Fig. 1 shows the result of computer 2D-simulation of salt diapir growing. Fig. 2. shows the comparison of salt diapir growing in case of different thickness of sediment overburden. Fig. 3. shows the comparison of salt diapir growing with and without erosion.

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Digital modeling of the rift processes in the Dniepr-Donets Basin, Ukraine

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Institute of Geophysics, National Academy of Sciences of Ukraine, Kiev, Ukraine

A model of the lithosphere, incorporating both dynamic and thermal processes, has been developed by solving a coupled system of differential equations governing stress and temperature in a 2D block-structured geophysical medium [Starostenko et al., 1999; 2001]. Using the kinetic energy of block k in functional form:

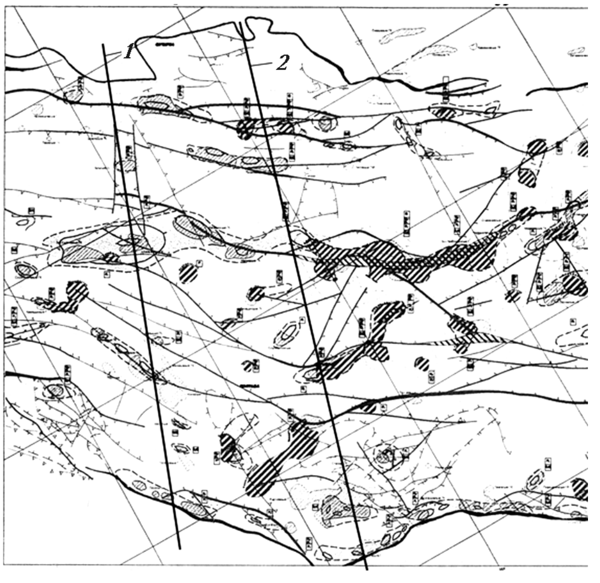

Fig. 1. Locations of seismic reflection profile Zachepilovka — Belsk (*1*) and Mikhailovka — Prokopenki (*2*) in the central part of the Dnieper-Donets Basin (DDB).

$$T_k = \frac{m_k}{2}\left\{ \upsilon_{k-1}^2 + 2\beta\left(r_{ok-1} - r_{k-1}\right)\upsilon_{k-1}\frac{\partial\upsilon_{k-1}}{\partial\vec{r}_{ok-1}} + \right.$$

$$\left. + \beta^2\left(r_{ok} - r_{k-1}\right)^2\left(\frac{\partial\upsilon_{k-1}}{\partial r_{ok-1}}\right)^2 \right\} +$$

$$+ \frac{1}{2}\left(1 + b_k\right)^2\left(\omega_{k-1}\times\omega_{k-1}\right)I_{k-1}^{l,j} +$$

$$+ I_{k-1}^{l,j}\left\{\frac{\beta^2}{2}\left(div\,\upsilon_{k-1}\right)^2 + \beta^2\frac{\partial\upsilon_{k-1}}{\partial r_{ok-1}}div\upsilon_{k-1}\right\} +$$

