Department of the Lithospheric Research

About

Works in two general scientific tasks were continued in the Department of the Lithospheric Research, in 2018 year: ”Structure and evolution of Central Europe's lithosphere with particular emphasis on the area of Poland” (NSL1) and “Structure and evolution of the northern Atlantic lithosphere in the contact zone of the Eurasian and North American plate in the Arctic and selected areas of Antarctica” (NSL2).

In the frame of the first task, the team was working on different stages of the projects: GEORIFT 2013 (Belarus-Ukraine), RomUkrSeis (Romania-Ukraine), TTZ-South (Poland-Ukraine), LUMP (Poland), and Sudetes (SW Poland). In the second task, the passive/active project KNIPAS (Knipovich Ridge) was implemented. A new active seismic project KNIPSEIS (Knipovich Ridge and Barents Sea) was started. Some of projects were finalized by publication, others were in the process of preparing seismic sections, interpretation, modelling or preparing the publication. For others, field measurements were carried out. They are described in more detail later in the report. Apart from the above-mentioned projects, which we devoted the most attention to, we also dealt with other projects: KOKKY and ESO (Finland), BalTec (Baltic Sea), BASIC (Sweden), VRANCEA 2001 (Romania) and modelling of 3-D structure and anisotropy of the Earth crust in SE Poland. Materials from these projects will be subject to elaboration in subsequent years. Most of the projects are carried out in international or national cooperation. Final results of our projects consist of the geological/tectonic interpretation of experimental data collected in active and passive seismic experiments.

Personel

Head of the Department
Tomasz Janik
Associate Professor

Aleksander Guterch
Professor

Piotr Środa
Associate Professor

Wojciech Czuba
Associate Professor

Monika Bociarska
Assistant Professor

Dariusz Wójcik
Research Assistant

Edward Gaczyński
Technician

Research Project

Profile of deep seismic soundings TTZ-South
Janik | NCN | 2017 -2020

Determination of the seismic anisotropy of the lithosphere in the Lower Silesia area
Środa | NCN | 2017 -2020

Structure of the Knipovich Ridge on the basis of seismic surveys - KNIPSEIS
Czuba | NCN | 2018 -2021

PhD Students

Julia Rewers | Poland
supervisor: Piotr Środa

Instruments and facilities

Equipment

- 90 x TEXAN portable seismic recorders with 1C 4.5 Hz geophones
- 60 x DATA-CUBE portable seismic recorders with 1C (60 pcs) and 3C (20 pcs) 4.5 Hz geophones
- 10 x Güralp CMG-DM24S3EAM broadband seismic stations with CMG-6T 30s seismometers
- 4 x Ocean Bottom Seismometers, semi-broadband (Güralp)
- 20 x L-4C-3D 1 Hz seismometers
- 6 x timing system devices (for shot time recording)

Research activity and results

Lithospheric structure along wide-angle seismic profile GEORIFT2013 in Pripyat–Dnieper–Donets Basin (Belarus and Ukraine) | T.Janik, A.Guterch, W.Czuba, P.Środa and Working Group

The GEORIFT 2013 (GR'13) WARR (wide-angle reflection and refraction) experiment was carried out in 2013 in the territory of Belarus and Ukraine with broad international cooperation. The aim of the work is to study basin architecture and deep structure of the Pripyat-Dnieper-Donets Basin (PDDB), which is the deepest and best studied Palaeozoic rift basin in Europe. The PDDB is located in the southern part of the East European Craton (EEC) and crosses Sarmatia—one of the three segments of the EEC. The PDDB was formed by Late Devonian rifting associated with domal basement uplift and magmatism.

The GR'13 extends in NW-SE direction along the PDDB strike and crosses the Pripyat Trough (PT) and Dnieper Graben (DG) separated by the Bragin Uplift (BU) of the basement. The field acquisition along the GR'13 (of 670 km total length) involved 14 shots and recorders deployed every ~2.2 km for several shot points, Fig. 1. The good quality of the data, with first arrivals visible up to 670 km for several shot points, allowed for construction of a velocity model extending to 80 km depth using ray-tracing modelling, Fig. 2. The thickness of the sediments (Vp < 6.0 km s-1) varies from 1-4 km in the PT, to ~5 km in the NW part of the DG, to 10-13 km in the SE part of the profile. Below the DG, at ~330-530 km distance, we observed an upwarping of the lower crust (with Vp of ~7.1 km s-1) to ~25 km depth that represents a rift pillow or mantle underplate. The Moho shallows southeastwards from ~47 km in the PT to 40-38 km in the DG with mantle velocities of 8.35 and ~8.25 km s-1 in the PT and DG, respectively. A near-horizontal mantle discontinuity was found beneath BU (a transition zone from the PT to the DG) at the depth of 50-47 km. It dips to the depth of ~60 km at distances of 360-405 km, similar to the intersecting EUROBRIDGE'97 profile.

The crust and upper mantle structure on the GR'13 may reflect varying intensity of rifting in the PDDB from a passive stage in the PT to active rifting in the DG. The absence of Moho uplift and relatively thick crystalline crust under the PT is explained by its tectonic position as a closing unit of the PDDB, with a gradual attenuation of rifting from the southeast to the northwest. The most active stage of rifting is evidenced in the DG by a shallower Moho and a presence of a rift pillow caused by mafic and ultramafic intrusions during the active phase. The junction of the PT and the DG (the BU) locates just at its intersection with the NS regional tectonic zone Odessa-Gomel. Most likely, the 'blocking' effect of this zone did not allow for further propagation of active rifting to the NW.

