of problems related to the determination of tectonic dislocations with a break of continuity of rock mass;



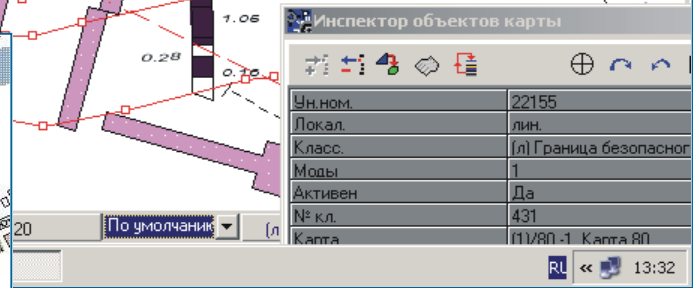
- to solve computation problems of surface subsidence displacement and deformations under the impact of extraction of coal seams;



• computation of allowable surface deformations under a built up territory



• computation of zones of underflooding induced by mining

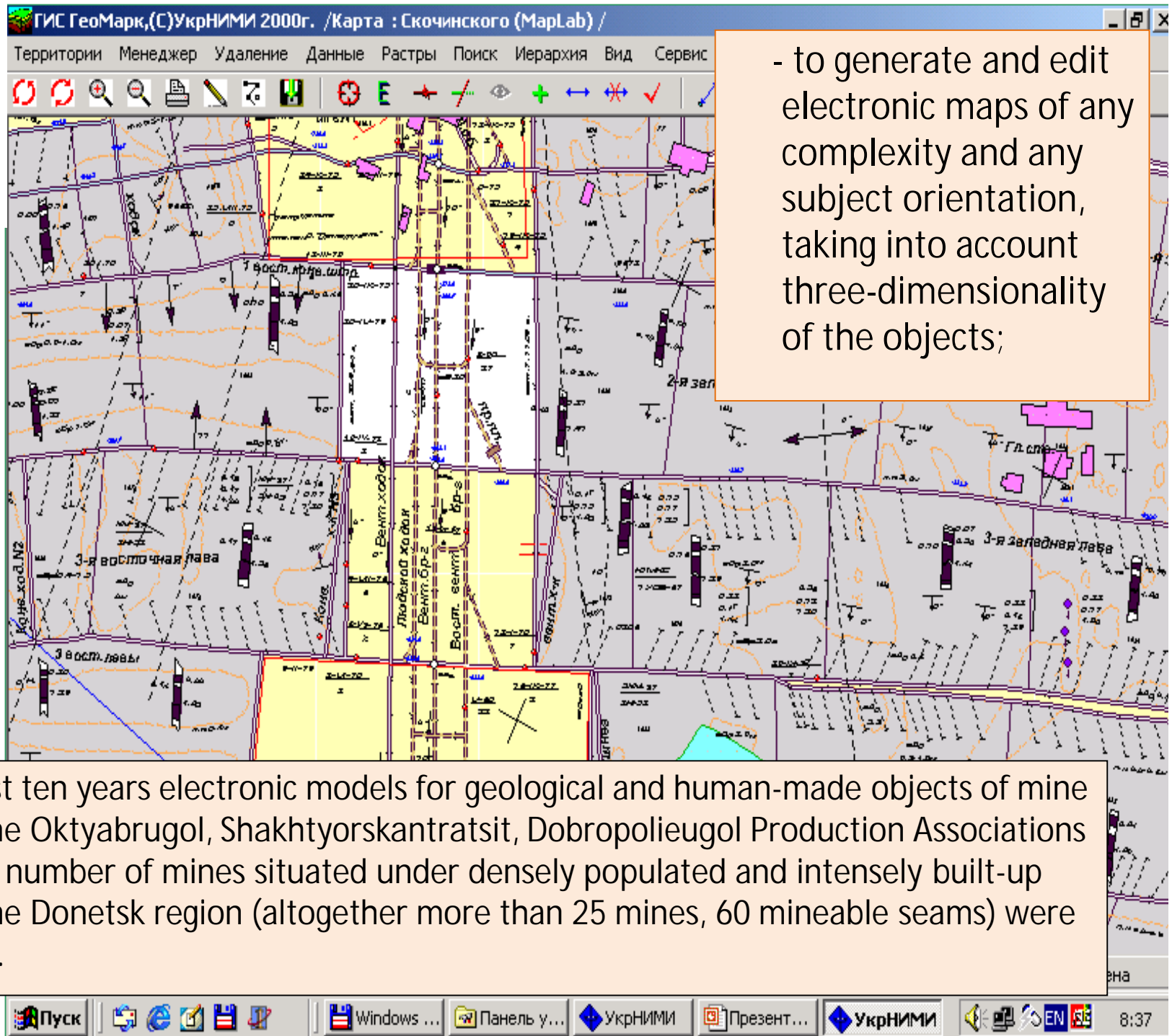




Donbass Arena Football Stadium.



The Stadium is constructed in complicated mining-geological conditions (intersection of