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P. I. Pigulevskiy[1],
orcid.org/0000-0001-6163-4486,
O. M. Stovas[2],
orcid.org/0000-0002-2294-9626

1 – Dnipropetrovsk Geophysical Expedition “Dniprogeofizika”, Dnipro, Ukraine, e-mail: pigulev@ukr.net
2 – Norwegian University of Science and Technology, Trondheim, the Kingdom of Norway

SEISMIC GEOTRAVERSE “GRANIT” (UKRAINIAN PART). REANIMATION

Purpose. To acquaint a wide range of geologists and geophysicists with the results of research on the “Granit” geotraverse.

Methodology. The studies were carried out by the methods of reflected waves and a common midpoint (CMP). The basic parameters of the acquisition system are: one side; fold is 12; central (when detailing, a fold is 24); the source step is 200 m; step and the receiver step is 50 m; the offset step is 100 m; cable length is 4,750 m; the maximum offset is 4,850 m. The recorded time length on the entire profile is 30 seconds. The source of excitation of elastic vibrations is explosion in wells with a mass of charge of 15 kg.

Findings. Geotraverse “Granit” passes through Odesa, Mykolaiv, Dnipro, Kharkiv regions and crosses the large geological structures: South Ukrainian monocline, Ukrainian shield, Dnieper-Donetsk depression. Sections of all geostructures are characterized by a high level of saturation by short, unevenly distributed reflective elements occupying positions from sub-horizontal to steeply inclined ones in space from. The reflective elements carry information about the nature of stratification, deformation and stress state of the structures of the consolidated crust and the upper mantle. The consolidated crust and the upper mantle have a complicated surface-block structure that is subject to certain spatial-correlated connections. The crust-mantle transition is a complex laterally changeable area, with a thickness of 3 to 7 km, determined by systems of sub-horizontal stratifications, expressed by the concentration of reflection zones.

Originality. Research on the “Granit” geotraverse allowed completing information on the seismic model of the crust and upper mantle of the territory of Ukraine. A number of new fracturing structures and gently sloping faults require further analysis in combination with other geological and geophysical studies on the potentiality of their ore genesis.

Practical value. The results of the studies on the Ukrainian part of the “Granit” geotraverse supplement the gap in the consolidated profile with a length of 3,600 kilometers (Urengoy – Verkhnyaya Tura – Kryvyi Rih) and create a reference section of the continental crust to solve geological problems on the evolution and geodynamics of the lithosphere.

Keywords: *seismic surveying, reflection seismic survey, common depth point method, geotraverse, reflection elements*

Introduction. Research on geotraverse “Granit” (Urengoy – Verkhnyaya Tura – Kryvyi Rih) was carried out according to the program of complex deep research on subsoil of East European and West Siberian platforms of different ages and geological structures between them [1]. This program resulted in the acquisition along a profile with a length of 3,600 kilometers, connecting three ultra-deep wells: SG-5 (Tyumenskaya), SG-4 (Uralskaya) and SG-8 (Kryvorizka).

The main purpose of the research was to study the deep structure of the Earth’s crust and upper mantle in various geological regions of the continent, including ancient shields (Ukrainian and Voronezh), platforms of ancient (East European) and young (West Siberian) age, as well as regions (zones) of different ages of the Earth: geosynclines, rifts, aulacogens.

The task of the research was to evaluate the thickness, structural and tectonic features, physical parameters of the Earth’s crust and its constituent parts, to establish the main parameters of the structure and changes in the physical features of the upper mantle. On this basis, it was planned to compile the geological and geophysical models (sections) of the studied structures and estimate their comparative characteristics.

On the territory of Ukraine, complex geophysical surveys were done by the following methods: seismic surveys – common depth point analysis (CMP), electrical surveys – magneto telluric sounding (MTS), gravity and magnetic surveys. These surveys were carried out by Dnipropetrovsk Geophysical Expedition “Dniprogeofizika” (Central Geophysical Expedition), Institute of Geophysics. S.I. Subbotin of the National Academy of Sciences of Ukraine and Dnipro Geological and Geophysical Expedition. The seismic data acquisition and processing on the Granit geotraverse were led by Mikhail Isakovich Borodulin [2].

