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IN MEMORIAM

History of Deep Seismic Soundings in Poland

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Edited by

Tomasz Janik, Wojciech Czuba, and Anna Dziembowska

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Front cover designed by Marek Górski applying Aleksander Guterch's photo by Miroslav Bielik

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C O N T E N T S

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Preface

This volume is an expression of respect for the outstanding **Man of Science, Professor Aleksander Guterch**, our long-time boss and colleague. We have tried to present his professional path and recall his greatest scientific achievements, presenting at the same time the history of the development of deep seismic soundings in Poland, which were inextricably linked to him. We also pointed out his significant, innovative contribution to this type of research conducted on a large scale in international cooperation in Europe and the polar regions. In addition to Aleksander's professional accomplishments, briefly outlined by his collaborators and scholars from the Polish and international scientific community, we paid a lot of attention to his non-professional life, strong ties with his homeland, and memories of his closest relatives and friends. Worth recalling was also his deep interest in history, specifically the history of Polish arms, and his avid passion for collecting *military* memorabilia.

Deep thanks to all the authors and people involved in the preparation of this volume, for their engagement and help.

Tomasz Janik, Wojciech Czuba, and Anna Dziembowska

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Professor Aleksander Jan Guterch
16 February 1936 – 28 December 2023

Aleksander Guterch, a professor at the Institute of Geophysics of the Polish Academy of Sciences, was a prominent geophysicist, dealing with the structure of the Earth's crust and upper mantle, the "father" of seismic studies of the lithosphere in Poland.

He was born in Sękowa near Gorlice in the Podkarpacie region, in a family with strong petroleum traditions. He attended primary and secondary schools there. Next, he studied at the Faculty of Physics of the University of Warsaw, where in 1961, under the supervision of Professor Tadeusz Olczak, he received a master's degree in geophysics specialization and took up

a job as a research assistant. In 1963, he moved to the Institute of Geophysics of the Polish Academy of Sciences (IG PAS; in Polish: IGF PAN), with which he bound his professional life for 60 years. In 1969, after defending his PhD, he headed the Deep Seismic Sounding Laboratory and then the Department of Seismic Lithospheric Research of IG PAS until 2012. He was an educator and mentor to many young employees, and promoted five PhD students. He built a strong research team around him, with which, starting in the 1970s, he took up the challenge of identifying the deep structure of the Earth's crust and upper mantle in Poland by seismic methods. The Trans-European Suture Zone (TESZ), which runs through the centre of Poland and is one of Europe's most prominent tectonic units, was of his particular interest. In scientific activities, the research team established strong cooperation with the Department of Physics of the Lithosphere of the Institute of Geophysics, the Faculty of Physics of the University of Warsaw, headed by Professor Marek Grad.

From 1997 to 2003, Aleksander Guterch initiated and organized or co-organized large-scale seismic research projects of deep crustal and lower lithosphere structures in Central Europe, from the Baltic Sea to the Adriatic. Smaller-scale surveys were also conducted in several East European countries and Finland. He also pioneered this type of research in the Arctic and Antarctic, organizing ten marine refraction seismic expeditions. The Professor also headed many scientific projects and programs in Poland.

Professor Aleksander Guterch was a full member of the Polish Academy of Sciences, a correspondent member of the Polish Academy of Arts and Sciences (Polska Akademia Umiejętności, PAU), an ordinary member of the Warsaw Scientific Society, the Polish Geophysical Society, an honorary member of the Hungarian Society of Geophysicists, and a member of many national and international Scientific Committees, Associations and Specialized Groups. He was also the recipient of many awards and honours, and the holder of several national decorations. The results of Prof. Guterch's scientific activities have been presented in more than 250 publications, mainly in international journals and monographs, as well as national ones. These works are highly valued by the scientific community dealing with the "hard Earth", as evidenced by the high number of citations.

In addition to his achievements in science, Aleksander Guterch also had significant achievements in the field of promoting and preserving the traditions of Polish colors and weapons. He was a long-time president and then a honorary member of the Association of Lovers of Old Arms and Uniforms. He also held the title of Honorary Citizen of the Sękowa Commune.

In the person of the Professor, we lose not only a great scientist but also a mentor to many generations of geophysicists and a very remarkable colleague and friend.

Tomasz Janik and Wojciech Czuba

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History of Deep Seismic Soundings (DSS) Research in Poland and the Role of Professor Aleksander Guterch in its Development

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1. INTRODUCTION

Poland has a quite special location on the geological map of Europe. The Trans-European Suture Zone (TESZ) runs through the center of Poland. It is one of the most prominent tectonic units in Europe, a contact zone between the old, Precambrian, East European Craton (EEC), and the younger Paleozoic platform. Recognizing the deep structure of this zone is a great scientific challenge. The best research tools for this type of task are experimental seismic methods. Aleksander Guterch has taken up this challenge since the 1960s and created a strong research team I have been a member for 45 years. In his activities, he could initially count on the support of leading Polish geologists, Professors Jerzy Znosko, Władysław Pożaryski, Ryszard Dadlez and others, and also had good contacts with PGNiG (Polish Oil and Gas Company), Geofizyka Kraków, and Geofizyka Toruń enterprises. He can be called the "father" of DSS in Poland, although it must be admitted that Eng. Jan Uchman initiated this activity at the Department of Geophysics of the Polish Academy of Sciences in 1956.

Over the last few years, I have repeatedly tried to persuade Olek (Aleksander Guterch) to write down the history of the beginnings of deep seismic soundings (DSS) [GSS – głębokie sondowania sejsmiczne, in Polish] at the Institute of Geophysics of the Polish Academy of Sciences (IG PAS), previously, until 1971, the Department of Geophysics of the Polish Academy of Sciences. He usually replied that he had everything figured out and all that was left to put it down on paper. He flatly rejected offers of technical assistance. Unfortunately, he did not manage to fulfil this promise. Since I joined the team in 1978, I do not know the earliest period of DSS research from my own experience. After Olek's death, as the oldest employee, I was responsible for writing this story. I describe everything that concerns the years before 1978 on the basis of literature and fragmentary information obtained from former employees of the team or the Institute. They may be unreliable or incomplete, for which I apologize. At this point, I would like to thank many colleagues, former and current employees of the IG PAS, for supporting my knowledge of many details that I did not know or did not remember.

What does the name Deep Seismic Sounding mean? It is about researching the Earth's crust and upper mantle using experimental seismic methods, mainly active methods. In our case,

these are refraction profiles with artificially generated seismic sources, usually detonations of chemical charges, made in holes drilled deep into the ground specifically for this purpose or at the bottom of shallow water reservoirs. We sometimes also use vibrators on land or air guns at sea as seismic energy sources. The latter are usually associated with reflective measurements. All such research requires huge, specialized technical and logistic support from geophysical companies specializing in seismic measurements. We usually cooperated with the PBG Geophysical Exploration Ltd., as well as with Geofizyka Kraków and Geofizyka Toruń.

The term "deep seismic soundings (DSS)", comes from the Russian (glubinnoye seismicheskoye zondirovania). In Western countries, the term "wide-angle reflection and refraction (WARR)", is more often used, which briefly defines which phases of seismic waves are used for interpretation.

This paper contains a brief description of projects in which the DSS research team of the IG PAS was the organizer and/or participant (Table 1); it is supplemented by four annexes published in electronic edition: Aleksander Guterch's Curriculum Vitae (Annex 1, https://pub.igf.edu.pl/files/Pdf/Arts/708.pdf?t=1732722512), Aleksander Guterch's Bibliography 1963–2023 (Annex 2, https://pub.igf.edu.pl/files/Pdf/Arts/709.pdf?t=1732722512), Measurement (Annex 3, https://pub.igf.edu.pl/files/Pdf/Arts/710.pdf?t=1732722512), and People (Annex 4, https://pub.igf.edu.pl/files/Pdf/Arts/711.pdf?t=1732722512). To enrich the otherwise plain text, Annexes 3 and 4 provide a collection of photos related to the development of measuring equipment and field experiments, as well as pictures of some members of the DSS team at work. The results of our extensive research have not been presented here, because this has been done in many other publications.

My intension was to present a condensed calendar of important, sometimes groundbreaking, events in the history of the Department of Lithospheric Research and Aleksander Guterch's participation in it. All our publications can be found on the website of the Department of Lithospheric Research, https://publikacje-zsbl.igf.edu.pl/.

Some data from our experiments can be obtained from the databases:

– EPOS-PL: https://cibsbl-platform.igf.edu.pl/,

– IG PAS: https://dataportal.igf.edu.pl/organization/lithospheric-research.

To obtain data that is not yet available in these databases, write to Department of Lithospheric Research IG PAS.

2. THE BEGINNINGS OF DSS RESEARCH

Preparations for the first DSS seismic experiment began at the Department of Geophysics of the Polish Academy of Sciences in 1956 under the supervision of Eng. Jan Uchman, who had already been involved in seismic exploration research in the Lviv region before the Second World War. Important problems to solve before the first measurements were testing solutions to ensure accurate measurement of the recording time and choosing the location of the first profile. The timing problem was solved by transmitting a standard time from the Central Office of Measures via the Warszawa I radio station, at a wavelength of 1320 m, which was received by seismic stations via ordinary transistor radio receivers. The first profile (A) was decided to be located between Racibórz (Radynia) and the Gulf of Gdańsk (around Stegna) with an additional shooting point near Konin. This profile location was chosen because it crossed the margin of the East European Craton. Measurements using 18 seismic devices, of course analogue, recording 6 channels on photographic paper, began along the profile in December 1960, and were continued, at 20 device spacings, in September and October of the following year. Measurements on the next profile (B) were carried out in 1963 and 1964, and on profile C in 1965 (Fig. 1). In 1963, a young graduate from the Faculty of Physics of the University of Warsaw (geophysicist), Aleksander Guterch, joined the small research team. The first publications pre-

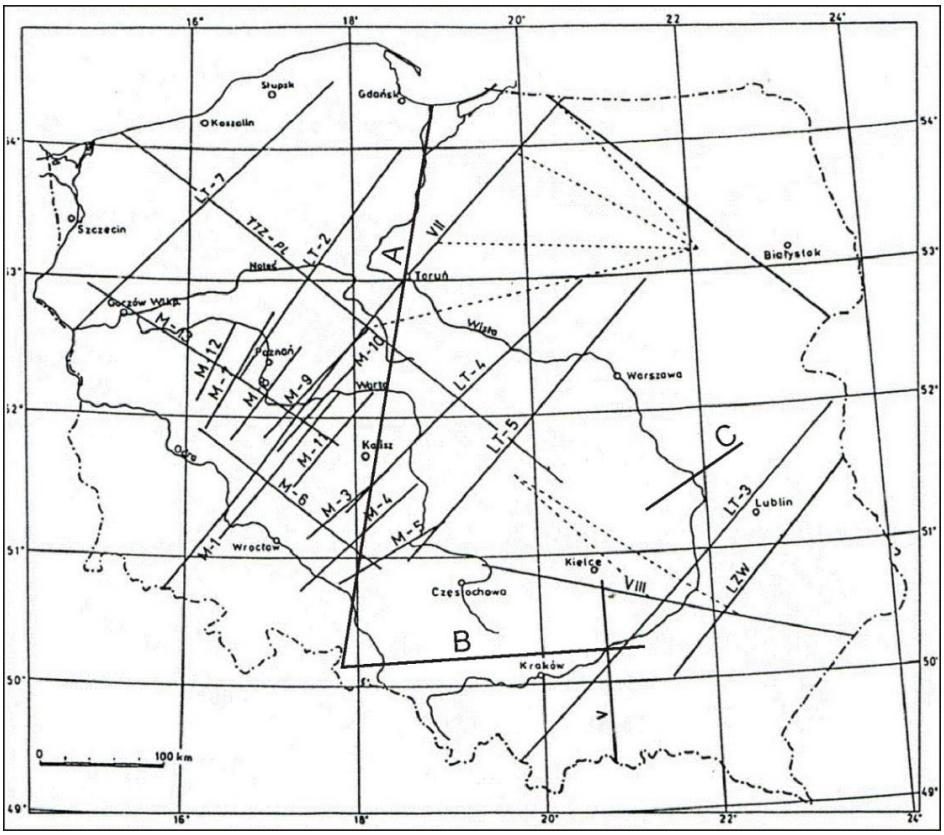


Fig. 1. Network of profiles of deep seismic soundings performed in the years 1960–1993 in Poland: first profiles, A, B, C; international profiles, V, VII, and VII; industrial profiles on the Fore-Sudetic Monocline, M-1 to M-13; profiles from the LT series: LT-2, LT-3, LT-4, LT-5, LT-7, and LZW (modified after Guterch et al. 1974; Guterch and Grad 1996).

senting the interpretation of the data collected along the DSS profiles are signed with the names of Bożenna Wojtczak-Gadomska, Aleksander Guterch, and Jan Uchman, in a different order of surnames, depending on the publication.

In 1969, the IG PAS DSS team joined the international DSS (research program conducted in Eastern European countries under the leadership of Prof. V.W. Sollogub from the Institute of Geophysics NANU in Kiev. As part of this cooperation, several international profiles were implemented. In Poland, measurements were made on profile V (Carpathian) in 1969, and on profiles VII and VIII in 1971–1973 (Fig. 1). In 1969, after defending his PhD, Aleksander Guterch took over the position of head of the Deep Seismic Sounding Laboratory. The team was also joined by geophysicists, Edward Perchuć (slightly earlier, from 1966, still as a technical employee), Jan Pajchel, and Eng. Rufin Materzok, M.Sc, with extensive experience in field work. A little later, in the 1970s, other colleagues joined us: technician Zbigniew Czerwiński, driver Zbigniew Gajewski, PhD student Marek Grad, who nominally worked at the Department of Geophysics, Faculty of Physics, University of Warsaw, but practically worked closely with the DSS team throughout his professional life, and in 1978 the team was joined by Tomasz Janik, graduate from the Faculty of Physical Oceanography of the University of Gdańsk. In the years 1971–1992, under the common name LT (LT-1 to LT-7), research work was carried out on a series of profiles crossing the edge of the East European Craton. The team also interpreted industrial profiles M-1 to M-13 made in 1967–1971 by Geofizyka Kraków on the Fore-Sudetic Monocline (Fig. 1). In the 1990s, other geophysicists joined the team: Edward Gaczyński, Piotr Środa, and Wojciech Czuba, and in the 2000s, Michał Malinowski and Mariusz Majdański, who later, in 2015, created the Geophysical Imaging Department.

The development of the DSS work was accompanied by the efforts of the staff of the Equipment Design Department of the IG PAS, who created subsequent generations of more perfect seismic equipment (see the online Annex 3 Measurement, https://pub.igf.edu.pl/files/Pdf/Arts/710.pdf?t=1732722512). Initially, they were very heavy six-channel tube devices, made in the Soviet Union, later replaced by devices of our own

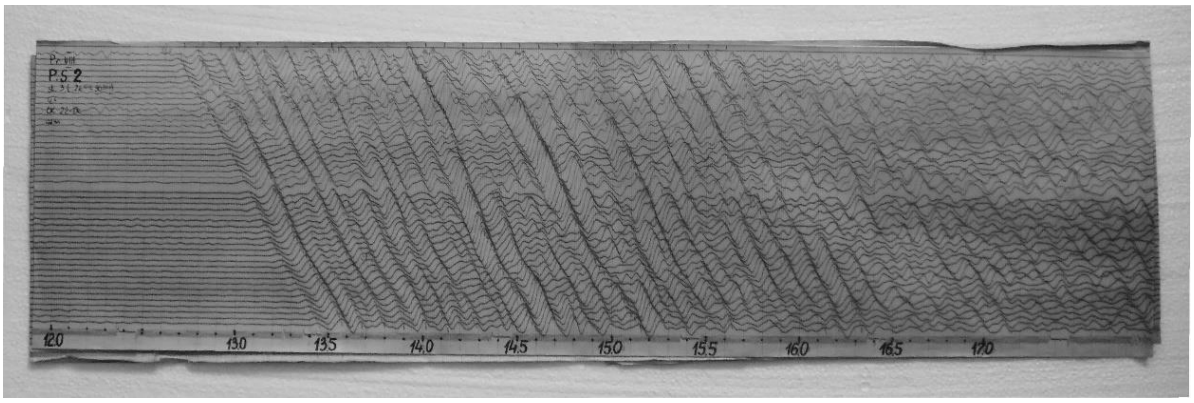


Fig. 2. Example of seismic recording from an industrial 48-channel equipment.

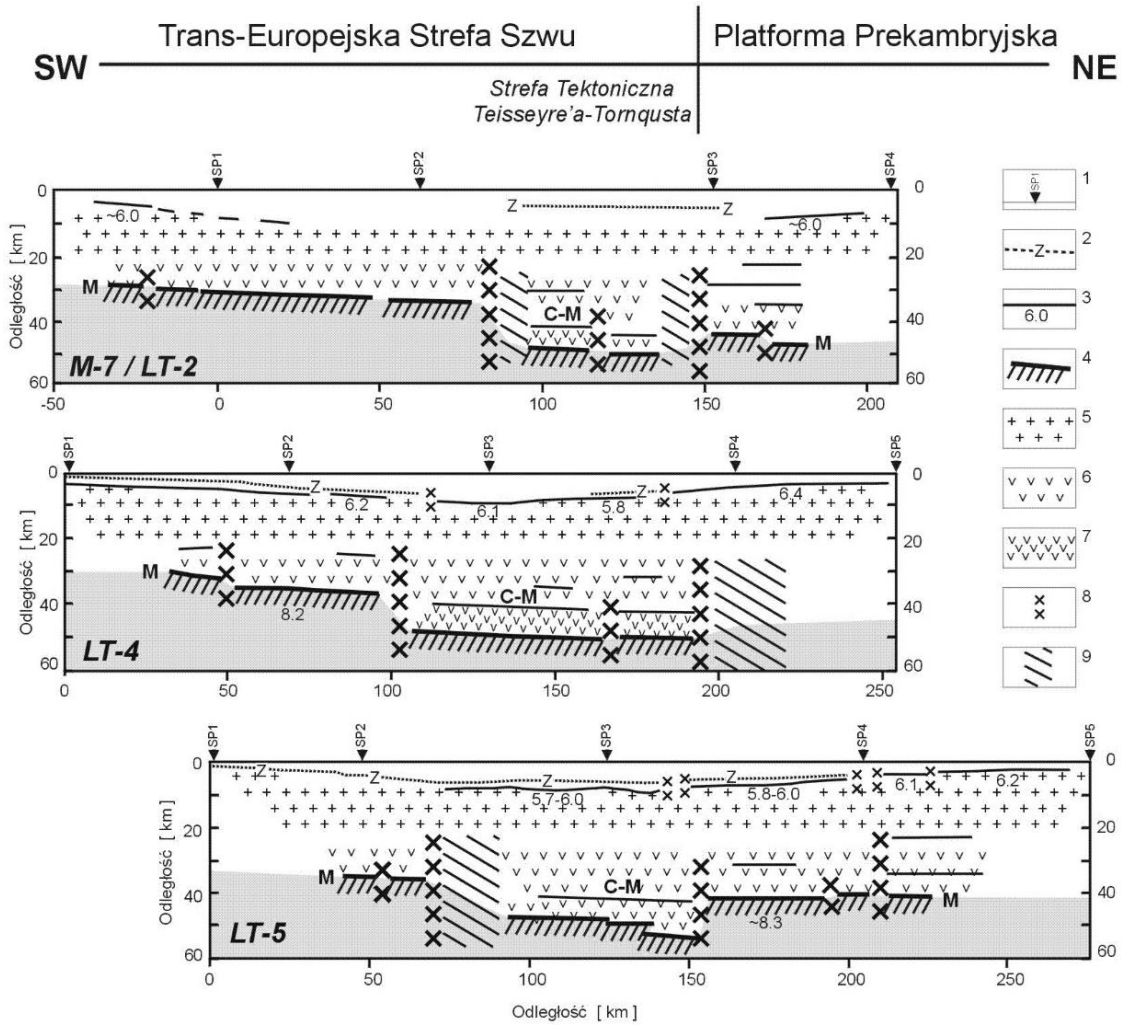


Fig. 3. Examples of seismic models from 1970 to1989 made using the 1D modeling technique. Cross-sections for profiles M-7/LT-2, LT-4, and LT-5 (modified after Grad et al. 2005).

design, the H700, both with recording of seismic energy and timing on photosensitive paper. Six sensors connected to the equipment with cables were placed along the profile at distances of 100 or 200 m. Sometimes, in cooperation with industrial enterprises, 24- or 48-channel POISK devices were also used (Fig. 2). From the mid-1970s, in addition to recording on paper, analogue data began to be recorded on magnetic tapes, which were then digitized on a specially designed device. New designs of receivers for time signals transmitted from dedicated radio stations in Moscow and Bavaria (DCF) also came into use. However, measurements on subsequent profiles were still carried out extensively by using only a few or at most a dozen or so devices. This made it necessary to repeatedly move the equipment spacing along the profile and use the same shooting point locations to ensure appropriate registration density. This generated high work costs. The first experiment carried out with a larger number of seismic stations (over 100) was the TTZ-PL profile performed in 1993, in international cooperation (Universities of Hamburg, Uppsala, Helsinki, and Oulu). Only one sensor was connected to each of the devices, and most of them had the ability to operate automatically throughout the entire measurement night, without the need to manually press the start/stop button at each recording. However, this required a considerable amount of time to be devoted to digitizing these records at a later date. The use of a large number of equipment resulted in significant savings in blasting costs, which are always the largest expense. In the mid-1990s, seismic stations with digital recording and GPS time receivers became increasingly available. The digital revolution and political changes, as well as the opening to cooperation with Western partners in the late 1980s, allowed for a complete change in the philosophy of planning and conducting measurement works. At the same time, there have been major advances in seismic modeling methods and the use of computers. The previously common 1D modeling (Fig. 3) was replaced by 2D modelling (Fig. 4),

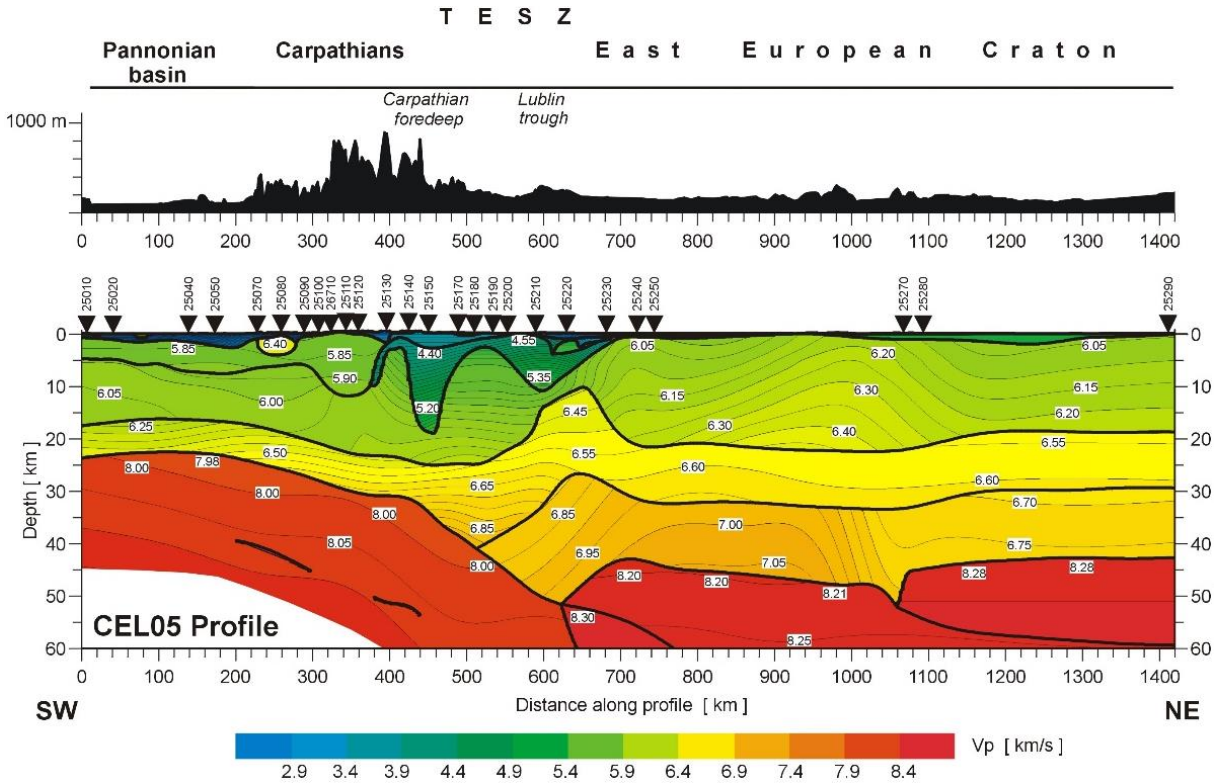


Fig. 4. Example of the two-dimensional P-wave velocity model for CELEBRATION 2000 profile CEL05 obtained by forward ray-tracing modeling using the SEIS83 package (Červený and Pšenčík 1984). The thick solid lines are layer boundaries and thin lines are isovelocity contours in km/s; numbered triangles refer to shot points. Vertical exaggeration for the model is ~6.8 (Grad et al. 2006).

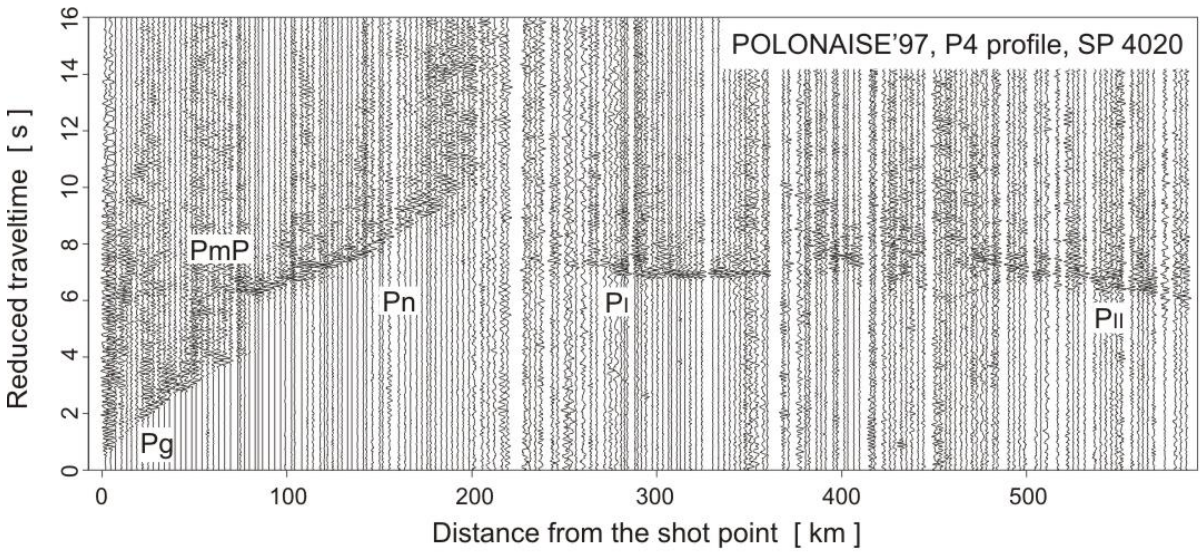


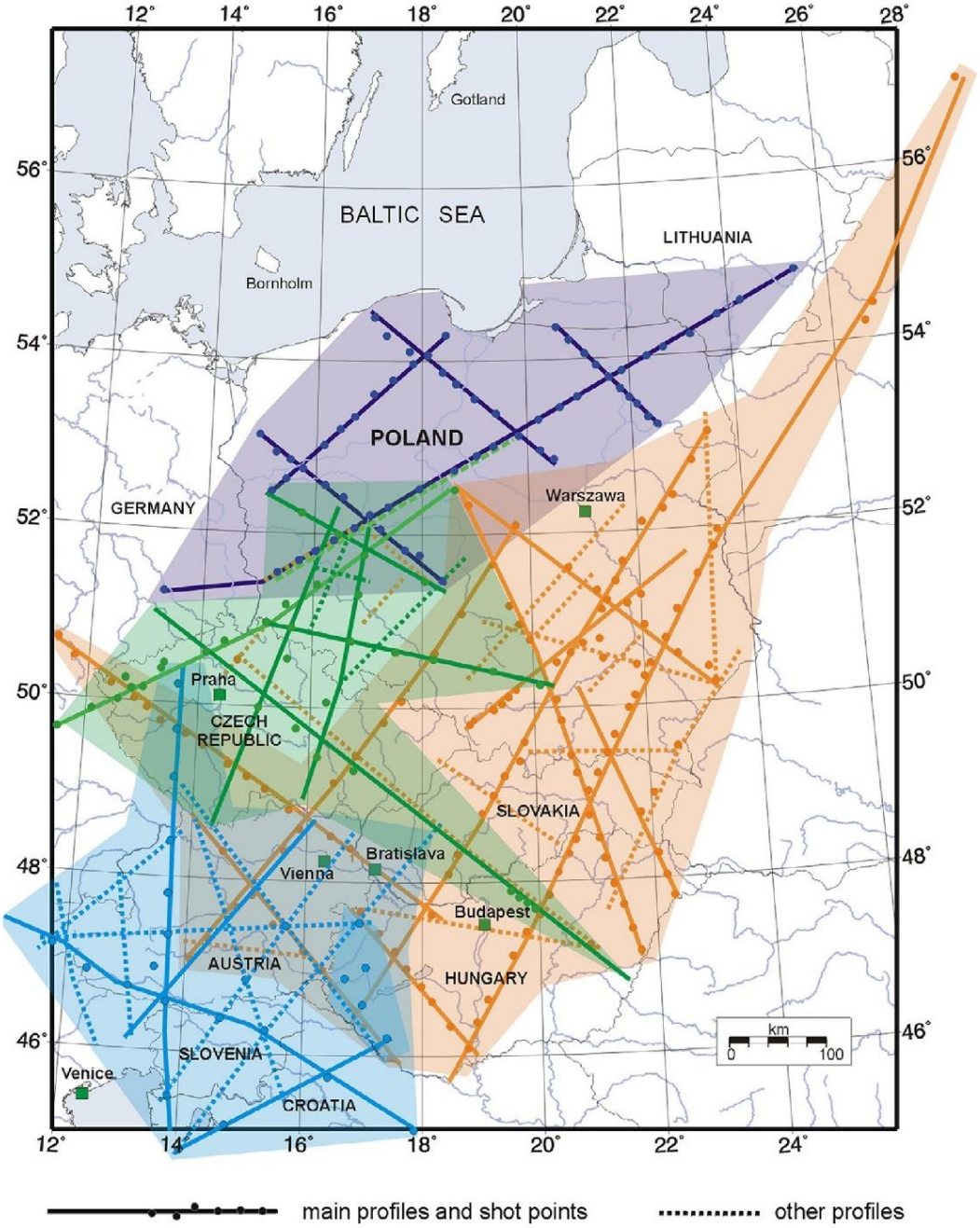
Fig. 5. Example of a shot gather recorded during POLONAISE'97 experiment. Observed seismic phases are: Pg – crustal refraction, Pn – mantle refraction, PmP – reflection from Moho, and P_I–P_{II} – mantle arrivals.

and it was possible to work directly with seismic sections (Fig. 5) on a computer screen, and not, as before, with travel-times on paper and photocopies of registrations, spread out on a ping-pong table. These great changes opened up the possibility of organizing large active seismic experiments, first in Poland and later farther to southern Europe.