overburden exposures of the Frantsuzsky and Koksovy thrust faults) under the guidelines of UkrNIMI experts.



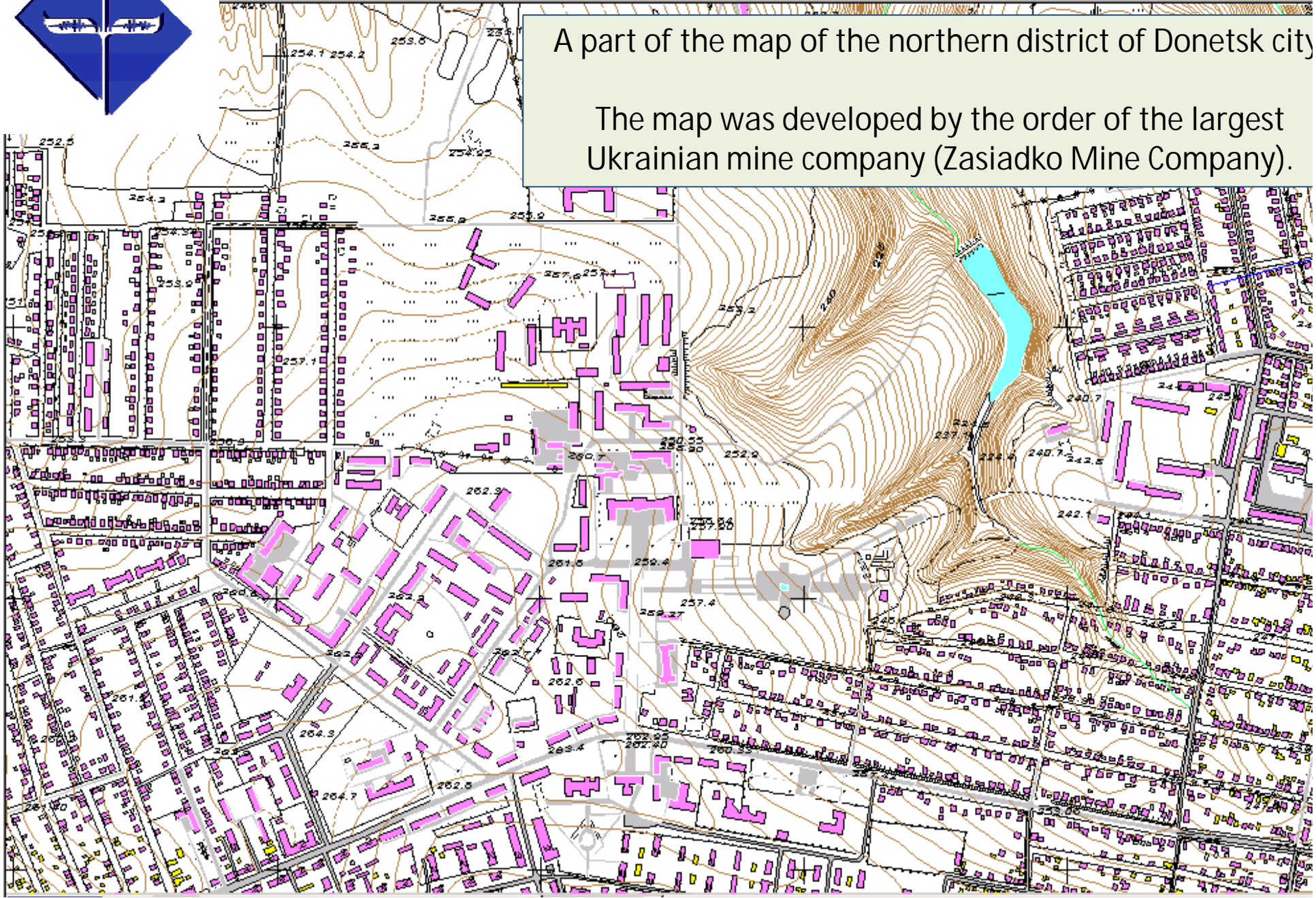
- to generate and edit electronic maps of any complexity and any subject orientation, taking into account three-dimensionality of the objects;