Due to organizational and financial problems, the seismic part of the program on the Granit geotraverse (Ukrainian part) was reduced, and the studies within the southwestern slope of the Ukrainian shield (Ush) and the Dnieper-Donetsk aulacogen (Fig. 1) were not fully performed. The breaking of industrial, scientific connections and the reduction of funding did not allow carrying out a comprehensive interpretation of geophysical studies in complete and unified manner and presenting the results to a wide range of scientists.

Literature review. Since the 1970s, a fairly large number of seismic studies have been carried out on the territory of Ukraine using the method of deep seismic sounding (DSS) in combination with the correlation method of refracted waves (Fig. 1). Since the beginning of the 2000s, more modern studies have been carried out on the DOBRE projects: DOBRE-99 [3], DOBRE-2000 [4, 5], DOBRE-3, DOBRE-4, DOBRE-5 [6, 7] and PANCAKE [8]. As a result of these projects, the main elements of the deep structure and the main horizons were identified along regional profiles: the surface of the crystalline basement, layers in the consolidated crust, the boundary between the crust and the upper mantle (Mohorovichich surface), and, in some cases, the surface of the asthenosphere. The features of the connection of the known large tectonic elements have been established or refined, and their “roots” have been traced to a considerable depth [6, 8]. Data on the structure of individual tectonic elements were obtained, and some general principles of the structure of the transition zone from the ancient continental platform to the active folded belt were refined. It is determined that the depth of the Moho surface within Ukraine ranges from 35 to 65 km. The Ukrainian shield on the profiles crossing it looks like a horst limited by deep faults. On the south side, the “roots” of these faults can be traced to a depth of more than 100 km; however, the nature of this boundary changes with depth (fault, weakened zone, and others).

Surveys along the DOBRE-4 profile, located in the Granit geotraverse strip (Fig. 1), were acquired in the format of a wide-angle seismic project using the reflection/refraction data [6]. Based on the results of this project, modeling of the structure of the velocities of longitudinal and transverse waves along the profile was performed, which made it possible to study the structures of the lithosphere of southern and central Ukraine in this class of models. The resulting velocity model showed a fairly uniform structure of the middle and lower crust both vertically and horizontally.

Fig. 1. Location of seismic geotraverses [6]: *DOBRE-4, "Granit" and other DSS profiles; Kryvyi Rih superdeep well SG-8* [10] *on the territory of Ukraine. Conventional annotations. Stars in yellow represent shot points; gray dots show recording stations of the DSS experiment; blue stars - survey points of the VRANCA-2001, DOBRE-5 experiments and recording devices along profile 26 (offshore part of DOBRE-5); black lines with Roman numbers – old DSS geotraverses; R-K, Putyvl- Kryvyi Rih profile; green lines are state borders. The inner map shows the location of the study area in Europe*

Based on purely seismic features, they were unable to identify the main tectonic units that are known on the geological surface. At the same time, the Moho surface is clearly outlined by a velocity contrast of 1.3–1.7 km/s^{-1} while the peculiarities of the velocity model involve successive changes in the shape of the signal at the Moho depth, with a wavelength of about 150 km and an amplitude of up to 8–17 km, the presence of its successive bends down and up (Fig. 2).

A similar wavy pattern is noted in the upper mantle and upper crust, with a shorter wavelength pattern in the latter. The origin of waviness [6] is explained by compressional buckling at the lithospheric scale and attributed to the Late Jurassic-Early Cretaceous and/or Late Cretaceous collisional tectonic events associated with the closure of the Paleotethys and Neotethys oceans [9] in this part of Europe.

The presence of several groups is considered as a typical pattern for lithospheric folding and reflects the rheological stratification of the lithosphere [6].

Purpose. The purpose of the study is to familiarize a wide range of geologists and geophysicists studying the deep structures of the East European Platform with the unjustifiably forgotten results of studies in the early 90s of the last century along the Granit geotraverse, which crosses the territory of Ukraine from the southwest to the northeast (Fig. 1). Its implementation made it possible to obtain a detailed model of the structure of the Earth's crust and upper mantle on the territory of Ukraine according to the reflectivity abilities of their internal structures to clarify the tectonic and geodynamic evolution of the East European Platform.

Brief information on seismic acquisition. Seismic surveys using the methods of reflected waves and a common depth point (CDP) along the geotraverse were started in January 1989 in the area of the Kryvorizka SG-8 [2, 10]. In 1990, they were continued on the territory of Odesa and Mykolaiv regions. Field work was completed in October 1993 in Mahdalynivka district of Dnipropetrovsk region.