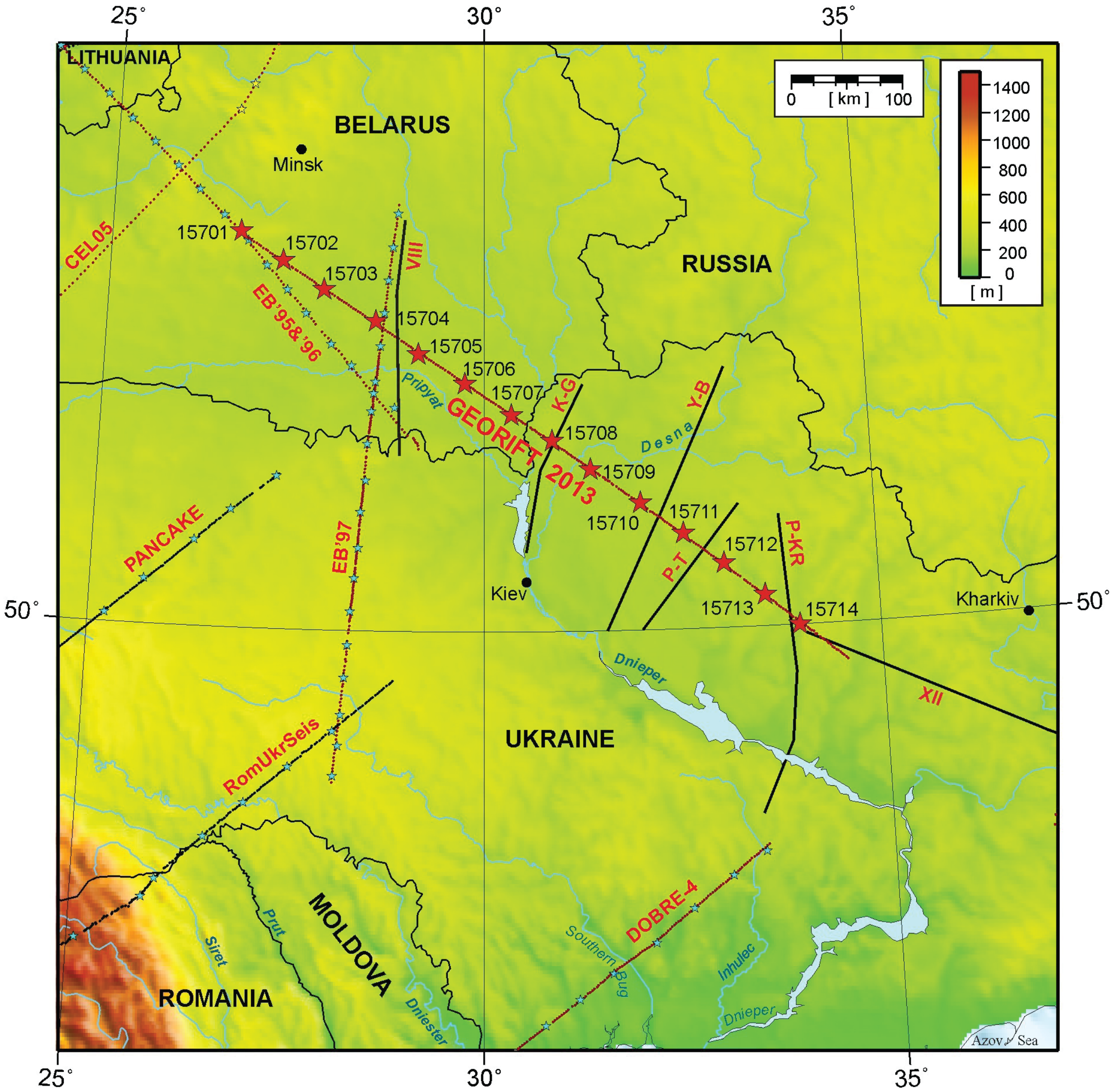

Figure 1: Location of the composite GEORIFT 2013 profile and previous refraction seismic profiles in the study area. Stars represent shot points; dots - recording stations. Abbreviations of profiles: K-G - Kiev–Gomel; Y-B - Yagotyn–Baturin; P-T - Piryatyn–Talalaivka; P-KR - Putyvl-Kryviy Rig; XII geotraverse XII (Poltava – Sverdlovsk), VIII - deep CDP line – all these lines represent main parts of the profiles. More lines are shown on the inset map showing the location of the Pripyat-Dnieper-Donets Basin and adjacent tectonic units at the southern part of the East European Craton.

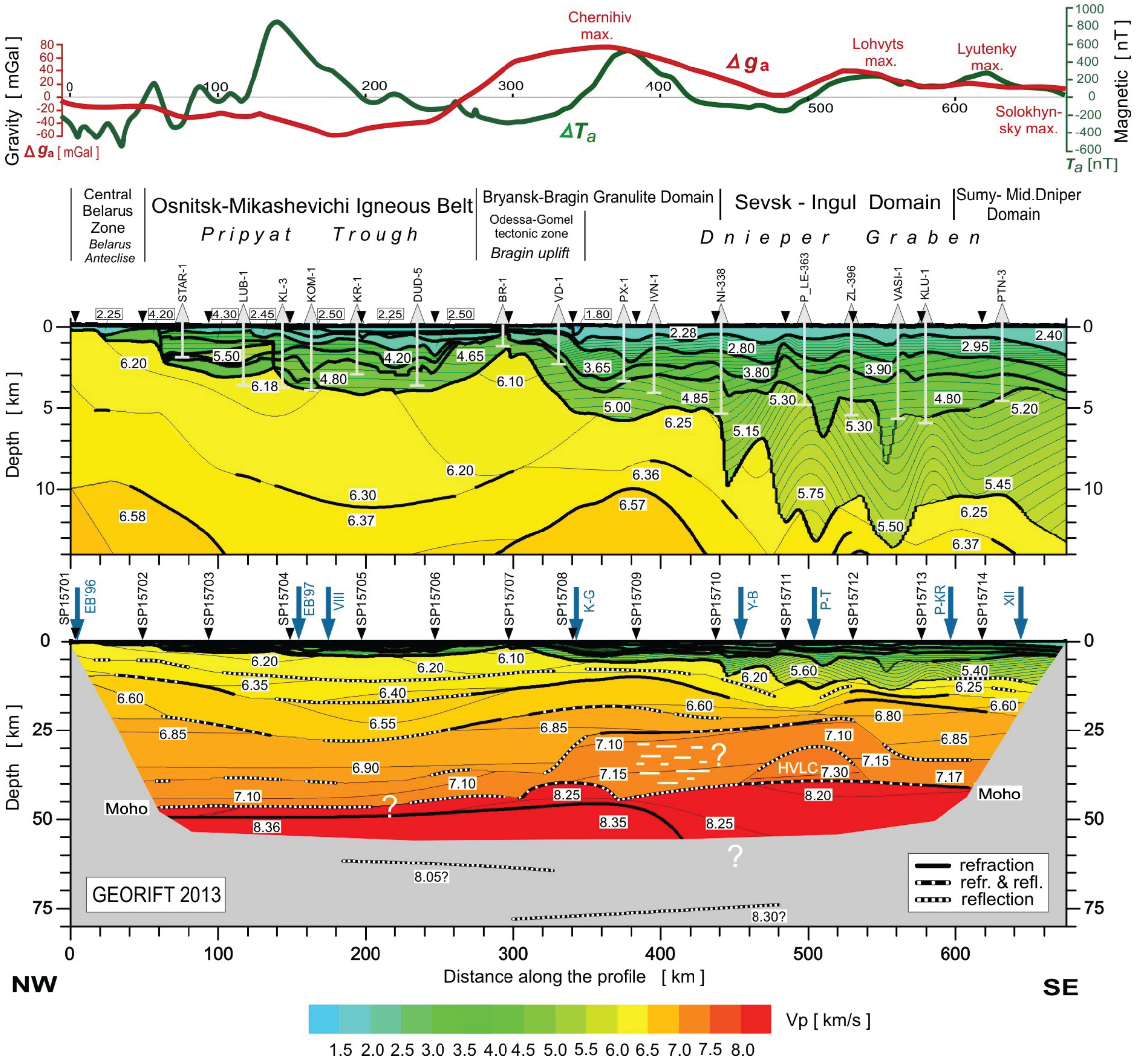

Figure 2: Two-dimensional model of seismic P-wave velocity in the crust and upper mantle derived by forward ray-tracing modelling using the SEIS83 package (Červený & Pšenčík 1984) along the GEORIFT 2013 profile. Thick, black solid and dashed lines represent major velocity discontinuities (interfaces). Colours represent velocity isolines with values in km s-1 shown in white boxes. The position of tectonic units is indicated. Arrows show positions of shotpoints. Blue arrows show intersections with other profiles. Vertical exaggerations are ~11:1 for upper part of the model, and ~2.4:1 for the whole model. Bouguer gravity and total magnetic field anomalies along the profile are shown on top diagrams (Starostenko et al. 1986; Pashkevich et al. 2014).

Follow final publication:

Starostenko V., Janik T., Yegorova T., Czuba W., Środa P., Lysynchuk D., Aizberg R., Garetsky R., Karataev G., Gribik Y., Farfuliak L., Kolomiyets K., Omelchenko V., Komminaho K., Tiira T., Gryn D., Guterch A., Legostaeva O., Thybo H., Tolkunov A., 2018. Lithospheric structure along wide-angle seismic profile GEORIFT 2013 in Pripyat-Dnieper-Donets Basin (Belarus and Ukraine), Geophysical Journal International, 212 (3), 1932–1962, https://doi.org/10.1093/gji/ggx509.

Research activity and results

Seismic model of the crust and upper mantle across the Eastern Carpathians – from the Apuseni Mountains to the Ukrainian Shield | T.Janik, W.Czuba, P.Środa and Working Group

The RomUkrSeis profile is a controlled source wide-angle reflection and refraction (WARR) profile acquired in August 2014. It is 675 km long (Fig. 1), running roughly SW-NE from the Apuseni Mountains in Romania and the Transylvanian Basin behind the arc of the Eastern Carpathian orogen, crossing this and terminating in the East European Craton (EEC) in SW Ukraine. A well-constrained velocity model has been constructed along the RomUkrSeis profile from 350 single component seismic recorders and eleven shotpoints in a single deployment. The Eastern Carpathian arc and the complex tectonic processes that formed it in the Cenozoic have obscured the pre-existing Trans-European_Suture_Zone, which is the transition zone between the EEC and terranes accreted to its southwest in pre-Cenozoic (especially Palaeozoic) times.

The good quality of the data, with first arrivals visible up to 675 km for several shot points, allowed for construction of a velocity model extending to 50 km depth using ray-tracing modelling, Fig. 2. Relatively low velocities are determined throughout the whole crust along the RomUkrSeis profile. The velocities in the southwestern part of the model (beneath the Apuseni Mts. and the Transylvanian Basin) are comparable with those of the Pannonian Basin (Vp <6.6-km/s) observed elsewhere while the crustal thickness is higher (>30 km). A high velocity body (Vp ~6.36-km/s) appears at depths of 3-12-km, its location corresponding to the surface expression of ophiolites in the Apuseni Mts. Immediately below this body, lower velocities are found. In the central part of the model, there is a large sedimentary wedge that comprises the Cenozoic Carpathian foreland itself as well as older sedimentary units. The wedge consists of two thick layers characterized by Vp ~4.7 and 5.35 km/s of ~30 km width, asymmetrically dipping to the SW and reaching a depth of ~15-km. Below it, up to a depth of 45-km, Vp value of ~6.3 km/s is determined. On the EEC side of the model, the velocities near the crustal base (to depths 33-43 km) reach values of Vp ~6.6 km/s. Strongly differentiated Moho depths are observed along the profile as a whole. Four segments can be identified from the southwest to the northeast, with depth variations from 32 to 50-km. Velocities below the Moho boundary are: 8.15-8.2 km/s and ~8.3-8.35 km/s below a sub-Moho discontinuity in the uppermost mantle (at depths ~52 km in the central part of the profile and ~47-km in its northeastern part).