- For the last ten years electronic models for geological and human-made objects of mine fields of the Oktyabrugol, Shaktyorskantratsit, Dobropolieugol Production Associations (PA) and a number of mines situated under densely populated and intensely built-up areas of the Donetsk region (altogether more than 25 mines, 60 mineable seams) were generated.



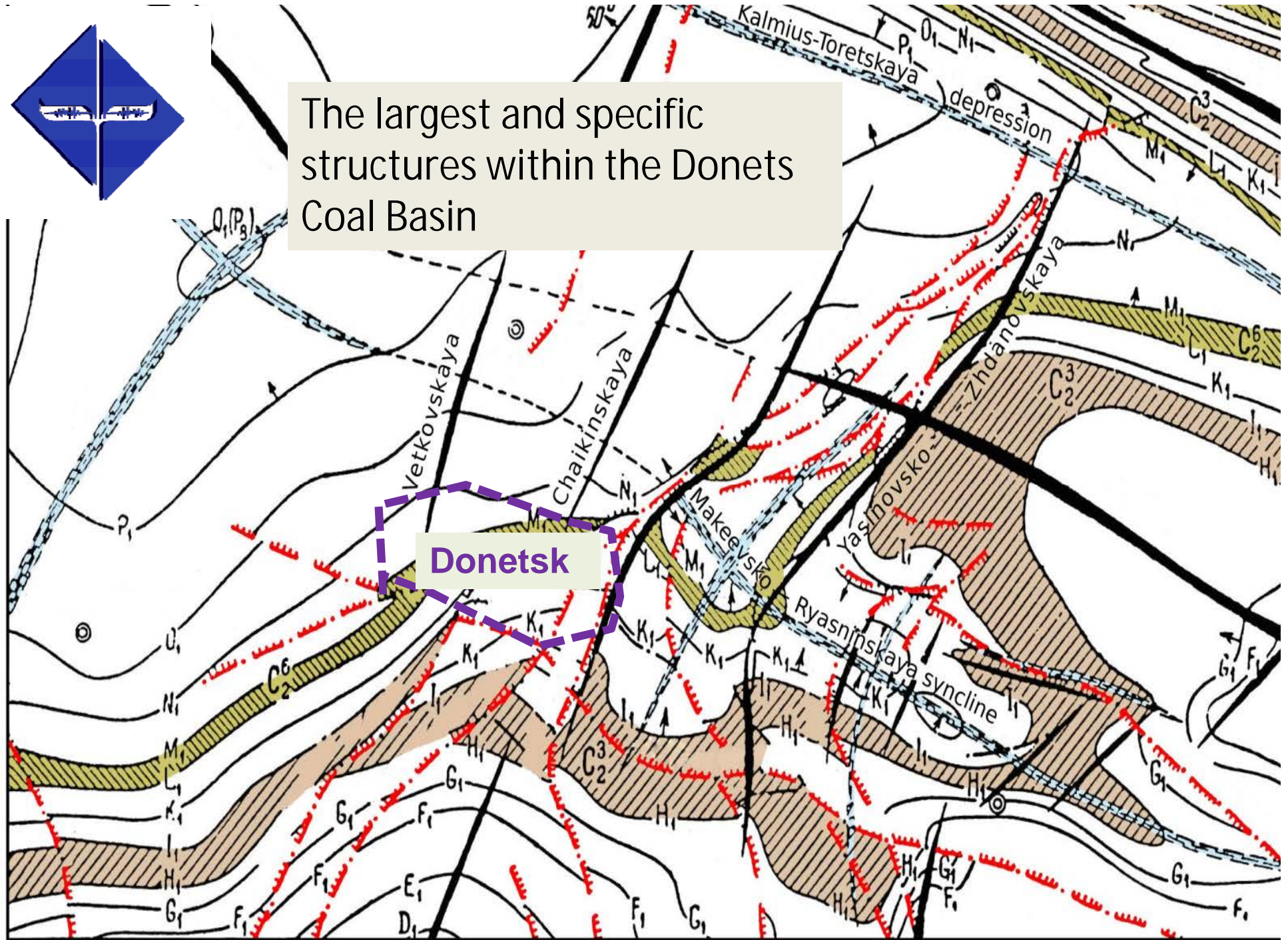
A part of the map of the northern district of Donetsk city