3. LARGE SEISMIC PROJECTS

In the years 1997–2003 Prof. Aleksander Guterch was the initiator and organizer or co-organizer of large seismic research projects on the deep structures of the Earth's crust and lower lithosphere in Central Europe, from the Baltic Sea to the Adriatic Sea (Fig. 6). These were the great refraction seismic experiments, commonly known as POLONAISE'97 (Polish Lithospheric Onsets – An International Seismic Experiment, 97), CELEBRATION 2000 (Central Lithospheric Experiment Based on Refraction), SUDETES 2003, GRUNDY 2003, ALP 2002 (implemented mainly in Austria on the initiative and with the participation of the Polish side). All main geological structures in the study area were covered by a system of modern seismic profiles with a total length of approximately 20,000 km. The research was conducted in cooperation with 35 scientific and industrial institutions from 15 European countries, the USA, and Canada. The interpretation of the research was presented in many important scientific journals, and a summary of the results was made by Guterch et al. (2015), in an article being a synthesis of the whole of geophysical research carried out so far in North-West and Central Europe. All the above-mentioned seismic experiments were carried out under the patronage of a specially established non-profit organization – Association for Deep Geological Investigations of Poland – founded and directed by Aleksander Guterch. Only this type of organization could receive research funding from extra-budgetary and foreign funds. In total, out of the multi-million costs of work only in Poland, the vast majority (over 70%), were covered from extra-budgetary and foreign funds.

Aleksander Guterch did not limit his scientific interests to the area of the Trans-European Suture Zone (TESZ) in Poland and Central Europe but extended them to other tectonic units of the East European Platform (Fennoscandia, Sarmatia). We have established long-term fruitful cooperation with the team of Prof. Urmas Luosto from the Institute of Seismology of the University of Helsinki and the University of Oulu, Finland. We participated not only in measure-



Experiment	Shots	Stations	Length
POLONAISE' 97	64	613	2000
CELEBRATION 2000	147	1240	8900
ALP 2002	32	1124	4500
SUDETES 2003	52	956	3450

Fig. 6. Location of seismic profiles in Central and Eastern Europe experiments: POLONAISE'97, CELEBRATION 2000, ALP 2002, SUDETES 2003; lines show seismic profiles of a total length of ca. 20,000 km, with ca. 7,000 seismic receiver positions; dots show 295 shot points (Guterch et al. 2004, 2015).

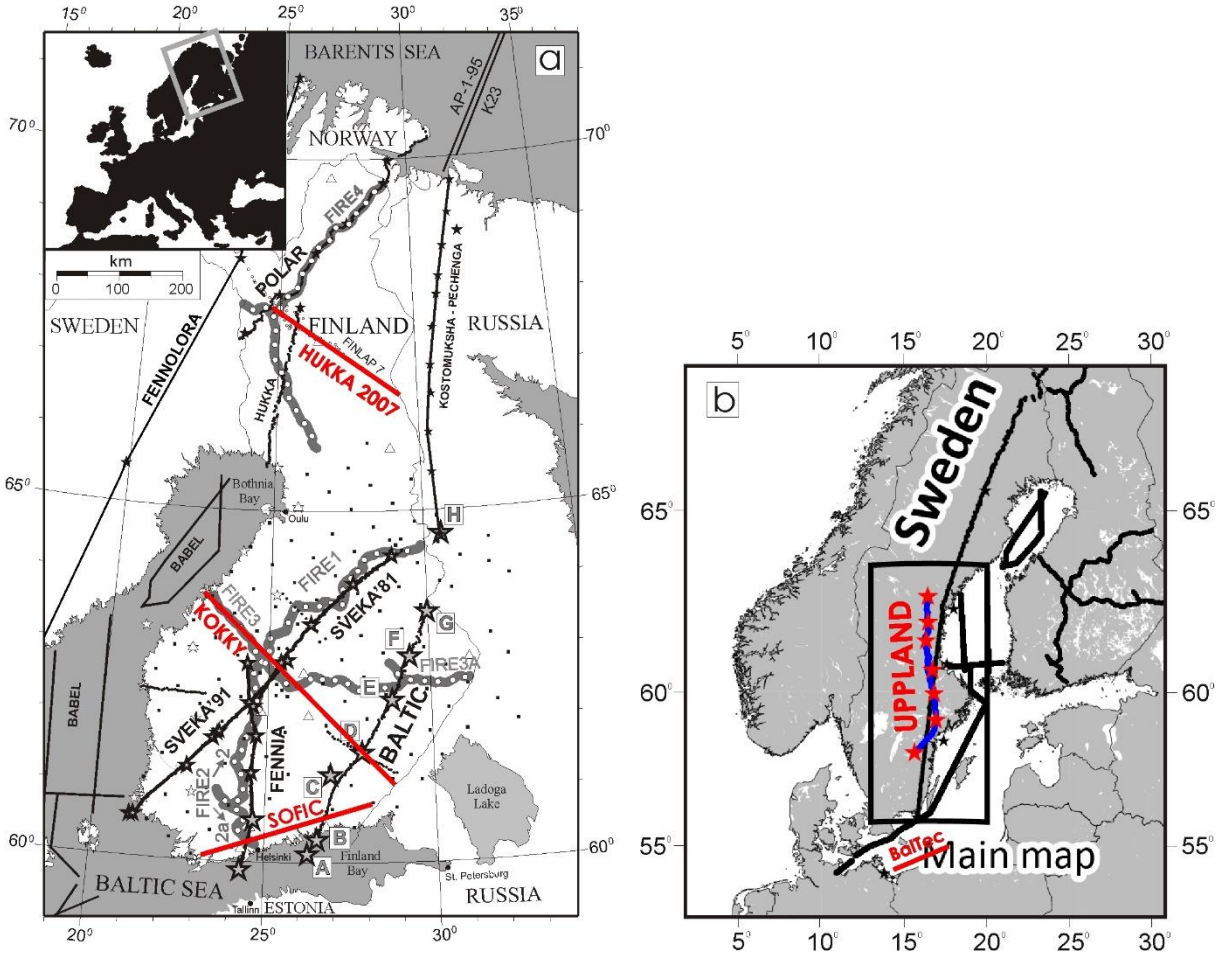


Fig. 7. Location of main onshore and offshore seismic experiments in the Fennoscandia and Baltic Sea: a – **SVEKA** transect (**SVEKA'81** and **SVEKA'91** profiles) **BALTIC**, **POLAR** and **FENNIA** profiles, and deep reflection profiles **FIRE 1–4** (modified after Janik et al. 2009). Positions of record stations of the **SVEKALAPKO** temporary passive array are denoted by rectangles (temporary broadband and short-period stations) and by triangles (permanent stations). Inset map shows the location of target area in Europe. Profiles conducted since 2007 are marked in red (a – **HUKKA 2007**, **KOKKY**, **SOFIC**, b – **UPPLAND** and **BalTec**). Stars represent the shot points of the profiles; black dots represent recording stations of the DSS experiment; grey dots represent receiver stations; and large white dots represent selected CDP points of the deep seismic reflection experiment **FIRE**. Additionally, the positions of other DSS profiles in the area (FENNOLORA, Kostomuksha–Pechenga and BABEL) were presented.

ments in their area, the SVEKA'81, FENNIA, SVEKA'91 profiles, but also in the interpretation of data from the BALTIC, POLAR, and many other projects (Fig. 7). Finns also often participated in our research. As part of the EUROPROBE project, we jointly participated in research on the DSS, EUROBRIDGE'95&96, EUROBRIDGE'97, and DOBRE'99 profiles on the territories of Lithuania, Belarus, and Ukraine. This research was conducted in broad international cooperation.

4. RESEARCH IN THE POLAR REGIONS

In addition to research in Poland, Aleksander Guterch initiated, in the 1970s, the marine DSS research in the polar regions.

In the years 1976–2008, he organized six geophysical expeditions to the Arctic (1976, 1978, 1985, 1999, 2005, 2008) to study the structure of the Mid-Atlantic Ridge and the edge of the Eurasian plate in the Svalbard area (Fig. 8).

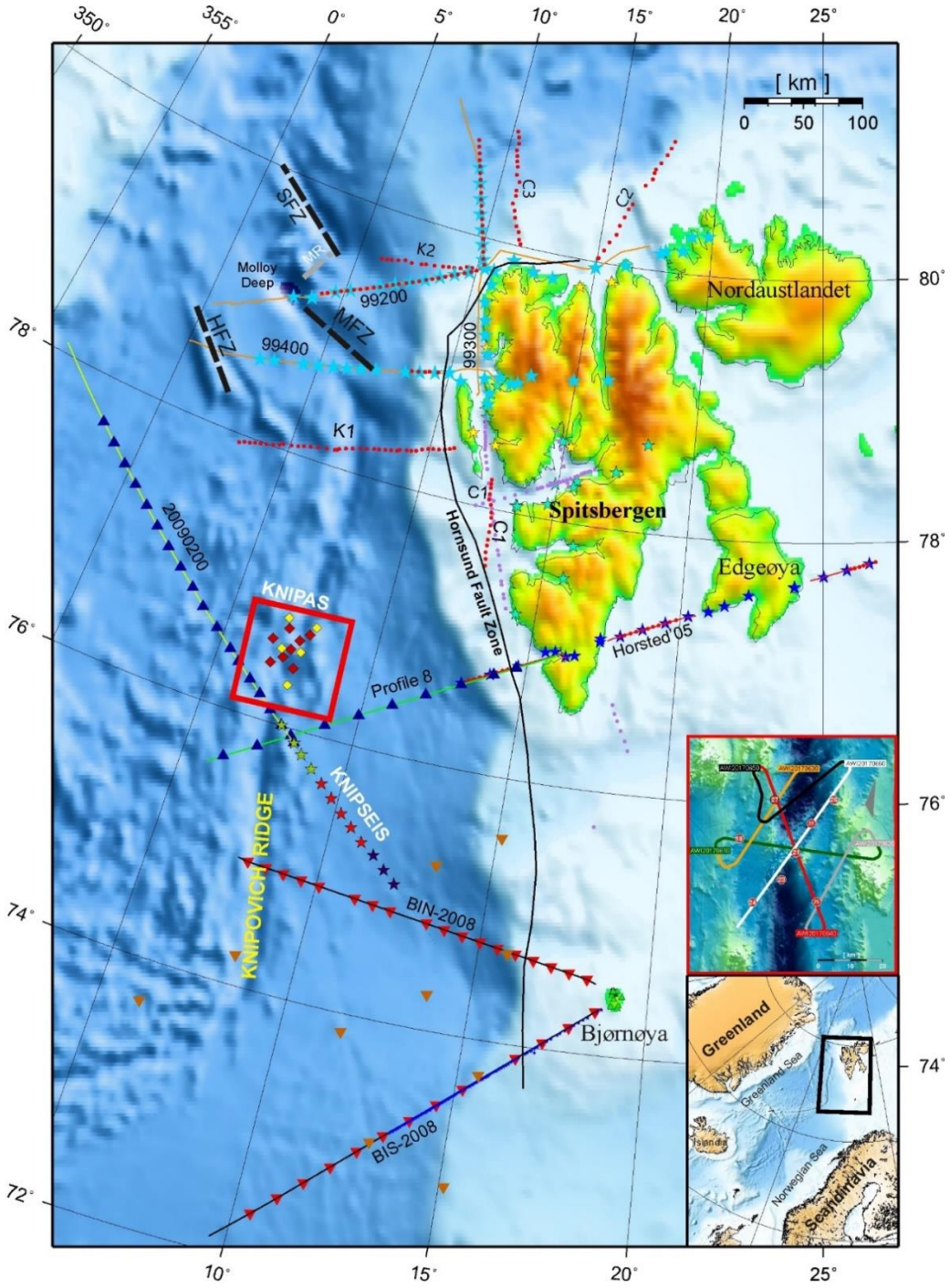


Fig. 8. Location map of the deep seismic profiles conducted by a Polish group in the years 1976–2017 in the ocean-continent transition zone in the western Svalbard and Barents Sea margin (modified after Czuba 2013) on the background of topography/bathymetry map (Jakobsson et al. 2000). Stars, diamonds, and triangles are receivers, thin lines and dots are airgun and chemical (TNT) shots, respectively. Green stars and pink dots are from projects of 1976 and 1978 years (profiles Isfjorden, Central and Coastal). Profiles C1, C2, C3, K1, and K2 are from the 1985 expedition, profiles 99200, 99300, and 99400 are from the 1999 expedition, profile Horsted'05 is from the 2005 expedition, and profiles BIN-2008 and BIS-2008 are from the 2008 project, our team took part in measurements along the BIS-2008 profile. The upper inset shows the map of seismic refraction lines of the active part of the KNIPAS project (2017) over the Logachev Seamount with OBS locations as red circles (red diamonds on the main map). Bathymetry is compiled of multibeam echo sounder data acquired during several cruises. The area is marked by the red frame on the main map. Lower inset – general map of the Arctic region.

In the years 1979–1991, four geodynamic expeditions (geophysics, geology, paleontology) were organized to West Antarctica (1979/80, 1984/85, 1987/88, 1990/1991). The seismic studies of the lithosphere conducted in the outer part of the Antarctic Peninsula (including the subduction zone of the former Phoenix Plate and the Pacific Plate below the South Shetland Islands), the Bransfield Strait and further south, up to Adelaide Island, allowed the presentation of a new geodynamic model of this part of West Antarctica. Some of the polar projects were carried out in cooperation with scientific institutions from Norway, Germany, Japan, and the USA.

Research in the polar regions, especially during the first expeditions, involved, of course, a lot of organizational effort, both before and during the expedition, for the entire team and the crews of the ships we used. These were different ships and different crews: ORP "Kopernik", a hydrographic ship with a Navy crew, and at the same time belonging to Geofizyka Toruń, whose staff operated seismic research equipment of the ship (Spitsbergen 1976, 1978, and West Antarctica 1979/1980); tugs of the Polish Ship Rescue Service, including the famous "Jantar" (West Antarctica 1984/1985, 1987/1988, and Spitsbergen 1985) and "Neptunia" (West Antarctica 1990/1991) (Fig. 9). Since we used manually operated seismic equipment during these expeditions, it required the stay of several (2–3) person measurement groups on land, in the few places where it was possible to locate the base and equipment. Mostly, these were abandoned huse (trapper cabins on Spitsbergen) or bases of polar explorers. Their technical condition varied greatly, from very bad to quite tolerable. However, adapting them to live for several weeks and conducting measurements always required a lot of effort from the entire team and the ship's crew. 2–3 tons of equipment and food had to be transported to the shore, four walls and a roof had to be secured for the measuring group, and a radio mast had to be erected. Sometimes, due to lack of other shelter, it was necessary to set up tents, and sometimes the "lucky" ones found accommodation near a functioning base. Later expeditions had a different character. Automatic recording devices were placed on land and did not require constant human service; alongside, we deployed bottom seismic stations (OBS) on the seabed. We used Japanese OBSs for the first time in Antarctica, in the Bransfield Strait, during the expedition at the turn of 1990/1991.

During four geodynamic expeditions in West Antarctica in 1979–1991, an extensive program of lithospheric research using explosive seismic methods was carried out along over 1,000 km of the shelf of the Antarctic Peninsula and the Shetland Trench, from the Elephant Island to the Adelaide Island (Fig. 9). Seismic measurements were carried out on 20 refractive marine profiles with recordings on land or using bottom seismometers (OBS). The Bransfield Strait is a back-arc basin between the South Shetland Islands and the Antarctic Peninsula. The still active subduction of the Antarctic plate beneath the peninsula is bounded by the Shackleton Fracture Zone (SFZ) to the north and the Hero Fracture Zone (HFZ) to the south. Further south, there is an inactive subduction zone. The occurrence of such diverse tectonics and the proximity of the Drake Plate make it one of the most attractive areas in terms of research, one of the tectonic nodes of the globe. During the first expedition, over 1,000 km of seismic reflection profiles were made in the area of the Bransfield Strait and the South Shetland Islands, using a streamer and air-gun seismic sources from the ORP "Kopernik" deck (Fig. 10).

In 1999, during an expedition to the North Atlantic, our team, in cooperation with German colleagues, used the "Polarstern" icebreaker. The receivers were German land stations, OBSs and bottom hydrophones (OBH). Air guns from the "Polarstern" deck and chemical explosions from the Polish yacht "Eltanin" were used as energy sources. The measurements on the Horsted profile were made in 2005 from the ship of the Gdynia Maritime University "Horyzont II" in cooperation with researchers from the University of Bergen and the Hokkaido University (Fig. 8). In 2008, research was carried out in the area of Bear Island using two ships, Polish

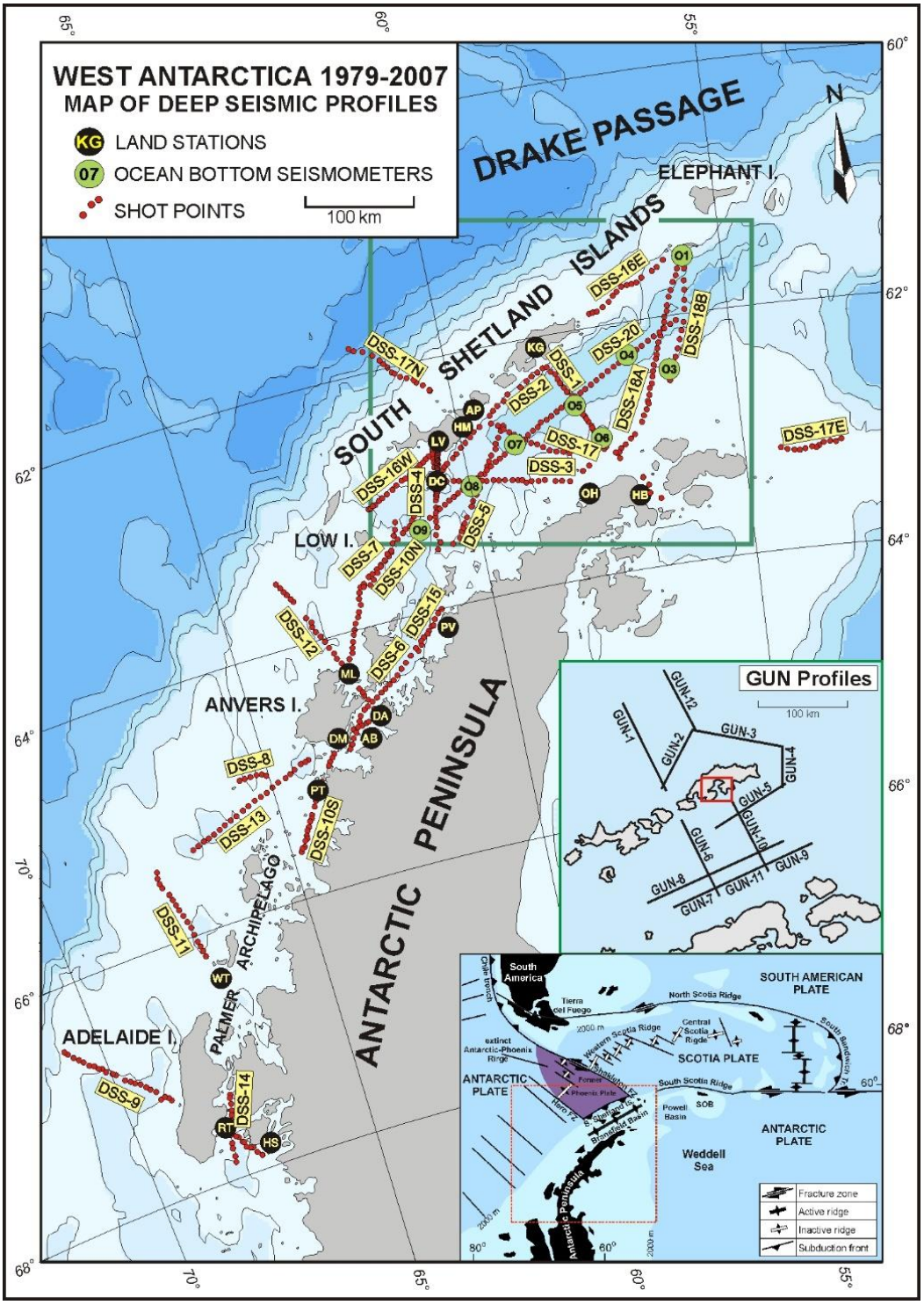


Fig. 9. Location of profiles of deep seismic soundings in West Antarctica carried out by Polish geodynamic expeditions in 1979–1991 (modified after Janik et al. 2014). Land seismic stations: AB – Almirante Brown; AP – Arturo Prat; DA – Danco; DC – Deception Island; DM – Damoy; HB – Hope Bay; HM – Half Moon Island; HS – Horse Shoe; KG – King George Island; LV – Livingston Island; ML – Melchior; OH – O'Higgins; PT – Petermann; PV – Primavera; RT – Rothera; WT – Watkins; 01–09 – underwater seismic stations (OBS). Bathymetric map with isobaths every 500 m (ETOPO5 database used, NOAA's NGDC), using the GMT program (Wessel and Smith 1995). Insets: Map of multi-channel seismic profiles (GUN) conducted by Polish Academy of Sciences during the Polish Geophysical Expedition in 1979/1980 and the tectonic map of the area. The red square marks the area of research during the 2007 expedition to the Admiralty Bay.

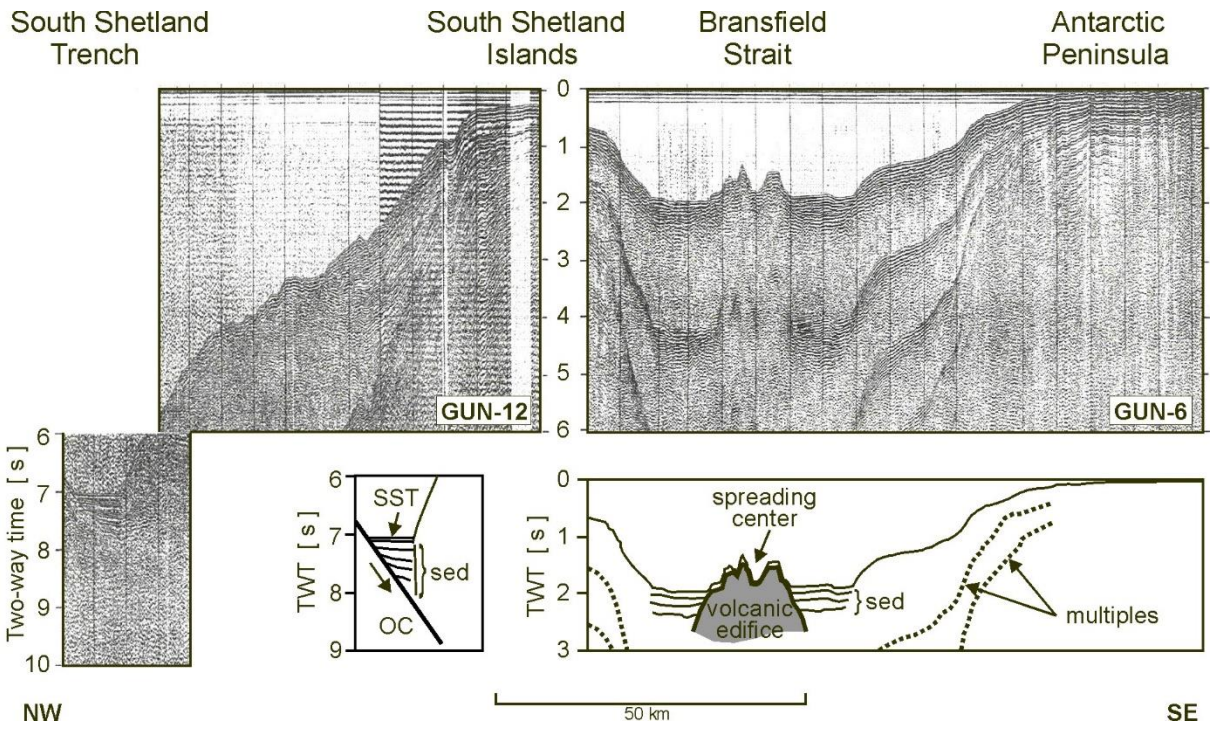


Fig. 10. Seismic reflection profiles and interpretative lines showing the trench sediment fill and structure of the oceanic crust (OC) in profile GUN-12 perpendicular to the South Shetland Trench (SST), and across the spreading centre of the volcanic edifice in the Bransfield Strait (GUN-6) (Janik et al. 2014).

"Horyzont II" and Norwegian "Håkon Mosby", in cooperation with Japan and Germany, using land and bottom seismic stations (OBS) and air-gun sources and chemical explosions.

In 2007, shallow 3D research was carried out in Admiralty Bay (King George Island) using the Russian ship "Polar Pioneer" (Fig. 9).

As part of the passive seismic project KNIPAS, in cooperation with AWI Bremerhaven, the Department's team deployed 5 broadband OBS Güralp stations on the bottom of the Greenland Sea (depth > 3 km), west of Svalbard (Fig. 8). The aim of the project was to study the structure and processes occurring in the mid-ocean Knipovich Ridge. These stations, together with similar German devices, recorded seismic events from September 2016 to July 2017. The Polish side of the project involved the ships "Horyzont II" and "Oceania".

In the summer of 2019, in Polish–Norwegian–Japanese cooperation, measurements were performed by the Norwegian scientific vessel "G.O. Sars" on the extension of the previously completed German profile 20090200, as part of the KNIPSEIS project. The aim of the expedition was to conduct deep refraction seismic studies in the Knipovich Ridge area (Fig. 8).

5. COOPERATION WITH THE INSTITUTE OF GEOPHYSICS, FACULTY OF PHYSICS, UNIVERSITY OF WARSAW

Already since his student days, in the mid-1970s, Marek Grad, later the professor and long-time director of the Institute of Geophysics of the University of Warsaw, collaborated with the DSS team, and later the Department of Lithospheric Research, in most seismic projects. He was Aleksander Guterch's "right hand" in many projects and co-author of publications. He was supported in several endeavors by his younger colleagues: Lech Krysiński, Monika Wilde-Piórko, and Marcin Polkowski.

6. PASSIVE SEISMIC INVESTIGATIONS

Professor Guterch was also engaged in research using experimental seismic methods other than deep refraction. The DSS research team under his supervision took part in large international passive seismic research projects in Europe: TOR (1996–1997) (Fig. 11a), SVEKALAPKO (1998–1999) (Fig. 7) in Scandinavia, and the PASSEQ project organized mainly in Poland (2006–2008) (Fig. 11b), which was led by Dr. Monika Wilde-Piórko from the Institute of Geophysics, University of Warsaw. This method allows recognizing the structure of the Earth's crust and upper mantle down to a depth of several hundred kilometers, i.e. to much greater depths than the usually interpreted DSS refraction profiles. It can reach below the lithosphere-asthenosphere boundary. By participating in these experiments, we gained experience in conducting this type of research.

