Pezdic J. etc. Laboratory simulation of adsorption-desorption processes on different lignite lithotypes from the Velenje lignite mine // RMZ — Mater. and Geoenv. — 1999. — **46**, № 3. — P. 555—568.

Psakhie S. G. etc. Movable cellular automata method for simulating materials with mesostructure // Theor. Appl. Fracture Mech. — 2001. — № 37. — P. 311—334.

Wolfram S. Theory and applications of cellular automata. — New Jersey: World Scientific, 1986. — 560 p.

Zavsek S. etc. Application of hybrid cellular automaton approach for computer-aided examination and forecast of strength properties of heterogeneous coal-beds // Proc. 11th Int. Conf. on Fracture, Turin, Italy, 2005. — P. 4502/1–4502/6.

Geodynamic and geotectonic position of the geoisostatic stress fields of seismically active segments of Ukraine

© ***M. Dovbnich, S. Demianets, 2010***

National Mining University, Dniepropetrovsk, Ukraine
dovbnichm@mail.ru

The majority of Ukrainian territory is situated in the Eastern European platform. Meanwhile the most seismically active is the young tectonic structures of its south and south-west framing. First of all it's a zone of articulation of the Eastern and the Southern Carpathians — Vrancea zone and Crimean seismically active segment. In the historical past the earthquakes repeatedly leaded to the catastrophic consequences.

The main geodynamic factor, defined the regions seismicity, is a moving and interaction of separate tectonosphere fragments — tectonic blocks. Studying the nature of tectonic forces, caused different scale geodynamic processes behavior, is an actual question in solving the fundamental and applied problems. The analysis of geological environment stress-deformed state is the key section in chain of the nature and the prognosis of seismic events investigation.

The aim of the work — using the satellite and ground gravity data to make an analysis of the geological environment stress-deformed state, occurred as a result of the disturbances of the tectonosphere equilibrium state and it further usage in the investigation of the nature and the prognosis of seismic events.

Authors investigate the disturbances of the Earth equilibrium state and connected with them tectonosphere stress fields — effects, caused by the deviation of factual Earth Figure — geoid from theoretical equilibrium Figure — ellipsoid. These investigations based on the phenomena called geoisostasy. The model of the equilibrium state of the rotating Earth, offered by K. F. Tyapkin, geoisostasy is well described in geological and geophysical literature [Tyapkin, 1984]. The minimization energy principle, in accordance with which every natural dynamic system is aspired to minimize its interior energy, is the physically mathematics basis of this conception. The equilibrium Figure of our planet is the rotating ellipsoid. In accordance with this principle, the planet will reach the hydrostatic equilibrium in the moment, when the deviation between geoid and ellipsoid in whole Earth will be equivalent to zero. Therefore, evolving Earth aspire to minimize the height of geoid anomalies. Otherwise, the Earth tried to reach the hydrostatic equilibrium, in which its equilibrium form will take the ellipsoid form. Meanwhile, the geoid deviations from ellipsoid, caused by the heterogeneities of tectonic nature inside the planet can be used as an equilibrium criterion. As far as there is the geoid deviations from ellipsoid, so in accordance with the mentioned above principle there must be forces aspired to smooth those deviations, to make it equivalent with the equilibrium Figure. Therefore the mechanic stresses will occur in the tectonosphere of the planet. The law of the stress distribution will be defined as a function of the geoid deviation from the ellipsoid appropriated to it. The value that was taken as a deviation measure from the equilibrium state is suitable because it can be calculated using the results of the Earth gravity field studying based on satellite and ground data. The tectonosphere stresses connect with these disturbances can be estimated using the data of the equilibrium state disturbances in time and in space [Dovbnich, 2008].

Taking into account that tectonosphere has difficult fault-block building it becomes clear that the

density boundaries appeared when the displacements of the tectonic blocks happen. In other words the relative tectonosphere block displacements leaded to appearance of lateral density heterogeneities, reflected in the geoid anomalies relatively the reference ellipsoid of the Earth, and in tectonosphere the stresses will appear as a result of forces aspired to smooth those disturbances of the equilibrium state of the rotating Earth [Demianets, Dovbnich, 2010]. The stress fields' analysis allows to answer the row of questions concern of the nature and the prognosis of the dangerous geodynamic processes.

Nowadays studying the orbits of the artificial Earth satellites broaden our knowledge about the geoid anomalies significantly. In this work we use the geoid anomalies, got in the framework of GRACE project (Gravity Recovery And Climate Experiment). But in spite of the increasing accuracy of satellite measurements of geoid anomalies there usage is possible only in regional investigations in the near future. Authors developed technology of the geoid anomalies restoration using the ground gravity data based on the approximating approach using the gravity force in the Faye's reduction (free-air anomalies).

The calculation of the stress fields using the satellite gravimetry is done in the Ukrainian territory. The comparison of the earthquakes with the geoisostatic nature stress fields is done in the Vrancea zone and in Crimea. It can be seen on the schemes the majority earthquakes are corresponded with the maximums of the tangent stresses. As it was mentioned above, the disturbances of the equilibrium state happen in case if the tectonosphere blocks displacements is vertical. Meanwhile the tangent stresses localized blocks boundaries, for which the relative vertical displacements take place. Therefore, it is possible to assert that the whole seismicity of the regions defines by the relative tectonosphere block displacements with the significant vertical component. It was proved by that in case with the North Anatolian Fault, represented itself as a practically clean shear and which is one of the main seismic generating structures of Turkey, there is no interrelation between the earthquake epicenters and the tangent geoisostatic stresses. It can be seen only correlation between the earthquake epicenters with the chain of compression zone along the fault.