A comparative study of the RomUkrSeis profile and two other WARR profiles that cross the Eastern Carpathians, PANCAKE to the northwest and VRANCEA-2001 to the southeast, will illuminate important aspects of the relationship between the emplacement of the Carpathian arc and the earlier crustal architecture of this fundamental tectonic transition zone.

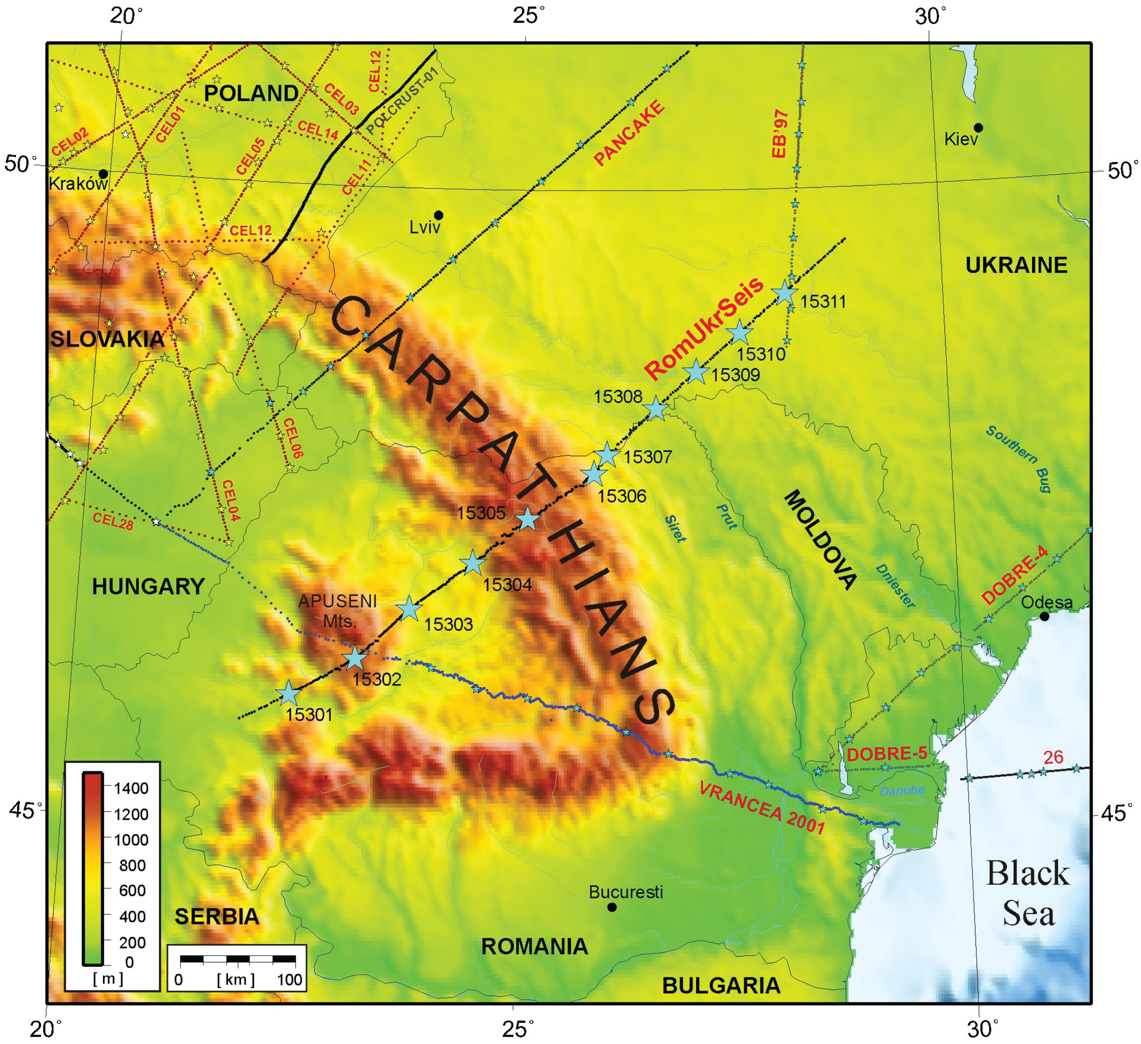

Figure1: Location of the composite of the RomUkrSeis profile and previous refraction seismic profiles in the study area. Stars represent shot points; dots - recording stations

The study was done in international cooperation, a publication is under preparation: Vitaly Starostenko1, Tomasz Janik2, Victor Mocanu3, Randell Stephenson4, Tamara Yegorova1, Tatiana Amashukeli1, Wojciech Czuba2, Piotr Środa2, Anna Murovskaya1, Katerina Kolomiyets1, Dmytro Lysynchuk1, Jan Okoń2, Alina Dragut3, Victor Omelchenko1, Olga Legostaieva1, Dmytro Gryn1, Jim Mechie5, Anatoly Tolkunov6 (1Institute of Geophysics, National Academy of Sciences of Ukraine; 2Institute of Geophysics, Polish Academy of Sciences; 3University of Bucharest, Romania; 4School of Geosciences, University of Aberdeen, Scotland; 5GFZ Potsdam, Germany; 6Ukrgeofizika, Ukraine).