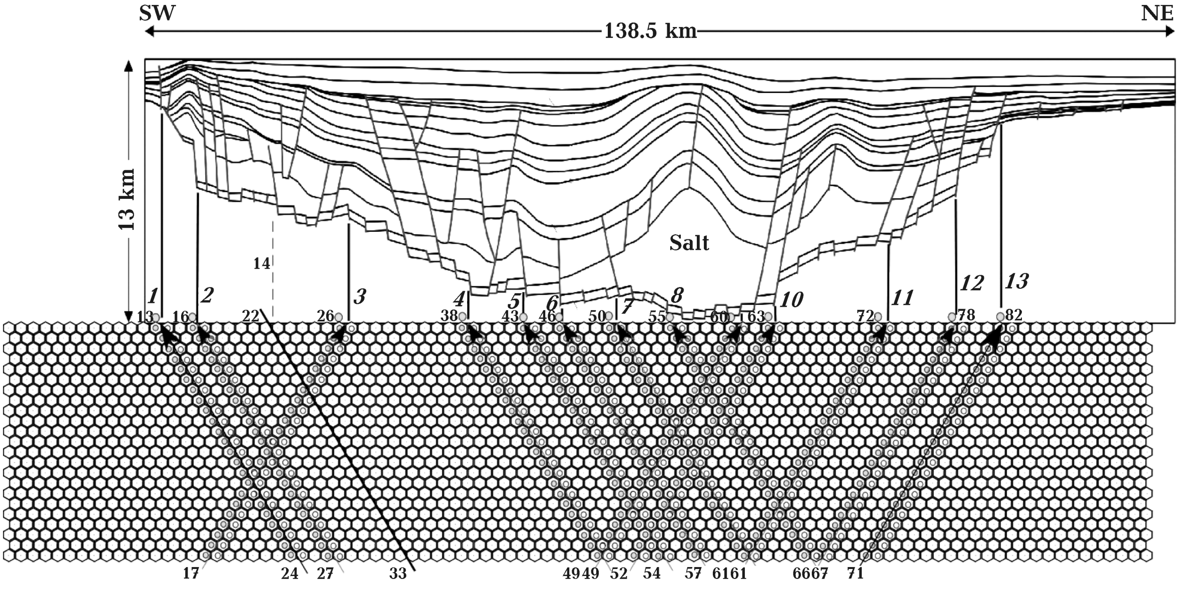

Fig. 2. Initial location of blocked layers of basin basement according to Zachepilovka — Belsk seismic profile: *1* ¯0 km (+); *2* ¯5.0 km (+); *3* ¯24.6 km (–); *4* ¯41 km (+); *5* ¯48 km (+); *6* ¯53 km (+); *7* ¯61 km (+); *8* ¯68 km (+); *9* ¯78 km (–); *10* ¯82 km (–); *11*¯ 98 km (–); *12* ¯106 km (–); *13* ¯ 113 km (–).

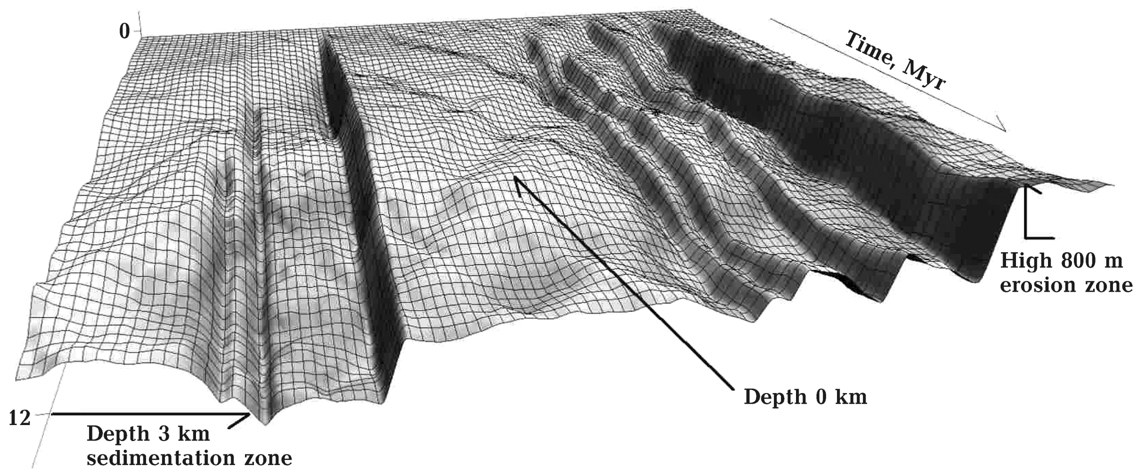

Fig. 3. Model predicted evolution of the sedimentary basin basement horizon along the Zachepilovka — Belsk profile from the beginning of the rift stage (370 Ma) until the late Fammenian.