More detailed buildings are done using the results of gravimetry survey in 1:200000 scales. First of all the transformation of gravitational field into the Bouguer reduction based on the frequency selection is done. This transform suggested by author [Dovbnich, 2005], allows to localize anomalygenerating objects in plan and in section. Building the cutsets of results of gravity fields transformation along the profiles, crossing the Vrancea zone and the Crimean segment in the NW-SE direction, there comparison with the earthquake centers allows to assert: In both case seismic events corresponded with the block boundaries, for which the density boundaries corresponded, there nature was described above. Just these boundaries are reflected on these sections. In the same time there are principle differences:

1) the free-air, Bouguer anomalies and the relief are identical for the Crimean segment, in the same time in the Vrancea zone the Bouguer anomaly are rather different than free-air anomaly and relief similar each others;

2) the penetration depth of the vertical density boundaries in tectonosphere are rather different and it is in good agreement with observed seismicity. These facts are the convincing evidence of differs in the forming and in the development of seismogenic Vrancea zone and Crimea: in the first case the seismicity is defined by the raised up blocks of Carpathian orogen relatively the Moesian Platlform, and in the second case — by blocks lowering of the Black Sea relatively to the Crimean orogen.

The calculation and the analysis of the geoisostatic stresses using the ground gravimetry was done for the detailed study of the stress state and of internal structure of seismically active segments: the Carpathian and the Crimea.

The results showed that in the geoisostatic stress fields the different scale block boundaries of the Earth crust are reflected. The block boundaries, on which the vertical displacements happen, reflected as linear elongate anomalies of the maximum of the tangent stresses, subhorizontal block displacement — as a axes of linear elongate anomalies of the maximum of the tangent stresses. The elements that are the tectonic basis of the seismic generating structures are reflected in the stresses.

Just with these stresses, practically with the block boundaries connect the majority of the seismic events. Taking into account the high values of geoisostatic stresses we can assert that the neotectonic activity of the dedicated zones is high. Probably, the high seismicity is connected with it, and also possibly landslide processes, anomaly values of modern displacement of the Earth crust and others. In whole the seismicity of the studying region defined as fracture zones crossings; the earthquake epicenter distribution features are defined by boundaries of interactions of the separate fragments — less order tectonic blocks.

References

Demianets S., Dovbnich M. Satellite and Ground Gravimetry — The Innovative Approaches in Studying the Earthquake Nature and Prognosis // Extended abstracts, 72th EAGE Conference, Exhibition. — Barcelona (Spain), 2010. — CD.

Dovbnich M. M. Disturbance of geoisostasy and tectonoshere stressed state // Geophys. J. — 2008. — **30**, № 4. — P. 123—132 (in Russian).

Dovbnich M. Geological model of greenstone belts of the Ukrainian shield on the gravimetry data // Extended abstracts, 67th EAGE Conference, Exhibition. — Madrid (Spain), 2005. — CD.

Tyapkin K. F. A new isostatic model of the Earth // Trans. Hung. Geophys. Inst. — 1984. — № 30. — P. 3— 10.

The seasonal location of the core of the Earth — is an important geodynamic factor of the planet

© *O. Drevitska, 2010*

National Medical Academy of Postgraduate Education named after P. L. Shupyk, Ministry of Health of Ukraine, Kiev, Ukraine
drevitska@ukr.net

The scientific literature is not elaborate enough to consider the importance of the seasonal location of the core of the Earth as a factor of geodynamic processes [Greiner-Mai et al., 2003; Antonov, Kondratjev, 2004; Malyshkov Yu., Malyshkov S., 2009]. In our work we present a logical rational of the concept.

The first position. Newton's second law of the force of gravity states that there is a direct proportional relation to the mass of bodies and inversely proportional to the distance between them. Weight is calculated as the product of the specific body weight and its volume. The core of the Earth has a larger proportion (this fact is proved by numerous gravimetric studies) [http://uk.wikipedia.org/wiki/Geophysic].

It is known that the Earth's core consists of 90% iron while the mantle contains of only 10 % iron and a proportion of the other elements — oxygen, silicon and magnesium [Allegre et al., 1995].

Therefore, the force of gravity per unit volume of Earth's core is higher and the nucleus constantly presses the inside the mantle. Pressure is directed towards the Sun and as the Earth rotates the constantly changing area of highest pressure is inside the kernel.

So, the Earth's core is heavier, and in accordance with Newton's second law, more attracted to the sun. This is partly accounted for in the scientific literature.

The second position. The axis of the Earth is tilted 23 degrees to the ecliptic plane. Earth is facing the Sun at an angle, in the summer inside the nucleus at an angle of more pressure on the northern hemisphere, and in the winter — on the Southern.

Findings from the provisions of 1 and 2.

The core of the Earth not only rotates inside the planet, but also seasonally shifts to the Northern Hemisphere and then to the Southern, as shown in the picture (Figure).

In the presented picture (when the Earth is right) shows how the Earth's core is offset at an angle of 23 degrees in the direction of the Northern Hemisphere, when we have the summer season.

Inside — the pressure on the mantle. The picture also shows (when the Earth is on the left) as the core is offset at an angle to the Southern Hemisphere, when we have the winter season.

Such internal displacement of the Earth's core (as conventionally shown "on the cut") reaches its highest value in the following periods: December—January and June—July.

The pressure inside the kernel, its friction and seasonal shifts significantly affects:

- earthquakes and volcanoes,
- the movement of continents and the formation of mountain ranges,
- the formation of plumes, subduction, nutation, and other geodynamic processes.

During the summer, forming elevations in the Northern Hemisphere, are active volcanoes, earthquakes that occur in the projections of the nucleus and the more pressure field "breaks" of tectonic