Geotraverse VIII "Granit" (Ukrainian part) crosses the whole territory of Ukraine from the southwest to the northeast and passes through the territory of Odesa, Mykolaiv, Dnipropetrovsk, Kharkiv regions with an entry into the Belgorod region of Russia (Fig. 1, Table). In structural and tectonic terms, the geotraverse crosses large geological structures: the marginal part of the Scythian plate (Western Black Sea region), the Ukrainian shield, the Dnieper-Donetsk depression and the southern slope of the Voronezh massif.

The acquisition parameters. The main parameters of the acquisition are as follows: flank; fold 12; central (when detailing – a fold of 24); sampling source step – 200 m; sampling receiver step – 50 m; offset 100 m; spread length – 4,750 m; maximum offset – 4,850 m. The source of excitation of elastic waves is explosion in wells with capping water, the charge immersion depth is 20–40 m. The diameter of blasting wells is 100–112 mm. The mass of the charge is mainly 15 kg. In swampy lowlands and river valleys, it is 10 kg.

The recording time for the entire profile was 30 seconds. The recording time of the seismic gathers was determined based on the presence of boundaries in the upper mantle at depths of about 80 km, both horizontal and inclined with orientations up to 45 degrees. The time sampling rate was 4 ms. Recording speed was 1.25 m/s. The frequency range was 3–62.5 Hz, with open channel. To reduce the level of electrical noise, recording was performed only with 50 Hz notch filters. Seismic receivers were SV-5, single.

The study on the upper part of the section (VSL) was carried out in specially drilled wells with a depth of 40–80 meters, located at characteristic points of the relief, using the direct vertical seismic profile (VSP) method using a special 70-meter sonde.

To determine the velocities at depths of more than 3 kilometers within the USh, the results of processing refracted and reflected waves along the geotraverse of deep seismic sounding GSZ-VIII, carried out under the guidance of V. B. Sollogub [2, 6].

Seismic data processing technique. The features of the method for processing the materials of the regional seismic exploration of the CDP are controlled by the adopted model of the Earth. Its most important features, as noted above, are:

1. High propagation velocities of reflected waves (5–7 km/s) result in minor effect of normal moveout correction, and seismic migration distance is very significant.

2. A complexly constructed section is formed by steeply dipping (inclination angles of reflecting interfaces identified by reflected waves reach 70 degrees) multi-directional fragmen-

Table

Detailed information about the shooting programme

Observation point	Latitude *N(j)*	Longitude *E(λ)*
230.4	46.708274	30.665995
411.6	47.715089	32.47635
564.5	48.458609	34.182094
603.1	48.745278	34.534934
636.1	48.929335	34.887911
667	49.122437	35.0343

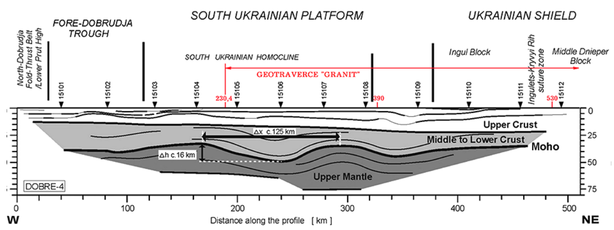

Fig. 2. Schematic section of the upper part of the lithosphere based on the seismic model of P-wave velocity along the DOBRE-4 profile [6]

tary horizons, which manifest themselves as a complex interference pattern on time sections. The presence of steeply dipping differently inclined reflecting elements leads to the ambiguity of the normal moveout velocity.

3. The absence of reference reflectors suitable for automatic static correction.

The method for seismic data processing of the regional CDP along the Granit geotraverse was based on the standard programs of the SCS-3 complex and supplemented by the procedures developed at the DGE "Dniprogeofizika" for static correction based on the first breaks, the computing of time sections with selection by the tilt angles of reflectors and kinematic migration of SNOS.

The block diagram of processing chart included five main blocks: 1 – preprocessing block; 2 – block for static corrections; 3 – block for the formation of time sections of the CDP; 4 – block for the formation of time sections with angular selection of reflecting boundaries; 5 – block for constructing reflectivity zones (kinematic migration).