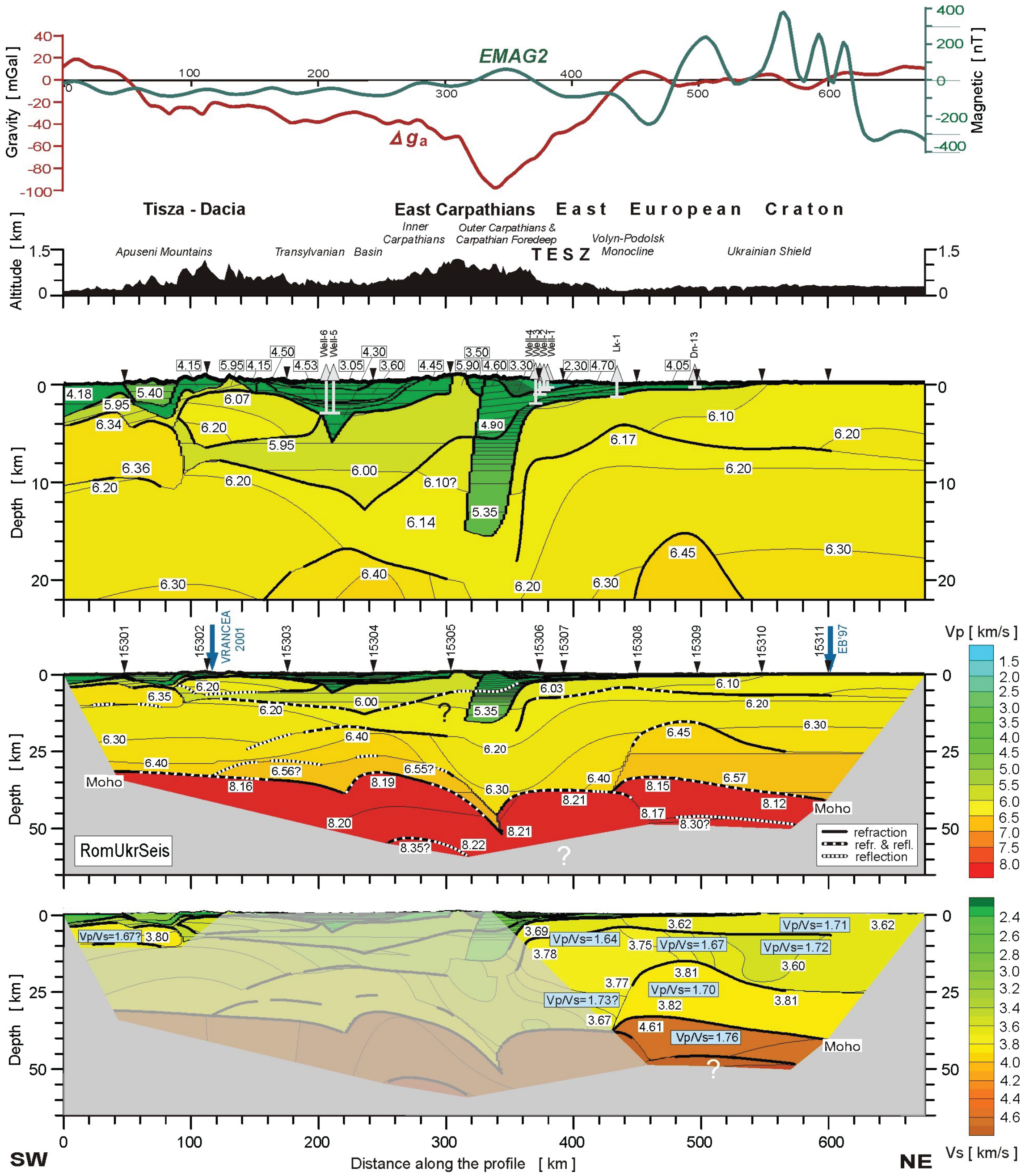

Figure 2: Two-dimensional models of seismic P- and S-wave velocity in the crust and upper mantle derived by forward ray-tracing modelling using the SEIS83 package (Červený & Pšenčík 1984) along the RomUkrSeis profile. Thick, black solid and dashed lines represent major velocity discontinuities (interfaces). Only those parts of the discontinuities that have been constrained by reflected or refracted arrivals of P-waves are shown. Thin lines represent velocity isolines with values in km s-1 shown in white boxes. The position of tectonic units is indicated. Arrows show positions of shot points. Blue arrows show intersections with the other profiles. Abbreviations as on Figs. 1 and 3. Vertical exaggerations are ~11:1 for upper part of the model, and ~2.4:1 for the whole model. Bouguer gravity and total magnetic field anomalies along the profile are shown on top diagrams (Starostenko et al. 1986; Pashkevich et al. 2014). For the EEC, model of Vp/Vs ratio distribution is shown.

Deep Seismic Soundings Profile TTZ-South | T.Janik, W.Czuba, P.Środa, D.Wójcik, and Working Group

In the period 7-14 September 2018, after over than one year of logistical preparation, measurements of deep seismic soundings along the TTZ-South profile were carried out, extending the transect TTZ-CEL03 located along the Teisseyre-Tornquist zone (TTZ). This profile is ~ 545 km long and runs in Poland (~ 240 km), partially overlaping the CEL03 profile, and in Western Ukraine (~ 300 km), to the border with Moldova (Fig. 1). The experiment was carried out by the teams of the Department of Seismic Research of the Lithosphere of the Institute of Geophysics PAS and the Institute of Geophysics of the National Academy of Sciences of Ukraine in cooperation with Geofizyka Toruń Sp. Zoo. and Ukrgeofizika, using also 150 seismic equipment from the GeoForschungsZentrum (GFZ) Potsdam equipment pool. Seismic energy was generated in eleven shot points using explosives (600-1000 kg TNT) placed in 20-30 m deep holes, deployed every 45-60 km along the profile Seismic registrations were conducted by ~300 field seismic stations deployed along the profile every 2.5-3.5 km. The analysis of the experimental data obtained, carried out with proven, modern interpretation methods (2D modelling), will be the basis for studies of the structure of the Earth's crust and the upper mantle.

The TTZ-South experiment aims at determination of the structure along a seismic profile located in the region of southeaster Poland and western Ukraine, along the Teisseyre-Tornquist Zone (TTZ). Studies of the tectonic structure of this area are extremely important for understanding of geodynamical processes which shaped the present structure of the lithosphere in this region of Central Europe. The oldest tectonic unit in this area is the East European Craton, of the age of over 1 Ga (Fig. 2). The southwestern part of Poland consists of younger (about 300-400 Ma), thinner, warmer and more mobile lithosphere of Palaeozoic Platform of Central and Western Europe. In the south, it is bordered by young alpine orogen, represented in Poland by Carpathian Mountains. The contact of these three large tectonic systems is represented by a broad transition zone (TESZ – Trans-European Suture Zone), extending from North Sea to Black Sea (Berthelsen, 1992). The northeaster edge of the TESZ, located near the EEC margin, is called the Teisseyre-Tornquist Zone (Winchester et al.., 2002).

Previously seismic investigations were performed along Polish part of the TTZ (transect TTZ-CEL03, Janik et al., 2005). Due to the nature of the deep seismic profiling method, the structure near both ends of the transect (ca. 100 km at each end) is relatively poorly documented. In this method, seismic rays used for imaging the deep structure do not probe the crust vertically, but at certain angle. Therfore a particularly important from tectonic point of view part of the transect - located in the southeaster Poland - was not illuminated by rays. It is an unique area of contact of these three large geological systems of Europe. Moreover, it is crossed by the boundary between two main units of the EEC – Fennoscandia and Sarmatia. The proposed deep seismic profile runs across this important tectonic node of the European continent. Results of previous seismic investigations performed on the Polish side (conducted within CELEBRATION 2000 project) and in the Ukraine (conducted within PANCAKE and

RomUkrSeis projects) revealed zones of substantial gradients of the crustal thickness (depth of the Moho discontinuity) perpendicularly to the TTZ. This suggests segmentation of the Precambrian crust to the SE from the Fennoscandia-Sarmatia suture, and possibly parallel to this suture. Planned investigations could help to solve this question, which is of a great importance for determination of the structure of the EEC, as well as for studies of Phanerozoic tectonic evolution of the Carpathian fragment of TTZ and TESZ.

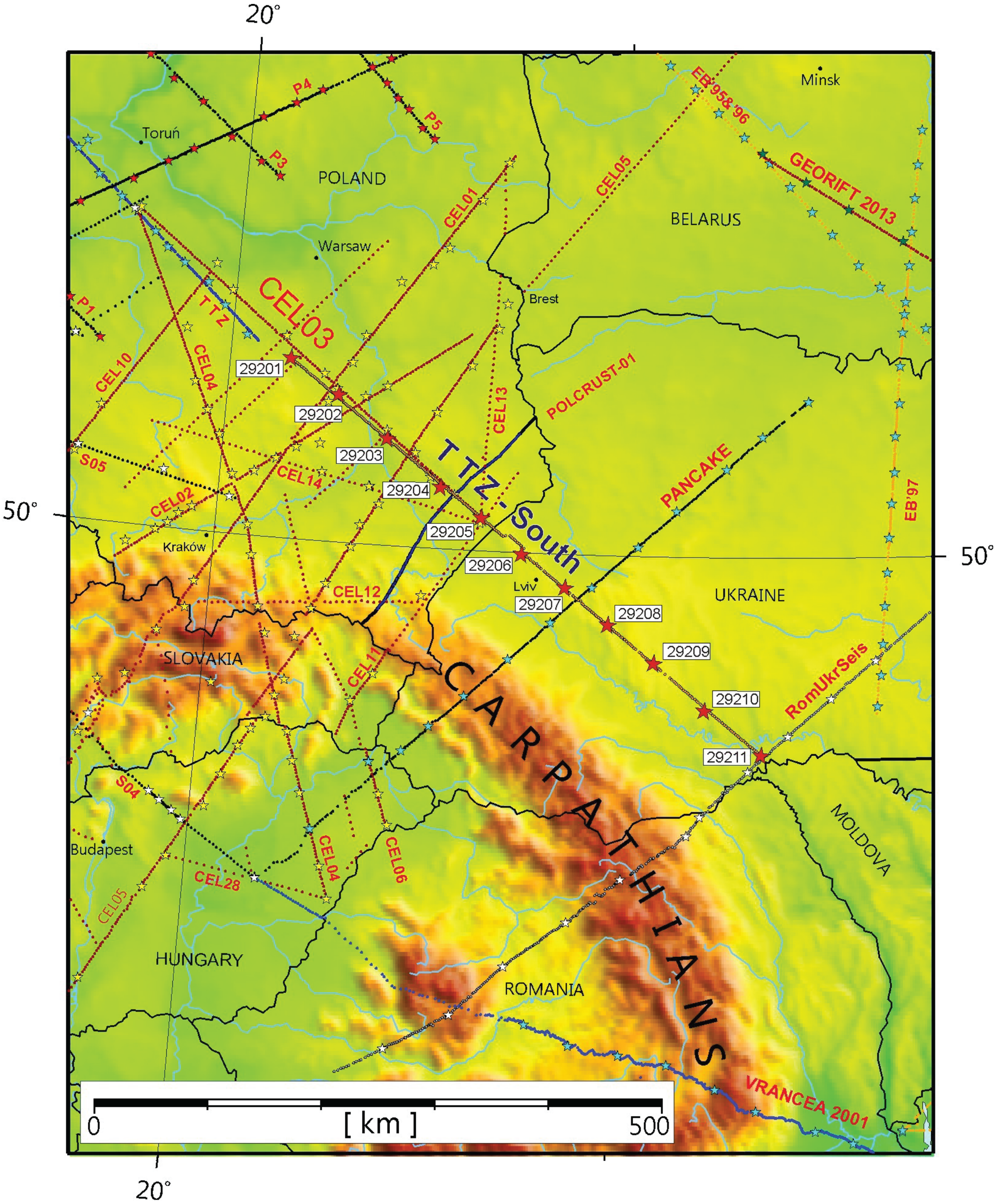

Figure 1: Location of the composite of the TTZ-South profile and previous refraction seismic profiles in the study area. Stars represent shot points; dots - recording stations.