The map was developed by the order of the largest Ukrainian mine company (Zasiadko Mine Company).





The largest and specific structures within the Donets Coal Basin



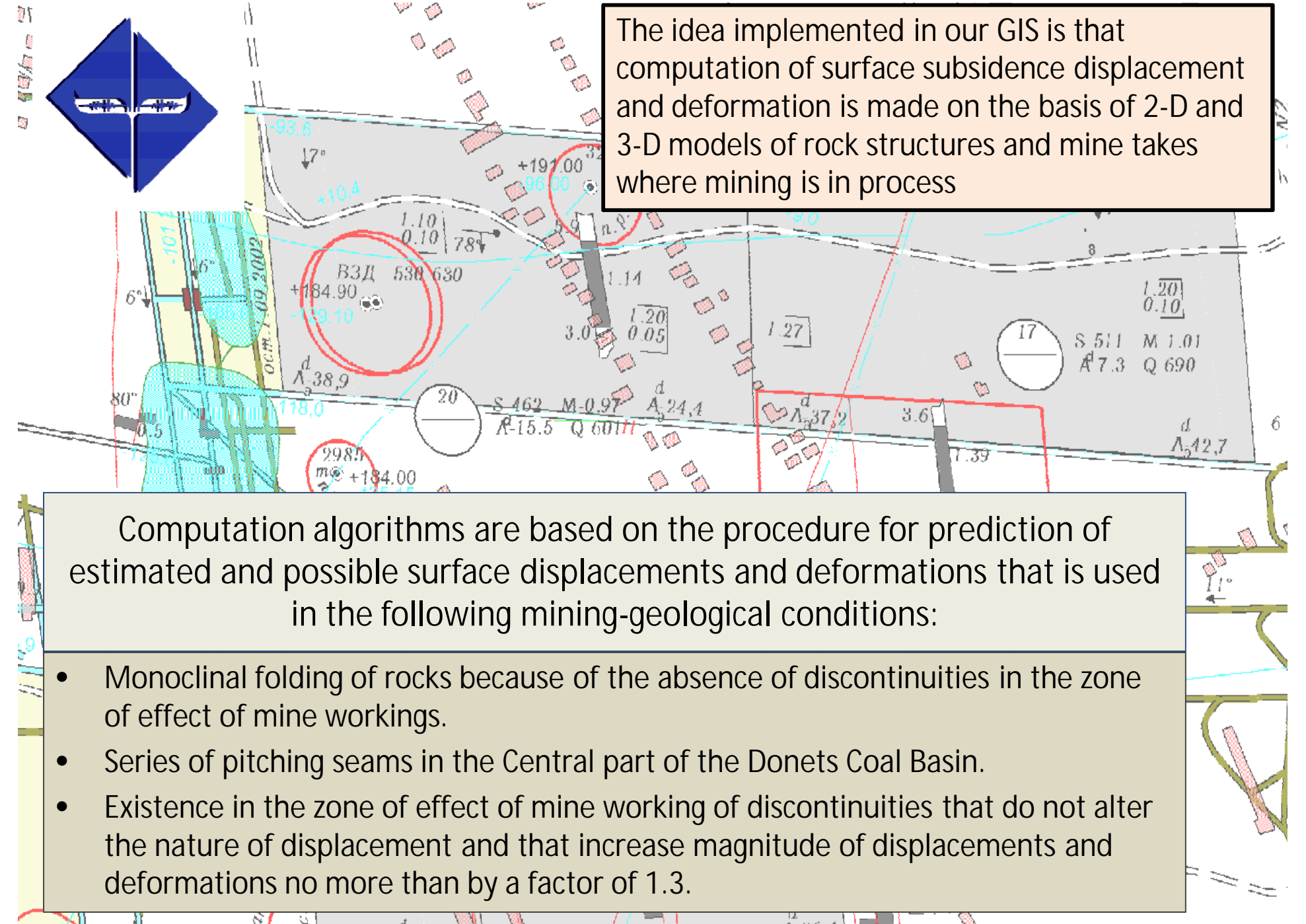
Underground mining of coal seams results in disturbance of steady state of rocks and their movement which are manifested in occurrence of the areas of ground subsidence.

Some points move non-uniformly in consequence of which vertical (bending, curvature) and horizontal (stretching, squeezing) deformations as well as cracking, benches, sinkholes occur.

As a result, structures located in mining-affected zones are under loads and are being damaged.