Computing of a seismic section. As a result of processing, the deep section (Fig. 3) has the form of a "dashed field", which was subsequently analyzed and systematized in order to identify the main structure-forming and deformation elements based on the details of reliability and stability of their tracking, correlation in the section, and compliance with the established patterns of the wave field.

As a result of the interpretation in the section of the Granit geotraverse, the main elements were identified by the total number of reflection elements:

1. Sub-horizontal boundaries of stratification in the crust, having a differentiated distribution in each of the blocks.

2. Sub-horizontal boundaries at the bottom of the consolidated crust, reflecting the nature of the stratification of the crust in the region of the crust-mantle transition.

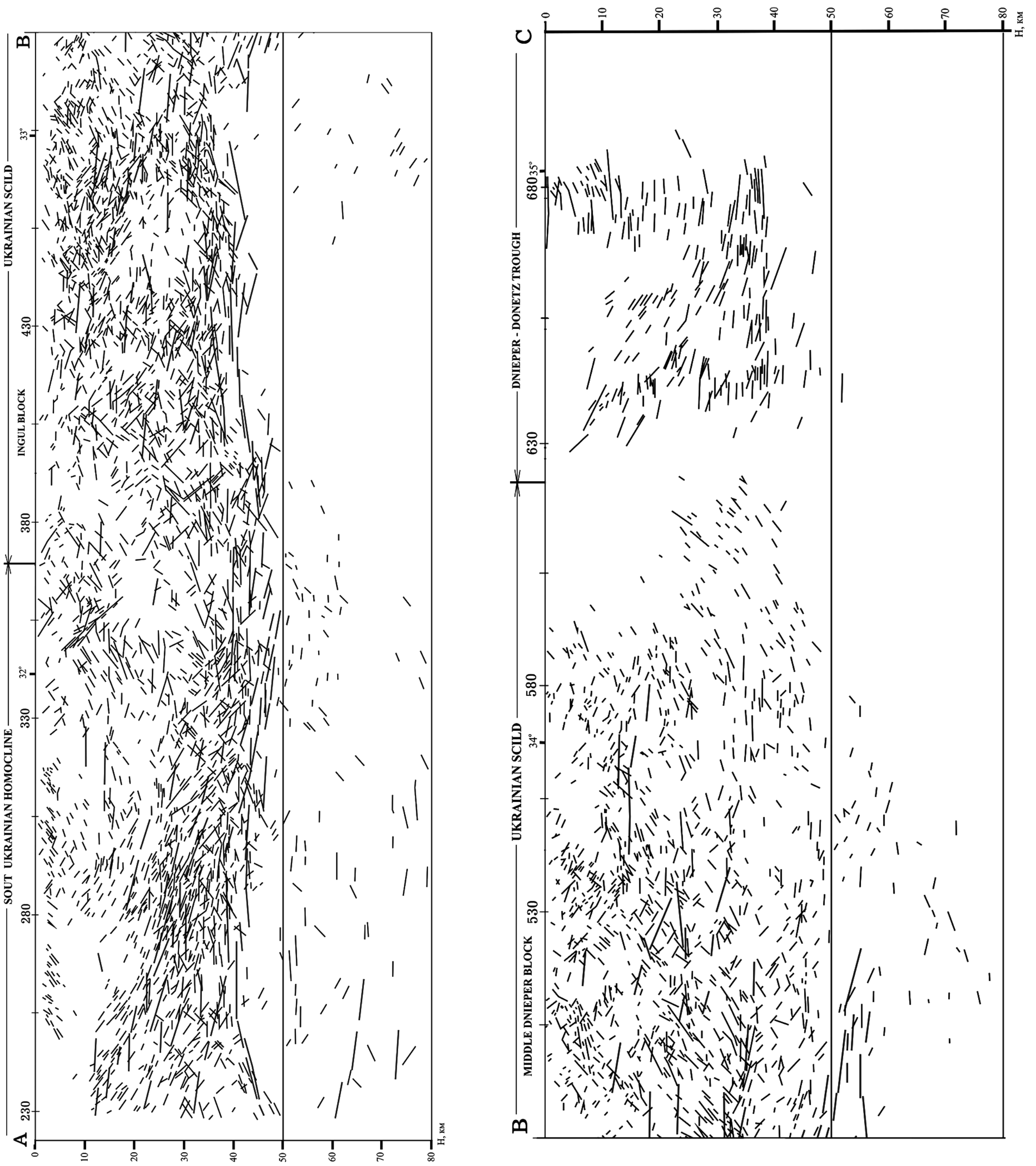

Fig. 3. Deep seismic section in the form of a "dashed field"

3. Zones of oblique reflections, identified primarily with the manifestation of dislocation phenomena (zones of faults, overthrusts, spalls).