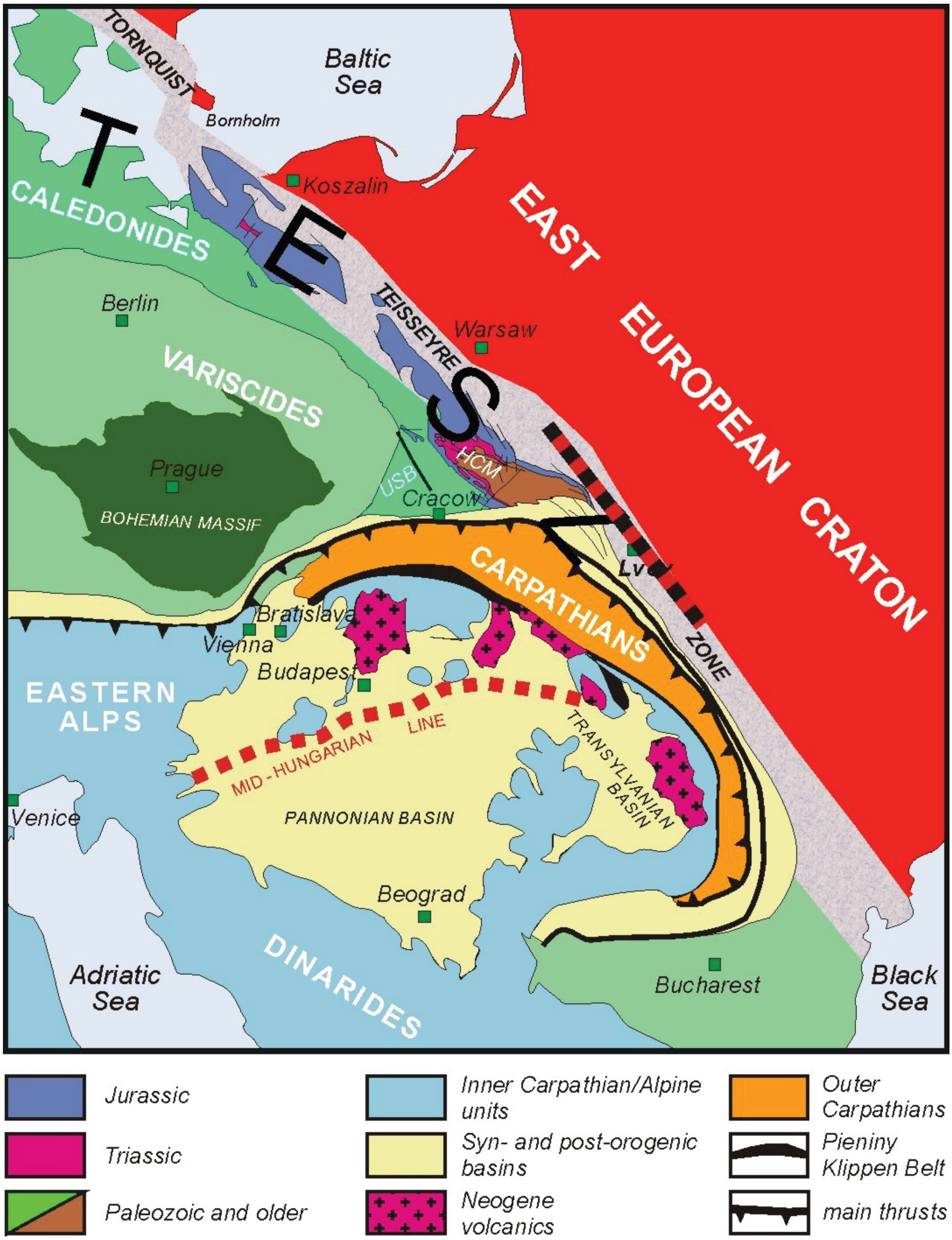

Figure 2: Location of the profile on the background of tectonic map of the Central Europe. USB – upper Silesian block; HCM – Holly Cross Mountains; TESZ – Trans-European Suture Zone. Stars represent shot points; dots - recording stations.

Verification of the seismic P wave velocities under Moho boundary: Central Poland case study, LUMP profile | M.Bociarska, T.Janik and Working Group

Published: Dec, M., Polkowski, M., Janik, T., Stec, K., Grad, M., 2018. Acta Geophysica, (on line), 1-17, doi:10.1007/s11600-018-0236-9

The tectonic settings investigated by several seismic projects in previous research targeting the structure in Central Poland mainly focused on the Earth's crust. We present P-wave velocity verification in the uppermost mantle beneath LUMP profile towards SSE-NNW. Using recordings of 36 DATA-CUBE recorders from ca. 300–490 km far earthquake in coal mine "Janina" in southern Poland, we calculated travel times to verify P-wave velocity below the Moho boundary from previous studies. It shows that a significantly lower mean velocity value should be used for the upper mantle while counting these offsets of travel times in the SSE-NNW direction than that used on previous profiles. We present two possible models: first, the most simple one that fits the observed first arrivals, and the second with a low-velocity layer beneath the Moho boundary. In both cases, we used a priori crustal model focusing only on P-wave velocity in the uppermost mantle. Both of them significantly improved adjustment of travel times to the observed data. To evaluate the tendency of adopting too high velocities beneath the Moho, we used also 11 broadband stations, Reftek 151-121 "Observer", from "13 BB Star" passive experiment and 6 STS-2 seismometers from permanent stations of the Polish Seismological Network (PLSN).

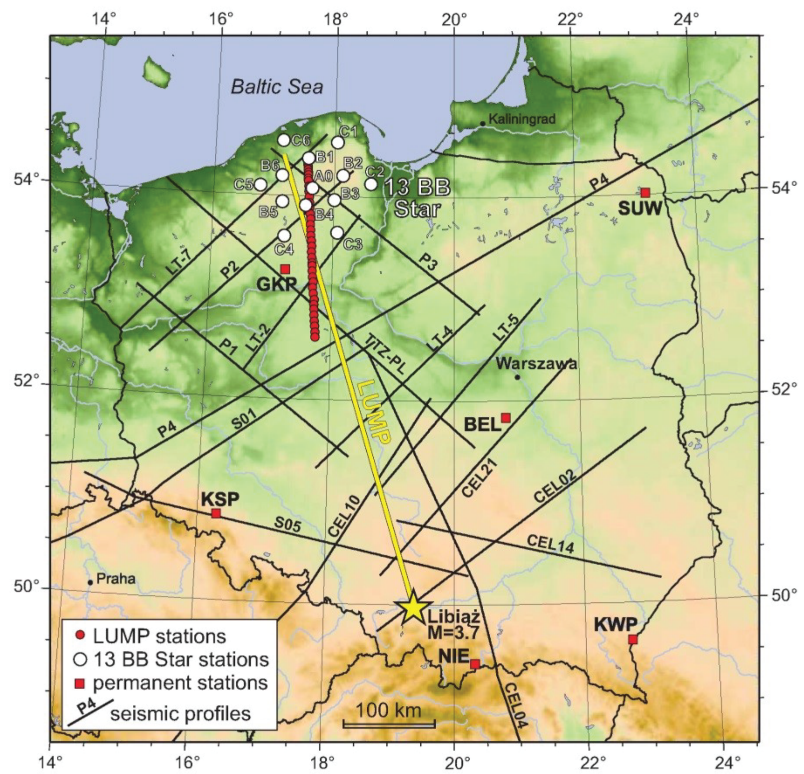

Figure 1: The net of selected profiles from the region neighboring the LUMP profile on the background of the topographic map. Yellow star shows location of Libiąż earthquake which was recorded at LUMP seismic stations (red dots). "13 BB Star" array of broadband stations is denoted with white dots and permanent seismic stations with red squares, respectively. Yellow line shows the LUMP profile. Thin black lines are profiles used for construction of the Model Z.

