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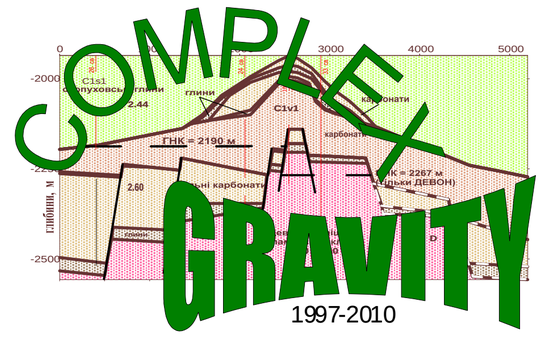
Gravitational monitoring substantiation by imitation modelling methods

Обґрунтування гравітаційного моніторингу методами імітаційного моделювання

S.G. Anikeyev, B.B. Hablovskyi, A.I. Tsiupiak
(Ivano-Frankivsk national technical university of oil and gas)



The imitation modelling of gravitational monitoring makes it possible to determine the reflection character and intensity in the gravitational anomalies of spatial-temporal local changes in the densities structure distribution in the geological section and, conversely, to explore restore these changes, even small in size, from data about gravitational spatial-temporal local anomalies.

The method of imitation modelling is a tool for assessing the ability high accuracy gravitational monitoring solve complex tasks of prognosis of posttech and natural ecologically dangerous processes such as karst formation, a rock massif integrity destruction or control over mineral deposits exploitation.

Interpretation technologies tests based on physic-geological models, as close as possible to the geological environments structure is an imitation modelling, and is the methodological principle of the theory and practice of potential fields interpretation.

The methodology of the imitation gravitational modelling of changes in its structure over time :

1. Imitation ("real") environment models (IEM) creation.
2. Solving the gravity direct for the IEM and selecting the theoretical (imitation) fields as "field observed".
3. Formation of "a priori" data on the IEM structure: the definition what is "known" about the IEM structure, and the formalization of these a priori data in the form of the primary a priori model (AEM).
4. The "geological task" formulation about the IEM structure restoration.
5. The "geological hypotheses" formation about the probable IEM structure.
6. The hypotheses formalization in the form of probable additions AEM.
7. The hypotheses realization by constructing ε-equivalent's models (EEM) by means of gravity inversion (GI) solution by the method and technologies being tested (here ε - error of constructing).
8. Comparative analysis of the AEM and an EEMs in order to choose the optimal environment model (OEM), or the new hypotheses formation.
9. Assessment of the IEM elements reproduction probability and accuracy in OEM.

Estimation of the reliability degree gravimetric method forecasting of underground sulfur smelting dynamics on the natural sulfur deposit

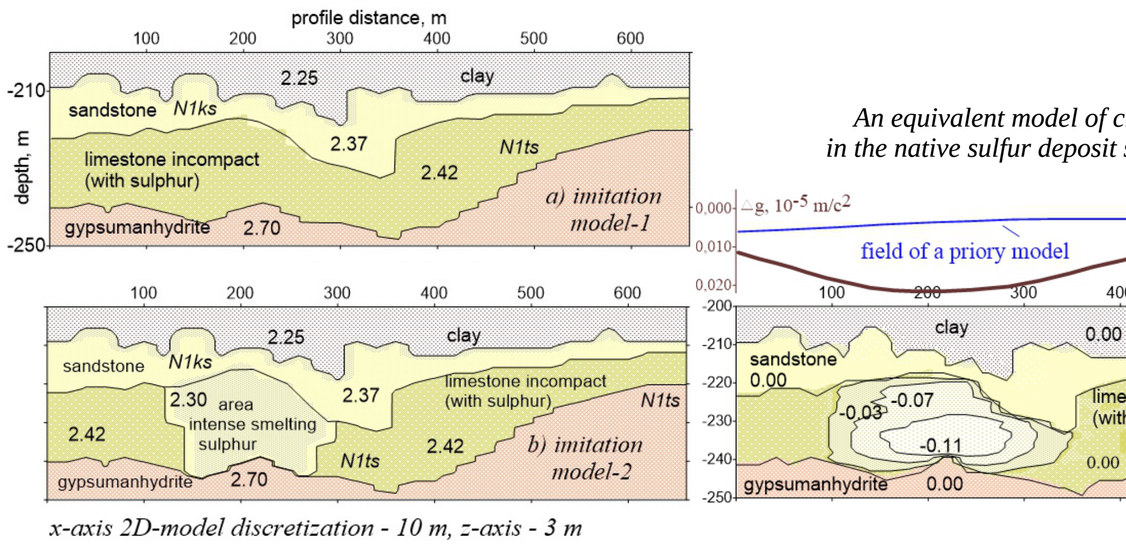


Figure 1 Imitation models of a section native sulfur deposits

Figure 2
An equivalent model of changes in the excess dense distribution in the native sulfur deposit section after underground sulfur smelting

-0.07 - excess density of rock, 10^3 kg/m^3;

parameters of gravity inversion solution.
finish discrepancy - 0.001×10^{-5} m/c^2,
first discrepancy - 0.018×10^{-5} m/c^2,
numbers of iterations - 12