$$+(1+b_k)[\omega_{k-1}\upsilon_{k-1}]\, m_k\ r_{ok-1}+$$

$$+\frac{1}{2}\beta\upsilon_{k-1} div\upsilon_{k-1} m_k\ r_{ok-1}.$$

We equate the dynamics of block media:

$$\frac{\partial}{\partial t}\left[\frac{\partial T_k}{\partial \mathbf{q}}\right]+\frac{\partial T_k}{\partial \mathbf{q}}+\frac{\partial U_k}{\partial \mathbf{q}}=\mathbf{F}_k'+\mathbf{F}_k''+\mathbf{F}_{kn}+\mathbf{F}_0,$$

$$k=1,2,..,n,$$

where m_k is mass of block k; $I_{k-1}^{l,j}$ is moment-of-inertia tensor of block k–1; $\mathbf{q}$, $\dot{\mathbf{q}}$, ω_I are generalized co-ordinate, linear and angular velocity; $\mathbf{F}_k'$ is summarized frictional force; $\mathbf{F}_k''$, $\mathbf{F}_{kn}$, $\mathbf{F}_0$ — forces owning to energy dissipation, elastic interaction and gravity.

The main rifting phase forming the Dnieper-Donets Basin (DDB) occurred in the Late Devonian (370—

363 Ma). In this approach the digital simulation of whole DDB region showed that after initial stretching and mantle thermal load the set of blocks became active over a period of 12 Myr.

Fig. 1 shows locations of test in presentation seismic reflection profiles Zachepilovka — Belsk (*1*) and Mikhailovka — Prokopenki (*2*) in the central part of the DDB according to geophysical observations. The mathematical 2D dynamic and thermal model is 140 km in length and 120 km deep and comprises three layers — 'granite', 'basalt', and mantle — with appropriate thermo-physical parameters. Fig. 2. shows the initial 'granite' and 'basalt' layers of blocks that have been built according to Zachepilovka — Belsk profile interpretations. Model results are shown in Fig. 3. as evolution of the sedimentary basin basement horizon along the Zachepilovkav — Belsk profile.

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Possibilities of seismic migration for interpretation of wide-angle reflection/refraction profiles

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Institute of Geophysics, National Academy of Sciences of Ukraine, Kiev, Ukraine
alversim@gmail.com

The migration of observed wave field is key procedure of processing and interpretation of seismic materials as gives the chance to receive an image of a deep section of investigated area where boundaries of environment and feature of their structure are accurately traced. At present there are a considerable number of variants of wave field migration transformations, but one of the most important problems still is involving in process of migration of the wave field recorded at wide-angle observations.

The traditional method of reflected field migration is used successfully for that part of a wave field which is received in rather small distant from a source. At rare and irregular observation system the more stability image of environment can be received with application of finite-difference reverse time depth prestack migration [Pilipenko et al., 1999].

The refracted waves dominate in a distant part of a wave field, from a source. In seismic prospecting, at interpretation under the refracted waves frequently understand waves which conform to theories of head wave propagation sliding along refracting border and thus not penetrate into refracting thickness. Such understanding of the refracted waves mismatches their real propagation in the environment. However, accounting of their penetration into in refracting thickness leads to complexities, as in theoretical and practical realization of migration. Thus the main problem of wide application of the refracted diving wave field migration is ambiguity in definition position of wave refraction (that is connected with two points of refraction: a penetration in refracting thickness and an exit from it) as opposed to uniquely fixing of a reflection place for the reflected waves. Therefore, the refracted wave field finite-difference migration, offered by Pylypenko V. N. in the eighties of the twentieth century [Pylypenko, Sokolovskaya, 1990] remains while the unique method which is based on refracted diving waves. The given method of migration provides carrying over of a source from a day surface on a surface of refracting boundary in a point of a wave penetration into refracting thickness and to form the boundary image on a point of an exit of wave in covering layer [Pylypenko, Verpakhovskaya, 2003]. Such approach has allowed realizing a correct method of refracted wave field finite-difference migration. The developed method has been successfully tested on a practical seismic material, observed in different parts of the world [Pylypenko, Goncharov, 2000; Makris et al., 2008; Pavlenkova et al., 2009].

Finite-difference migration of refracted wave field