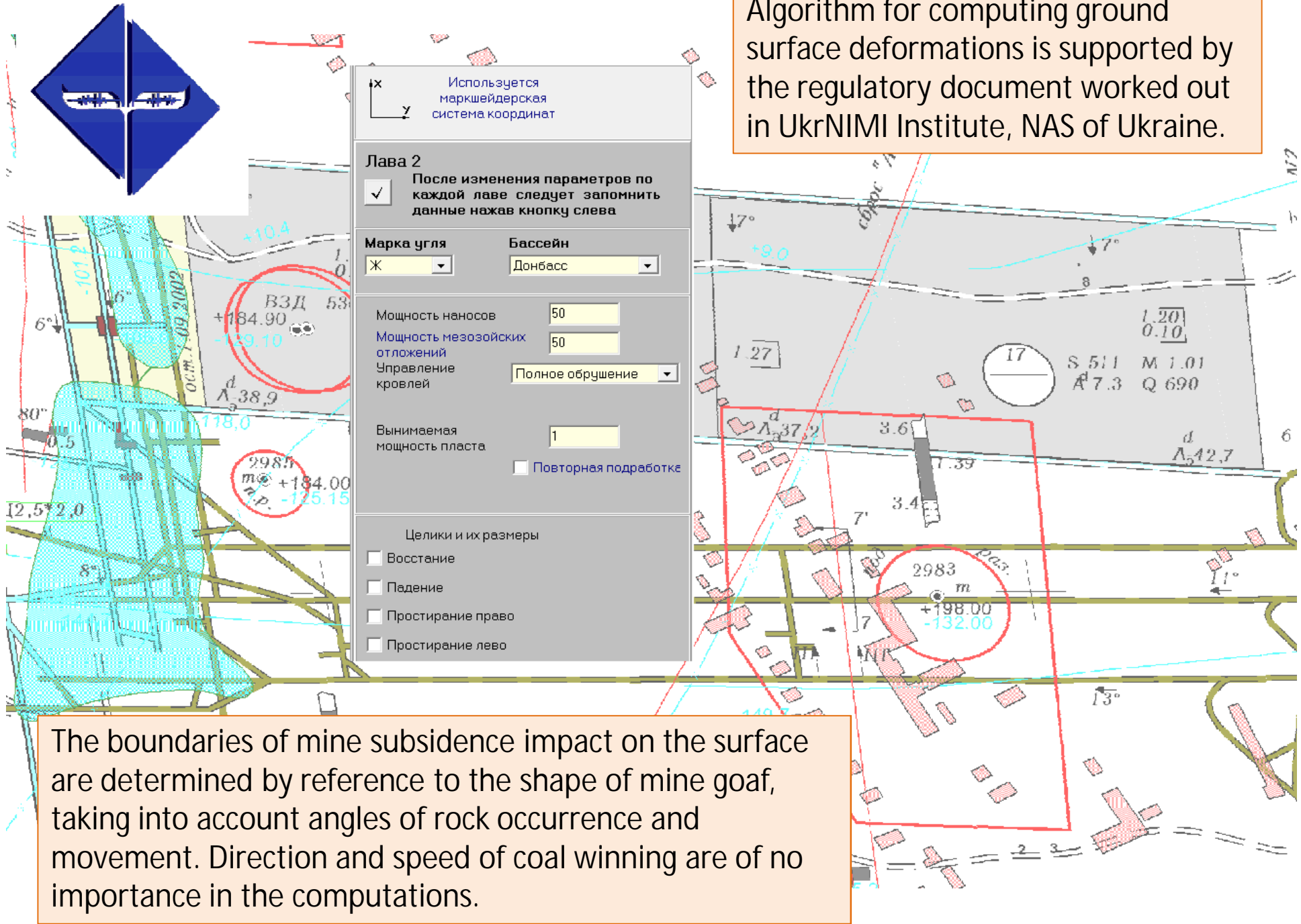


The idea implemented in our GIS is that computation of surface subsidence displacement and deformation is made on the basis of 2-D and 3-D models of rock structures and mine takes where mining is in process

Computation algorithms are based on the procedure for prediction of estimated and possible surface displacements and deformations that is used in the following mining-geological conditions:

- Monoclinical folding of rocks because of the absence of discontinuities in the zone of effect of mine workings.
- Series of pitching seams in the Central part of the Donets Coal Basin.
- Existence in the zone of effect of mine working of discontinuities that do not alter the nature of displacement and that increase magnitude of displacements and deformations no more than by a factor of 1.3.