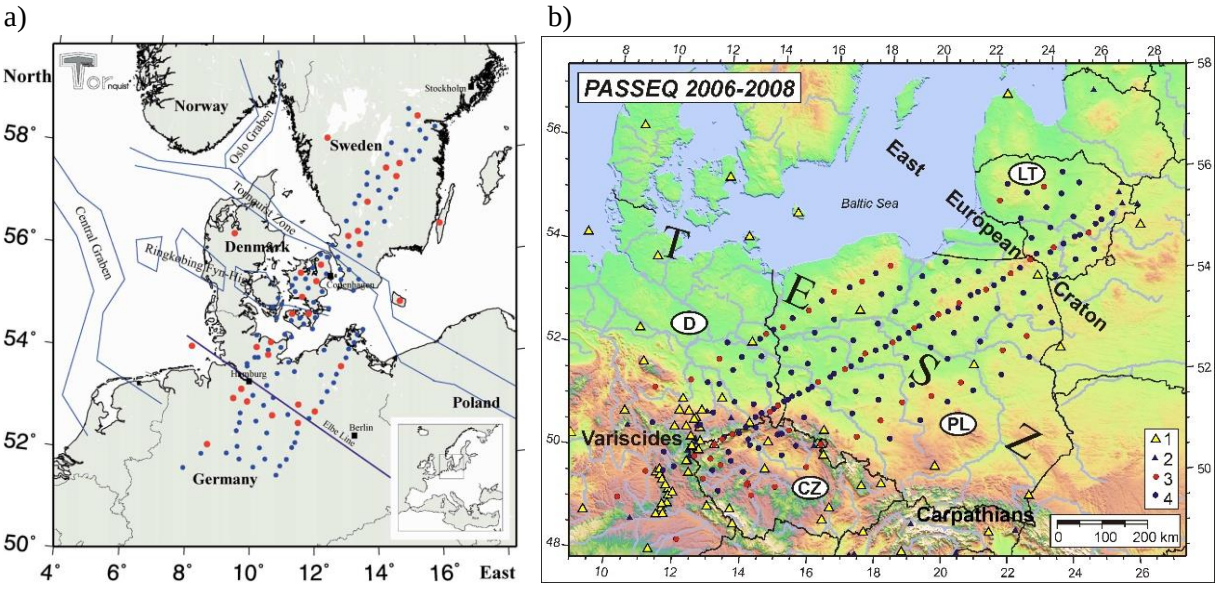


Fig. 11: a) The location of seismometers during the field work of the TOR project 1996–1997. The small blue dots indicate short-period seismometers and the large red dots indicate broad-band seismometers. The tectonically important features are also depicted (Gregersen et al. 2002); b) Location of PASSEQ 2006–2008 seismic experiment around the Trans-European Suture Zone (TESZ): 1, 2 – permanent broad-band and short-period seismic stations of national and regional observatories; 3, 4 – temporary broad-band stations and temporary short-period stations (Wilde-Piórko et al. 2008).

7. DEEP REFLECTION SEISMIC SURVEYS

Another seismic research method, complementary to the previously mentioned ones, is deep seismic reflection research. Sections made of reflective profiles allow you to obtain an accurate image of geological structures, but they are many times more expensive. After long efforts to obtain funds, thanks to the support of the Ministry of the Environment and PGNiG, Prof. Guterch also managed to conduct deep reflection soundings (Figs. 12 and 13) in south-eastern Poland on a 210 km long profile, project POLCRUST-01 (2010).

8. ACTIVITY AFTER 2012

Aleksander Guterch led DSS research at the IG PAS for over 40 years. From 1969, he was the head of the Deep Seismic Sounding Laboratory, renamed as the Independent Deep Structures Laboratory, and later the Department of Seismic Lithospheric Research. He held this position until 2012, when he handed it over to Tomasz Janik, the author of this text. Since then, he has

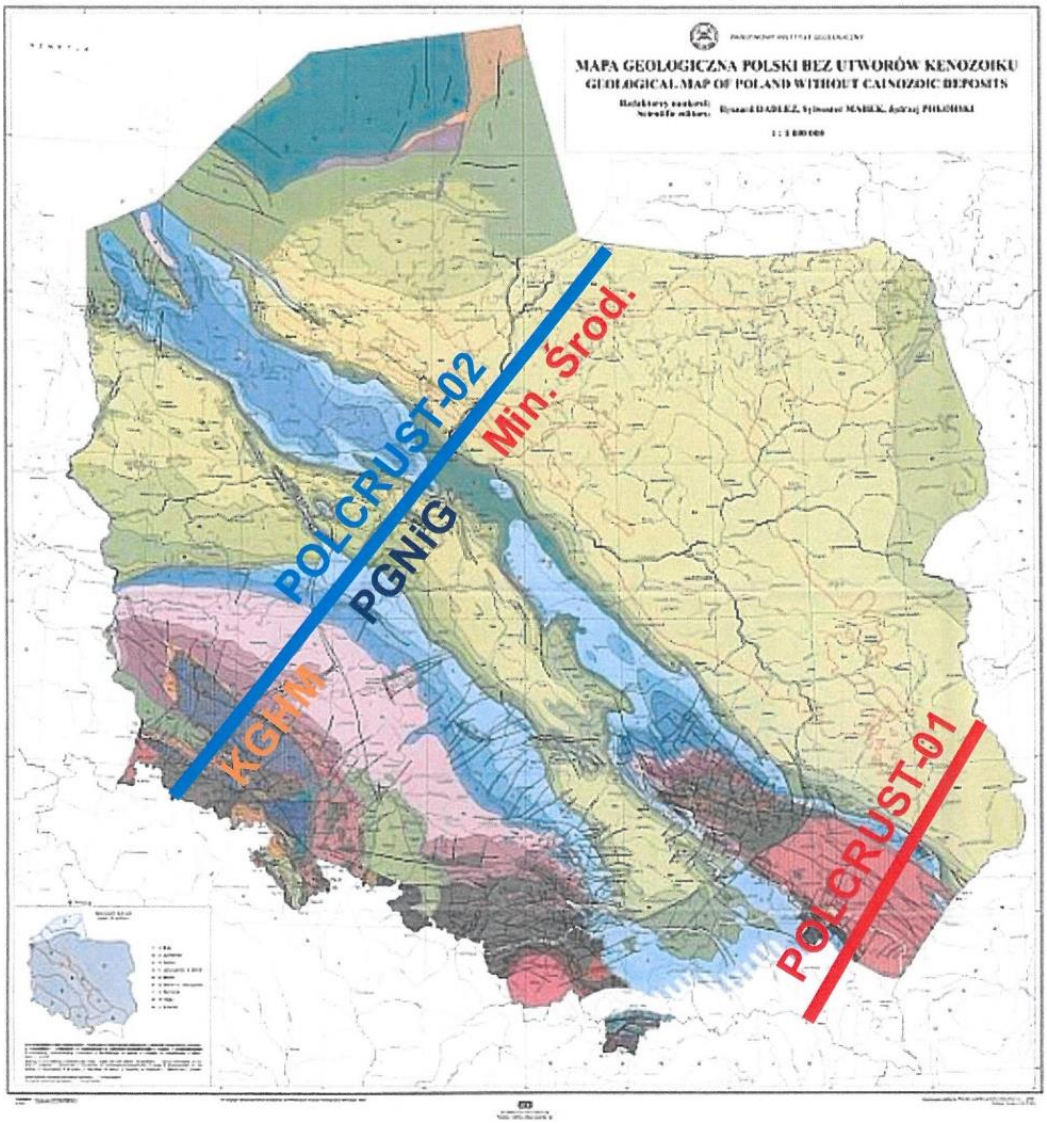


Fig. 12. Location of profiles of deep reflection seismic soundings POLCRUST-01 carried out in 2010 and the planned profile, with three potential sponsors (KGHM, PGNiG, and the Ministry of the Environment) POLCRUST-02, unfortunately not implemented. In the background, a geological map of Poland (Dadlez et al. 2000).

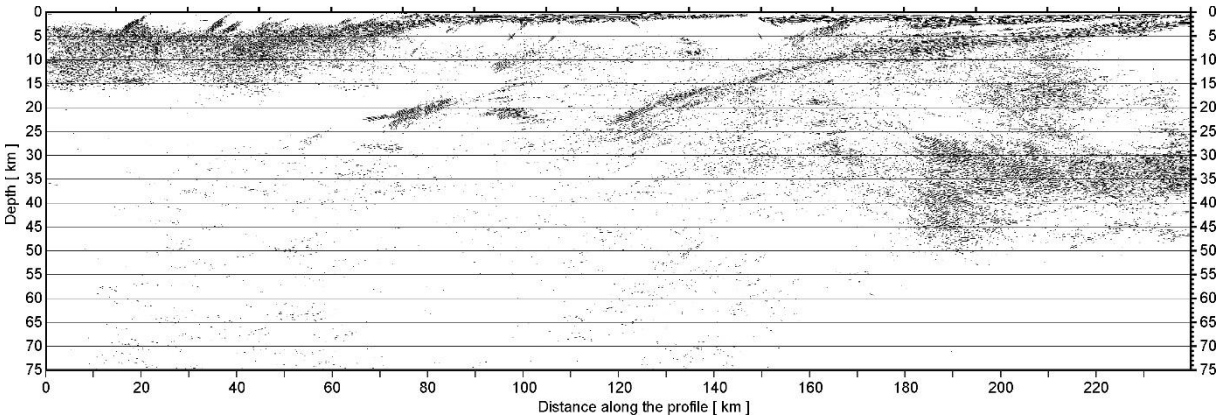


Fig. 13. The POLCRUST-01 profile, post-stack migrated final time seismic reflection section after curvelet denoising (Malinowski et al. 2015).

worked on a nominally part-time basis. He focused his activity mainly on efforts to gain support and funds for conducting research on another deep reflection seismic profile, POLCRUST-02. This profile, approximately 500 km long, was planned to cross all the most important tectonic units from the Sudetes on the SW to the East European Craton (around Braniewo) on the NE. These activities were extremely difficult. Such a long profile, which should reach the structures of the upper mantle and pass through the deep Polish basin, had to be made to the highest technical standards for this type of research. Of course, this required obtaining sufficiently high funds. Professor Guterch was the initiator of the creation of a consortium for the implementation of this project, which included potential sponsors of individual parts of the profile, KGHM, PGNiG, the Ministry of the Environment, and potential organizers and units responsible for interpretation, IG PAS, IGF UW, and PIG PIB. The project went through many "ups" and "downs" (see M. Narkiewicz, this volume). Olek was not discouraged by the failures and fought for the project, in the thicket of necessary consents and acceptances, until the pandemic in 2020. Twice it seemed that the success was literally within reach. However, at crucial moments the support from the geological community was not strong enough. This failure had a heavy impact on Olek. There were also health problems. However, as much as he could, he tried to be active in the scientific community until his last days.

Under the new management, the Department continued research on the structure of the Earth's crust and upper mantle using experimental seismic methods carried out in two statutory research topics, focused on land measurements NSL1: "Structure and evolution of the lithosphere of Central Europe with particular emphasis on the area of Poland" and on marine measurements NSL2: "Structure and evolution of the North Atlantic lithosphere in the contact zone of the Eurasian and North American plates in the Arctic and selected areas of West Antarctica".

Active seismic research

Thanks to the increase in the pool of short-period field devices to over 200 and our existing interpretation experience, we have become an even more significant partner in DSS research. In land research, we have established close cooperation with Prof. Vitaly Starostenko and his team from the Institute of Geophysics NANU in Kiev. These were not large, spectacular projects like those carried out in earlier years, but systematically prepared DSS profiles, usually aimed at determining the structure of the margin of the East European Craton south of Poland, up to Crimea and the Azov Sea, or concerning the Prypiat'-Dnieper-Donets Basin and the structures of the Ukrainian shield. Measurements and interpretation in these projects were usually performed in various international collaborations, but our team always played a significant role. Profiles made (Fig. 14): DOBRE-2 (2007), PANCAKE (DOBRE-3) (2008), DOBRE-4 (2009), DOBRE-5 (2011), GEORIFT 2013 (2013), RomUkrSeis (2014), TTZ-South (2018), SHIELD'21 (2021), with a total length of approximately 5,000 km, jointly constitute the second largest uniform DSS measurement system in Europe after the CELEBRATION 2000 project. The only profile that we initiated, partly implemented in SE Poland and partly in Ukraine, was the TTZ-South profile, an extension of the previous TTZ and CEL03 profiles, running along the TTZ. This is due to great difficulties in obtaining appropriate financial resources for this research. We also continued cooperation with the Universities of Helsinki and Uppsala in researching the structure of Fennoscandia. The KOKKY, ESO2 (Finland), and UPPLAND (BASIC) (Sweden) projects were implemented on the Baltic shield (Fig. 7).

Passive seismic research

Due to increasingly restrictive ecological regulations regarding shooting works in Western Europe, interest in active refraction seismic experiments is systematically decreasing. Finding partners to run such projects is difficult. However, passive seismic research is developing rap-

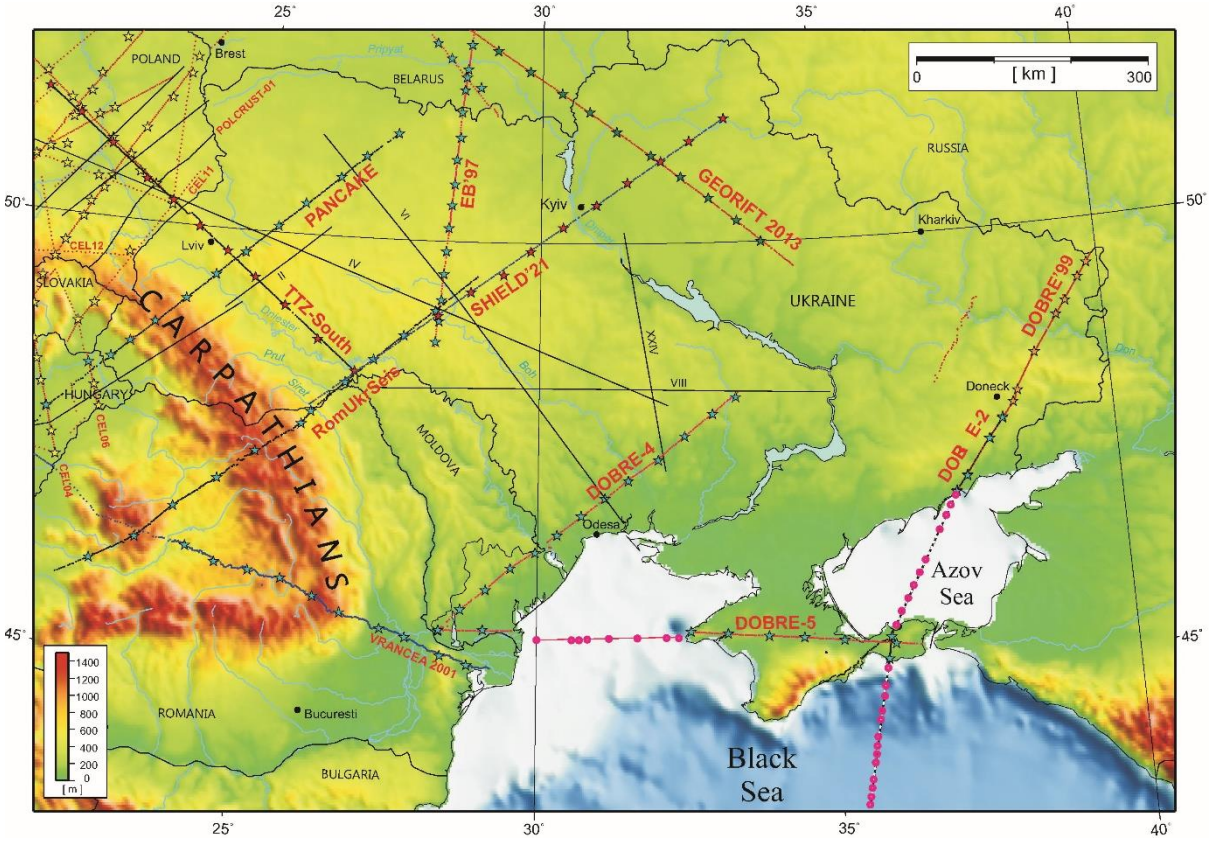


Fig. 14. Location of the deep seismic sounding (DSS) profiles in Ukraine and neighboring countries. Stars refer to locations of shot points along the profiles but large red dots show OBS's location at the bottom of the Azov and Black Seas. The profiles EB'97, DOBRE'99, DOBRE-2, PANCAKE, DOBRE-4, DOBRE-5, GEORIFT 2013, RomUkrSeis, TTZ-South, and SHIELD'21 were made to new (digital) standards unlike the previously made (in analog standards) profiles II, IV, VI, VIII, XXIV.

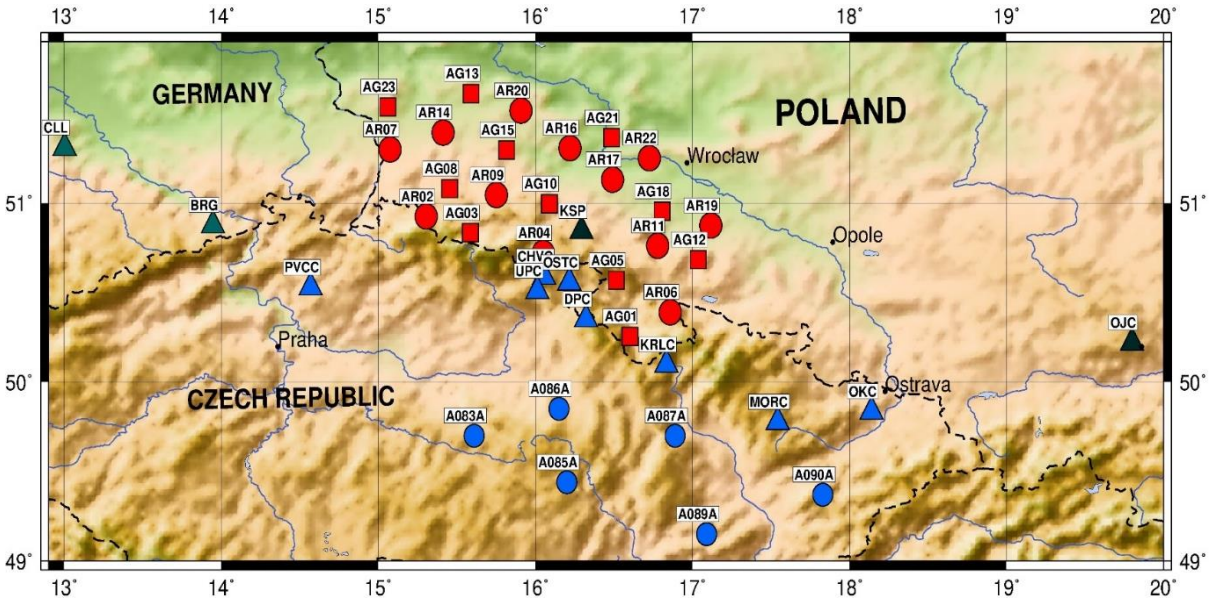


Fig. 15. Seismic stations of the passive experiment AniMaLS (modified after Bociarska et al. 2021). Temporary broadband stations with 120 s sensors are shown as red circles, stations with 30 s sensors as red squares and permanent stations of the Czech Regional Seismic Network and Polish Seismological Network with 120 s sensors as blue triangles. Elevation map based on GTOPO30 dataset (US Geological Survey 2018).

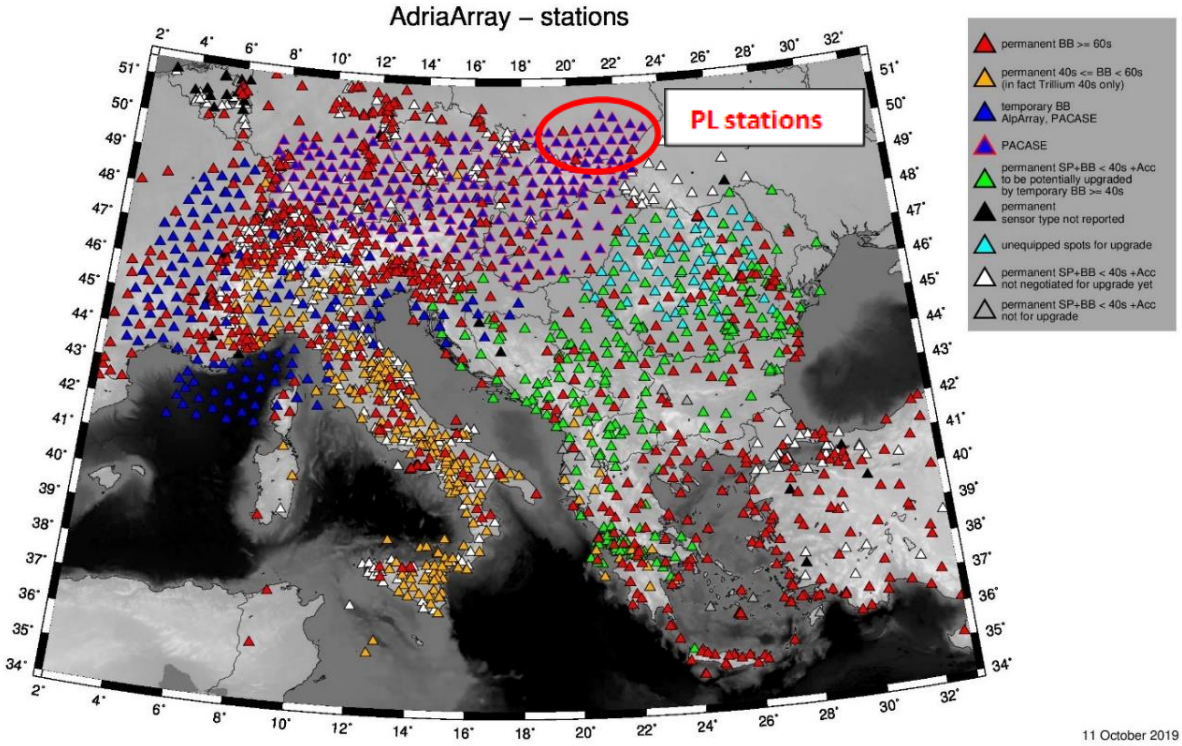


Fig. 16. AdriaArray project (units around Adria plate – from Carpathians to Mediterranean). The red ellipse marks the area where Polish seismic stations were located in the AdriaArray experiment, and previously in the PACASE experiment (modified after AdriaArray 2023).

idly. Having some experience in this respect, after obtaining 11 broadband devices of our own and 12 broadband devices from the University of Warsaw (Prof. M. Grad's pool), we started a research project aimed at determining the deep structures of the Earth's mantle, including the seismic anisotropy of the lithosphere, under the Sudetes (AniMaLS, 2017–2019) (Fig. 15), and later expanding the pool with 7 devices from the University of Silesia, under the Polish Carpathians, as part of the large international projects PACASE (2019–2023) and AdriaArray (2023–2026?), covering the area from the Carpathians to the Mediterranean Sea and from the Alps to the Black Sea (Fig. 16).

Offshore investigations

After purchasing six broadband OBSs, we were able to participate even more actively in marine research. Together with researchers from Hamburg University, we conducted active research (air-gun seismic sources) from the deck of the ship "Maria S. Merian" along the profile crossing TESZ, located along the Polish coast (BalTec 2016) (Fig. 7). Registrations were conducted by 15 OBSs and 3 land stations. Then, for almost a year, our OBSs were located at the bottom of the North Atlantic, at a depth > 3 km, in the area of the Knipovich Ridge, which is part of the Mid-Atlantic Ridge, west of Spitsbergen. This rift is unique, attracting the attention of researchers, one of the few rifts of the so-called "ultra-slow" type. This was the KNIPAS passive research project (2016–2017) of researchers from the Alfred Wegener Institute in Bremerhaven, with a small additional active program using air-guns from the ship "Maria S. Merian" (Fig. 8). Another active experiment in the same area was performed in 2019 in cooperation with the University of Bergen (ship "G.O. Sars") and Hokkaido University (operating some of the OBSs) along approximately 200 km long KNIPSEIS profile (Fig. 8). Our contribution to the project was the participation of the scientific team, including the expedition leader (Wojciech Czuba) and several OBSs.

9. SUMMARY

The Department of Lithospheric Research, mainly under the supervision of Prof. A. Guterch over several decades of his activity, has developed standards for seismic field measurements, preparation of seismic record sections and their interpretation, which are among the highest in the world. The analysis of the obtained experimental data, carried out using proven modern interpretation methods, is the basis for accurately determining the structure of not only the Earth's crust, but also the lower lithosphere. Our team's research covered the entire range of tectonic units distinguished by plate tectonics: continental plates, including old Precambrian platforms and younger Paleozoic plates cut by rift zones; areas related to the Alpine orogen; ocean plates; subduction zones with island arc and back-arc basin; and mid-ocean ridges with spreading centers.

The seismic studies of the Earth's lithosphere in Europe and the polar regions of the Earth, carried out by teams from the Institute of Geophysics of the Polish Academy of Sciences and the Institute of Geophysics of the University of Warsaw under the supervision of Prof. A. Guterch and Prof. M. Grad, are among the largest research projects of this type in the world. In particular, they provided results of key importance for understanding the structure and evolution of the Earth's crust in the geological heart of Europe, which is undoubtedly the area of Poland. Their result was the development of new seismic models of the Earth's crust, identifying and precisely defining drastic changes in physical properties in the area from the Variscan structures of western Poland, through the TESZ zone, to the Precambrian structures of NE Poland, and the creation of a tectonophysical framework for the three-dimensional interpretation of the geophysical and geological lithosphere of the entire area of Poland.

The POLONAISE'97, CELEBRATION 2000, and SUDETES 2003 seismic experiments conducted in Central and Northeastern Europe, each with a grid of multiple profiles, were international experiments organized and directed by the Polish side. These experiments were considered among the largest research projects of this type in the history of world geophysics. 35 scientific and industrial institutions from 15 European countries, Canada, and the USA participated in them.

The list of seismic experiments in which the team of the Lithospheric Research Department participated in the period 1960–2024 is presented in Table 1.

Table 1

Field seismic experiments in which the Department of Lithospheric Research participated, as the organizer and/or participant. The gray background experiments were carried out when Aleksander Guterch was in charge of the deep seismic sounding team.

Profile/experiment name	Years	Country/areas
A (Radynia – Zatoka Gdańska)	1960–1961	Poland
B (Radynia – Rodogoszcz)	1963	Poland
C (Starachowice – Radzyń Podlaski)	1965	Poland
V (Carpathians)	1969	Poland, Czechoslovakia
M1–M13 (Fore-Sudetic monocline)	1967–1971	Poland
VII International	1970–1973	Germany, Czechoslovakia, Poland, USSR
LT-2 (Stęszew – Starogard Gdański)	1971	Poland
VIII (Staszów – Tarnopol)	1973	Poland, Ukraine
LT-3 (Orava Lake – Brześć)	1976	Poland
SPITSBERGEN	1976	North Atlantic, Spitsbergen

LT-4 (Syców – Raciąż)	1977–1979	Poland
LT-5 (Pajęczno – Pułtusk)	1977–1979	Poland
LZW (Włodawa – Dębica)	1978	Poland
SPITSBERGEN	1978	North Atlantic, Spitsbergen
Lithosphere	1979	Poland, Ukraine
West Antarctica (I)	1979/1980	South Shetland Islands, Bransfield Strait
LZW (continuation)	1980–1981	Poland
SVEKA'81	1981	Finland
West Antarctica (II)	1984/1985	South Shetland Islands – Adelaide Island
SPITSBERGEN'85	1985	North Atlantic, Spitsbergen
LT-7	1987	Poland, DDR
West Antarctica (III)	1987/1988	South Shetland Islands, Bransfield Strait
West Antarctica (IV)	1990/1991	South Shetland Islands, Bransfield Strait
SVEKA'91	199	Finland
LT-7 (continuation)	1992	Poland
TTZ-PL	1993	Poland
FENNIA	1994	Finland
EUROBRIDGE'95	1995	Lithuania
GRANU'95	1995	Poland, Germany
EUROBRIDGE'96	1996	Lithuania, Belarus
TOR (passive)	1996–1997	Denmark, Germany, Sweden
POLONAISE'97	1997	Poland, Lithuania, Germany
EUROBRIDGE'97	1997	Belarus, Ukraine
SVEKALAPKO (passive)	1998–1999	Finland, Russia
SPITSBERGEN	1999	North Atlantic, Spitsbergen
DOBRE'99	1999	Ukraine
CELEBRATION 2000	2000	Poland, Belarus, Austria, Czech Republic, Hungary, Slovakia, Germany, Russia
VRANCEA 2001	2001	Hungary, Romania
ALP 2002	2002	Austria, Hungary, Slovenia, Croatia, Czech Republic, Slovakia
SUDETES 2003	2003	Poland, Austria, Czech Republic, Slovakia, Hungary, Germany
GRUNDY 2003	2003	Poland
SPITSBERGEN	2005	North Atlantic, Spitsbergen
ALPASS (passive)	2005–2006	Eastern Alps
PASSEQ (passive)	2006–2008	Poland, Germany, Lithuania, Czech Republic
West Antarctica	2007	Admiralty Bay
DOBRE-2	2007	Ukraine

HUKKA 2007	2007	Finland
SPITSBERGEN	2008	North Atlantic, Bear Island
PANCAKE (DOBRE-3)	2008	Ukraine, Hungary
DOBRE-4	2009	Ukraine
POLCRUST-01 (reflection)	2010	Poland
DOBRE-5	2011	Ukraine
GEORIFT 2013	2013	Belarus, Ukraine
RomUkrSeis	2014	Ukraine, Romania
KOKKY	2012–2014	Finland
P2 (extension)	2014–2015	Poland
SOFIC (ESO2)	2014	Finland
ARKO (LUMP)	2015	Sweden, Poland
BalTec	2016	Baltic Sea, Poland, Germany
KNIPAS (passive)	2016–2017	North Atlantic
UPPLAND (BASIC)	2017	Sweden
AniMaLS (passive)	2017–2019	Poland, Sudetes
TTZ-South	2018	Poland, Ukraine
KNIPSEIS	2019	North Atlantic
PACASE (passive)	2019–2023	Poland, Carpathians
SHIELD'21	2021	Ukraine
AdriaArray (passive)	2023–2025	Poland, Southern Europe

Some data from our experiments can be obtained from the databases: EPOS-PL: https://cibsbl-platform.igf.edu.pl/ and IG PAS: https://dataportal.igf.edu.pl/organization/lithospheric-research. To obtain data that is not yet available in these databases, write to Department of Lithospheric Research IG PAS.

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Remembering Professor Aleksander Guterch

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A beautifully colored map of Poland and Lithuania by De Vitt, cartographer of Karol Gustav, from 1655, bought in Oslo in 1976 by the advice of Prof. Aleksander Guterch, is a very pleasant memory of 13 years of our close cooperation.