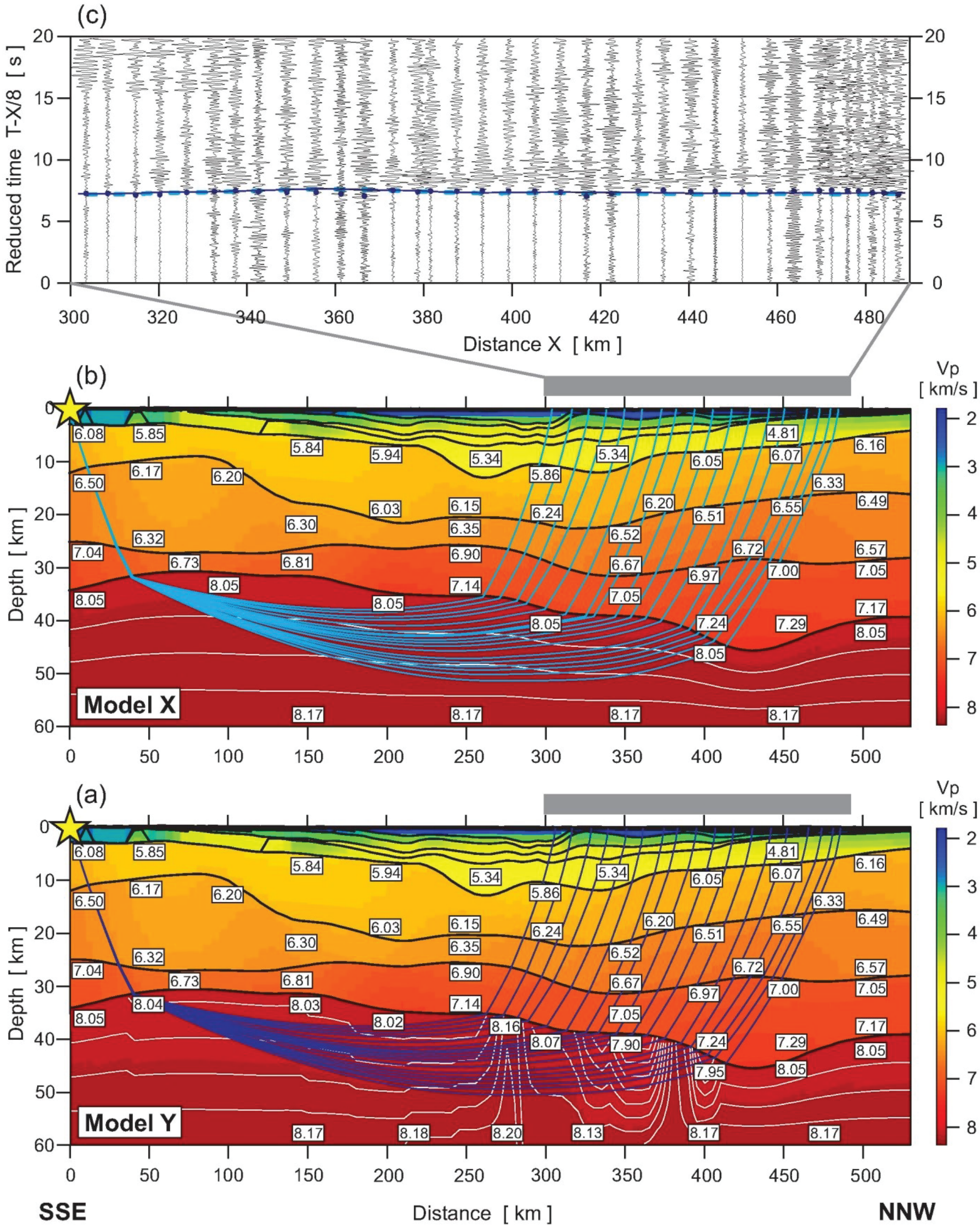

Figure 2: (a) The Model Y of the LUMP profile obtained by seismic inversion (Model Y). Thick, black lines represent velocity discontinuities (interfaces). Velocity values in km/s are shown in white boxes. Thin, white lines represent velocity contour lines (each 0.03 km/s). Blue lines correspond to ray paths. (b) The Model X - vertical cross-section obtained from 3D model of P-wave velocity in Poland between event location and middle point of the LUMP profile with Model X below the Moho discontinuity. (c) Seismic section with calculated travel times: navy blue line - for the new model presented in (a); light blue dashed line - for model (b), and first arrivals (navy blue dots), filtration 1.5-6.0 Hz.

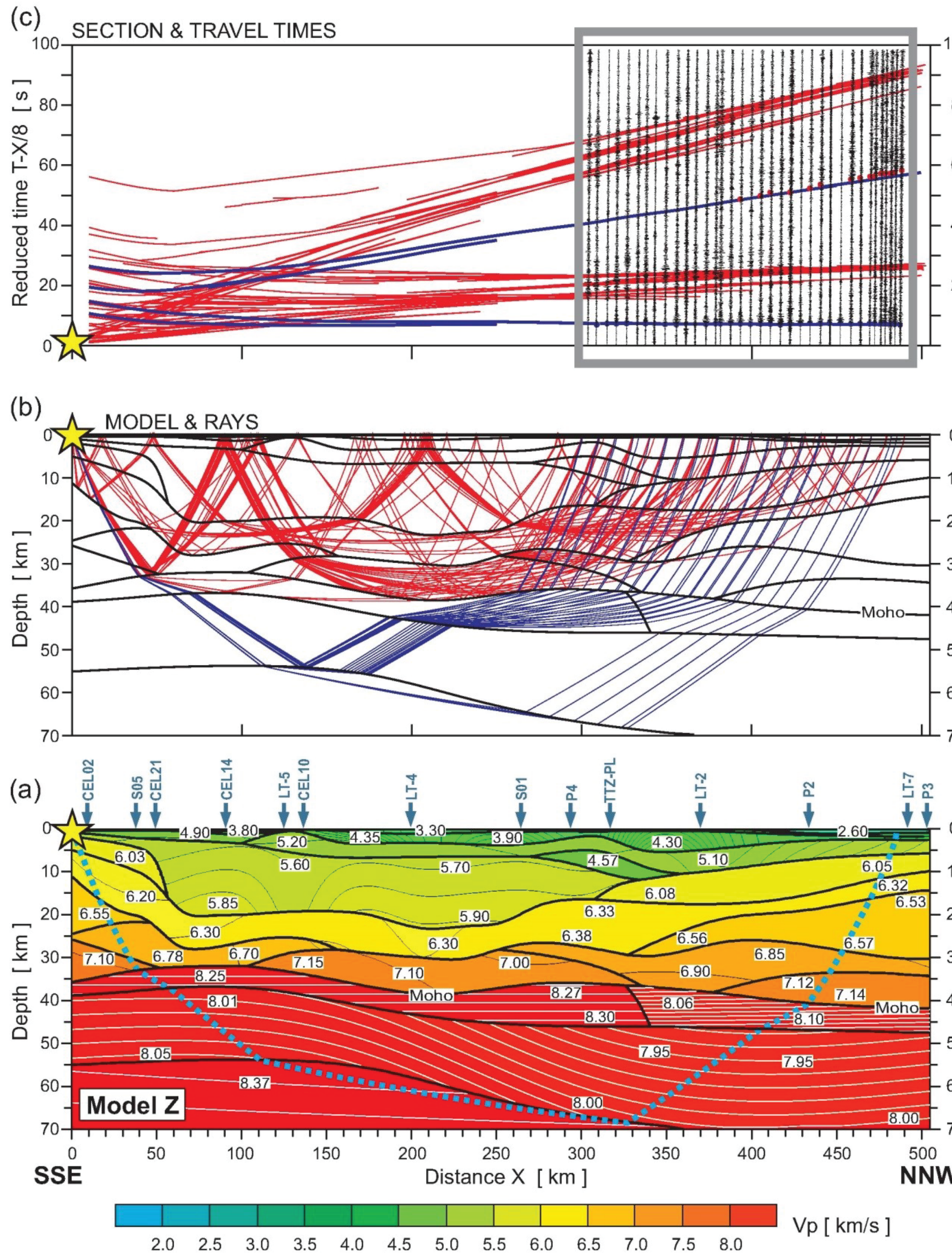

Figure 3: (a) The Model Z – 2D raytracing P-wave velocity model for the LUMP profile. Please note that the crustal part of the model is constructed from models listed in Table 2, which cross the LUMP profile. Only velocities in the uppermost mantle were modelled. Thick, black lines represent velocity discontinuities (interfaces). Thin black lines represent velocity contour lines in the crust (each 0.1 km/s). Thin white lines represent velocity contour lines under Moho (each 0.01 km/s). Blue lines correspond to ray paths. Blue dashed line corresponds to range of rays propagation. Velocity values in km/s are shown in white boxes. (b) The ray paths refracted and reflected at crustal uppermost mantle discontinuities with multiples. (c) Seismic sections with travel times calculated for the model presented in (a). Red rays on (b) and travel times on (c) and (d) diagrams represent selected crustal multiples which can explain high amplitudes after first arrivals. They are not included in modelling.