4. Areas of arcuate bundle.

5. Areas of increased level of section saturation with reflections.

6. Local areas where there are practically no reflections.

In the section of the upper mantle, the following is identified:

1. Areas of scattered distribution of reflection elements with a low level of saturation.

2. The area of absence of reflective elements.

3. Zones of oblique reflections identified with fault zones.

Characteristic of the wave field. The wave field along the Granit geotraverse according to its main characteristics corresponds to the wave field obtained during deep studies of the CDP carried out within the USh [2, 6]. At the same time, a number of features have been identified, which, on the one hand, makes it possible to carry out its interpretation in more details, and, on the other hand, makes it somewhat different from previous researchers.

The wave field formed in the consolidated crust and upper mantle is represented on time sections by reflection elements of various lengths and orientations. The length of the reflection elements, within which phase correlation can be carried out, ranges from 1 to 3 km. Both single in-phase axes and groups (packages) united by common kinematic and dynamic characteristics are registered. The temporal interval of packets can reach 1–2 s. The position of the reflection elements in the section varies from horizontal to oblique and steep (up to 70 degrees). Groups of oblique reflections dominate in intensity.

Among the main features of the wave field, spatially correlated relationships can be distinguished, against the background of which numerous inhomogeneities are manifested, characterizing both individual blocks and individual parts of the section.

1. The predominantly single sub-horizontal reflection elements of low intensity are recorded above to the crust-mantle interface. Their distribution in the section is from chaotic to linear with a differentiated manifestation in each of the blocks.

2. The region of the crust-mantle transition stands out in the wave field as a zone of concentration of sub-horizontal reflection elements of increased intensity in a time window from 1 to 3 s. As a zone of oblique reflections, it stands out only in sections of the profile where the thickness of the crust dramatically changes.

In the USh section, the region of the crust-mantle transition stands out quite confidently. At big changes in the thickness of the crust, the zone of transition to the upper mantle over a significant interval of the profile remains relatively consistent of about 2.8 s. The structure of the crust-mantle transition zone in the PK 385-460 interval is distinguished by an anomalous character. Here, in time interval of 13–18 s, there is a high concentration of sub-horizontal weakly inclined reflections, which form a lenticular body complicated by oblique reflections.

3. The upper mantle stands out as an area of sharp reduction in the number of reflections and a decrease in their intensity. In the USh section under the Inhul megablock in the PK 360-480 interval, a zone of absence of reflections is identified in the upper mantle, above which a lenticular body of reflection concentration is observed in the region of the crust-mantle transition.

4. Groups (packets) of oblique intense reflections are most widely represented in the wave field. They differ from each other in dynamic characteristics, temporal interval, reflection intensity, tilt angle and traceability interval in the section. The nature of the manifestation of groups of oblique reflections is significantly inhomogeneous in the lateral direction.

5. Along with the background of the noted regional features of the wave field, a number of local contrasting inhomogeneities stand out: a sharply discordant (reverse) slope of the reflections in the upper and lower parts of the section in the PK 260-330 interval; high reflection intensity of the upper and middle parts of the section in the PK 420-480 interval, which is created not only due to the high concentration of oblique reflections, but also, as a result, the registration of groups of reflections forming arcuate shapes in this profile interval.

Regional features of the section. The sections of all studied geostructures are characterized by a high level of intensity with non-extended, chaotically distributed reflective elements (areas). With all the variety of mutual arrangement of both individual sites and their groups, a fairly strict subordination is established, confirming the opinion of most researchers of reflecting elements primarily carrying information about the nature of the stratification, deformations, and stress state of the structures of the consolidated crust and upper mantle.