I met Prof. Aleksander Guterch in the summer of 1969, after graduating from the Faculty of Mathematics and Physics at the University of Warsaw, with a master's degree in physics of the Earth. Following the advice of Prof. Tadeusz Olczak, I applied for a job at the laboratory of deep lithosphere research by means of deep seismic soundings (DSS) in the Department of Geophysics, Polish Academy of Sciences (PAS). Professor Aleksander Guterch (later AG) just completed his doctorate and was organizing a new laboratory, looking for appropriate candidates. I was hired by Prof. Roman Teisseyre (later RT), the Deputy Head of the Department. During the job interview, RT joked that my interest in mathematical methods in physics and understanding of geology will be beneficial for a new laboratory. RT referred to my mother's long-term cooperation with Prof. Jerzy Znosko at the Polish Geological Institute (PGI), an outstanding expert on Polish tectonics. He was an enthusiastic spokesman for DSS and, over time, had many publications with AG laboratory.

As a fresh graduate, I understood that I had to learn a lot, but I was met with support and friendliness from Prof. Aleksander Guterch and colleagues Edward Perchuć and Rufin Materzok, who helped me through this process. Engineer Jan Uchman – a precursor of crustal studies, also always found time to share his experience with me, despite not being a member of our lab.

These were the pioneering times of DSS. We were young and full of enthusiasm. Working on DSS profiles, in any weather and regardless of the terrain conditions, with registrations in the middle of the night, required mutual help and tolerance. I see this as, among other things, the source of our very good working atmosphere. AG was a demanding leader, with several years of experience, who knew how to criticize and praise. Sharing his passion for Polish and European history with us, AG relieved the tensions that were inevitable in the demanding research work.

Well-acquainted with the research capabilities of the Department of Geophysics, PAS, and cooperating institutions, AG shared his experience with me. This allowed me to quickly create a professional network. The most important cooperation was with the modeling group of the European Seismological Commission, headed by Prof. Slava Červený from Karlova University in Prague and Ivan Pšenčík from the Czech Academy of Sciences.

The DSS laboratory was located in the former telephone company's headquarters "Pasta", in the center of Warsaw. A prewar skyscraper with very high ceilings and small windows placed high above the floor. There we laid out seismograms on ping-pong tables, as they provided a lot of space to conduct interpretations. All of us welcomed every spring with joy because it gave us the opportunity to go with seismographs to the DSS profiles and see what was behind those "high walls".

AG did tremendous "promotional" work in institutions responsible for funding DSS, first and foremost the Polish Geological Institute (PGI). It was not an easy task to convince some of the geologists that the key to understanding shallow tectonics lies within deep crustal studies. When the first results of our work arrived, they became strong supporters of DSS.

Field campaigns along International Profile VII and VIII were a very busy time for the laboratory, but especially for AG. Coordination of shooting and registration programs required constant monitoring.

In contrast to continuous support from RT, our field campaigns were heavily criticized by the institute administration. They simply had too much work because of us.

Seismograms recorded often in very harsh conditions were of great value to us. AG attached great importance to the detailed identification of the wave field. It was verified by modeling and served as a basis for depth model construction. This method was a "guideline" in my future work with real seismic data, coming from research and prospect projects. Modeling was CPU demanding. AG warned me that CPU capacity will be a "never-ending story".

Results from DSS were published in *Acta Geophysica Polonica*, *Studia Geophysica et Geodaetica*, and presented at several conferences in Poland and abroad (e.g. Guterch et al. 1975, 1985). The achievements of AG and his group were recognized in 1976 with a National Award in Science of the first grade.

Working on international profiles was also full of surprises. After three years of joint registration and interpretation on profile VIII with geophysicists from the Ukrainian Academy of Sciences, our then good friends said: "it was high time to talk". "Sure thing", replied AG, "tomorrow we'll go to a restaurant". "No restaurant, we have to talk in the lab without witnesses". The next day, the two friends from Ukraine brought a couple of suitcases. After work, they opened it on the ping-pong table. Both were full, in one bread, canned meat, and pickles, in the other Ukrainian vodka. They wanted to honestly discuss the problem: who oppressed Ukraine more? Russian communists or Polish nobility? The discussion lasted from the afternoon until late night. AG showed great historical knowledge and political skills. I learned a lot myself. It took them three years to dare to do it.

Professor Roman Teisseyre signed in 1976 a long-term cooperation between the Institute of Geophysics, PAS, and Prof. Markvard A. Sellevoll (later MS) from the University of Bergen (UiB) in Norway dedicated to studies of the Earth's structure (Fig. 1). In the summer seasons of 1976 and 1978, AG's laboratory participated in collecting seismic and DSS data along three profiles in West Spitsbergen. This was a joint project between Norwegian, German, and American institutions granted by the NSF. This time the foreign contacts for Polish scientists were very limited. In the book "Jordskjelvstatjonen" (Sellevoll and Sundvor 2001), released for its anniversary, MS cited RT words about Bergen as "Det Polske pustehull mot Vest" (the Polish breathing window on the West). Profile locations were a scientific "compromise" of four nations and AG was the unquestionable project leader. Thanks to this project, I was able to go to the Bergen University for a research fellowship in 1979.

In 1976, AG was on board the shooting vessel R.V. H.U. Sverdrup during a profile when the vessel was hit by a heavy storm. It was a matter of honor for Norwegians to perform a shooting program in spite of the weather. The shooting program was terminated when dynamite

Fig. 1. Professors Roman Teisseyre, Jerzy Jankowski, and Aleksander Guterch in Bergen after signing the cooperation agreement with the University of Bergen.

exploded under the boat, damaging acquisition instruments on board. Norwegians were impressed by AG's calm behavior in this difficult situation, and the story became legendary in the Seismological Observatory of UiB.

The first Polish Geophysical Expedition to West Antarctica was organized by AG in 1979 (Guterch et al. 1984). The project was done in cooperation with the Argentine Antarctic Institute and happened half a year before the Falklands war. The tense situation demanded political skills from AG during meetings with Argentine and English marine forces active along the Antarctic peninsula. MS Kopernik visited the Arctowski Station in Admiralty Bay to get fresh water from a glacier. That day I sailed by a rubber boat to the Dufayel Island, known in the world for its rock crystals. After climbing the overhang, I found an eroded spherical geode. After returning to the Kopernik's deck with a fully loaded backpack, I was invited by AG to his cabin, to show my "trophies". Much to my surprise, AG selected the prettiest groups of crystals with a comment: "it will be a nice gift from the expedition". "This one for Prof. Kaczmarek, this one for Prof. Ney, this for..." and so long. When I was close to exploding from anger, AG handed me a radiogram from Poland with information that my son Piotr was born while I was on Dufayel Island.

On the way back to Poland, we visited the Argentine Antarctic Institute in Buenos Aires. During this stay, AG, thanks to his authority in the Polish Academy of Sciences, and in spite of possible consequences for him, prevented my sudden sending to Poland, demanded by persons having nothing in common with the scientific program. I'm still very grateful for AG's proof of trust in me.

SVEKA DSS profile was a result of a cooperation between IG PAS and the Institute of Seismology in Helsinki in 1981. Experience of AG in DSS was appreciated by Finish and Swedish partners (Luosto et al. 1982). The registration program ended in a very Finnish way, with a sauna party in the Finnish forest.

Thanks to the positive attitudes of AG and Prof. Roman Teisseyre, I was able to work as a research fellow at the UiB in the years 1982–1985, on leave from the IG PAS (Sellevoll et al. 1991).

Fig. 2. Professor Markvardt Sellevoll and Prof. Aleksander Guterch in our home in Bergen in 2009. They had very open and friendly relations.

Fig. 3. Professor Aleksander Guterch with his wife Barbara and my wife Bibianna in front of the former home of Edward Grieg, Bergen 2009.

After accepting the offer of 3 years research position at the UiB, I had to leave the IG PAS. But to be honest, thanks to both of them I was still working as a geophysicist. I later worked on direct and inverse problems of 2D and 3D seismic at the UiB and after that, in the Research Center at Norsk Hydro and Statoil for the next four decades.

In the following years, AG sent me handwritten letters informing on DSS progress, with copies of the publications for MS and me. The cooperation between AG and the Bergen University continued. AG visited Bergen several times, often accompanied by his wife Barbara (see Figs. 2 and 3), and we had the opportunity to have very nice meetings in our house or at MS's place. When I visited Warsaw several times with MS, AG always found time, in addition to meetings in the Institute, to invite us to his place for dinner prepared by Barbara. MS was delighted with the excellent food and the wonderful atmosphere of those evenings together. In 2006, MS asked me to accompany him on his "farewell" visit to Warsaw. He wanted to thank AG personally for many years of cooperation on Spitsbergen, for which he received the Copernicus Medal of the PAS. In the Institute MS met Prof. Kacper Rafał Rybicki and AG. The long-lasting cooperation between AG and MS has made MS an "ambassador" of the Polish arctic research in Norway.

AG was always positive about inviting presenters to the Institute whom I had the honor to work with. Dr. Tijmen Moser, a distinguished SEG lecturer, presented a short course about seismic diffractions in 2014. Professor Yngve Kristoffersen (see Fig. 4), a pioneer of collecting geophysical data from drifting ice with the help of a hovercraft in the Arctic, presented in 2019 the results from his expedition FRAM-2014/15, lasting 353 days that took him from the North Pole to Greenland.

We had regular contact with Olek and Barbara during our summer visits to Warsaw. In recent years, meetings were only possible at their home. Copies of the latest publications were waiting for me and after a delicious meal prepared by Barbara, Olek always found time to show me the

Fig. 4. Professor Aleksander Guterch and Prof. Yngve Kristoffersen after the presentation of FRAM 2014/15 expedition in the Institute in 2017.

latest maps purchased for his extraordinary collection. I had accompanied his great passion since 1969 when we met. During our business trips, Olek often opened a book and showed me the next map or saber he was going to buy, with fantastic historical documentation of the validity of his choice. If there was a historical museum in the city where the conference or work meeting was held, a visit to it in our free time was "obligatory", with Olek as a first-class guide. Thanks to him, I still buy books about old maps.

I'm deeply grateful to Prof. Aleksander Guterch for his support and friendliness during 13 years of joint research work and beyond. But no less, if not more, for the trust shown in me in 1980, when I needed it most, something I will never forget.

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Professor Aleksander Guterch, a Leader in Geophysics

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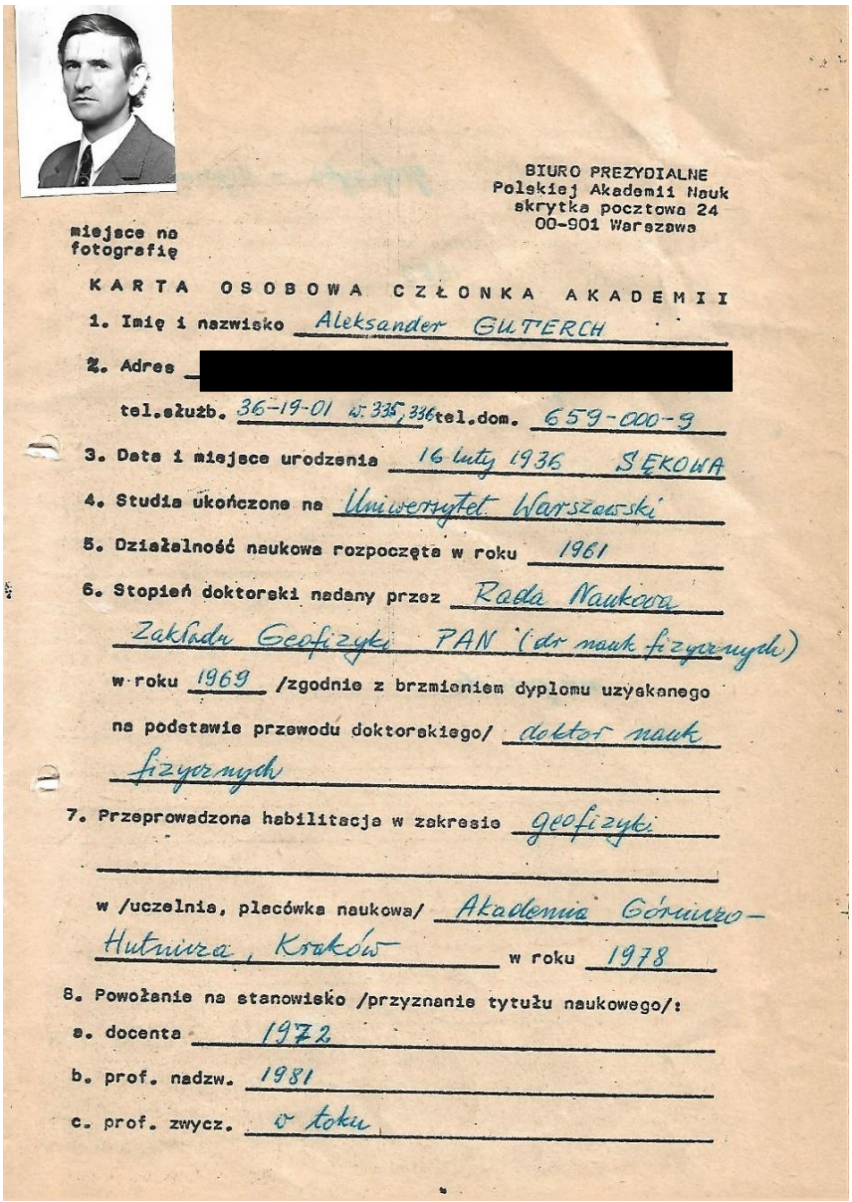
Few geophysicists have been as productive and ground-breaking as Aleksander Guterch. Fascinated from an early age by the Earth in general and the lithosphere in particular, his field surveys and theoretical works have vastly expanded our knowledge of the structure and geodynamics of the Earth's crust and upper mantle in Europe and in the polar regions. Among other achievements, the research led to his (as the leading author) Petroleum Geological Atlas of the Southern Permian Basin Area. Professor Guterch has become a leading voice on the crucial importance of the understanding of the deep structures of Earth's crust. One of his main accomplishments, the CELEBRATION 2000 seismic experiment, carried out in Central and Eastern Europe over an area of approximately 500,000 km^2 using 1250 cutting-edge seismic stations has been recognized in the report of the European Science Foundation as the greatest research project of its kind in the history of world geophysics. The area of Central Europe, thanks to him, is the region with the currently best-explored deep structure of the Earth's crust and lithosphere to a depth of 100 km. To start all that work required vision and great courage.

A lot of his major accomplishments occurred at the time when I had the privilege to be the deputy and then the main director of the Institute of Geophysics of the Polish Academy of Sciences. It is easy to guess that with such individuals on board I felt safe and Prof. Guterch was certainly my great support in running the Institute.

I am not going to write about the scientific investigations of Prof. Guterch and his team. Others, the specialist in the field, will do it much more properly and they well describe wide-angle reflection and refraction projects during Antarctic expeditions and also deep reflection measurement programs, results of deep sounding investigations, all being a brandmark of Prof. Guterch' work. I rather would like to recall my observations of Prof. Guterch's exceptional effectiveness and efficiency. The time was not favouring large-scale projects which were logistically difficult and extremely expensive. But I could see Prof. Guterch visiting both public authorities, ministries, environmental funds as well as commercial companies. And he never came back with nothing. He knew how to guarantee relevant funds for his co-workers and this is what I observed with great satisfaction. I have to stress that the high ranks of the Institute owe a lot to Prof. Guterch. He had a unique skill to achieve his ambitious goals and this is what made his achievements in geophysics so spectacular. He was also a leader in his field. A leader's credibility begins with personal success. It ends with helping others achieve personal success and this well describes Prof. Guterch. Some people say that the difference between a boss and

a leader is that a boss says “Go” and the leader says “Let’s go”. In this sense Prof. Guterch was definitely a leader, being an active part of all major experiments. And he was particularly fortunate to work with a series of highly competent younger researchers who would go on to prominent careers in their own right.

Professor Guterch was elected the corresponding member of the Polish Academy of Sciences in 1989, a year after I had started my work at the Institute. So one can imagine that he was already a legend when I started my research career. And although I worked in a completely different area, his research path was an example that I could follow. When I was elected the corresponding member of the Polish Academy of Sciences, Prof. Guterch was my guide through that complicated structure. I happened to see his personal file (Fig. 1) in the archives of the Academy and there are things that you read there with pride. The proposal to accept him as corresponding member was submitted by six top Polish researchers, namely Professors Jerzy Znosko, Zdzisław Kaczmarek, Czesław Druet, Władysław Pożaryski, Roman Teisseyre, and Jerzy Jankowski (Fig. 2).



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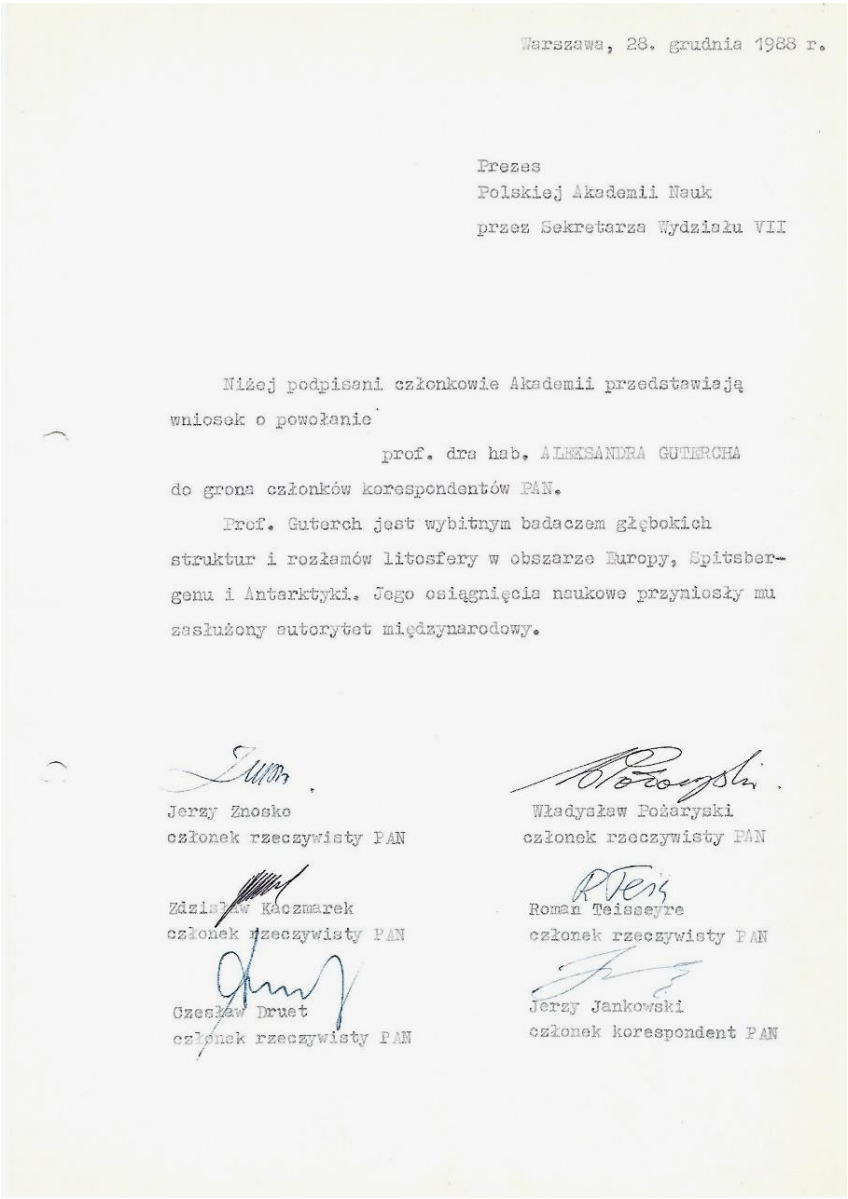
miejsce na fotografię

KARTA OSOBOWA CZŁONKA AKADEMII

1. Imię i nazwisko Aleksander GUTERCH
2. Adres [redacted]
tel.służb. 36-19-01 w. 335, 336 tel.dom. 659-000-9
3. Data i miejsce urodzenia 16 luty 1936 SĘKOWA
4. Studia ukończone na Uniwersytet Warszawski
5. Działalność naukowa rozpoczęta w roku 1961
6. Stopień doktorski nadany przez Rada Naukowa Zakładu Geofizyki PAN (dr nauk fizycznych)
w roku 1969 /zgodnie z brzmieniem dyplomu uzyskanego na podstawie przewodu doktorskiego/ doktor nauk fizycznych
7. Przeprowadzona habilitacja w zakresie geofizyki
w /uczelnia, placówka naukowa/ Akademia Górniczo-Hutnicza, Kraków w roku 1978
8. Powołanie na stanowisko /przyznanie tytułu naukowego/:
a. docenta 1972
b. prof. nadzw. 1981
c. prof. zwycz. w toku

Fig. 1. The first page of personal file of the member of the Academy.



Warszawa, 28. grudnia 1988 r.

Prezes
Polskiej Akademii Nauk
przez Sekretarza Wydziału VII

Niżej podpisani członkowie Akademii przedstawiają wniosek o powołanie

prof. dra hab. ALEKSANDRA GUTERCHA

do grona członków korespondentów PAN.

Prof. Guterch jest wybitnym badaczem głębokich struktur i rozłamów litosfery w obszarze Europy, Spitsbergenu i Antarktyki. Jego osiągnięcia naukowe przyniosły mu zasłużony autorytet międzynarodowy.

Jerzy Znosko
członek rzeczywisty PAN

Władysław Pożaryski
członek rzeczywisty PAN

Zdzisław Kaczmarek
członek rzeczywisty PAN

Roman Teisseyre
członek rzeczywisty PAN

Czesław Druet
członek rzeczywisty PAN

Jerzy Jankowski
członek korespondent PAN

Fig. 2. Application to nominate Prof. Guterch the Corresponding Member of the Polish Academy of Sciences.

The procedure was complicated and had to start with the opinion of the Committee of Geophysics of the Polish Academy of Sciences and all (out of 25) votes were for him. I like to read the resume as prepared by the candidate – you can learn from such a document what was important for a candidate himself. On top of the detailed descriptions of the scientific achievements one may find that Prof. Guterch particularly appreciated his internship at the Institute of Mathematics of the Academy of Sciences of USSR in Leningrad on one side and his fellowship at the University of Dallas in 1971/72. He was also strongly involved in cooperation with the Finnish Academy of Sciences and Letters and the University of Helsinki. So the international collaboration was something that built his scientific ground. From his cv, you may also learn that he highly appreciated the financial support of many organizations that helped him to do what was his main research aim and what was extremely expensive. And yet one more fact that shows his personality was his involvement in the Association of Lovers of Old Arms and Uniforms – his second great passion.

Professor Guterch fitted very well into the Institute of Geophysics's tradition of geophysical experimentation. He considered the mixture of professional and consulting activities to be both enjoyable and crucial for his performance as a mentor for geophysical community.

Professor Aleksander Guterch achieved real professional success, and was internationally respected and recognized for his activities. He loved his work with a passion and immersed himself totally in it, dedicating his life to scientific endeavors as the core of life's meaning. And as such he will be remembered at the Institute of Geophysics, PAS. For me, he was a remarkably perspective and intuitive thinker. His contributions became major milestones in geophysics and his name is forever connected to the Institute of Geophysics, PAS, and the Polish Academy of Sciences itself.

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To the Memory of Prof. Aleksander Guterch

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Professor Tomasz Janik sent out a letter that on December 28, 2023, Prof. Aleksander Guterch passed away. It was very sad news for all geophysicists and geologists who had known him personally; it was sad, too, for those who had not but had read his outstanding classical works. Aleksander Guterch was a world-class specialist and a wise, well-rounded, interesting and kind man.

It is my great pleasure to say that Professor Guterch had long-established, creative, and lasting scientific connections with our S.I. Subbotin Institute of Geophysics of the National Academy of Sciences (NAS) of Ukraine.

Let us recall how it all came to be.

The Deep Seismic Sounding (DSS) works were established at the turn of the 1950s and 1960s at the Institute of Geophysics of the Polish Academy of Sciences. Initially, it was headed by Eng. Jan Uchman, who had some experience in seismic field measurements carried out in Lviv before World War II. Aleksander Guterch became interested in the technique; he wanted to learn it faster. So, in 1963, Aleksander Guterch started working in this laboratory, and in 1964, a paper with the first results of GSS measurements in Poland was published with his co-authorship (Wojtczak et al. 1964).

Professor V.B. Sollogub, a world-famous specialist of our Institute and a corresponding member of the Academy of Sciences of the Ukrainian SSR (Kharitonov 1982), was successfully studying the structure of the Earth's crust and upper mantle with the method of DSS (Subbotin et al. 1967). V.B. Sollogub initiated a large-scale program of DSS observations in Ukraine and in Eastern Europe in general (Kharitonov 1982). It was interesting for Aleksander Guterch and he started coming to Kyiv, to our Institute, to make the acquaintance of V.B. Sollogub and work with him on this program. V.B. Sollogub was glad to have this cooperation. This began the successful cooperation of the Institute of Geophysics of the AS of the Ukrainian SSR and the Institute of Geophysics of the Polish Academy of Sciences using the DSS to study the layout of deep geological structures.

The intense coworking yielded findings that were used to prepare outstanding publications.

The first paper, co-authored by Aleksander Guterch with V.B. Sollogub, A.V. Chekunov and others, came out in 1974 (Guterch et al. 1974). In 1975, at the XIV General Assembly of

the European Seismological Commission, which took place in Berlin, another work summarizing the primary results for the VIII International Profile (Kielce, Poland – Tarnopol, Ukraine) was presented (Sollogub et al. 1975). The study's final results were published in a well-known Polish research journal *Acta Geophysica Polonica* (Sollogub et al. 1976).

The results of their assiduous research became the foundation for monographs (Guterch et al. 1977; Sollogub et al. 1978a, 1980a). Aleksander Guterch also took part in editorial work; for instance, he was an editor of Sollogub et al. (1978b, 1980b). These articles and monographs attest to his profound professionality and outstanding capacity for work.

Aleksander Guterch kept actively working with us; the studies were published in the most prestigious international thematic journals and monograph series (Bogdanova et al. 2006; Starostenko et al. 2012, 2013a,b, 2015). These are the results worthy of an international professional group of geophysicists and geologists engaged in active and deep investigations, and one of the central specialists it included was Aleksander Guterch.

His last visit to Kyiv was in 2012. He and I met with an exceptional man and scientist, the President of NAS of Ukraine, Acad. B.Ye. Paton, who praised our work highly. Together with his younger Polish colleagues, he visited me and my wife in our summer cottage on the outskirts of Kyiv (Fig. 1).

I had long ago established a good personal relationship with Aleksander, in addition to a purely professional one. If I came to Warsaw, he would invite me home. I made the acquaintance of his wife, Barbara, a most marvelous cook. Visiting him was very pleasant and also very

Fig. 1. At a dacha in Kyiv, 2012. Seated from the left: Aleksander Guterch, Wojciech Czuba (in the background), Svetlana Starostenko, driver, Vitaly Starostenko (photo by Tomasz Janik).

Fig. 2. A visit to the house of Aleksander Guterch, 2013. Standing from the left: Vitaly Starostenko, wife Svetlana, Aleksander Guterch. Collections of maps, engravings and sabers can be seen on the walls (photo by Tomasz Janik).

entertaining since Aleksander's home holds several invaluable collections (Fig. 2). I learned that he had been gathering various oddities having to do with geography, history, literature, and religion. These collections had grown over many years; Aleksander had to have been quite an interesting person since his youth.

He was brave, too. Only brave people go to Antarctica, and he is known to have been there.

Aleksander Guterch died, yet he remains with us forever. For this, we have our memories and his works.

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The Great Conductor

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There are people you meet and never forget throughout your life, no matter how often or how long you interact. You just feel fortunate that fate brought you together with such individuals, allowing you to work with them and share the fruits of your labor. One such person was Prof. Aleksander Guterch. Regardless of the numerous academic degrees, titles and awards he held, his works, scientific ideas, along with the courage required to undertake sometimes very risky projects and, not least, the conditions and environment he used to work left the greatest impression. I am referring here to a decade of research in the Arctic and Antarctica.

When we first met, this romantic period was over, but the preparation of the newly launched EUROPROBE program for complex geological and geophysical studies has started. We met at a scientific conference in the Danish town of Nykobing Falster, devoted to the planning of this program. The participants were invited to submit proposals for the Deep Seismic Sounding (DSS) projects, in particular, the target areas and regions. I proposed conducting deep seismic sounding between the shields of Fennoscandia and Ukraine, aiming to determine the lithospheric structure in this little-explored area. The profile bridged both shields, from Sweden, across the Baltic Sea, through Lithuania, Belarus, and Ukraine. Hence the name I came up with – "Bridge".

However, it was just a theoretical idea since, at that time, Lithuania lacked both the equipment and the experience required for such work. The audience knew this, so my proposal did not receive much attention. However, someone noticed and appreciated it. During a break between sessions, Aleksander approached me, introduced himself and said that he supported my proposal. Immediately, he began naming the countries whose scientists could participate in this work, how much and what kind of equipment they could bring and what was needed for the successful implementation of the project from our side.

At that time, I was the director of the Lithuanian Geological Survey and could answer such questions specifically and reliably. After this short conversation, the project already seemed quite feasible; although many unresolved issues remained, they were no longer crucial.

I shared my meeting with Aleksander with Svetlana Bogdanova, one of the leaders of EUROPROBE, known for her excellent organizational skills and a sense of humor, among other qualities. She immediately declared that if Aleksander Guterch is involved, it's serious, and

eventually became an active participant of the project and its leader on the geological interpretation stage. Another leader of the program, the renowned Swedish geologist, Roland Gorbatchev, known as a man of few words, upon learning that Aleksander Guterch would participate in the project, did not see the need to comment and only suggested renaming it to Eurobridge, thus connecting it with the EUROPROBE program. Finally, the Eurobridge was successfully performed and was one of the key projects of the entire program.