Determination of seismic anisotropy of the upper mantle beneath Sudetes – a passive seismic experiment | P.Środa, M.Bociarska, J.Rewers and Working Group

In 2017, a passive seismic experiment was launched, involving 23 broadband and 6 short-period seismic stations deployed in the area of Sudetes and Fore-Sudetic block, between Elbe Fault in SW and Odra Fault in NE. The measurements cover a ~200x100 km large area, with spacing between stations of ~30 km. The stations, deployed for a period of 18 months, will provide broadband recordings of local, regional and teleseismic events. Obtained data will be supplemented with the data from five permanent seismic stations, operating in this area in Poland and Czech Republic. The aim of the experiment is to study the structure, seismic velocity variations including anisotropy distribution, and to map the upper mantle seismic discontinuities (Moho, lithosphere-asthenosphere boundary, mantle transition zone).

The area of Sudetes, located at the margin of the Bohemian Massif, represents the NE part of the Variscan internides. The region consists of a collage of several units. It has complex tectonic history ranging from the upper Proterozoic till the Quaternary. The crustal structure of this region is relatively well studied, e.g. by seismic wide-angle experiment SUDETES 2003. However, unlike for other parts of the Bohemian Massif where numerous seismic passive (teleseismic and regional) studies have been carried out, in Polish Sudetes only scarce data about the upper mantle properties were collected.

The results of the seismic experiment will provide new information on the mantle structure of the region and will be compared with recent results of petrological studies of crystal preferred orientation in upper mantle xenoliths found in Tertiary volcanics in Lower Silesia. Based on obtained results, we will attempt to enhance the understanding of the evolution and deformations of the Sudetic lithosphere, including the impact of the Alpine orogeny on the present architecture of Sudetes.

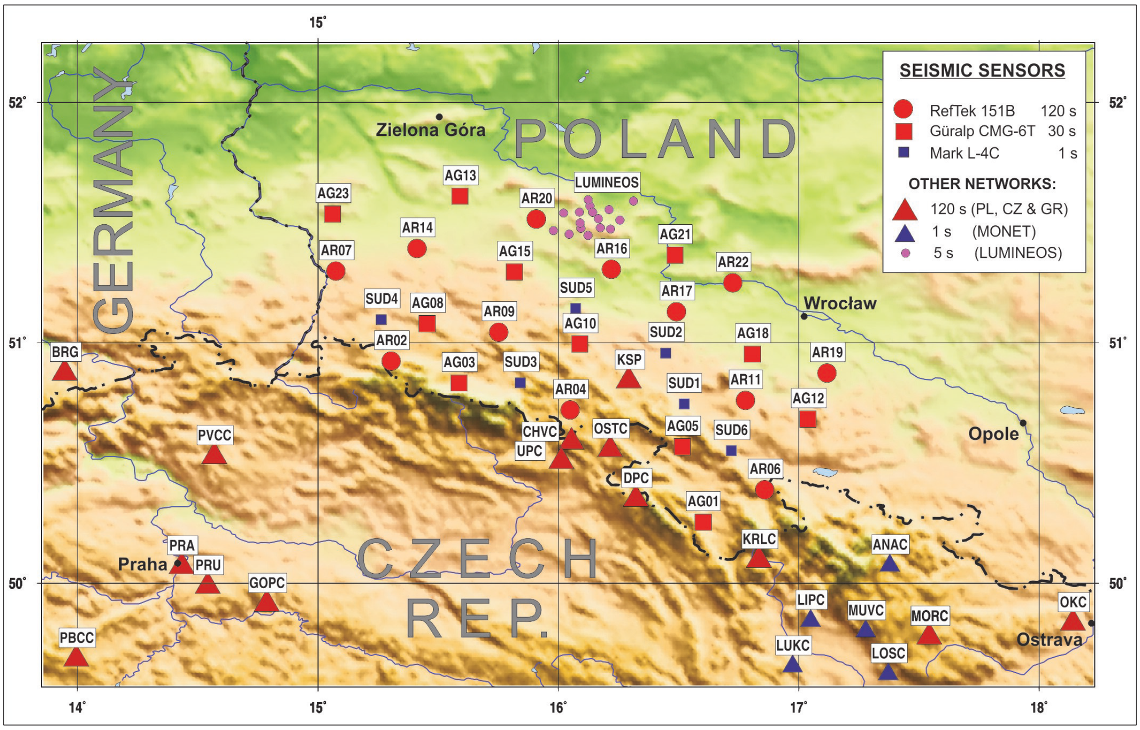

Figure 1: Location of seismic stations operating during the experiment.

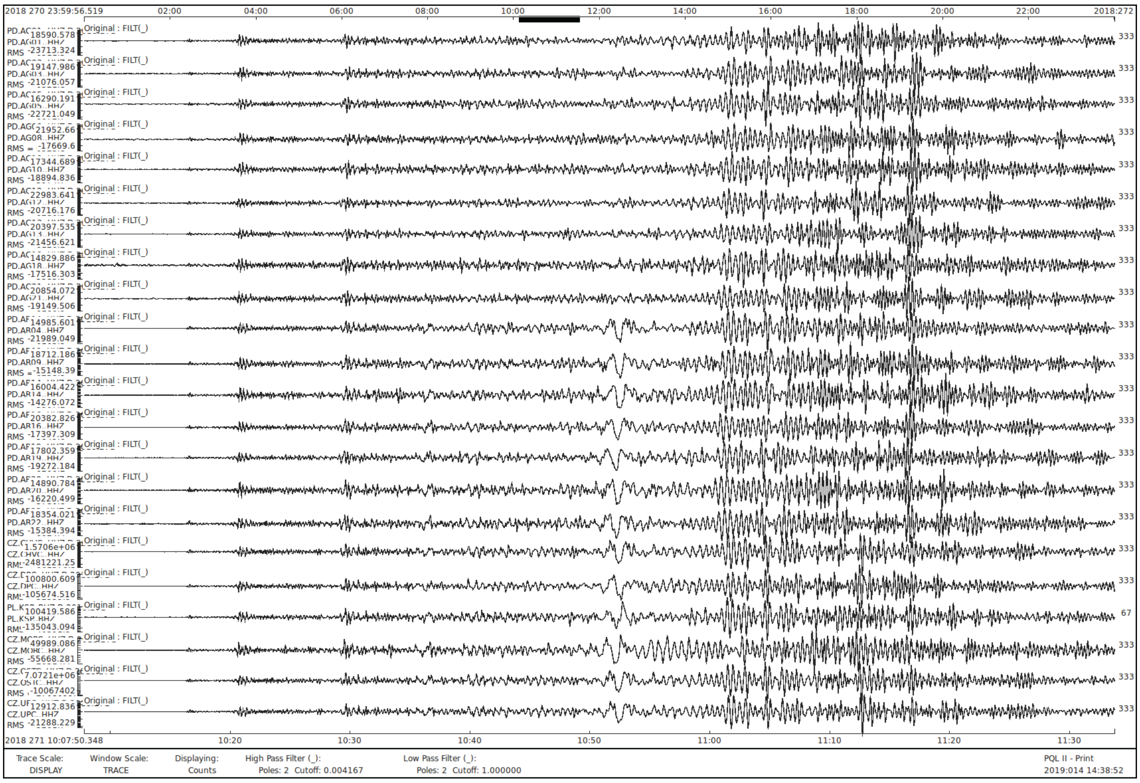

Figure 2: Example of seismic recording – event 28 Sep 2018, M7.5, Indonesia, Z-component.

Seismic Modeling of the Lithopshere Structure Near the Logachev Sea Mount In the Region of Knipovich Ridge | W.Czuba, T.Janik, D.Wójcik and Working Group

To better understand the lithospheric structure beneath the ultraslow-spreading ridges the active seismic survey within the Knipovich Ridge Passive Seismic Experiment (KNIPAS) was carried out. The aim of this work was to provide a segment-scale image of lithosphere structure, velocity field and its boundaries beneath the Logachev Seamount on the Knipovich Ridge. The whole work had been done in cooperation with Germans among others from Alfred Wegener Institute for Polar and Marine Research.