By comparing the sections along the Dobre-4 [6] and Granit geotraverses, a clear pattern is noted that the downward and upward bends in the features of the velocity model with a wavelength of about 150 km and an amplitude of up to 8–17 km (Fig. 2) correspond to zones of increased intensity of reflection elements (Fig. 3). At the same time, when lifting, the thickening zones are located under it, and when lowering, they are above it. The authors of [6] explain the origin of waviness by compressive buckling on the lithospheric scale, which is associated with collisional tectonic events during the closing of the Paleo-Tethys and Neo-Tethys oceans [6, 9].

The predominantly single sub-horizontal reflection elements which in the wave field correspond to non-extended dynamically weakly expressed in-phase axes are identified up to the crust-mantle interface within all geostructures. The nature of the distribution of these reflections is not substantially sustained along the lateral and vertical directions.

In the studied fragment of the South Ukrainian monocline (Fig. 4), increased layering [6, 7] characterizes the upper part of the section to depths of 5–10 km, as well as the lower part of the consolidated crust at depths of 30–37 km (Fig. 3).

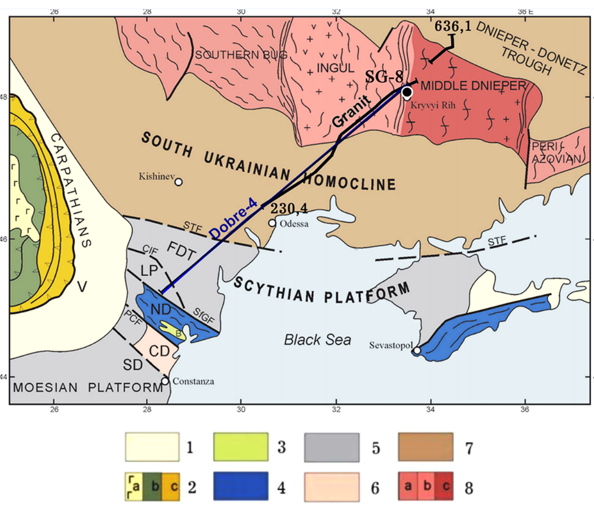

Fig. 4. Tectonic setting of the Dobre-4 [6] *and Granit profiles and the Kryvyi Rih superdeep well SG-8* [10]:

B – Babadag depression; CD, Central Dobrudja; CIF, Kagulo-Ismail fault; FDT, Fore-Dobrudja trough; LP, lower Prut High; PKF, Pechenyaga-Kamensky fault; SD, South Dobruja; SfGF, Sfantu Gheorghe Fault; STP – Scythian-Turan plate; B, Vrancea. Miocene-Pliocene foredeep basins – 1; Mid-Cretaceous – Pliocene (Alpine) fold-thrust belts a) Neogene volcanics; b) Cretaceous; c) Tertiary – 2; Late Cretaceous post-orogenic basin – 3; Late Jurassic – Early Cretaceous (Cimmerian/Early Alpine) fold-thrust belts exposed – 4; Palaeozoic platform locally affected by Mesozoic tectonism – 5; Late Neoproterozoic (Cadomian) basement of Palaeozoicplatform exposed – 6; Precambrian platform – 7; Precambrian shield with various (a, b,c) consolidation ages – 8

The crust of the Ukrainian Shield is interpreted by a completely different character of stratification, which is also reflected in the morphology of the anomalous gravitational field [11]. In the Inhul megablock [12], intermittent horizontal reflections form three sub-horizontal stratification boundaries at depths of 10–15, 20–25, and about 35 km (Fig. 3). In the Middle Dnieper megablock [10, 12], within the West Dnieper block of the second order, only the middle and lower boundaries of the stratification are clearly manifested. If we visually combine the Orel and East Pridneprovsky blocks, then two sub-vertical stratification areas can be distinguished here, which are delimited by a thick zone of oblique reflections. Within the USh, the lower intervals of the section are also characterized by increased layering in blocks with the maximum thickness of the crust, where reflections, as it were, perform "deflections".

Despite the different nature of the manifestation of sub-horizontal reflections, a certain regularity is also visible within the crust. They can be traced in the most orderly piecewise-linear manner in the intervals of the section, where intersections of differently oriented groups of oblique reflections, a change in the angle of their general inclination, and a displacement in the section are noted. The noted regularity testifies to the sub-ordination of sub-horizontal bundles to oblique bundles. At the same time, the revealed correlation has, in turn, a differentiated nature of manifestation – layer by layer and block by block.