Our collaboration did not end on this project. Aleksander and his staff continued to generate ideas and lead us further. Next, the DSS project POLONAISE'97 was designed, consisting of five profiles. The longest profile, P4, extended from Germany across Poland into Lithuania, where the final shot point was just about 20 km north of Vilnius.

As soon as the last explosion shook the ground, we called Toruń, where the experiment headquarter was located, to report that everything was successful and heard Aleksander's calm voice on the other end saying: "We already know, congratulations". The seismic wave outpaced our call.

Our final joint project was the passive seismic experiment – PASSEQ, during which hundreds of seismic stations worked in a non-stop regime for more than a year, registering teleseismic events from the big deal of the globe. The responsibility to organize this project has already been entrusted to the younger generation of researchers.

Observing the professor's work during the experiments and his attitude toward the involved colleagues creates an impression that you see a well-coordinated orchestra of which you are also a member. Each orchestra participant masterfully handles their instrument, knows their part well and the conductor achieves harmony in this orchestra just with a slight hand movement. The essential difference in this comparison is that this orchestra does not perform music written by someone long ago but creates new opuses which enrich the entire scientific world. "The Great Conductor" is perhaps the most accurate description of Prof. Aleksander Guterch as a scientist and as a person.

The research initiated, organized or supported by Aleksander Guterch is indeed of a continental scale. Taking alone the Lithuanian geology, the knowledge obtained is a tremendous contribution, which provided impetus for the development of geophysics and new geological research.

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Geoscience without Boundaries: in Memoriam of Professor Aleksander Guterch

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On 28 December 2023, just before the start of the new, 2024 year, I received sad news by e-mail from my colleague Dr. Tomasz Janik that Prof. Aleksander Guterch had passed away at the age of 87. Compared to the colleagues from the Institute of Geophysics of the Polish Academy of Science, with whom Prof. Guterch was working side-by-side for many years, I have no reminiscences related to everyday routine research work with him. However, for me personally this news was particularly sad, as it is one of the events marking the end of an important and very intensive period of my scientific career. This period is related to participation in the EUROPROBE program, in which Prof. Aleksander Guterch was one of the key persons.

It is worth to remember now, in 2024, that the history of the EUROPROBE program started in the early 1980s. It was a time of great political and social progress in Europe, initiated not only by well-known "perestroika" processes in the Soviet Union, but by similar processes in many countries of Central and Eastern Europe. Without these political changes, it would not be possible to overcome the language and cultural barriers between scientists of Western, Central, and Eastern Europe that formed by that time. These barriers created numerous problems for successful scientific cooperation in many disciplines. Such a cooperation is particularly important for Earth Sciences, as geological units do not follow the state and political boundaries and tectonic processes forming our Earth are not dependent on the present state of relations between different countries and political blocks.

The first idea of cooperation between Earth Scientists of Western, Central, and Eastern Europe started to form in the 1980s, when the leading Earth Scientists from Western Europe and the Soviet Union started to discuss integrated geophysical and geological studies along some tentative east-west profile from the border zone between Asia and Europe to the Iberian Peninsula and the Atlantic margin (Gee and Stephenson 2006). The idea was presented at the International Geological Congress in Moscow in 1984, that is, one year earlier than the official start of "perestroika" in the Soviet Union in 1985. So, it could be said that the Earth Sciences researchers in Europe started the own "perestroika" earlier than politicians. This would not be possible without contribution from individuals with enhanced vision of the future of European science. Professor A. Guterch was one of the persons with such a vision.

The planning of scientific program of EUROPROBE started in 1988–1989, and the support of the European Science Foundation (ESF) helped organize the two planning workshops in Moscow (Russia) and Jabłonna (Poland) in 1991. In the last workshop, the first idea of the EUROPROBE/EUROBRIDGE project was presented by Prof. Svetlana Bogdanova from Sweden (Bogdanova 1993). She then became a scientific leader of the EUROBRIDGE/ EUROPROBE project. Finally, the program consisting of 10 projects was approved by the ESF. The program was governed by an Executive Committee headed by Prof. David Gee, in which Prof. Aleksander Guterch represented Poland. He was also a coordinator of TESZ (Trans-European Suture Zone)/EUROPROBE project from Poland and a member of the EUROBRIDGE Seismic Working Group.

All these facts and pre-history were not known to me in 1994, then a PhD at the Institute of Geochemistry and Geophysics of the Academy of Science of Belarus. I was doing my PhD thesis in geophysics (then it corresponded to a Candidate of Science degree in the old USSR degree system) under the supervision of Prof. German Ivanovich Karataev, then the head of the Laboratory of Geophysics at that institute. Professor Karatayev, together with a famous geologists, Academician of the Academy of Science of Belarus, Radim Gavrilovich Garetsky, were the leading Belarussian scientists in the EUROBRIDGE/EUROPROBE multidisciplinary geological-geophysical project. The project aimed to study the region of the East European Craton between the Fennoscandian and Ukrainian shields covered by platform sediments. That is why a geophysical transect from southeastern Scandinavia, across Lithuania, Belarus, and Ukraine (all of them already independent countries then) was a backbone of the project. It was quite natural that the Laboratory of Geophysics and me personally were involved into the project. The key geophysical experiment was a seismic wide-angle reflection and refraction profile along the transect that was planned by a EUROBRIDGE Seismic Working Group composed of scientists from Poland, Germany, Denmark, Finland, Belarus, Ukraine, Lithuania, and Sweden. As the experience of seismologists from Belarus in deep seismic soundings was limited, international cooperation was particularly important for realization of the EUROBRIDGE'96 profile in Belarus.

The project was realized during 1994–2002 and became a very successful cooperation between West- and East European scientists despite numerous economic difficulties in new independent states of the former Soviet Union (Bogdanova et al. 2006). The support of INTAS organization (European Commission 2024) was particularly important for involvement of young scientists into the EUROBRIDGE and for their travels to EUROBRIDGE workshops organized in different countries involved in EUROPROBE.

After I started my work in EUROBRIDGE, Prof. Karatayev presented to me some papers by A. Guterch describing results of deep seismic sounding studies in Poland (c.f. Guterch 1970). This was for the first time I heard this name and started to familiarize myself with deep seismic sounding techniques, as previously I was dealing mainly with potential field studies and inverse geophysical problems. Later, during the EUROPROBE and EUROBRIDGE workshops organized during 1994–2002, I met Prof. Guterch in person many times. For me, it was quite clear then that he was one of the leading persons and drivers of the whole project. He was a person who could organize efficient work of research team composed of scientists with diverse cultural background and age. It was particularly interesting to observe this during the meetings of the EUROBRIDGE Seismic Working Group, where planning of EUROBRIDGE seismic profiles and data interpretation was done as a team work. During those hot discussions, I was particularly impressed seeing how Prof. Guterch communicated with young Polish colleagues, governing them extremely politely, without suppression of individuality. Together with other EUROBRIDGE senior scientists, Prof. Guterch created a very warm and friendly atmosphere at these workshops that did not exclude quite vivid discussions. I believe that working in the

EUROBRIDGE was an important experience not only for me, but for other junior researchers as well. The main skills learned then were the ability to see the European lithosphere at large scale, without limitations posed by political boundaries, and the ability to listen and respect diverse opinions. It is not a surprise that many young researchers that started their careers in the EUROBRIDGE became later not only recognized scientists in their countries, but also members of wider international scientific community.

Later, after I moved to the Department of Geophysics of the University of Oulu in Finland in 1996 and started to work with seismologist Jukka Yliniemi in the EUROPROBE/ SVEKALAPKO project, I also understood the role of Prof. Guterch in the development of deep seismic soundings and lithosphere studies in Finland. Several Finnish deep seismic sounding profiles (SVEKA'81, FENNIA, and SVEKA'91) were realized via communication between Finnish seismologists (Prof. Urmas Luosto from the Institute of Seismology of the University of Helsinki, Jukka Yliniemi from the University of Oulu, and other colleagues) and the group of Polish seismologists from the Institute of Geophysics, Polish Academy of Sciences led by Prof. A. Guterch. These experiments were an important contribution to lithosphere studies in Finland. In particular, extremely deep (more than 60 km) Moho boundary beneath Central Finland (Luosto et al. 1984) was one of the motivations for SVEKALAPKO deep seismic tomography experiment in 1998–1999 (Hjelt et al. 2006) that was part of the EUROPROBE/ SVEKALAPKO project.

Later, in the beginning of the 21st century, Prof. A. Guterch was one of initiators of a unique CELEBRATION 2000 (Central European Lithospheric Experiment Based on Refraction 2000) project that was a huge international cooperative effort that involved 28 institutions from Europe (including Finland) and North America (Guterch et al. 2003). The project collected high-quality deep seismic sounding data along profiles in Poland, Hungary, the Czech Republic, the Slovak Republic, Austria, Russia, Belarus, and Germany. My colleague Jukka Yliniemi from the University of Oulu was one of the members of the CELEBRATION 2000 EXPERIMENT TEAM (Guterch et al. 2003), so I was also extremely excited to observe this huge effort, and its results, although I was not involved directly into this project.

I would not write much about the role of Prof. Guterch in the projects devoted to lithosphere studies in Poland or in Polish Polar Research, as my colleagues from the Institute of Geophysics, Polish Academy of Sciences, can do it better than me. But I think that the CELEBRATION 2000 project, its data and results would be considered as a best monument in memoriam of Prof. Aleksander Guterch, one of the scientists who created the European geoscience without boundaries.

Acknowledgments. I express my gratitude to my colleague, Dr. Tomasz Janik, for invitation to prepare my own memoirs about Prof. Aleksander Guterch and our common work in the EUROBRIDGE project.

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When I Met Aleksander Guterch

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I first met Aleksander Guterch at the beginning of the POLONAISE Experiment in 1997. I had arrived in Warsaw several days before the rest of U.S. contingent and briefly met with Aleksander to discuss plans for the upcoming experiment. He had learned that my ancestors had emigrated from the Gdańsk region in the 19th century and thoughtfully decided that a good place for me to recover from jet lag was Gdańsk. After a night at the Academy of Sciences he put me on a train to Gdańsk. Gdańsk was interesting in itself, but more interesting to me was that I was able to locate the grave of my great-great-grandmother.

Later during the POLONAISE'97 Experiment Aleksander and his wife took me to the Old Town area of Warsaw pointing out all of the buildings destroyed in WWII that had been meticulously rebuilt from original plans. They also introduced me to the tradition of drinking hot tea from glasses (you need to lift the glass by its rim). I also worked with Aleksander during the CELEBRATION 2000 Experiment as well as an experiment SUDETES 2003.

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Remembering Professor Dr. Hab. Aleksander Guterch

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The Western Carpathians are an important mountain range of the Alpine-type structure in Central Europe, which is also a common orographic phenomenon mainly in Slovakia, Poland, and partially in the Czech Republic. For the sake of completeness, it should be stated that research and interpretation of the development and structure of this orographic phenomenon would not be possible without knowledge of the inner Western Carpathians and their basins, which are part of the Pannonian basin. It extends mostly to the territory of Hungary, and, in the east, also partly to the territory of the present Ukraine. The dominant importance of the Carpathian Mountains for the knowledge of the geological development of Central Europe to the east of the Alps, and the Bohemian Massif to the south of the European Platform and to the north of the Dinarides and Balkanides follows from the above.

Thanks to this mountain range, a very long and fruitful history of joint geological research by Slovak, Polish, Czech, Hungarian, and Austrian geoscientists was written, extending from the times of the Austro–Hungarian Monarchy to the present day. Its important examples are thousands of reports, manuscripts and maps, hundreds of scientific publications and monographs. The obtained results were often of great benefit to the development and trend of knowledge of the geology of the world.

While thinking about Prof. Aleksander Guterch, but also Prof. Marek Grad (our last joint photo is in Fig. 1) and a whole range of geologists and geophysicists of the Polish Academy of Sciences (PAS), it should be emphasized that the breathtaking mountains of the Western Carpathians significantly contributed to their scientific knowledge and interests. The results of the geological and geophysical research of the University of Warsaw, the Jagiellonian University, the AGH University of Science and Technology, the Polish Geological Institute, the Slovak Academy of Sciences, the Comenius University, the State Geological Institute of Dionýz Štúr, the Eötvös Loránd University, the Eötvös Loránd Geofizikai Intézet (ELTE), the Magyar Állami Földtani Intézet (MÁFI) Budapest, the Vienna University, the Charles University, the Institute of Geophysics of the CAS, the Institute of Geology of the CAS, and others are also successfully included in these results.

Fig. 1. Our last joint photo (Aleksander Guterch in the center, Marek Grad on the right, and Miroslav Bielik on the left); it was taken at the premises of the Faculty of Physics, University of Warsaw, on February 19, 2020.

Professor Aleksander Guterch and Prof. Marek Grad have been the main initiators and coordinators of large-scale geophysical research in Central Europe since the 1990s, e.g., the POLONAISE'97, CELEBRATION 2000 (Central European Lithospheric Experiment Based on Refraction, June 2000), ALPS 2002, and SUDETES 2003. All these projects represent the most extensive geophysical research of deep structure in a continental environment on a global scale. The greatness of the leading personality of Aleksander Guterch lies in the formation of the intentions and goals of a whole set of projects with international participation conducted in the form of seismic transects passing through the eight countries from the Baltic to the Adriatic; in other words, from the European Platform, through the Alpine–Carpathian orogenic belt to the Dinarides–Balkanides. The logistics of the project preparations was based on the ideas of Aleksander Guterch and Marek Grad. With their help, the project was further elaborated in the individual states involved. However, in order to cope with demanding scientific tasks, it was necessary to extend the cooperation of Central European countries to include countries that could contribute not only materially but also by contributing intellectual knowledge and experience. These were countries such as Denmark, Finland, Turkey, the USA, and Canada, but also Italy, France, Germany, and Sweden.

It should be noted that this great plan was preceded by many years of geological and geophysical research, with the results published in numerous publications of several generations of scientists in all participating countries.

From the entire summary of results, the deep-seated relationship of the outer Western Carpathians to the European Platform and the deep-seated course of the Pieniny Klippen Belt should be mentioned at least. In the central and inner Western Carpathians, there are important lineaments, such as faults of a deeper reach − the Čertovica line, the Pohorelská line and the

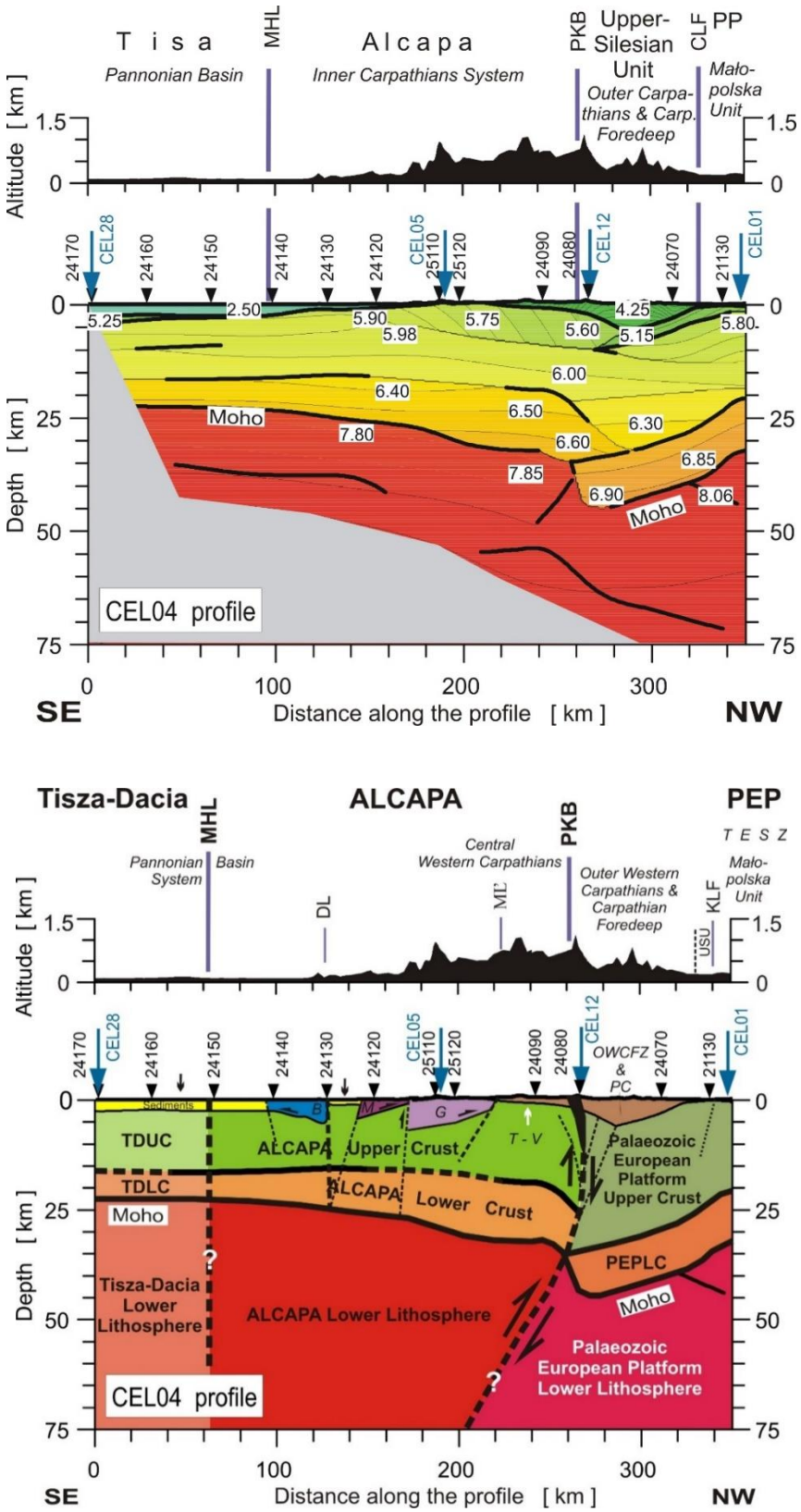

Fig. 2. The 2D model of seismic *P*-wave velocity along the profile CEL04 and its geological interpretation. Legend: PEP – Palaeozoic European Platform, PEPLC – Palaeozoic European Platform lower crust, TDUC – Tisza-Dacia upper crust, TDLC – Tisza-Dacia lower crust, PKB – Pieniny Klippen Belt lineament, MHL – Mid-Hungarian lineament, T-V – Tatroveporicum, DL – Darnó line, ML' – Margecany-Ľubeník line; – overthrusting, – undethrusting (Janik et al. 2011).

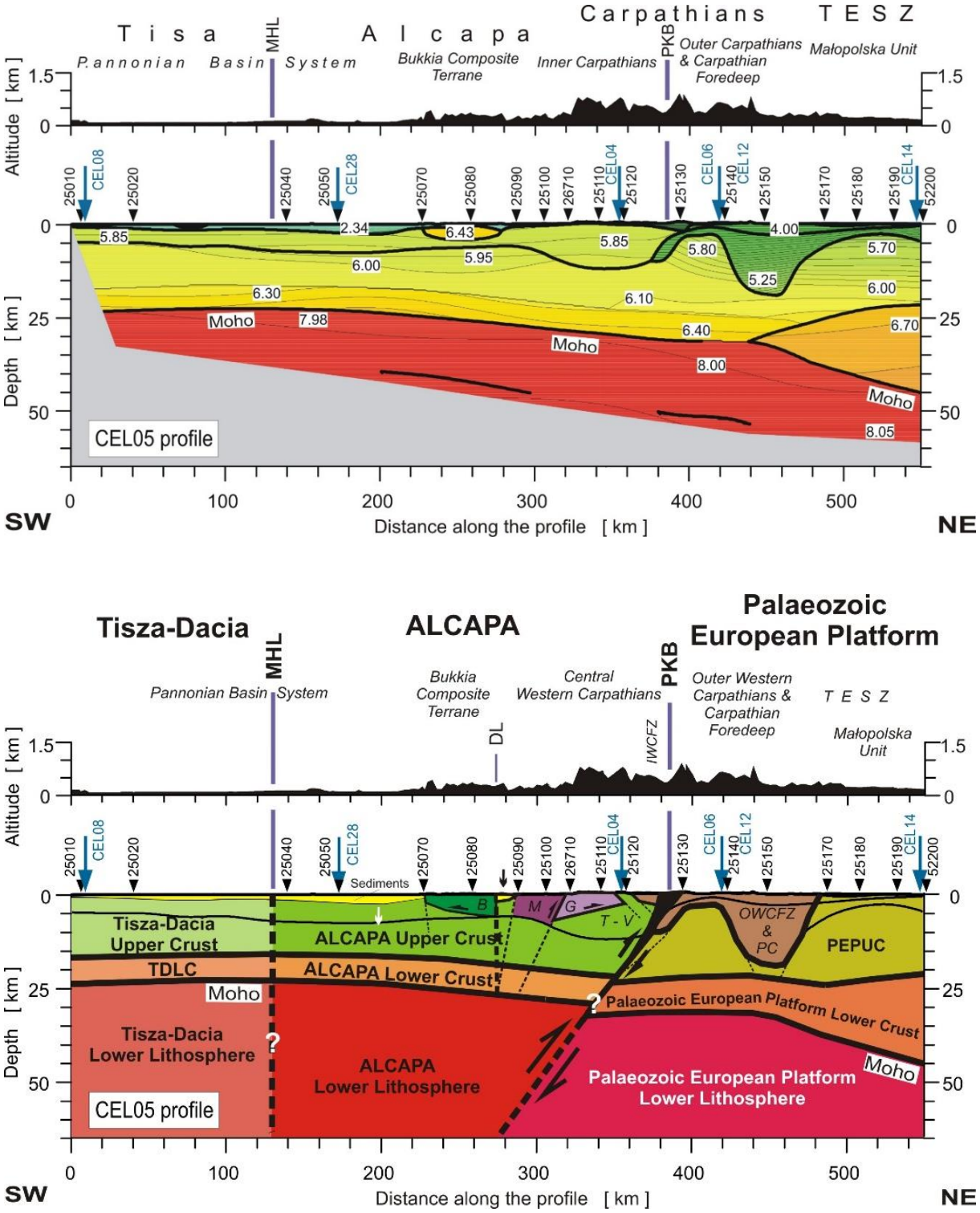

Fig. 3. The 2D model of seismic *P*-wave velocity along the profile CEL05 and its geological interpretation. Legend: PEPUC – Palaeozoic European Platform upper crust, TDLC – Tisza-Dacia lower crust, PKB – Pieniny Klippen Belt lineament, MHL – Mid-Hungarian lineament, IWCFZ – Inner Western Carpathian fault zone, OWCFZ&PC – Outer Western Carpathian fault zone, B – Bükkicum, M – Meliati- cum, T-V – Tatroveporicum, DL – Darnó line; – overthrusting, – undethrusting (Janik et al. 2011).

Muráňsky fault, but mainly the phenomena of the relationship of the innermost Gemeric and Veporic units – the Ľubenická and Margecanská lines, as well as shallow faults: Štítnic, Hornád, Rožnava, and others. For the regional solution, especially transects CEL04, CEL05 (Figs. 2 and 3) brought a picture based on which we defined and interpreted the internal structure of the Gemericum, including the intrusive body of granites and the tectonic contact of the southern and northern Gemericum. These are: the basement of the Gemeric unit and the significant suture of the so-called Darnó lines and the phenomenon of Meliaticum, and, in a less prominent image, also the remains of the upper slices of the napped structure of the Turnaicum and Silicicum. We published these results collectively in Grad et al. (2006), Janik et al. (2011), and others.

The significance of the realization and interpretation of seismic refraction transects across the Alpine units, specifically in the Western Carpathians, brought a new perspective on the structure of the Earth's crust, the depths of the MOHO discontinuity, important interfaces of the tectonic units of the inner, central, and outer Western Carpathians, the morphology and definition of the layers of the Tertiary fills in the inner Western Carpathians basins and their connection to sub-basins of the Pannonian basin system and their basements. From the point of view of the Alpine structural phenomena, it was extremely important for the Western Carpathians to determine both the horizontal and vertical positions and relationships of their main tectonic units. The results of the CELEBRATION 2000 project were gradually published in many scientific articles.

The CELEBRATION 2000 project also included a group of potential fields that compiled the gravity and magnetic map of the CELEBRATION 2000 region for the first time (Bielik et al. 2006).

For the knowledge gained from the CELEBRATION 2000 project, as well as the subsequent ALPS 2002 and SUDETES 2003 projects, huge thanks go to Prof. Aleksander Guterch and his colleague and friend Prof. Marek Grad. Without their exemplary and admirable activity, scientific vision, managerial work and logistics, such extensive work would never have been possible. Today, generations of geologists and geophysicists have inexhaustible and original sources of information about the deep-seated structure of Central Europe at their disposal.

For these excellent results and exemplary human qualities, great thanks and honour go to Prof. Aleksander Guterch.

Our Dear Aleksander – you will always live in our memories.

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Memories and Thanks to Aleksander Guterch

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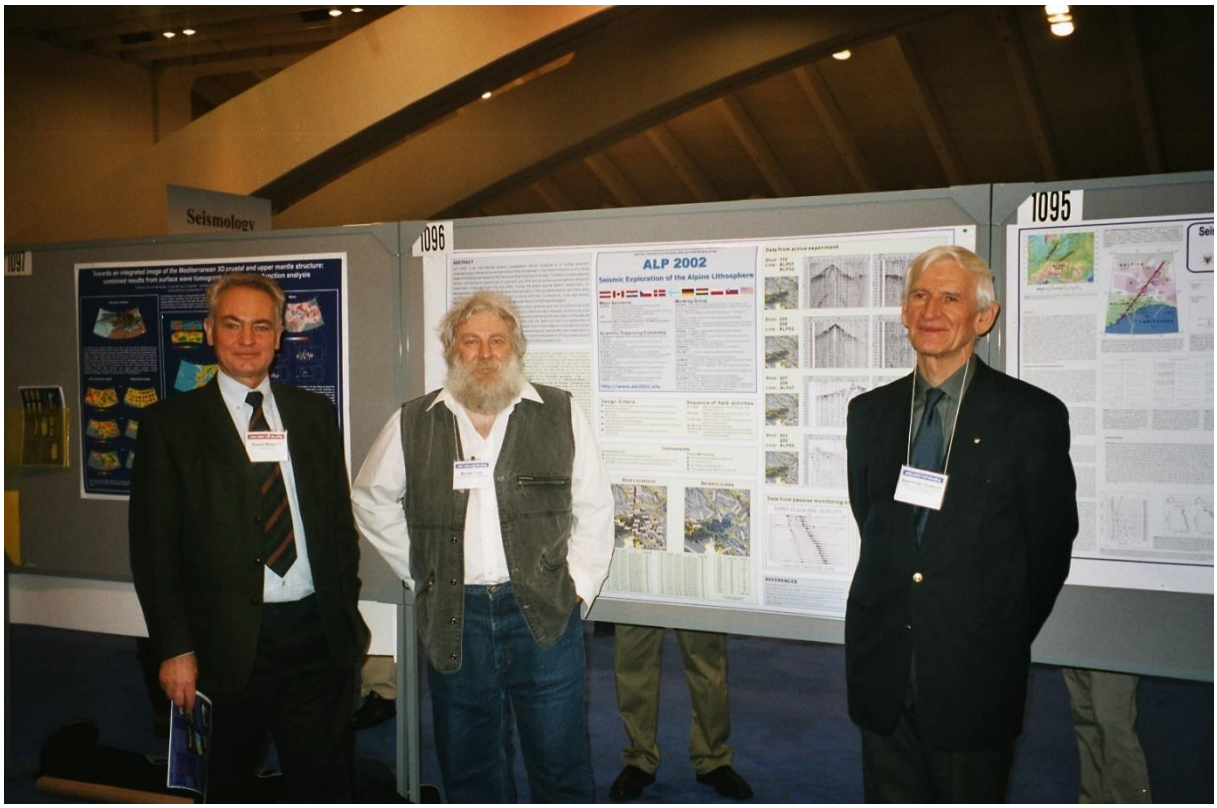
My memories of Aleksander Guterch are closely linked to his great personality, but also to his formative influence on the exploration of the lithosphere in Central Europe and the wider Eastern Alpine and Pannonian region using seismic methods. Firstly, I will try to summarize the latter in a brief overview from the perspective of the Austrian participants in the relevant projects and place these research activities in the context of overall development.

In 1975, the Alpine Longitudinal Profile ALP'75, which spanned the entire Alpine arc, provided a model of the Eastern Alpine lithosphere that went beyond the basic findings of Mohorovičić and Conrad. The Institute of Meteorology and Geophysics at the University of Vienna was intensively involved in both the data acquisition and the evaluation of the Eastern Alpine part of ALP'75. One striking result was the almost step-like decrease in Moho depth east of the Tauern window. Based on this finding and the study of seismicity along conjugate fault systems, Kayhan Aric and Rudolf Gutdeutsch († 2021) developed a tectonic block model (1987), which I personally consider to be a forerunner of the "lateral extrusion" model according to Lothar Ratschbacher (Ratschbacher et al. 1991).

In 1998, data acquisition began along the TRANSALP profile crossing the Eastern Alps from Munich to Venice. The most important members of the Transalp Working Group were the University of Munich, the University of Leoben, and the University of Trieste. Originally, as Head of Geophysics at the then Institute of Geodesy and Geophysics at the Vienna University of Technology (TUW), I was keen to participate in TRANSALP. Volker Höck (University of Salzburg) and Franz Kohlbeck († 2016) from my working group drew my attention to the CELEBRATION 2000 experiment that was in preparation and had already established contact with Aleksander Guterch. It quickly became clear that participation as a full partner in CELEBRATION 2000 was preferable to a marginal contribution to TRANSALP. In addition to the TUW team, members of the geophysical and geological institutes at the universities of Vienna, Leoben, and Salzburg were also willing to participate in the field campaign. The prerequisite for successful participation in CELEBRATION 2000 was the rapid inclusion of the Austrian team in the CELEBRATION 2000 working group by Aleksander Guterch, but also the willing transfer of know-how regarding organization and data acquisition on a large geographical scale by the Polish working group, in particular Marek Grad († 2020).