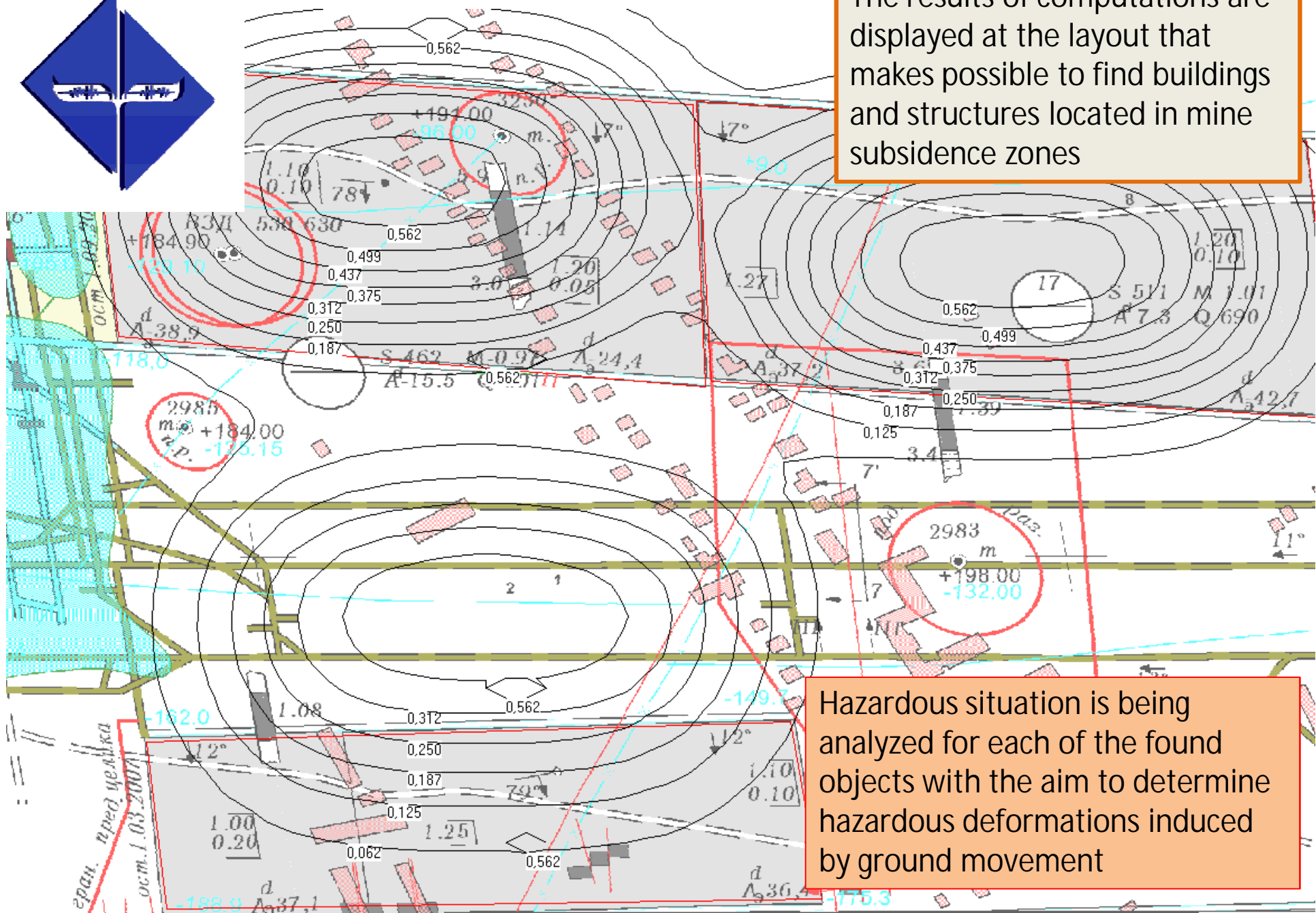
Algorithm for computing ground surface deformations is supported by the regulatory document worked out in UkrNIMI Institute, NAS of Ukraine.



The boundaries of mine subsidence impact on the surface are determined by reference to the shape of mine goaf, taking into account angles of rock occurrence and movement. Direction and speed of coal winning are of no importance in the computations.



The results of computations are displayed at the layout that makes possible to find buildings and structures located in mine subsidence zones



Hazardous situation is being analyzed for each of the found objects with the aim to determine hazardous deformations induced by ground movement



Essential importance are several features of GeoMark geoinformation system:

- a three-dimensional representation of topology and geometrical description of natural, geologic and industrial objects,
- employment of specialized object classification

The system GeoMark supports data exchange with the most popular in the world and in Ukraine systems of such purpose. It allows involving into operation maps obtained with other GIS. The module makes possible to import objects into maps of different formats and target classifiers and to combine maps of different initial layouts into a single whole.