The region of the crust-mantle transition is interpreted in the section as a zone of concentration of sub-horizontal reflection elements (Fig. 3), which are characterized by increased intensity in the wave field. The structure of the transition area is not consistent, and its thickness varies from 3–4 to 7–8 km.

In the section of the South Ukrainian monocline, the crust-mantle transition has no clearly defined boundaries. Deep intra-crustal stratifications without pronounced dynamic contrasts pass in the depth interval of 37–47 km into crustal-mantle stratifications and then into upper mantle stratifications. Within the specified depth interval, only a certain concentration of the number of reflections is noted.

Within the USh, the region of the crust-mantle transition stands out with much greater contrast, and its most consistent character is noted in blocks where the crustal thickness is about 40 km. In the blocks with the maximum thickness of the crust, the region of the crust-mantle transition is characterized by a reduction in the number of reflections and a decrease in their dynamic manifestation. Conversely, with a reduction in the thickness of the crust, both the number of reflections and their dynamic features increase sharply. Within most of the USh, the thickness of the crust-mantle transition is 3–4 km.

The northeastern part of the Inhul megablock is identified by an anomalous structure. Here, the minimum thickness of the crust and the maximum thickness of the crust-mantle transition region, reaching 7–8 km, are noted. Within the considered interval of the section, the reflections of the lower sub-horizontal boundary of the stratification in the consolidated crust merge with the zone of the crust-mantle transition.

Throughout the profile interval, the structure of the crust-mantle transition region is significantly complicated by numerous oblique reflections, both single and grouped, cutting through the entire crust or its individual intervals. Consequently, in the region of the crust-mantle transition, the superimposed character of two systems of stratifications, sub-horizontal and inclined, is most clearly manifested, each of which has its own regional and local characteristics. Attention is drawn to the fact that the vast majority of oblique reflections cease to be traced below the region of the crust-mantle transition. Hence, it can be assumed that the crust-mantle transition zone is an area where both the accumulation of stresses and their most intense realization in the form of certain deformations occur. The actual section of the crust-mantle (the bottom of the transition region of the crust-mantle) is in this case the boundary of the contrasting nature of the stress state of the Earth's shells – the consolidated crust and the upper mantle.

A large number of groups of oblique reflections were registered along the Granit geotraverse, identified primarily with fault zones [10, 13]. They are characterized by different density, dynamic manifestation, inclination tilt, intensity of reflections, different internal structure, tracking interval, different sub-ordination with sub-horizontal reflections.

The main part of the faults begins to stand out in the area of the crust-mantle section and can be traced through almost the entire Earth's crust. The roots of individual faults can be traced in the section of the upper mantle in the interval of the first 10–20 km.

According to the nature of the manifestation of faults, their spatial relationship with sub-horizontal boundaries in the crust and, first of all, with boundaries in the area of the crust-mantle transition, we can say that the faults manifest themselves as large tectonic plates (scales), chips, thrusts.

The biggest faults, reaching 10–14 km in cross section, practically do not experience sharp breaks and changes in dip angles, but some flattening of their dip angle with depth is still noted. Those faults are more often identified in areas characterized by an increase in the thickness of the crust, that is, their formation is due to deeper stresses.

Fault zones with a cross section of 4–7 km are most widely represented in the section. These faults often experience ruptures, displacements, accompanied by a change in the angle of inclination, and these changes, as noted above, are genetically associated with sub-horizontal stratifications. Faults of this rank can be traced both through the entire crust and fragmentarily in one or another interval of the crust. They are characterized by an unsteady internal structure.

A significant role in the section belongs to smaller inclined faults. They are mainly identified in the upper part of the section, down to depths of 10–15 km, but they can also be fragmented in the section of the entire crust.

The well-known, mapped from the surface, large faults are spatially correlated with the zones of manifestation of oblique faults, while the subvertical ones are correlated with the zones of intersection of obliquely dipping faults or with the intersection peaks of oblique faults that form multi-tiered local structures resembling "herringbones", referred to in strike-slip tectonics as "feathering cracks". The formation of the latter is due to the development of second order structures in the fault zones.

Thus, all the faults form a multi-tier complex subordinate system. At the same time, their types appear in seismic data not in the form of main lines, but in the form of zonal bodies with one or another section.