Aleksander Guterch, Marek Grad, and Ewald Brückl (from right to left) presenting the first results of ALP 2002 at the AGU meeting 2002 in San Francisco, USA.

I don't need to tell about the CELEBRATION 2000 success story. The Austrian side came up with the plan to extend the CELEBRATION 2000 data set over the Eastern Alps into the Dinarides. Almost the entire CELEBRATION 2000 team was prepared to realize this plan as part of the new ALP 2002 project. Aleksander Guterch entrusted me with the project management, but assured me of his full support. Thanks to the cooperation of all project partners, ALP 2002 was also a success. A third project that emerged from the cooperation with Aleksander Guterch and the involvement of members of the CELEBRATION 2000 working group was ALPASS. Between May 2005 and May 2006, teleseismic data were collected from temporary and permanent seismic stations distributed over the entire ALP 2002 area in order to create a model of the lithospheric slabs subducting beneath the main ridge of the Eastern Alps. The results initially contradicted another model created as part of TRANSALP, but are likely to have been confirmed in the end. Furthermore, the lateral extrusion process could be interpreted as a lithospheric scale process.

The most important scientific papers on CELEBRATION 2000, ALP 2002, and ALPASS were published by Austrian participants until 2010. It should also be mentioned that all three projects were funded by the project partners on a national basis. In Austria, this was the Austrian Academy of Sciences, with academician Franz Weber († 2013) making a special effort to obtain this funding. In terms of content and organization, however, Aleksander Guterch was the personality who opened up significant opportunities for seismic research of the lithosphere in Austria. The results of the CELEBRATION 2000, ALP 2002, and ALPASS projects should be seen in the context of the findings of the concurrent TRANSALP project and the subsequent AlpArray project.

At the beginning I mentioned my memories of Aleksander Guterch as a great personality and I will now go into more detail. Even at the first meetings, I was impressed by his noble

reserve and politeness. Soon the profound preparation of the respective agenda was evident at the meetings. Finally, behind Aleksander Guterch's seemingly modest demeanour, the persistent will and ability to consistently realize large scientific projects and pursue very ambitious scientific goals came to light. In the first decade of the 21st century, geophysics in Austria has benefited greatly from the collaboration with Aleksander Guterch. It would only be appropriate if the name Aleksander Guterch remains visible in the history of geophysics in Austria.

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Large-scale Central Europe Refraction Experiments: Professor Aleksander Guterch in Memoriam

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I first encountered Professor Aleksander Guterch in the spring of 2000 when I became involved with an international research group focusing on refraction experiments in central Europe. At that time, Professor Guterch led the group from the Department of Lithospheric Research at the Institute of Geophysics, Polish Academy of Sciences, in collaboration with Marek Grad from the University of Warsaw. However, the initiative for refraction experiments began earlier, in early 1997, when Professor Guterch initiated the POLONAISE'97 experiment in Poland. Its success led to further experiments spanning central Europe, extending from the Baltic to the Adriatic seas. This endeavor resulted in an unprecedented network of seismic refraction experiments, including POLONAISE'97, CELEBRATION 2000, ALP 2002, and SUDETES 2003, involving a vast network of seismic profiles.

Professor Guterch played a pivotal role in spearheading this extensive international collaboration, which encompassed over 30 institutions from 16 countries across Europe and North America. These countries deployed seismic recording instruments provided by various institutions, including the IRIS/PASCAL Instrument Center, the University of Texas at El Paso, the Geological Survey of Canada, and others. Notably, the CELEBRATION 2000 experiment alone comprised over 1230 stations and 147 shot points along seismic lines totalling approximately 9 000 km, with the total length of seismic profiles in all experiments reaching about 20 000 km. The abundance of seismic sources and stations facilitated both 2-D and 3-D data interpretation approaches.

The overarching goal of this initiative was to investigate the structure and evolution of the intricate collage of major tectonic features in the Trans-European Suture Zone (TESZ) region, as well as the southwestern portion of the East European Craton, including the Carpathian Mountains, the Pannonian Basin, the Alps, and the Bohemian Massif.

Professor Guterch, a distinguished individual with grey hair and a warm personality, consistently displayed noble behavior and style, often wearing a smile. For me, his leadership provided an invaluable opportunity to delve into the investigation of lithospheric structure with unprecedented data acquisition. I am deeply grateful to him for welcoming me into this international group, where I was able to learn and contribute to advancing our understanding of geophysics. This period will always hold a special place in my professional journey.

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Modern Deep Seismic Reflection Investigations in Poland: Fulfilled and Unrealised Ideas of Professor Aleksander Guterch

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The present author has been impressed by the scientific activity of Professor Aleksander Guterch since the early 90s of the last century, when the EUROPROBE Program (1992–2001) has been carried out. Professor was one of the key figures in this fruitful international scientific project. He raised respect for his previous achievements, while his organizational skills contributed much to the scientific output of the program. It was then that the Professor's extraordinary personality trait became apparent: his ability to define key scientific challenges and then his persistence in carrying out research leading to their solution. In this contribution, this unique determination will be presented through an example of a fragment of his scientific activity regarding deep seismic reflection research in Poland.

1. THE PIONEERING POLCRUST-01 PROGRAM

By the end of the first decade of the present century, Prof. Aleksander Guterch, assisted by Prof. Marek Grad (Institute of Geophysics, University of Warsaw), put forward the idea of the first modern seismic reflection profile in Poland, imaging the whole crust down to the Moho boundary. The idea referred to previous similar international projects such as the Canadian LITHOPROBE, German DEKORP or Finnish FIRE. Owing to the Professors' authority and determination, it was possible to organize the Industry–Academia Consortium led by the Institute of Geophysics, PAS, and with participation of Geofizyka Toruń Ltd. and PGNiG S.A. – the Polish Oil and Gas Company. The project, conducted in 2010–2012, was co-funded by the Polish Ministry of Environment through the National Fund for Environmental Protection and Water Management, and Polish Oil and Gas Company PGNiG S.A.

The ca. 240 km long POLCRUST-01 profile runs across SE Poland more or less along the line linking Sanok and Zamość cities (Fig. 1). The geological importance of this area stems from the fact that it covers different, partly weakly recognized deep structures, and that it has been the subject of petroleum exploration for a long time. The profile crosses, from SW, the East Carpathian nappes, the Carpathian Foredeep Basin with its Precambrian basement, Caledonian and Variscan units of the Małopolska and Łysogóry blocks, contacting with the East European Platform (EEP) through the Teisseyre–Tornquist Zone (TTZ). The general pattern of crustal structure of the region has been known since the deep refraction seismic

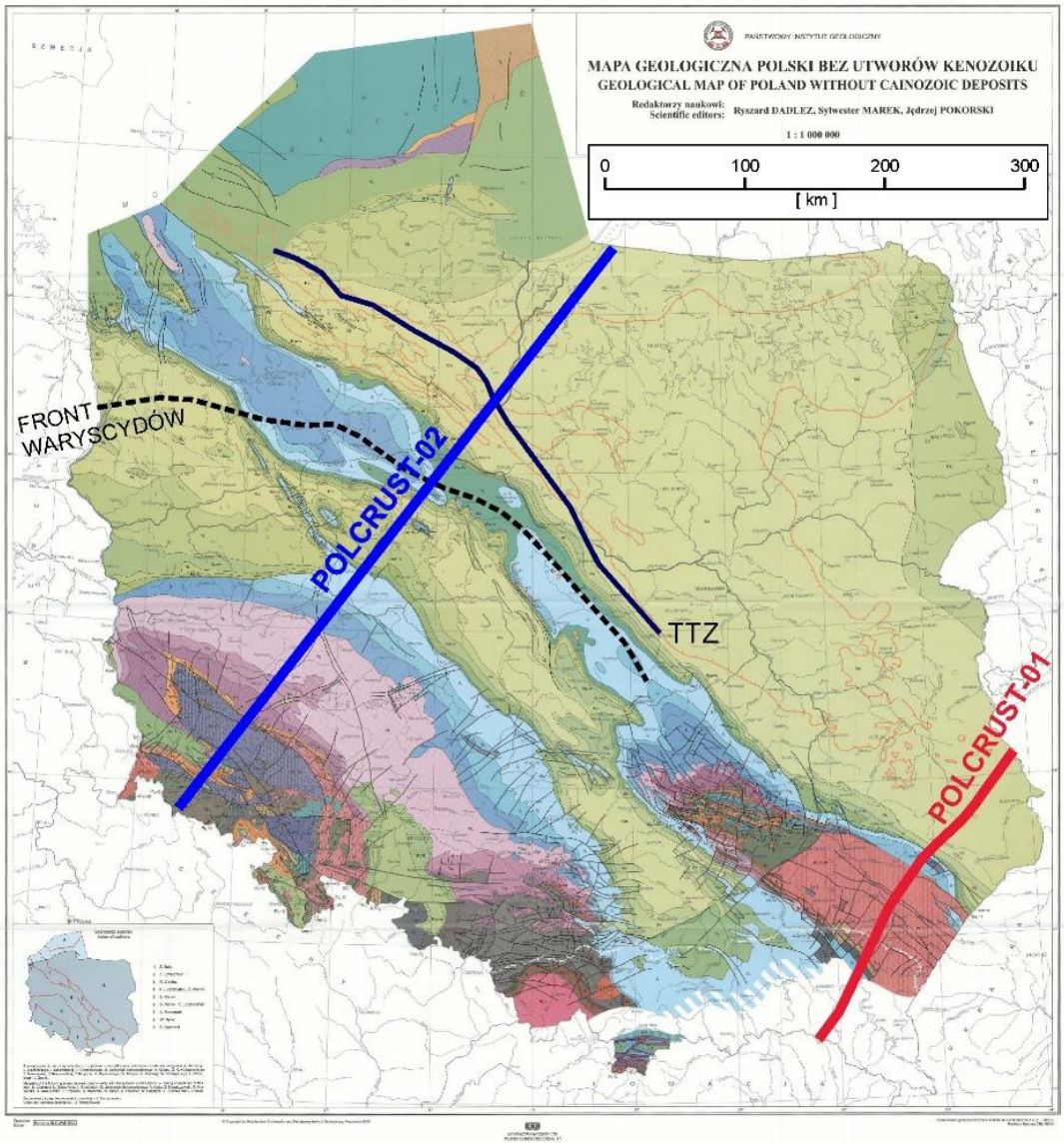

Fig. 1. Location of the POLCRUST-01 and -02 profiles against the map of Poland without a Cenozoic cover (Dadlez et al. 2000). Version attached by Prof. Guterch to materials promoting the POLCRUST-02 program during 2015–2020.

CELEBRATION 2000 Project led by Professor Guterch (e.g., Guterch et al. 2003; Narkiewicz et al. 2011). The relatively small thickness of the post-Paleozoic sediments pierced by numerous boreholes ensures a reliable seismic representation of a basement structure. Because of all these circumstances, the area was optimum for executing the methodologically and organizationally precursory POLCRUST-01 profile.

The seismic data was acquired from August to October 2010 applying the Vibroseis (ca. 4000 shot points) and, to a lesser extent, explosives, with parameters typical for exploration seismology (30 m receiver and 60 m source intervals) and high (175) nominal CDP fold, with an unusually high source effort and long recording time attaining 30 seconds. Such methodology, coupled with the application of novel processing techniques (Malinowski et al. 2013, 2015), resulted in the unprecedented quality of the whole crust imaging. This provided excellent material for the geological interpretation of shallow and deep crustal structure, including the Moho boundary, and made it possible to trace the relationship between superimposed structural patterns of different age.

The confrontation of the data obtained with those from the previous seismic refraction projects shed new light on architecture and deep crustal controls of Paleozoic and Mesozoic basins in the marginal part of the EEP and neighbouring tectonic blocks. The data contributed to a revised model of the Lublin Basin development, including the importance of inherited pre-Devonian tectonic structures. For the first time, the results revealed complexities of the tectonic contact between the craton and main neighbouring units, the Małopolska and Łysogóry blocks in particular. They stressed the importance of near vertical tectonic discontinuities representing repeatedly reactivated fault zones with a strong strike-slip overprint (Narkiewicz et al. 2015).

2. THE IDEA OF THE POLCRUST-02 PROGRAM

Professor Guterch intended that the POLCRUST-01 profile would be only the beginning of the new era of investigations of the deep geology of Poland. The main aims were to study deep tectonic controls on the establishment and development of sedimentary basins and better constraints on hydrocarbon and metal ore exploration targets. The natural consequence of the finished project was thus a planned POLCRUST-02 profile, ca. 500 km long, crossing Poland approximately along the line linking Jelenia Góra–Leszno–Bydgoszcz–Elbląg cities (Fig. 1). The methodology of seismic investigations would generally follow that applied for the POLCRUST-01, making it possible to obtain accurate records including upper sedimentary layer as well as the crystalline crust down to the Moho boundary. Such an approach, successfully tested in the previous project, would enable tracing deep crustal features and their possible influence on depocenters' evolution.

The planned profile runs across the zones of contact of the main geological provinces of Europe: from the EEP separated by the TTZ from the Caledonian accretion belt and crossing the outer and inner (Sudetic) domain of the Variscan Orogen. In the post-Variscan structural pattern, the line crosses the Permian–Mesozoic Polish Basin (part of the Central European Basin System), including hydrocarbon- and metal-bearing Rotliegend and Zechstein strata of the Southern Permian Basin. The profile could thus supply valuable data to solve crucial issues of regional and economic geology, such as:

- the tectonic structure of the Pomeranian sector of the TTZ and depositional architecture of Ediacaran and Lower Palaeozoic basins of the EEP margin;
- sub-Devonian structure of the crust south-west of the TTZ, including the nature of Caledonian structures and possible occurrence of crustal blocks and separating tectonic sutures;
- architecture of the Variscan Orogen, both its deeply buried external part (Wielkopolska Externides) as well as the shallow internal part (Fore-Sudetic Block and the Sudetes – part of the Bohemian Massif);
- localization and characteristics of the buried Variscan Front and the Rheno-Hercynian Suture separating the outer and inner parts of the orogen, respectively; the possible occurrence of Carboniferous coal basins potentially sourcing the gas traps in the Permian reservoirs;
- relationship between the sedimentary fill of the Polish Basin with its hydrocarbon potential and metallogenesis and deep Caledonian–Variscan substrate inaccessible by boreholes; deep controls on Permian–Mesozoic tectonism.

3. EFFORTS TO IMPLEMENT THE NEW PROGRAM

Professor Guterch started his efforts to launch the POLCRUST-02 Program soon after the formal termination of the previous one. The initial plan was to organize a scientific-industrial consortium with a leading role played by, besides the Institute of Geophysics PAS, the PGNIG S.A. and the Polish Geological Survey (PGS) represented by the Polish Geological Institute – National Research Institute (PGI–NRI). From the outset, the management of the upstream sector in the PGNiG had a positive attitude, taking into account the promising results of the

POLCRUST-01 project. Aiming for formal inclusion of the PGS in the new project, Professor arranged a workshop in the Ministry of Environment on September 25, 2013, with the participation of the Main Geologist of the Country (MGC) as well as staff members and director of the PGI–NRI. During the meeting, the project was preliminarily approved by MGC who accepted the PGI–NRI as the participant. As a representative of the government supervising the PGS, he recommended that the director of the PGI–NRI should take formal steps to confirm its accession. Unfortunately, it never happened as the director did not issue an expected document, whereas the dismissal of the MGC from the office in December 2013 stopped further action to organize the program (Narkiewicz 2019).

All these circumstances were at the beginning of a sequence of events, tightly connected with the political, organizational, and personal changes in the institutions involved, which in successive years hindered or even paralysed the efforts of Professor Guterch. In our later conversations, Professor repeatedly returned to the year 2013, stressing his disappointment with the obstruction of the PGI–NRI director in a situation when the decision to launch the POLCRUST-02 Program seemed to be within reach. Nevertheless, with his typical optimism, he did not give up further efforts, tirelessly maintaining contacts with institutions that could participate in the research financially and organizationally.

Being ensured as to the positive intention of the PGNiG, Prof. Guterch made a proposal to participate in the consortium to the management of KGHM Polska Miedź S.A. The main concessions of this giant copper and silver mining and processing company are located in the Sudetes and its foreland – exactly in the area crossed by the planned profile. During the visit to the KGHM headquarters in Lubin (May 10, 2015), the main premises and objectives of the program were presented, stressing its potential significance for metallogenic questions connected with the ores. Key representatives of KGHM expressed their interest in participating in the consortium and promised a positive recommendation to the management and the CEO of the company. Professor Guterch was asked to issue an official letter to the CEO with a proposal to participate.

Consequently, the Professor prepared a project of the letter to be signed by the management of both the Polish Geological Institute–NRI and the Institute of Geophysics PAS. Earlier, on March 16, 2015, the director of the latter institute sent to the PGI–NRI an invitation to participate in the planned scientific-industrial consortium. At Prof. Guterch's request, the present author met with the then-head of the PGI–NRI, but he refused to sign the letter, referring to previously obtained negative opinions. He abstained from presenting the arguments behind such opinions, promising their later disclosure by the authors (which never happened, though). Thus, the management of the PGI–NRI again effectively torpedoed the efforts to launch the POLCRUST-02 Program, without providing any rationale.

The coming years were spent by Prof. Guterch on further arduous efforts, focusing mainly on meetings and discussions with successive incarnations of decision-makers in the planned participating institutions. In each case, Professor was forced to explain *ab ovo* the idea of the program, convincing his more or less competent interlocutors about its scientific and practical significance. He, as always, showed great patience and persistence, never losing hope for a positive outcome of these efforts.

The next and, as it later appeared, the last attempt to initiate the POLCRUST-02 program took place at the turn of 2019 and 2020. At that time, the organizational plan formulated by Prof. Guterch assumed to maintain the earlier methodological assumptions of the project. The scientific-industrial consortium would include the Institute of Geophysics PAS, the Institute of Geophysics of the University of Warsaw, the Ministry of Environment, the PGS, the PGNiG S.A. and, possibly, the KGHM S.A. The schedule would include performing, in 2021–2023,

seismic fieldwork, collection and processing of data and comprehensive geophysical and geological interpretation based on all available regional and detailed materials and using various methodologies, including geological-geophysical modelling.

The key to launching the plan was a positive decision of the then MGC to allocate financial resources to the planned PGS project "Program of deep reflection seismic investigations of the Earth's crust in the area of central and south-western Poland – POLCRUST-02". On February 17, 2020, the project was presented by M. Narkiewicz in the Ministry of Environment. It was positively assessed by the MGC (letter from February 22, 2020), but, unfortunately, this did not mean a positive end to the effort. The meeting arranged in the ministry by the MGC in March 2020 revealed the disagreement of the PGI–NRI management represented by the Director of PGS. It also appeared that after repeated changes in organization and management, the PGNiG lost its interest in the program. The arguments put forward by Prof. Guterch, Prof. Grad, and the present author were disregarded, and finally, the project has not been accepted.

It was a strong blow to the plans of Professor Guterch, who did not hide, in private conversations, his disappointment with the short-sighted approach of officials supported by some narrow-minded scientists. Later contact with Professor attested to his ongoing determination and the pursuit of new attempts to revive the idea of the POLCRUST-02 Program. The climate for such attempts in the ministry (which in the meantime changed its label to "Climate and Environment") was not favorable. The premature death of Marek Grad (May 17, 2020), who supported Professor in his efforts, and the exploding COVID-19 pandemic added to the difficulties in further organizational arrangements...

4. FINAL THOUGHTS

The personality and scientific accomplishments of Prof. Aleksander Guterch left a lasting mark on the deep reflection seismic research in Poland. His unquestionable achievement is the first modern profile POLCRUST-01, which provided a wealth of new data about the deep geological structure of Poland. It laid the foundations for the implementation of similar projects, including the planned POLCRUST-02 transect crossing the entire country – from the Sudetes to the border with Lithuania. Professor devoted a lot of energy to organizing this research and believed in its implementation until the end of his scientific activity. Unfortunately, due to a combination of various circumstances presented here, this supposedly groundbreaking project was not launched. The Professor's efforts did not have a happy ending during his lifetime, although they will certainly not be without consequences in the future. They are the testament of Prof. Aleksander Guterch to future researchers who, sooner or later, will return to the ideas He outlined.

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Professor Aleksander Guterch's Cooperation with the Faculty of Geology, Geophysics and Environmental Protection at the AGH University of Krakow[1]

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Professor Aleksander Guterch was habilitated in 1978 at the Faculty of Geological Prospection of the Stanisław Staszic Academy of Mining and Metallurgy in Krakow, Poland. The title of his habilitation thesis was: "Structure and physical properties of the crust and upper mantle of the Earth of the Polish area in the light of the results of deep seismic soundings". The reviewers in the habilitation proceeding were Prof. Jerzy Kowalczuk (AGH, Krakow, Poland), Prof. Roman Teisseyre (Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland), and Prof. Władysław Pożaryski (Polish Geological Institute – National Research Institute, Warsaw, Poland). The resolution of the Council of the Faculty of Geological Prospection at the AGH was passed on 9 June 1978, and the approval by the Central Qualification Commission was on 30 October 1978. Aleksander Guterch received the Habilitation degree of Geological Sciences in the discipline of seismology.

Two aspects of Prof. Aleksander Guterch's cooperation with the Faculty of Geological Prospection at the Stanisław Staszic Academy of Mining and Metallurgy in Krakow are presented:

1. Comprehensive geophysical research – magnetic and gravimetric, which used the results of seismic studies of teams led by Prof. Aleksander Guterch,
2. Professor's participation in the training of scientific and research staff of geophysicists, as well as the development and acquisition of scientific degrees by faculty members.

Re. 1. The results of seismic surveys performed under the direction of Prof. Aleksander Guterch by teams of employees of the Institute of Geophysics of the Polish Academy of Sciences inspired and were extensively used by potential field specialists to obtain the possibly most accurate structural models of the Earth's crust and upper mantle in the zones covered by

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international seismic surveys. The results of seismic studies of deep lithospheric structures were implemented in the comprehensive geophysical research – gravimetric and magnetic realized by teams headed by Prof. Teresa Grabowska.

The deep structures of the lithosphere recognition, carried out under the international research projects in the 1980s and 1990s, EUROPROBE, POLONAISE'97, and CELEBRATION 2000 by Professor A. Guterch and a team of employees of the Institute of Geophysics of the Polish Academy of Sciences in Warsaw, became the basis for work on the construction of two-dimensional density and magnetic models of the Earth's crust and upper mantle in the area of Poland. This work was carried out at the Interdepartmental Institute of Applied Geophysics and Petroleum Geology, Faculty of Geological Prospection, AGH, later named the Department of Geophysics and now the Chair of Geophysics at the Faculty of Geology Geophysics and Environmental Protection at AGH University of Krakow. The work was carried out within the framework of statutory activities, and in later years as projects financed by the Committee for Scientific Research. Gravimetric and magnetic modeling was carried out by a team of employees of the Department of Geophysics under the direction of Prof. Teresa Grabowska, with the creative participation (development of original software for 2D gravimetric and magnetic modeling) of Dr. hab. Grzegorz Bojdys. Specialists from the Polish Geological Institute in Warsaw, as well as specialists from the Slovak Academy of Sciences and the Slovak University in Bratislava as well as the Ukrainian Academy of Sciences in Kiev and the Belarusian Academy of Sciences in Minsk were also invited to cooperate.

The results of intensive work on density models of the Earth's crust and upper mantle and magnetic models of the Earth's crust were presented at numerous national and international scientific conferences and symposia, as well as published in specialized national and international scientific journals (a list of conference presentations and published articles is attached as References).

The ongoing dissemination of the results of research and modeling work has been served by their presentations at numerous scientific conferences and symposia at home and abroad.

Noteworthy are the conferences jointly organized by the Polish Academy of Sciences, the National Committee of Geophysics and Geodesy, the Commission of Geodynamics, the Committee of Geophysics and the Commission of the Earth's Interior, entitled "Geodynamic Research in the Earth's Interior". "Geodynamic Research in Poland", held periodically in Jabłonna in 1977, 1981, 1983, and 1989, as well as the EUROBROBE International Scientific Symposium entitled "Tectonic evolution of the Tornquist–Teisseyre Zone and adjacent terranes", organized by the Institute of Geophysics of the Polish Academy of Sciences and the European Science Foundation (Jabłonna, 28 September – 4 October 1991).

In the 1980s, important from the point of view of the exchange of research results on deep geological structures of Central Europe was the participation of the Polish team in international scientific symposia entitled "Problémy Současné Gravimetrie" [Problems of Contemporary Gravimetry], organized by the Institute of Geophysics of the Czechoslovak Academy of Sciences in Prague and Brno Geophysics in Liblice in 1982, 1984, 1986.

Over the years 1970–1980, equally important for the exchange of research results on deep geological structures of Central and Eastern Europe was the participation in the meetings of the Commission of the Academy of Sciences on Planetary Geophysics in Eastern Europe (KAPG), organized by the Interdepartmental Geophysical Committee under the Presidium of the Academy of Sciences of the USSR, and the opportunity to present the results of the Polish team's research at international geophysical conferences and symposia, such as:

a. International Geophysical Conference entitled "Geophysical and Geodynamic Model of the Central and Eastern European lithosphere" organized by the USSR Institute of Geophysics, Yalta, 15–25 December 1983, paper: "Predvaritel'ni rezul'tati issliedovanii

gravimetricheskoi i magnitnoi modeli zemnoi kori vdol VI Geotraversa na territorii Pol'shi" (not published),

b. International Symposium entitled "Comprehensive Geophysical Research of the Lithosphere of Central and Eastern Europe" organized by the Commission for Multilateral Scientific Cooperation of the Academy of Sciences of the Socialist Countries, KAPG, S.I. Subbotin Institute of Geophysics AN USSR, Yalta, 21–28 December 1987, paper: "Comprehensive model of the crust and upper mantle in the area of the Polish Lowlands" (not published),

c. XVIII Meeting of the Academy of Sciences Commission on Planetary Geophysics in Eastern Europe (KAPG), organized by the Interdepartmental Geophysical Committee under the Presidium of the Academy of Sciences of the USSR, Sochi, 18–24 April 1985, Communiqué: "Rezul'tati issledowanii glubokoi strukturi ziemnoi kory na territorii Pol'shi" (not published).

In the 1990s, the results of research in potential fields were presented at conferences and workshops organized within the framework of the EUROPROBE project by the Chief National Geologist of Poland, the Institute of Geophysics of the Polish Academy of Sciences in Warsaw, the National Geological Institute, also the Association for Deep Geological Research.

Noteworthy is the participation and presentations in the form of posters of the work of the AGH team at conferences organized by the European Geophysical Society (EGS) in Wiesbaden (1993), Grenoble (1994), Hague (1999), Nice (2000), and also participation in conferences organized by the European Union of Geosciences EUG 7, EUG 8 in 1993 and 1997 in Strasbourg, and later by the European Geosciences Union (EGU) in Nice (2004, 2005).

We should also mention the establishment of cooperation with Slovak geophysicists (Bielik et al. 2006) and participation in Conference and 2nd Workshop on International Gravity Field Research, 2006 (WIGRFR 2006), Smolenice, Slovak Republic.

As an example of international cooperation in the field of comprehensive geophysical research of deep lithospheric structures, selected excerpts from the article entitled "Density and magnetic models of the lithosphere along CELEBRATION 2000 Profile CEL01" by T. Grabowska, G. Bojdys, and geophysicists from Comenius University in Bratislava – M. Bielik and K. Csicsay – can be presented. This article, published in *Acta Geophysica* (Grabowska et al. 2011), presents the results of the application of potential field methods in deep crustal and upper mantle studies, taking into account broadly the information from deep seismic and geological surveys carried out under the direction of Prof. Aleksander Guterch. This paper shows two-dimensional (2D) density and magnetic models of the crust and upper mantle along the CEL01 deep seismic sounding profile, carried out as part of the CELEBRATION 2000 international project. This profile crosses the most important geological units of Central Europe. These are the Alps-Carpathian-Pannonian region (ALCAPA), the southeastern part of the Paleozoic Plateau (PLZ), the Trans-European Suture Zone (TESZ), and a section of the southwestern part of the East European Craton (EEC).

Density and magnetic models were constructed based on a 2D velocity model transformed into a density model, while taking into account geological as well as geothermal data and geophysical modeling results for the lithosphere-asthenosphere boundary (LAB). This allowed the construction of a consistent 2D geophysical model of the crust and the extension of the geophysical-geological characterization of the lithosphere in the Pannonian basin, the Carpathian orogen, and the transition zone (a fragment of the Paleozoic PLZ platform) between the ALCAPA region and the East European Craton (EEC).