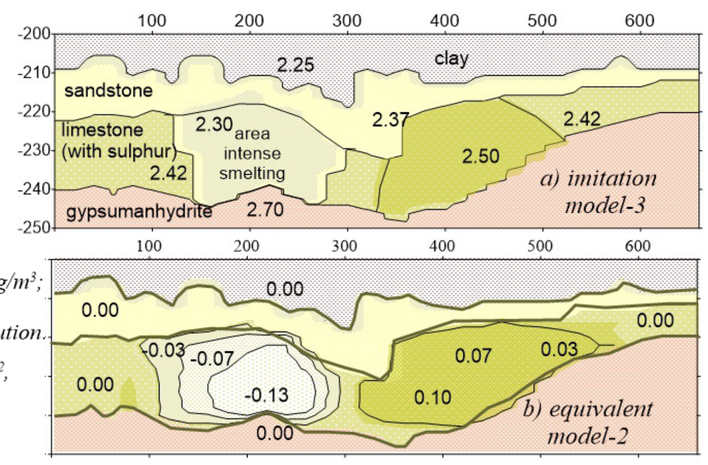


Figure 3
An imitation and equivalent model of changes in the densities distribution in a native sulfur deposit after underground smelting of sulfur

Dangerous post-man-made karst formation high-precision gravity monitoring substantiation (detection and control over their development) in mines fields conditions in potassium salt deposits

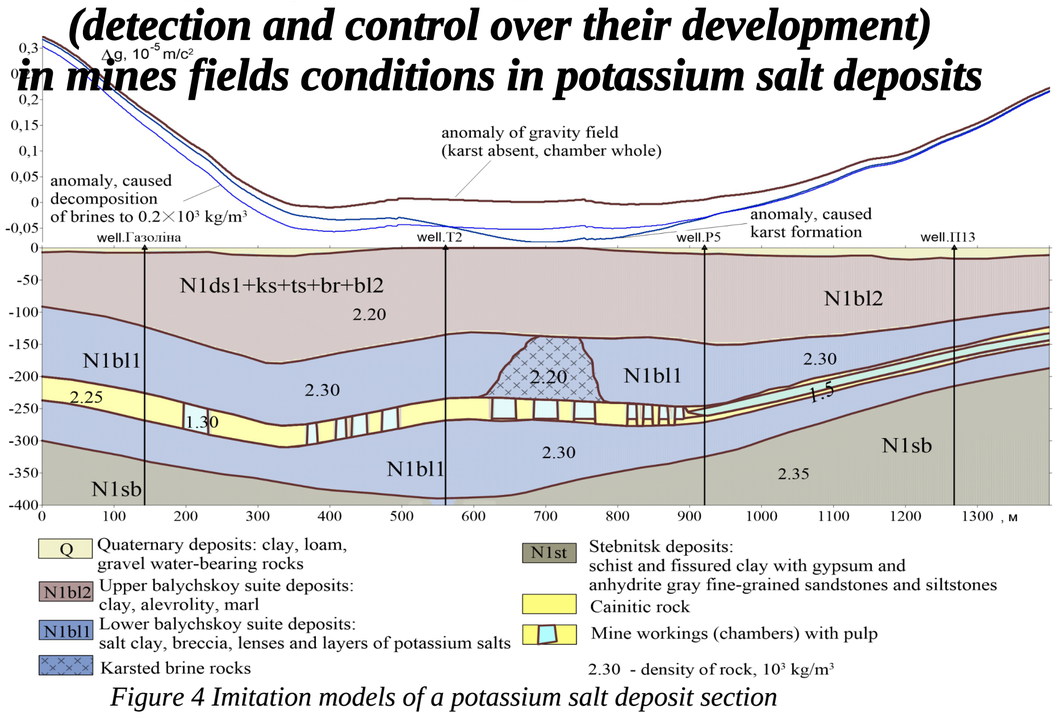


Figure 4 Imitation models of a potassium salt deposit section

Control of the gas-water contact (GWC) level in the hydrocarbons deposit

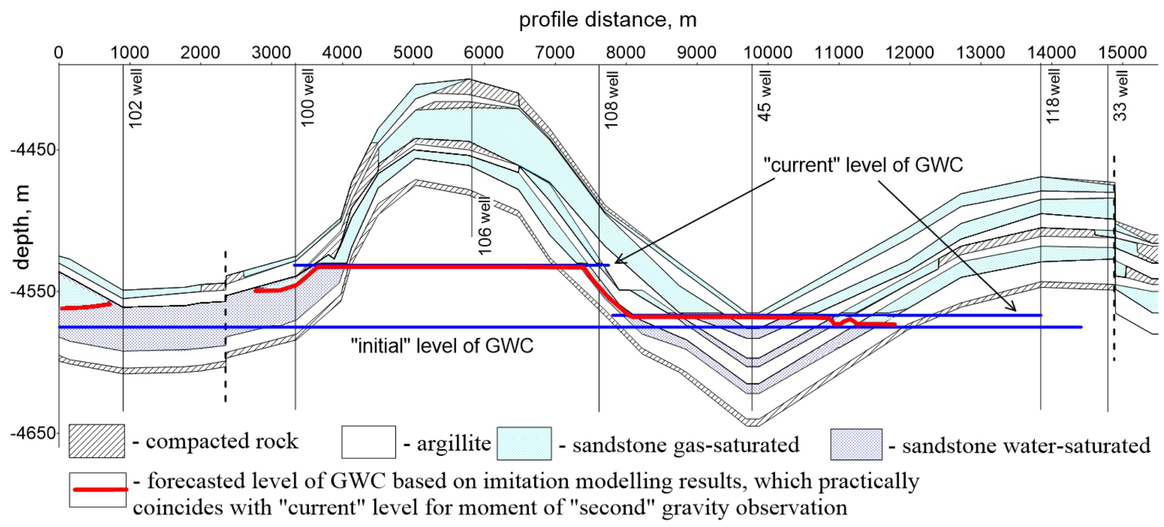


Figure 5 Detection of the GWC "current" level in a productive horizon of the Berezivsky gas condensate field in the Dnipro-Donetsk depression according to imitation of gravity monitoring