Conclusions. In-depth studies of the CSP-CDP made it possible to analyze the structural and tectonic features of the consolidated crust and upper mantle in more detail than during the DSS, to form an idea of the structure under study as an integral system of objects at various levels of its organization. But the most complete and objective information about the structure of the entire section can only be provided by complex data of the CSP-CDP and DSS.

The consolidated crust and upper mantle have a complex block structure, subject to certain spatially correlated relationships, against which numerous heterogeneities are manifested, inherent both in specific blocks and in their constituent elements [14].

In the modern structure of the considered section, a significant role belongs to faults and tectonic plates, the vast majority of which manifest themselves as inclined zonal bodies with different orientations. Fault and plate systems form a complex hierarchical subordination.

The crust-mantle transition is a complex laterally variable area with a thickness of 3 to 7 km, determined by systems of sub-horizontal stratifications, expressed by the concentration of reflection elements. The most homogeneous and contrasting region of the transition is manifested in the structures of ancient consolidation, with a crustal thickness of about 40 km.

The modern block structure of the crust has captured its multiple dislocation, metamorphic and magmatic processing with shifting in time and space conditions of compression and tension with a constant striving for energy and isostatic equilibrium.

Along with the confirmation of previously known faults in the Earth's crust, seismic data revealed a number of new fault structures, which, together with geological, geochemical and other geophysical materials, should be further evaluated from the standpoint of their possible ore content. Particular attention, obviously, should be given to gently dipping faults, which are still given insufficient attention in the USh.

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Сейсмічний геотраверс «Граніт» (Українська частина). Реанімація

П. Г. Пігулевський[1], *О.М. Стовас*[2]

1 – Дніпропетровська геофізична експедиція «Дніпрогеофізика», м. Дніпро, Україна, e-mail: pigulev@ukr.net

2 – Норвезький університет науки та техніки, м. Тронхейм, Королівство Норвегія

Мета. Ознайомити геологів і геофізиків із результатами досліджень за геотраверсом «Граніт».

Методика. Дослідження проводилися методами відбитих хвиль і спільної глибинної точки (МВХ-СГТ). Основні параметри системи спостережень: флангова; кратність 12; центральна (при деталізації кратність 24); крок між пунктами вибухів 200 м; крок і відстань між сейсмоприймачами 50 м; винос 100 м; довжина розстановки – 4750 м; максимальна відстань вибух-приймання – 4850 м. Тривалість запису корисного сигналу 30 секунд. Джерело коливань – вибухи у свердловинах зарядом 15 кг.

Результати. Геотраверс «Граніт» проходить по території Одеської, Миколаївської, Дніпропетровської, Харківської областей і перетинає геологічні структури: Південноукраїнську моноклиналь, Український щит, Дніпровсько-Донецьку западину. Розрізи всіх геоструктур характеризуються високим рівнем насичення непротяжними, нерівномірно розподіленими відбиваючими елементами, що займають у просторі положення від субгоризонтального до крутонахилого. Відбиваючі елементи несуть інформацію про характер розшарування, деформації й напружений стан структур консолідованої кори й верхньої мантії. Консолідована кора та верхня мантія мають складну поверхово-блокову структуру, що підкоряється певним просторово-корелюємим зв'язкам. Перехід кора – мантія являє собою складну, латерально мінливу область потужністю від 3 до 7 км, що визначається системами субгоризонтальних розшарувань, виражену концентрацією майданчиків відбиття.

Наукова новизна. Результати досліджень за геотраверсом «Граніт» доповнюють інформацію про сейсмічну модель кори та верхньої мантії території України. Виділений ряд нових розривних структур і пологопадаючих розломів потребують подальшого аналізу в комплексі з іншими геолого-геофізичними дослідженнями на потенційність їх рудогенезу. Матеріали мають унікальний характер і зроблять свій внесок до геологічної теорії та практики.

Практична значимість. Результати досліджень за українською частиною геотраверса «Граніт» дозволять доповнити відсутню інформацію на зведеному профілі довжиною 3600 кілометрів (Уренгой – Верхняя Тура – Кривий Ріг) і створити опорний розріз континентальної кори для вирішення геологічних проблем по еволюції та геодинаміці літосфери.

Ключові слова: *сейсморозвідка, метод відбитих хвиль, метод спільної глибинної точки, геотраверс, відбиваючі елементи*

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