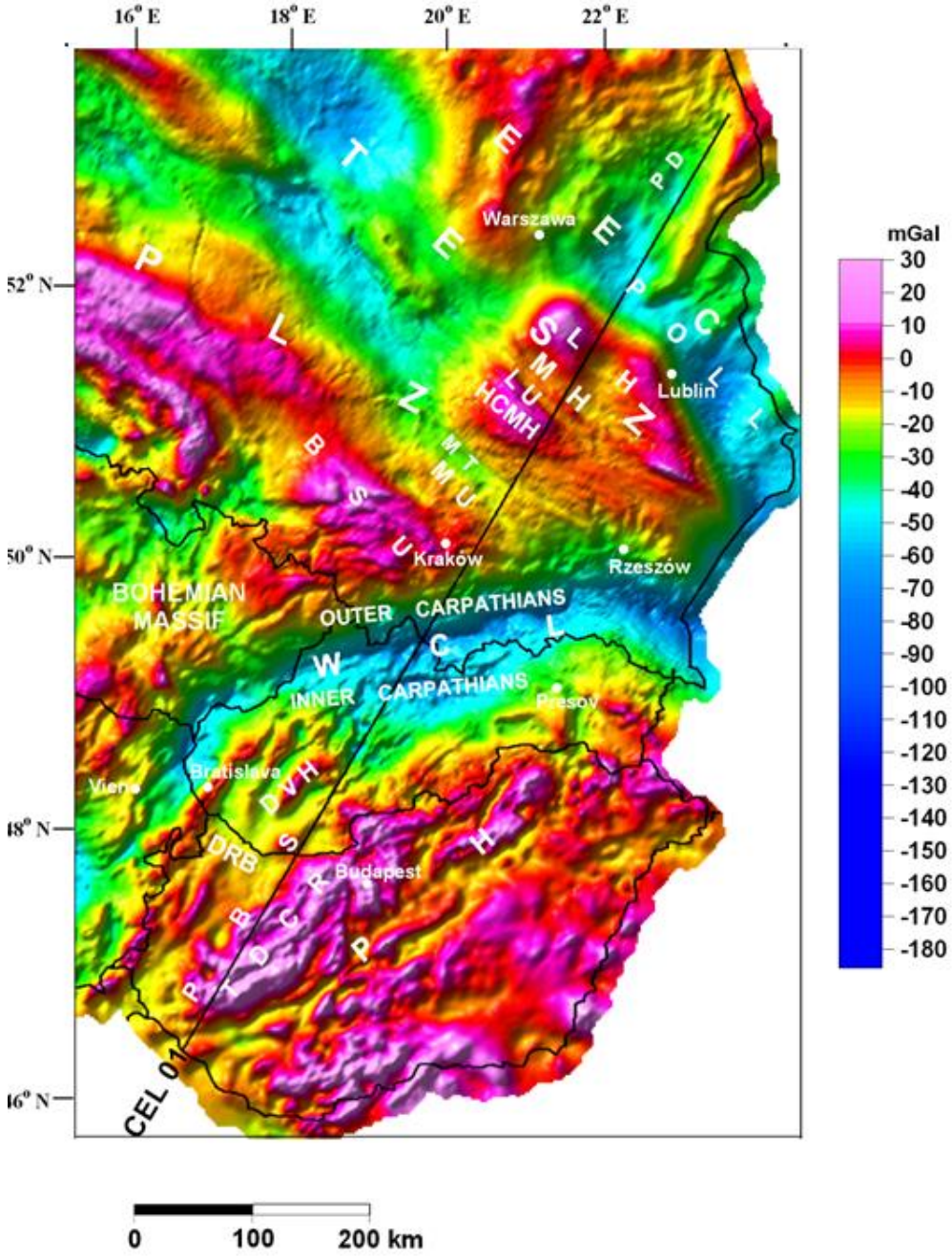

Fig. 1. The Bouguer gravity anomaly map of the CELEBRATION 2000 region (Bielik et al. 2006). The Bouguer gravity anomaly and terrain corrections were calculated for the reduction density of 2.67 Mg/m^3. Constructed on regularly distributed data (grids): Austria – 1×1 km, Czech Republic – 2.5×2.5 km, Hungary – 2×2 km, Poland – 1×1 km, and Slovakia – 1×1 km. Abbreviations: ALCAPA – Alpine–Carpathian–Pannonian microplate, BSU – Bruno Silesian Unit, CF – Carpathian Foredeep, DB – Danube Basin, DRB – Danube–Raba Basin, DVH – Danube Vah High, EEC – East European Craton, HCF – Holy Cross Fault, HCM/HCMH – Holy Cross Mts. / Holy Cross Mts. High, IGRF – International Geomagnetic Reference Field, JA – Jordanów anomaly, KF – Kock Fault, KLZ – Krakow–Lubliniec Zone, LAB – Lithosphere/Asthenosphere hypothetical boundary, LH –Lublin High, ŁU – Łysogóry Unit, MH – Małopolska High, MT – Miechów Trough, MU – Małopolska Unit, PBS – Pannonian Basin System, PD – Podlasie Depression, PH – Pannonian High, PKB – Pieniny Klippen Belt, PLZ – Paleozoic Platform of Central and Western Europe, POLL – Podlasie–Lublin Low, TDCR – Transdanubian Central Range, TESZ – Trans-European Suture Zone, TTZ – Teisseyre–Tornquist Zone, WCL – Western Carpathians Low, ZB – Zala Basin.

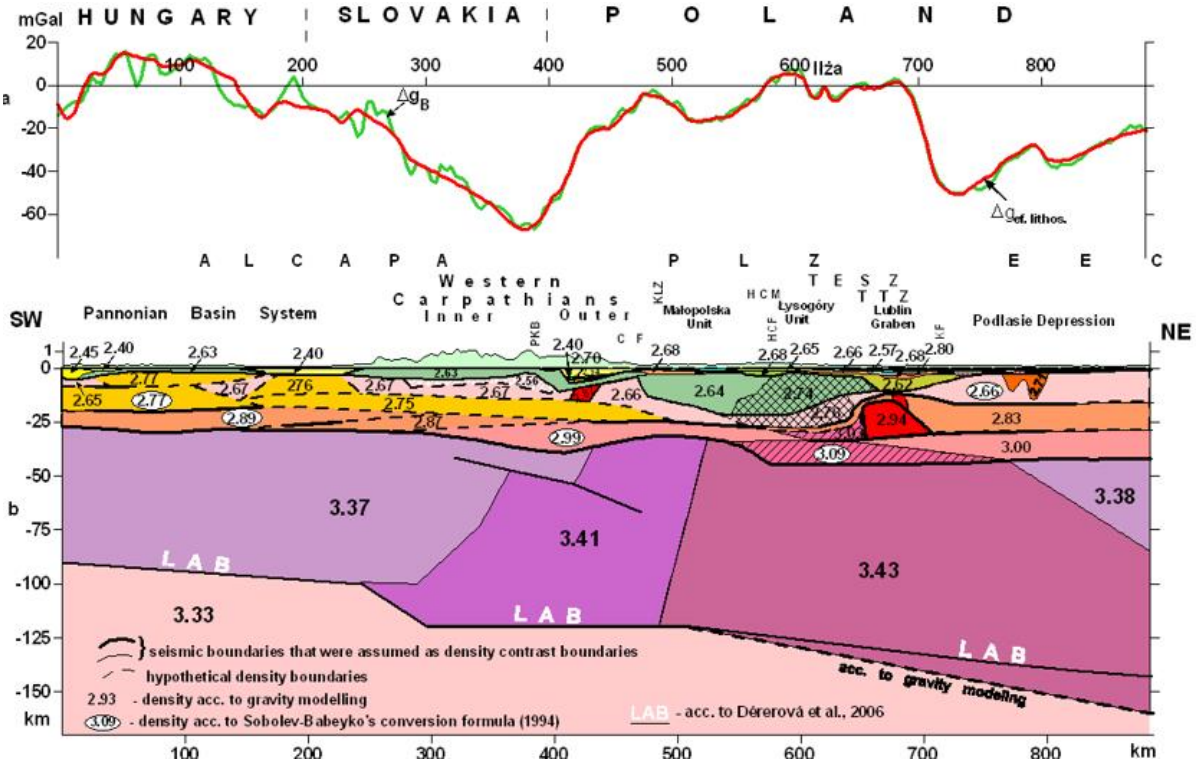

Fig. 2. A 2D density model of the crust and the upper mantle along profile CEL01 constructed on the basis of geological data (sedimentary cover), seismic and geothermal data (crystalline crust and upper mantle), and gravity modeling. Panel a) Δg_B – Bouguer gravity anomaly, $\Delta g_{ef.lithos.}$ – 2D total gravity effect calculated for the density model of the lithosphere which comprises the sedimentary cover, crystalline crust, and upper mantle; Panel b) Density model of the lithosphere. For abbreviations see Fig. 1.

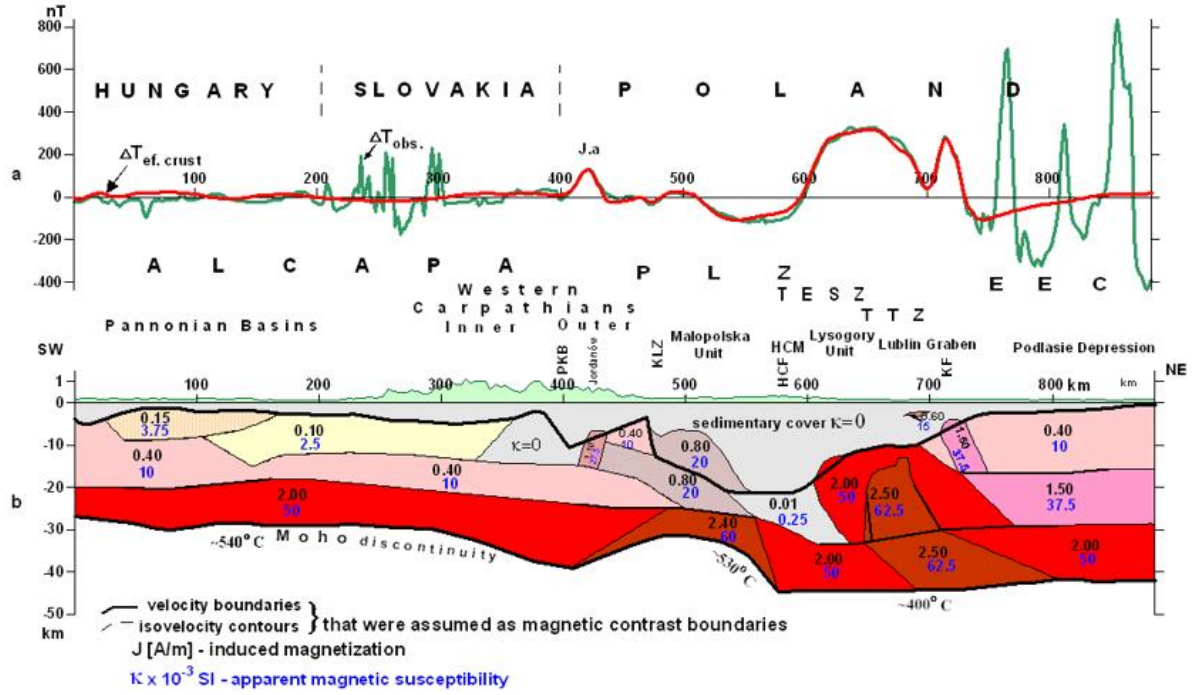

Fig. 3. A 2D magnetic model of the crystalline crust along profile CEL01. Panel a) $\Delta T_{obs.}$ – a magnetic anomaly of the total intensity of the geomagnetic field, $\Delta T_{ef.crust}$ – 2D magnetic effect calculated for the model. Panel b) Magnetic model constructed on the basis of seismic data, gravity data, and 2D magnetic modeling. The top and the bottom of the layer with the magnetic susceptibility correspond to crystalline basement and Moho discontinuity. Other abbreviations and explanations as in Fig. 1.

In Fig. 1, the Bouguer gravity anomaly map of the CELEBRATION 2000 region is presented. In Fig. 2, a 2D density model of the crust and the upper mantle along profile CEL01 constructed on the basis of geological data (sedimentary cover), seismic and geothermal data (crystalline crust and upper mantle), and gravity modeling is shown. The modeling performed provided evidence for density differentiation in the lithospheric mantle, the terrane concept of the EEC foreland, and confirmed the possibility of rift phenomena along the SW boundary of the Precambrian craton in SE Poland.

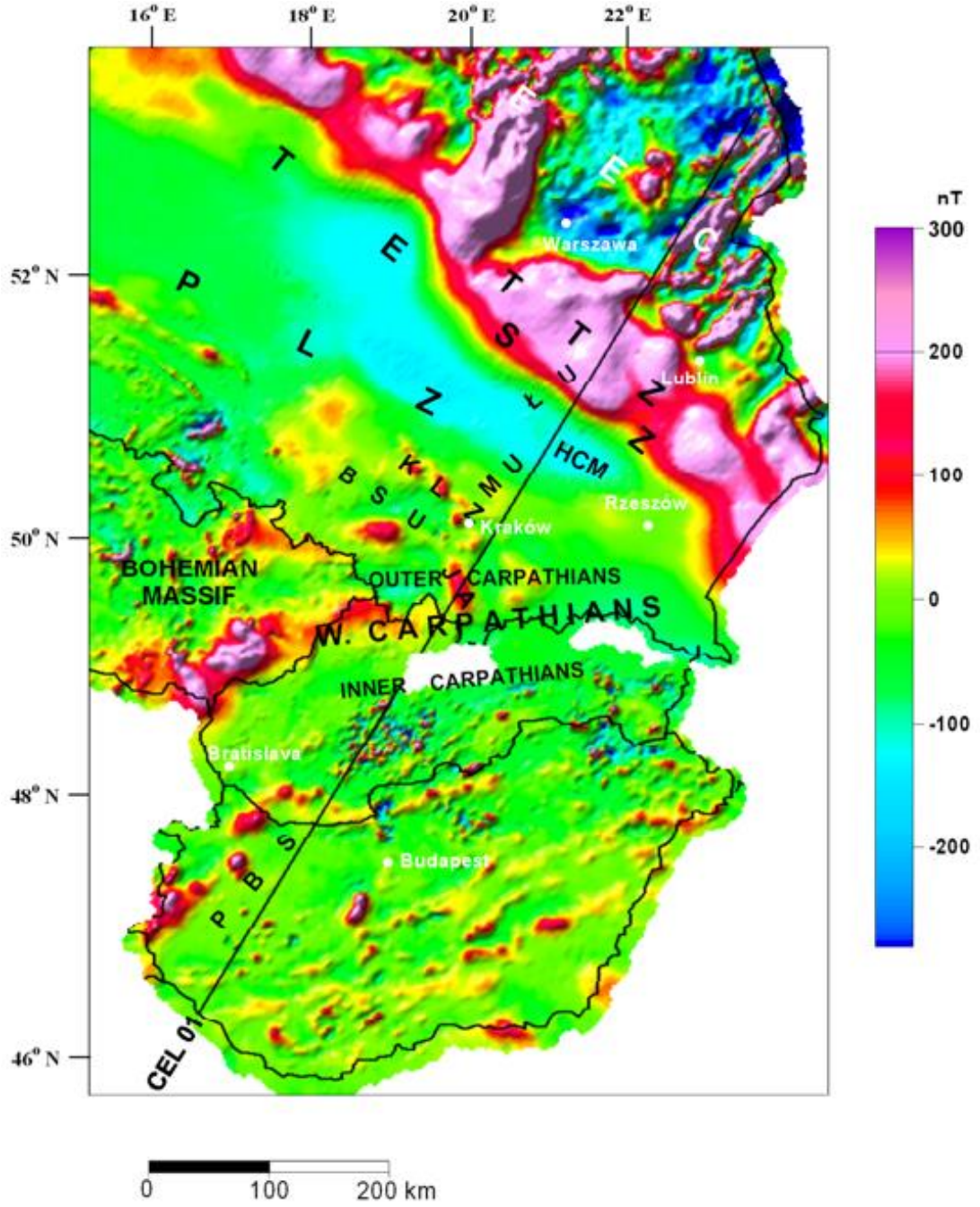

Fig. 4. A magnetic anomaly map of the total intensity of the geomagnetic field of the CELEBRATION 2000 region (reproduced from the unpublished map by Wybraniec and Bielik from 2006, courtesy of authors), constructed on a regularly distributed data with – 1×1 km grid. IGRF – 1982,5. For abbreviations see Fig. 1.

In Fig. 3, a 2D magnetic model of the crystalline crust along profile CEL01 is presented and in Fig. 4 a magnetic anomaly map of total intensity of the geomagnetic field of the CELEBRATION 2000 region (reproduced from the unpublished map by Wybraniec and Bielik from 2006, courtesy of authors) is included.

Some selected publications illustrating the work of Prof. Teresa Grabowska and colleagues from the Chair of Geophysics at the Faculty of Geology, Geophysics and Environmental Protection, AGH University of Krakow, through the years 1985–2011 are attached in References (Grabowska and Perchuć 1985; Guterch et al. 1988; Grabowska et al. 1992, 1993, 1998, 2011; Grabowska and Koblański 1992; Chekunov et al. 1993; Grabowska and Dolnicki 1994; Grabowska and Bojdys 2001, 2004). **Their purpose was to show that the results of seismic surveys conducted by Prof. Aleksander Guterch inspired and were used by specialists in potential fields to obtain the most accurate structural models of the Earth's crust and upper mantle in the zones covered by international seismic surveys.** Similarly, selected conference abstracts are also presented in References (Grabowska and Dolnicki 1993; Thybo et al. 1993, Grabowska et al. 1994; Grabowska and Bojdys 1997, 2004; Bojdys and Grabowska 1999, 2000; Bielik et al. 2006).

Re. 2. Professor Aleksander Guterch actively participated in the development and qualification of the scientific and research staff of applied geophysics at the Faculty of Geological Prospection at the AGH. Table 1 includes lists of reviews performed by the Professor in doctoral and postdoctoral dissertations conducted at AGH in 1975–1991. Professor contributed to the doctoral degrees of seven seismic scientists who have joined research teams at the AGH Faculty of Geological Prospection (pos. 3, 4, and 6), at the Oil and Gas Institute – National Research Institute (pos. 2 and 7), as well as at the enterprise Geofizyka Krakow, where Andrzej Marian Ptak, Ph.D., was the long-time head of the seismic group, then head of the Exploration Geophysics Department. One review concerned the doctoral thesis of the employee of the Geophysical Research Company in Warsaw – Adolf Mikołajczak, Ph.D., who worked at the institution for many years. A doctoral student from Mongolia (pos. 8) completed his doctoral internship at the AGH and prepared his dissertation under the supervision of Prof. Teresa Grabowska.

The teams of geophysicists and geologists from the Faculty of Geological Prospection/ Geology Geophysics and Environmental Protection at the AGH who had the chance to listen to Prof. Aleksander Guterch's lectures, participate in discussions of the results of seismic, gravimetric, and magnetic work, and prepare papers based on his concepts are grateful to fate for this opportunity.

Acknowledgments. Prof. Dr. hab. Teresa Grabowska (Department of Geophysics, Faculty of Geology Geophysics and Environmental Protection, AGH University of Krakow) has reviewed Prof Guterch's extensive publication record and selected representative articles and conference papers on the use of seismic, gravimetric, and magnetic methods, illustrating the cooperation between geophysical teams from the Institute of Geophysics, PAS, and the AGH University of Krakow. Ms. Urszula Godyń of the Dean's Office of the AGH University of Krakow has compiled data on reviews prepared by Prof. Aleksander Guterch in habilitation proceedings. Information about the doctoral dissertations in which Professor A. Guterch prepared reviews was obtained from the AGH Main Library Catalog.

Table 1

Reviews of the doctoral theses and reviews in the habilitation proceedings carried out at the Faculty of Geological Prospecting of the Academy of Mining and Metallurgy, Krakow, Poland[2], prepared by Prof. Aleksander Guterch

Reviews of the doctoral theses			
No.	Forename and name of Ph.D. student	Title of doctoral thesis	Year of degree conferral
1	Adolf Mikołajczak, M.Sc.	Analysis of refraction waves (with Vg 5.7 km/s – Paleozoic formations) in terms of increasing the efficiency of refraction seismic surveys in the area of Western Pomerania	1975
2	Józef Smolik, M.Sc.	Study of reflection seismic wave dynamics for thin – bedded systems	1976
3	Eng. Ryszard Ślusarczyk, M.Sc.	Kinematic modeling of seismic waves undergoing diffraction in a geological medium	1976
4	Eng. Jerzy M. Szwejkowski, M.Sc.	Theoretical approximation of the disturbance of the seismic wave propagation velocity field around selected tectonic structures	1976
5	Eng. Andrzej Marian Ptak, M.Sc.	Seismic reflection methodology – selected issues in seismic signal generation, reception and recording	1981
6	Eng. Ewa Szabelska-Latała, M.Sc.	New method of stacking velocity transformation into other seismic velocities	1981
7	Anna Półchłopek, M.Sc.	Analysis of seismic migration modes using the wave equation	1987
8	Dawaagijn Lchagwadorż, M.Sc.	Structure of the Earth's crust of the northern part of the Polish Lowlands in the light of gravimetric studies	1991
Reviews in the habilitation proceedings			
9	Dr. Eng. Zbigniew Kasina	The Problem of Elastic Wave Attenuation in Seismic Prospecting Aspect. Dr. Hab. in technical sciences, applied geophysics	1982
10	Dr. Eng. Grzegorz Bojdys and Dr. Eng. Marek Lemberger	Gravimetric Modeling as a Method of Lithosphere Examinations on Example of Carpathians. Dr. hab. in natural sciences, geophysics	1989

[2]later Geology Geophysics and Environmental Protection of the AGH University of Krakow

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CONFERENCE AND WORKSHOP ABSTRACTS

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Bojdys, G., and T. Grabowska (1999), Geological implications of magnetic and gravity anomalies of the southeastern segment of the Tornquist–Teisseyre zone (TTZ) in the area of Poland. **In:** *Abstract in 24th General Assembly EGS, Society Symposium, Solid Earth Geophysics & Geodesy, 19–23 April 1999, Hague, The Netherlands.*

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Professor Aleksander Guterch (1936–2023) – Eminent Polar Explorer and Seismologist, Researcher of the "Gateways" to the Arctic and Antarctic

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Over the last two decades, the authors of these memoirs worked closely with the late Prof. Aleksander Guterch in organizing Polish polar research, preparing and implementing programs and projects for Arctic and Antarctic research, as well as in representing the Polish polar environment in various organizations and international forums. However, the beginnings and nature of the relationship with this Eminent Scientist of each of us were different (as indicated in the text with our initials: JJ and PG).

My (JJ) first meeting with Prof. Aleksander Guterch took place in the late 1970s, at one of the annual conventions of the, then still young, "Polar Club". These were combined with scientific Polar Symposia. In 1976, Prof. Guterch entered into extensive seismic studies of the Earth's crust of the Svalbard region on a grand scale. He used to present high-class papers at polar symposia, showing the progress of his research on the structure of the Arctic crust and the Earth's upper mantle. These were later extended to the marine region between the Antarctic Peninsula and the South Shetlands archipelago. He often reported the results jointly with his student, Marek Grad (1951–2020), PhD holder at that time, usually on behalf of a larger research team. The subject matter and the great spatial scale, as well as the technical and logistical complexity of these marine studies of the Earth's crust, were bewildering to me. At that time, I was a young researcher of the geomorphology of Svalbard's periglacial slopes and a novice glaciologist. These fields of my scientific interests were on a diametrically more modest scale in terms of space, instruments, and, of course, finances as well. I associated Prof. Guterch and his team mainly with large and complicated projects and grand visions of new, huge scientific programs, as well as international cooperation, which was rare in the reality of Poland at that time. It should be emphasized that Prof. Aleksander Guterch headed three Geodynamic Expeditions in the North Atlantic in the Svalbard region in the years 1976–1985, and four such expeditions to West Antarctica in the years 1979–1991. Conversations with participants of these expeditions made me realize how complicated these projects were, with multi-person teams of researchers on research ships and in various locations on land, with seismographs, their power

supply, also at the bottom of the sea. In addition, it involved the cooperation with specialists in explosives detonated in the sea, as a source of seismic waves. Such projects required detailed planning, good communication, and precise coordination of activities and measurements. In the times before the use of satellite positioning (GPS), this must have been additionally very difficult, but always crowned with success. Since those years, I have associated the modest and rather insular figure of Prof. Guterch with great scientific projects. Not only in the Arctic, which is close to my heart.

I (JJ) had more direct contact with Prof. Guterch when I was in the team of the late Prof. Marian Pulina (1936–2005) and participated in the implementation of one of the topics in the large project "Inter-ministerial Nodal Problem of the Polish Academy of Sciences – Polar Research" (1982–1985), of which he was the Coordinator and Manager. During the meetings and reporting sessions, there was an opportunity to observe this outstanding researcher more closely and talk to him. His openness to interact with teams from other disciplines was a positive and pleasant surprise to me. Of course, his priority was the cooperation in research on the Earth's crust, for example, with the late eminent geologist Prof. Krzysztof Birkenmajer (1929–2019) and younger associates. They cooperated mainly in the South Shetlands and the Antarctic Peninsula, but worked in the Svalbard region as well. The results of geological surveys on land allowed for an appropriate interpretation of the large lithospheric structures of the shelf and seafloor and led to a better understanding of the large-scale tectonic processes.

This resulted in new, globally unique results and publications (e.g. Birkenmajer et al. 1990; Guterch and Perchuć 1990; Sellevoll et al. 1991; Grad et al. 1993).

Within the framework of these central "nodal programs", the Coordinator also noticed (and incorporated into the plans) the studies on other elements of the natural environment of polar regions, including the domain of our research – glaciology, hydrology, and hydrochemistry. At that time, I (PG) joined the environmental research team as a researcher of the physico-chemical characteristics of water and ice. Then, we observed that the outstanding seismologist was well-versed in priority research directions in other fields of polar research.

In 1999, Prof. Aleksander Guterch, with a team from the Institute of Geophysics of the PAS, in close cooperation with the Alfred Wegener Institute in Bremerhaven (Germany), the Hokkaido University in Sapporo (Japan) and the University of Bergen (Norway), carried out a large field experiment on the "99200" profile as part of the international project "SMORE II". The work involved the German research icebreaker r/v "Polarstern" and the Polish yacht "Eltanin" (as an auxiliary unit). Seismic profiling of the Earth's crust structure was performed on a 430-km-long profile in the north-western region of Svalbard. This was the area of the Fram Strait – the Atlantic "gateway" to the Arctic. The profile covered the transition zone between the oceanic and continental crust. During this large-scale experiment, ocean bottom seismometers were used, together with a continuously operating, modern broadband seismometer at the Polish Polar Station Hornsund. During this expedition, we briefly came into personal contact with Prof. Guterch directly in the Arctic. His research made it possible to identify an extremely complex basin structure in the central part of the profile. The thickness of the Earth's crust in the studied area ranges from 30 km on the continent to only about 3 km below the ocean surface, in the rift zone of the Molloy Deep and the Knipovich Ridge. In the following years, the results were processed, by performing 2- and 3-dimensional modeling of the lithospheric structure in this particularly interesting region. On this basis, significant publications were created. Further research into the lithosphere of this "gateway" to the Arctic was developed during the 4th International Polar Year (e.g., Grad et al. 2011).

I (PG) got to know Prof. Guterch better after I moved to work at the Institute of Geophysics of the PAS in Warsaw, around the year 2000. I remember that he was the only person at the Institute who had two office rooms where he could be met. However, we mostly used to talk in

the room on the ground floor next to the library. He always considered all matters, whether minor or major, to be a priority, hence, I often met him in the Institute's director offices, where he discussed plans to implement big projects and large undertakings for field experiments. We began to cooperate more closely while working on the processing of materials and graphic design for the first Arctic and Antarctic Research Programme of Poland in 2002–2010, published in Polish and English. I didn't realize that this cooperation would develop so much and consume an incredible amount of time. However, Prof. Guterch's vision of Poland's active involvement and broad participation in the planned 4th International Polar Year was large enough to storm the offices of various ministers and department directors. The effects were coming slowly, but supported by a lot of optimism and determination, they usually had a happy ending. This culminated in the granting of special funding by the State Committee for Scientific Research for the so-called commissioned project "Structure, evolution and dynamics of the Lithosphere, Cryosphere and Biosphere in the European sector of the Arctic and the Antarctic". The granted funds allowed the active participation of Polish polar explorers from many scientific centers in Poland in the tasks carried out during IPY 2007–2008. I appreciated that in the following years, Prof. Guterch, even though we were in different departments of the Institute of Geophysics, used to come to me at least once a week to share his new ideas and plans.

In the 1990s, Prof. Guterch became more intensively involved in the activities of the Committee on Polar Research [Komitet Badań Polarnych, KBP] at the Presidium of the PAS, becoming its Vice-Chairman (1991–1999) and then Chairman in 1999–2007. We then became his successors in performing this function (JJ in the period of 2008–2018, and PG from 2019 – still). He also became a member of the Editorial Board of the KBP's international quarterly journal "Polish Polar Research". The chairmanship of the Committee on Polar Research also involved representing the PAS and Polish polar researchers in international organizations. In the years 2000–2007, Prof. Guterch chaired the National Committee at the PAS Presidium for the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Scientific Committee (IASC), taking part in their work.

In terms of Poland's representation in SCAR and other organizations and bodies related to Antarctic research, he cooperated and coordinated the initiatives and activities with the late Dr. Seweryn Maciej Zalewski (1932–2019), Prof. Stanisław Rakusa-Suszczewski, Prof. Krzysztof Birkenmajer, Prof. Krzysztof Jażdżewski, Prof. Andrzej Gaździcki, and other members of the KBP. Alongside, we were gradually introduced to participate in the work of IASC and international bodies related to Arctic research by Prof. Birkenmajer and Prof. Guterch since the beginning of the 21st century.

On the initiative of Dr. Odd Rogne, the IASC Executive Secretary, starting from 1999, the annual meetings of international Arctic organizations were cumulated during one period of the year (spring) and held in agreed-upon cities of member countries, under the common name Arctic Science Summit Week (ASSW). They were combined with major scientific symposia. These important gatherings brought together the most distinguished representatives of Arctic researchers and organizers of this research. They had the character of Arctic congresses. Together with Olek, because already at that time Prof. Aleksander suggested that we should be "on first-name terms" (which was a surprise, but a great honor), we participated in several ASSWs: in Kiruna (2003), Reykjavik (2004), Kunming (2005), Potsdam (2006), Bergen (2009), and of course in Kraków (2013), as well as in Helsinki (2014). During our trips to ASSW, we shared the tasks of representing the Committee on Polar Research of the PAS in various international organizations. Professor Guterch focused on his activities at the European Polar Board, EPB (2001–2014) located in Strasbourg. He was elected Vice-President of the EPB during the 2004–2007 term. At that time, the European Polar Board operated within the European Science Foundation. After the reorganization of EPB and a change of membership rules, Olek resigned

from the position of National Representative. Gradually worsening health problems, hampering the mobility during foreign trips, probably contributed to this. For years, we admired how Olek, helping himself, first with an elegant cane and then with crutches, traversed the long corridors of airports, the halls and stairs of conference centers, and sometimes certain distances in cities. He never complained about this, certainly a great and probably painful inconvenience. It emphasized a special trait of his character: stubbornness and striving for a goal.