Active seismic profiles were acquired during cruise no. MSM67 in September 2017. On the ocean floor at depths from 2.3 to 3.3 km seismic energy was recorded by 8 ocean bottom seismometers (OBS). In total 320 km of seismic data was collected along 6 profiles with lengths varying from 30 to approximately 60 km covering the area of around 2200 km2. The profiles are crossing each other over the centre of the Logachev Seamount. High resolution bathymetric data acquired during the cruise combined with previous bathymetry data sets were utilized as an ocean bottom layer within the seismic model. Our intention underlying this work is to provide evidence of crustal thickness variation beneath the Logachev Seamount and therefore substantially contribute to an understanding of this type of ridges. For the 2D modelling process only data from OBSs near the profiles were used. Seismic model was prepared for each seismic line by iterative trial-and-error ray tracing.

After preparation and initial processing of the acquired data, picking of visible first breaks on all seismic sections had been done. Layers of the model were added to assume the best fit between calculated travel times and picks. Five lithospheric layers for the longest profiles were separated with substantial velocity contrasts at the boundaries. Besides first arrivals, later phases and multiples were used. Water wave and its multiples allowed estimation of the velocity in the sea water. Available non-linear information from all profiles will be used for further 3D tomography modelling.

By combining the available observables from all seismic profiles we draw the following conclusions. The resulting 2D lithosphere models show relatively high velocity gradients especially for the middle oceanic crust. High velocities 5.3 – 5.8 km/s are observed just below the surface over the seamount centre. We found ca. 1.5 km uplift of the lower oceanic crust layer to the East of the Logachev Seamount. For the longest profile layer with velocity above 8 km/s was distinguished at depth of approximately 10 km which can suggest presence of the Moho discontinuity.

Preliminary results of the seismic modelling were presented during the SEISMIX 2018 Symposium by Dariusz Wójcik.

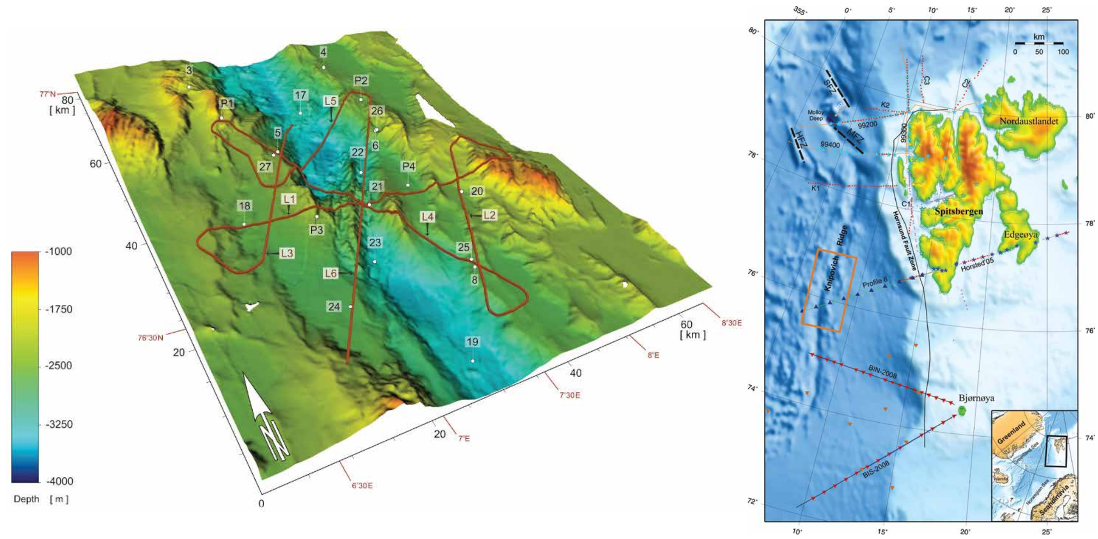

Figure 1: Bathymetry of the study area with seismic lines with OBSs and localization of the study area (red rectangle).

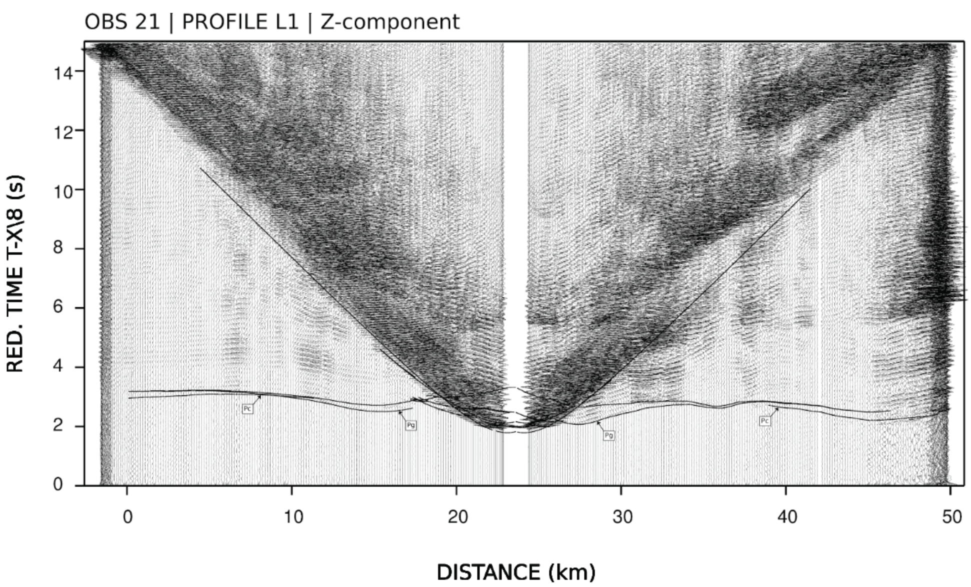

Figure 2: Example of seismic record section (receiver gather) from OBS 21 on the profile L1 with calculated travel-times.

Seminars and teaching

Seminars and lecture outside of the IG PAS

- Czuba | *Lithospheric Research Infrastructure Centre (CIBSBL) in the EPOS-PL project* | Seminar
  Institute of Geophysics, Warsaw Univ.| Warsaw, Poland

Teaching thesis

- Julia Rewers | *Modeling of Seismic Anisotropy of the Earth's Crust and the Upper Mantle in the Region of Fore-Sudetic Monocline and Bohemian Massif* | Supervisor: Środa

Visiting scientists

- Vitaly Starostenko, Viktor Omelchenko, Dima Lysynchuk, Olga Legostaeva, Sergey Czulkov | Institute of Geophysics, National Academy of Sciences of Ukraine | Kiev, Ukraine
- G. Randy Keller | University of Oklahoma | Norman, OK, USA
- Ewald Brueckl | Vienna University of Technology | Vienna, Austria

Meeting, workshop conferences and symposia

EGU General Assembly | Vienna, Austria

Środa | Fossil margin of Baltica in SE Poland – an analogue to present continental margins? | poster

Czuba, Janik | KNIPAS – exploring active seafloor spreading processes at segment-scale | poster

SEISMIX 2018 | Cracow, Poland

Wójcik, Czuba, Janik | Preliminary results of the Logachev Seamount seismic modeling | poster/oral

Wójcik, Janik | BASIC: A high-density crustal-scale refraction seismic profile across the Bergslagen ore district, Sweden | poster

Środa, Bociarska | Passive seismic experiment in Sudetes, SW Poland | poster

Czuba, Janik, Środa | RomUkrSeis: the deep structure of the TESZ where it is obscured by the Eastern Carpathians | poster

Czuba, Janik | KNIPAS – exploring active seafloor spreading processes at segment-scale | poster

Środa | Anomalous upper-mantle phases in the Western Carpathians: Indication of the ALCAPA and the European Plate contact | poster

AGU General Assembly 2018 | Washington, USA

Środa | Crustal-Scale High Density Body at the Fossil Rifted Margin of Baltica in Poland – an Analogue to Atlantic Continental Margins? | poster

1st Scientific and Technical Conference dedicated to the EPOS-PL project | Jachranka, Poland

Wójcik | Database construction, metadata structure, formats and standards of CIBSBL | oral

Czuba | Task 7: Lithospheric Research Infrastructure Centre (CIBSBL): Data and measurement facilities held | oral

Publications

Wojciech Czuba, Aleksander Guterch, Tomasz Janik, Piotr Środa, 2018, Lithospheric structure along wide-angle seismic profile GEORIFT 2013 in Pripyat–Dnieper–Donets Basin (Belarus and Ukraine); GEOPHYSICAL JOURNAL INTERNATIONAL

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