As already mentioned, at the beginning of the 21st century, thanks to the efforts of Prof. Guterch, the Arctic and Antarctic Research Programme of Poland, put forward by the Polish Academy of Sciences for the years 2002–2010, came into being. His particular interests included seismic characterization of the Earth's crust in the transition zone from the South Pacific to the Antarctic Peninsula in West Antarctica and three-dimensional modeling of the structure of the Earth's crust in the contact zone between the Antarctic Peninsula and the South Pacific based on seismic data. As part of this program, research was also conducted on other components of the polar environment. Professor Guterch's special merit, while he was chairing the Committee on Polar Research of the PAS, was stimulating the Polish research community to actively prepare for the 4th International Polar Year 2007–2008 (International Polar Year, IPY) both in Poland and internationally. Within the authorities of the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU), the initiative to carry out planned and coordinated research on the Arctic and Antarctic on a global scale, 50 years after the International Geophysical Year (3rd International Polar Year) 1957–1958, appeared relatively late – around mid-2003. It was also incorporated into IASC action plans for the preparation of long-term plans for Arctic research. This was the initiation of the process of preparing the International Conference on Arctic Research Planning (ICARP II) at ASSW in Kiruna in the spring of 2003. The ICARP II conference was held in 2005 in Copenhagen.

A group of leading Polish polar researchers, led by Prof. Guterch, began preparations for Polish involvement in the IPY multidisciplinary research program. As a result of these efforts, the State Committee for Scientific Research announced a competition for a "commissioned" research project that would prepare Polish scientific teams for strong cooperation within this huge international undertaking. A well-structured and justified project proposal for the whole polar research environment was prepared, entitled: "Structure, evolution and dynamics of the lithosphere, cryosphere and biosphere in the European sector of the Arctic and in the Antarctic", which received funding for the years 2004−2007. Its coordinator and manager was Aleksander Guterch. For Polish polar researchers, this was a very important project. The project made it possible to strengthen and consolidate research in many fields of polar sciences. It enabled Poland to be well-prepared for participation in the IPY (2007−2009). This project was one of the factors enabling several teams from various Polish scientific centers to enter into closer cooperation with foreign teams and their large research programs during the IPY. These topics were officially approved by the International Polar Year's steering committee. Professor Guterch was personally involved in the IPY project (Cluster 77): "Plate Tectonics and Polar Gateways in Earth History", as the head of the Polish team, which later resulted in important publications (e.g., Pirli et al. 2010; Janik et al. 2014).

However, it became somewhat of a paradox that while funding of the equipment and research preparing Poland for the IPY through the aforementioned commissioned project was satisfactory, obtaining national funding for participation in programs during the Polar Year was extremely difficult. The gradual incorporation of an independent government agency, the State Committee for Scientific Research, into the structures of the Ministry of Science (2004–2005) contributed to this. The indefatigable Prof. Guterch and other prominent polar researchers tried to convince ministerial decision-makers of the need to ring-fence the funds for financing Poles' participation in the IPY. Such an effort wasn't successful. Project proposals from individual

teams for research within the agreed plans for the IPY had to compete in general competitions within their disciplines. Fortunately, some of them received grants, although usually with less funding than expected, which significantly limited our capabilities in this international partnership.

Looking back, it should be emphasized that Aleksander Guterch, then the chairman of the Committee on Polar Research of the PAS, as well as the chairman of the Polish National Committee for the 4th International Polar Year, active in the years 2006−2011, greatly contributed to the preparation and realization of Poland's participation in this world's largest research program. It is worth recalling here that over 50,000 researchers, observers, and technical staff from over 60 countries were involved in the IPY 2007−2008. They carried out 228 internationally coordinated scientific projects (see Krupnik et al. 2011). Polish teams were invited to 40 projects, but only 18 received financial support from the Ministry of Science and Higher Education.

It is worth emphasizing that Prof. Guterch markedly contributed to the preparations of IPY on an international scale. He was a representative of Poland in an important steering body – Heads of the Arctic and Antarctic IPY Secretariats (HAIS). During these meetings, we (JJ and PG) used to support Olek or replace him, if needed. The HAIS-5 meeting (26–27 May 2008), organized by us in Poland, in the historic interiors of the former Rectorate of the Jagiellonian University in Kraków, also became part of the IPY's history. A certain measure of the success of Prof. Guterch's efforts for Poland's participation in the Polar Year was the active participation of Polish scientists in the conference formally closing the IPY, i.e., "Oslo Science Conference: Polar Science – Global Impact" (8–12 June 2010). It was the largest-ever gathering of Arctic and Antarctic researchers at a single conference. It brought together approximately 2,300 participants from 53 countries. Apart from the participation of approximately 500 scientists from Norway (as hosts and organizers), the active participation of 71 researchers from Poland made it the 6th largest national delegation (Krupnik et al. 2011). This statistic somehow reflects the scale of Olek's initiatives and efforts. Of course, they were supported by the enthusiasm and commitment of many scientific teams from Poland to the IPY. The most valuable part of the legacy of the activities of that period was the beginning of greater consolidation and cooperation of the hitherto fragmented Polish polar research community. Further good effects of these initiatives and activities can be observed today.

During the organization and implementation of research projects related to the IPY 2007–2008, Prof. Guterch managed to noticeably strengthen contacts and cooperation between the Committee on Polar Research of the PAS and the Polish Ministry of Foreign Affairs. He chaired the National Committee for Polar Treaties at the Presidium of the PAS (Arctic Council, Antarctic Treaty). The intensification of this cooperation was a great merit of H.E. the Titular Ambassador Jakub Wolski, who at that time headed the Legal and Treaty Department of the Ministry of Foreign Affairs of Poland. A line of scientific diplomacy in polar research was then developed and has been continued thereafter. The Ministry of Foreign Affairs established, in cooperation with the Polish Academy of Sciences, an interdepartmental task force called the "Polar Task Force", which used to meet once a year, engaging and trying to solve substantive and legal problems of the functioning of Polish polar research within the framework of the Antarctic Treaty, the Spitsbergen (Svalbard) Treaty and Poland's participation in the Arctic Council, with a status of an observer state. Professor Guterch used to take a very active part in these activities as an advisor and expert, including meetings of representatives of observer states at the Arctic Council, called "Warsaw Format Meeting". We owe many initiatives and activities in this field to his work.

The Ministry of Foreign Affairs recognized the importance of promoting Polish science and raising Poland's prestige in the world through achievements in the field of polar research. Professor Aleksander Guterch, together with a group of polar researchers, was awarded the Honor-

ary Badge of the Ministry of Foreign Affairs "Bene Merito" in 2015. This is a very honorable distinction awarded for activities strengthening Poland's position in the international arena.

The expert report for the PAS on the state of Polish polar research after the IPY (Guterch et al. 2010), edited and published under the supervision of Prof. A. Guterch, is also part of the history of Polish polar research. He then served as the Chairman of the Interdepartmental Expert Team of the Polish Academy of Sciences for Polar Research (2009–2010).

Professor Aleksander Guterch, as an eminent scientist, strengthened the Polish community of polar researchers through his personal prestige as a member of the Polish Academy of Sciences (Corresponding Member since 1989 and Ordinary Member since 1998), the Polish Academy of Arts and Sciences, and other influential bodies and organizations in Poland. Of great importance for the University of Silesia in Katowice, especially the Faculty of Earth Sciences in Sosnowiec, was his participation as a reviewer in the procedure of awarding the highest academic dignity – the Honoris Causa Doctorate to an outstanding glaciologist and Arctic researcher – Prof. Jon Ove Hagen from the University of Oslo (see Fig. 1). The ceremony of promoting this Honorary Doctor of the University of Silesia took place in May 2008 in connection with the Earth and Polar Research Festival in Silesia (Guterch 2008).

Professor Guterch clearly cultivated his commitment to polar matters also during the last years of his life. He actively participated in the work of the Committee on Polar Research at the Presidium of the PAS, providing advice and support in engaging in challenges and solving problems. He used to diligently participate in plenary sessions, skipping the KBP meetings very rarely. He used to speak out on important matters. He also attended the December KBP PAS meeting at the Staszic Palace in 2023, three weeks before his unexpected departure to Eternity.

The professor's personality was a combination of great scientific passion, diligence, and research integrity with courtesy, academic elegance, and modesty in contact with others. These

Fig. 1. Professor Aleksander Guterch (first from the left) – as a reviewer during the ceremony of granting the dignity of Doctor Honoris Causa of the University of Silesia to Professor Jon Ove Hagen (third from the right) on 20 May 2008 (photo: Leszek Kolondra).

qualities attracted people willing to cooperate, not only in the field of seismology, but also in broadly understood polar sciences. Moreover, his persistence in pursuing the goals and the ability to convince decision-makers to his plans, all made with a great culture of personal contacts, ensured success in obtaining funds for many large-scale scientific programs. Both in Europe and in the polar regions.

We will remember Olek as an eminent Scientist and Organizer of research into the Earth's polar regions, taking into account their various aspects. He was always prepared substantively and usually had his talks or theses for discussion precisely written down. Despite so many achievements and his high standing in the academic world, he remained a modest man, willing to help and advise younger scientists.

Polish Arctic and Antarctic researchers will always keep in grateful memory his commitment to polar sciences and raising funds for the realization of great scientific projects, especially in connection with our country's participation in the 4th International Polar Year. He used to deepen our knowledge about the lithosphere structure in the maritime "gateways" to the Arctic and Antarctic, thereby widely opening the "gateways" of opportunities for younger researchers from many scientific disciplines to explore the environment of the polar regions.

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Professor Aleksander Guterch in Memoriam

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I worked with Professor Aleksander Guterch for seventeen years, first at the Association for Deep Geological Investigation, then also at the Institute of Geophysics, Polish Academy of Sciences, in the Department of Lithospheric Research (see its staff in Fig. 1). Professor was a remarkable person and a very good boss. He always calmly and with great patience helped me implement myself in topics that were new and unfamiliar to me, since I am not a geophysicist by education.

In addition to issues related to our work, we sometimes talked about other problems that interested him, whether it was history or current events. He was the President of the Association of Old Arms and Uniforms and sometimes shared his knowledge on these interesting matters

Fig. 1. The staff of the Department of Lithospheric Research, 2013. Standing from the left: Andrzej Górszczyk, Michał Malinowski, Aleksander Guterch, Ewa Mazurek, Tomasz Janik, Piotr Środa, Jarosław Grzyb. Seated from the left: Mariusz Majdański, Anna Adamczyk, Wojciech Czuba, Edward Gaczyński.

with me. Such moments were not frequent, though, because the Professor had no free time left, working tirelessly on his main scientific projects of searching deep into the earth's lithosphere; he invented, organized, implemented and interpreted the world-breaking seismic experiments in various regions of Earth.

Of course, it is not my role to write about the tremendous scientific and organizational achievements of this Great Man; I just wanted to say that the death of Professor Aleksander Guterch is not only a huge loss for world science but also for all who worked with him, whatever their position was. I am sure, his personality left a mark on all who were fortunate enough to be his collaborators.

I also wish to express my deepest condolences to his wife Barbara, daughters, and grandchildren.

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The Oil Industry in Sękowa[1]

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In Sękowa, the place Professor Aleksander Guterch was born, as well as in neighbouring localities Siary and Ropica Ruska (now Ropnica Górna), people had "always" been aware of the presence of oil. Rock oil, which comes from natural spills, often accompanied by exhalations of natural gas, has been observed in the Gorlice region for as long as its history goes.

The evidence for the existence of oil deposits in the area comes from multiple historical sources: one of the earliest dates back to 1530, when Seweryn Bonar, treasurer of King Sigismund the Old, burgrave of Cracow and mayor of Biecz, while searching for gold in the village of Ropa under Chełm Mount, came across oil that flooded his mine.

Another historical message about oil dates back to the 17th century. In the treatise on Galicia, Antoni Schneider[2] wrote: "In Galicia, the existence of asphalt was known in the past in the area of Gorlice, Iwonicz, Lisk, Stara Sól; it had been utilized to cover roofs, even as far as Warsaw. And Adam Jastrzębski, a builder and musician of King Władysław IV, describing Warsaw as it was in 1643, mentions that the stones covering the roof of the Ossoliński Palace, in order to prevent harming it by snow and rain, were »ditched« with the earth tar. For this purpose, by distilling the light and volatile fractions, the so-called Jewish tar was made, which, by admixing sand, was transformed into asphalt and ooze." The presence of oil in the area is also reflected in numerous names of rivers, villages, and family names.

For centuries, people of the Gorlice and Nowy Sącz regions have used the fat material as an effective remedy against various human and animal diseases. They treated with it the throat diseases, wounds, and sores in humans, fasciolosis in sheep and pastern dermatitis in horses. Cobblers employed oil to soften leather; it was also used to treat wood, for firelighters, and finally as a lighting material in various types of candles.

In the 1850s, Prince Stanisław Jabłonowski, one of the pioneers of the oil industry in Poland, developed his business and established an asphalt factory near his Kobylanka palace. Initially, he drew oil from the legendary oil wells owned by Jan Wybranowski in the village of Siary.

[1] This text is an abbreviated, ammended and translated version of the internet article written by the author and published at the address: https://www.sekowa.info/index.php?go=34&id2=40 *(added by the editors)*.

[2] *Encyklopedya do Krajoznawstwa Galicyi*, zebrał i wydał Antoni Schneider, Vol. 1, Lwów 1871, Vol. 2, Lwów 1874.

Fig. 1. An oil worker called “łebak”.

Responding to the demand for crude oil needed for the production of asphalt, in January 1852, Jabłonowski established the world’s first oil mine in the Puste Pole in Siary near Gorlice; in July of that year he got a plentiful flow of oil through the “Stanislaw” dug well in a depth of 12 fathoms[3].

The Cracow daily “Czas” of January 19, 1854, reported that rich deposits of rock oil had been discovered near Gorlice in Męcina Wielka, Lipinki and Magdalena. The distribution and size of these deposits gave the mines under the administration of Prince St. Jabłonowski the first place in the Monarchy[4]. Hence, the development of oil industry as a separate industrial branch in the Gorlice region dates back to 1852. Numerous mines were established, a forest of shafts kept growing, and many hard-working people were employed (see an ancient oil worker in Fig. 1).

Initially, oil wells, known as dug wells (kopanki) were drilled with a shovel and pickaxe, which were later replaced by an auger, and around 1874 a steam engine was used to move the auger. The largest number of dug shafts was made within the Siary–Sękowa–Męcina Wielka mining region, so they are the oldest ones in the Gorlice oil area, characterized by a shallow occurrence of oil-bearing levels, starting from a depth of 30 meters (not counting natural seeps).

In the years 1881–1886, the Gorlice region was the most abundant oil-producing area in Galicia, which ranked third after the United States and Russia, with a production of 40 000 tons, and half of this Galician production came from the Gorlice Basin.

At that time, the region became a mecca for world-class entrepreneurs and ordinary people who bravely and often sacrificially sought work and a way to improve their existence. Among the former was Mr. Mac Garvey from Canada, who, having made a tour of all the centers in

[3] 1 Viennese fathom (sążeń wiedeński) ≈ 1.9 m.

[4] Galicia, to which the region belonged, was a Crownland of the Habsburg Monarchy (1772–1804), Austrian Empire (1804–1867), and Austria-Hungary Monarchy (1867–1918) *(added by the editors)*.

Galicia, decided to start his business in the Gorlice area and became permanently associated with this place chosen to realize his great initiative, e.g., the construction of a drilling tool factory and refinery in Glinik Małopolski in 1883.

In 1873, products from the local mines were presented at the Vienna World's Fair**.** It is known that earlier (already in 1854) Ignacy Łukasiewicz[5] had a share in the local mine of Jan Szymonowicz. After the Polish Uprising of November 1831, many refugees found shelter in local mines, including miners from Silesia, who became the first diggers there. By 1875, there were as many as 60 active shafts. In 1881, oil was exploited by 9 companies and private people.

They were accompanied by 16 workshops. The drilling workshop consisted of a high-impact auger, a shearer, and a shepherd crook (pasterka in Polish) suspended on a rope. About 250 people were employed in the local oil industry. Initially, the mines were in the hands of private individuals, only later coming under the management of companies and larger enterprises.

The total production in 1881 was about 350 tons of oil. A distillery was put into operation in 1886, and a larger refinery was established by the end of the 19th century. The growing oil industry in the area had a vitalizing effect on other areas of life. There was a need to improve the communication between the mines and refineries, which gave rise to new roads and a railroad line to Gorlice.

Fig. 2. Oil shaft of Mieczysław Mrazek in Sękowa, January 1901.

[5] Jan Józef Ignacy Łukasiewicz was a well-known Polish pharmacist, engineer, and inventor (kerosene lamp).

ש. גרף (מימין) בלוויית מזכיר העיר ושני פרופסורים־מומחים לקידוחי נפט
Sh. Graf first from right in company of experts.

Fig. 3. Experts visiting mine “Fred” in Sękowa in 1910.

Fig. 4. Oil refinery in Sękowa near Aleksander Guterch’s family house, 1930s.

In 1900, more than a dozen companies were in operation in Sękowa, including "Galician Carpathian Oil Company" (formerly "Bergheim at Mac Garvey"), "Joint Stock Society for the Petroleum Industry", "Anonyme Societe Belge de Petrole de Galicie", "Kruszewski Bolesław", "Austro-Belgian Oil Society", "Mieczyslaw Mrazek – Oil Mine and Drilling Company" (Fig. 2), Arnold Spitz (mine "Apollo").

In 1927, drilling work was carried out on the "Ugoda" mine, but with meager results. Then drillings took place on the mines "Fred" and "Paul" (Fig. 3). A certain crisis occurred in the early 1930s, when production declined significantly. The regression was overcome, and production began to increase again in 1932. The mines "Puste Pole" and "Szczęść Boże" were then established and "Ćwiartka" was reactivated. In 1934, the company named "Future" drilled a hole "Marysia".

Fig. 5. In front of the "Sękowa" mine in 1957. Mr. Edward Szloch, with his children Halinka and Wiesio, stand on the right. Aleksander Guterch was the children's uncle – their mother was his sister.

In the 1930s, most of the local wells ranged in depths from 180 to 150 meters. The 255-meter-deep "Szczęść Boże" well achieved the highest yearly production, namely, 62.7 tons of oil in the year 1934. Second in terms of production was the 487-meter-deep "Marysia" well, attaining 36.2 tons of oil per year. The shallowest, 100-meter-deep, and offering the smallest production of only 500 kg of oil per year was the "Puste Pole XXII" well.

In 1945, the "Sękowa 4" well was drilled down to a depth of 517 meters, and produced 1.6 tons of oil per day. The following mines worked there: "Sękowa-Kretowicz" (255.8 tons), "Apollówka" (6.5 tons), "Dobra" (47.8 tons), "Kamila", "Magdalena", "Stanisław", "Szczęść Boże", and "Maria III–IV". A total of 432.6 tons were mined yearly. 237 wells were drilled, including 98 digging and 137 impact drilled. The main method of oil extraction was pumping. Pistoning was also used on a small scale.

In 1970, the "Sękowa" mine had 180 boreholes and yielded 18 tons/24 h. All these shafts were closed down by the Krosno Mining Company in 2000.

Summarizing, a total of 248 dug and impact-drilled wells had been executed in Sękowa. More than 200 000 tons of gasoline-paraffin oil had been extracted.

Currently, no oil is produced in Sękowa. The last wooden workshops in „Puste Pole" have been dismantled. Small-scale prospecting drills have not yielded any results so far. All the dig pits have been buried, and the pipes have been sealed. One of the long-time workers created the Museum of Oil Industry in Sękowa.

Over nearly 150 years of oil production in Sękowa, many generations of people worked in it; almost every house had somebody involved. Among them were Professor Aleksander Guterch's family members, who worked in the oil industry and had an oil refinery nearby their home (Figs. 4 and 5).

Professor Aleksander Guterch, a great son of the Sękowa Land and its Honorary Citizen, highly respected geophysicist and an outstanding person, will always be remembered. Farewell to this Great Man, rest deservedly after a difficult and wonderful life! Honor to His Memory!

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On the Geodynamics of One Earth

ANDREW KOBOS' INTERVIEW WITH PROFESSOR ALEKSANDER GUTERCH CONDUCTED IN 2009

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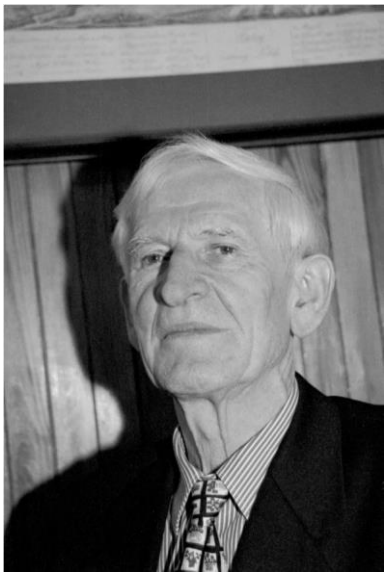
A word of introduction

It seems that we came across the most valuable material for the present volume while tidying up the Professor's office room. It is an interview of Mr. Andrzej Kobos with Professor Aleksander Guterch, published in the prestigious series "On the Ways of Scholars" by the Polish Academy of Arts and Sciences (Polska Akademia Umiejętności, PAU) in 2009[1]. Thanks to the courtesy of Mr. Andrzej Kobos and the PAU Editors, we were able to post this interview below, in a slightly modified form.

Tomasz Janik



fot. Andrzej M. Kobos

ABOUT YOUNG YEARS

Andrzej Michał Kobos [**AMK**] – *Please tell us about your young years*.

Aleksander Guterch [**AG**] – I was born in 1936 in village Sękowa, Gorlice region of Podkarpacie. It was the site of the oldest center of the oil industry in Poland; Ignacy Łukasiewicz, the pioneer of this industry, was active there in the 19th century. My family, including my grandfather and mother's brother, worked in the oil industry. They were specialist drillers and used to travel to other countries as sought-after professionals. My close family – father and brothers – was involved in the oil industry in Podkarpacie. I remember from my childhood the smell of crude oil lin-

[1] Guterch, A., and A.M. Kobos (2009), O geodynamice jednej Ziemi. **In:** *Po Drogach Uczonych. Z Członkami Polskiej Akademii Umiejętności Rozmawia Andrzej M. Kobos*, Vol. 4, 75–100.

gering in the air, extracted from numerous boreholes located in the Gorlice area. I was the youngest in a family of ten. We spent the German occupation there. Unfortunately, my father died very early, in 1940. Those were very difficult years. I graduated from the High School in Gorlice in 1954, with a one-year break caused by a serious accident, the effects of which I still feel today. I remember my High School studies very fondly because of the teachers. It was still a cadre of pre-war teachers who, in the terrible Stalinist times, were able to conduct lessons, even history, in such a way that they clearly conveyed to young people true information about the history of Poland and the history of the world. I remember the characteristic moment: Professor Stanisław Motyka devoted the last five or ten minutes to what he had to do, starting: "And now the same events in the light of the Marxist theory of history... Remember this, because they will ask you about it". Polish language lessons taught by Professor Elżbieta Dniestrzańska (my class tutor), I remember to this day. And again, in these difficult times, when Polish language textbooks were full of slogans about socialist realism in literature, she was able to instil in us the respect for the great Polish literature of the eras of Romanticism and Positivism, the interwar and war period. It was then that we already learned about Krzysztof Baczyński and other banned authors of literature. Ms. Dniestrzańska was a widow; it was quietly said that her husband died in Katyń – without any doubt who did it. I remember with reverence the extraordinary figure of Professor Jan Sikorski, a soldier of the Polish Legions, a powerful gentleman of stature who used to visit various countries on official delegations before the war. Walking along the desks in the classroom, he used to teach geography, astronomy, and geology, as these subjects were then taught separately. He also used to brilliantly educate us on ancient history. I remember the Battle of Thermopylae and the history of Alexander the Great from his lecture to this day. Decades later, when I found myself in Greece, I travelled to the Thermopylae Gorge. There, in my mind, I saw the powerful figure of Professor Sikorski when, after the story about the death of King Leonidas and his team, he wiped his eyes with a handkerchief out of emotion, and the whole class remained silent for a long time out of impression...

AMK – *However, you went in the direction of mathematics and physics...*

AG – It was also the influence of the school. The same Professor Jan Sikorski, while teaching geography, geology, and astronomy, used to tell us that the basis of all knowledge is mathematics and physics.

AMK – *Which, after all, were created by the ancient Greeks*.

AG – Exactly. In 1954, I entered the Faculty of Mathematics, Physics and Chemistry of the University of Warsaw, majoring in physics with a specialization in geophysics.

AMK – *Who was chairing geophysics at the University of Warsaw at that time?*

AG – These were the beginnings of teaching geophysicists together with physicists, while the Faculty of Geology was operating separately. In the field of lithospheric physics, which was particularly interesting to me, there was Professor Tadeusz Olczak, who began his activity in geophysics before the war as an assistant to Professor Tadeusz Banachiewicz at the Jagiellonian University, in a new branch of knowledge – Earth sciences – based not on observations or comparative analysis, but on strict principles of physics and mathematics. During the first years of our studies, we had a full course in physics and mathematics. Geophysics was located at Hoża 79 Street, a couple of buildings behind the Institute of Physics of the University of Warsaw.

AMK – *You probably did your specialization and master's thesis under Professor Olczak?*

AG – Yes. Unfortunately, I finished my five-year studies with a two-year delay because I had serious orthopedic problems after an accident when I was still at school. I underwent two serious surgeries performed by Professor Adam Gruca in Warsaw.

AMK – *It's unbelievable – later on, you walked in Spitsbergen and Antarctica. About that in a moment.*

AG – I graduated from the University in 1961 and started working as a research assistant to Professor Tadeusz Olczak in the Lithosphere Physics Department, one of the two Departments of Geophysics, University of Warsaw. However, I did not see my future in theoretical research, since I was more interested in exploring the Earth through experimental investigations, which could not have been expected at the University. Professor Olczak accepted my resignation with true regret, but also with understanding, encouraging me to remain in regular contact with him, which I continued, with great benefits, until Professor's death. Following Professor Olczak's advice, I decided to apply for a job at the Department of Geophysics, Polish Academy of Sciences. I was hired by Professor Roman Teisseyre. Being also a theoretician, he initially tried to encourage me to change my interests by presenting relevant problems to be solved in theoretical seismology, but, seeing the lack of enthusiasm on my part, he assigned me to the experimental lithosphere research laboratory. It was not an easy start. Geophysics at PAS, particularly seismology, suffered from a lack of highly qualified personnel. None of the seismology staff, apart from Roman Teisseyre, were PhD holders. So independence and maximum activity were required, but the foreign contacts were very limited. There was, by the standards of the time, a well-supplied library, and this was the basic source of knowledge for young seismologists. Under such conditions, it was only possible to work effectively with the support and friendliness of the management and colleagues. One of my first tasks was to organize, under the patronage of Roman Teisseyre, nationwide geodynamic symposia in Jabłonna near Warsaw, in order to integrate various Earth researchers. These symposia, usually three-day long, were very popular, provided opportunities for formal and informal discussions, and initiated joint research projects. The resulting papers were published in the *Publications of the Institute of Geophysics PAS* (in 1976, 1980, 1984, 1985, 1991). When, after several years of work and having completed my doctorate, I was already well acquainted with the research capabilities of the Department of Geophysics, PAS, and the cooperating institutions, first and foremost the Polish Geological Institute (PGI) and the Geophysical Exploration Company (presently the PBG Geophysical Exploration Ltd.) in Warsaw, and the AGH University of Science and Technology in Kraków, I presented a more detailed program of deep lithosphere research by means of deep seismic soundings in Poland.[2]

ABOUT THE EARLY PERIOD OF YOUR WORK IN GEOPHYSICS

AMK – *What did you begin to deal with?*

AG – I started to deal with a completely new field – the application of active seismic methods to study the structure of the entire Earth's crust. Just before World War II, seismic surveys for exploration purposes began, and in the late 1950s, active seismic methods were developed to study the interior of the Earth's crust; active, that is, based not only on the analysis of the seismic wavefield from natural earthquakes, but primarily on the analysis of seismic waves induced artificially, in a precisely defined place and at a very precisely defined time. The 1950s saw the development of this research, and the first American and Russian papers on the subject appeared. And it was in this field that I began my professional activity, which I continue to this day.

AMK – *For comparison – the geophysical profiles that Professor Marian Mięsowicz used to make in the late 1940s with methods of recording ionizing radiation were shallow, while here*

[2] The editors took the liberty to include an excerpt from the recent publication: Guterch, A. (2023), Remembering Professor Roman Teisseyre, *Publs. Inst. Geoph. PAS* **446 (A-32)**, 53-55, DOI: 10.25171/InstGeoph_PAS_Publs-2023-013, where the author describes his early years in science.

you go deep into the Earth's crust, down to a depth of many tens of kilometers. The quality of the results probably depends on the sensitivity of the measuring instruments.

AG – Here we enter deep into the Earth's lithosphere, currently even to a depth of 100 km or more. At the initial stage, we used seismic instruments that were already functioning in the oil industry – primitive from today's point of view. We adapted this instrumentation and methods to deep seismic soundings. Thanks to this, it was already possible to reach a depth of 40–50 km, using – unfortunately – very powerful explosive charges, since the sensitivity of the recorders was not high. Tube electronics was a "manual" job. Then I also started working closely with the Polish oil industry; we organized these investigations in breaks between their industrial tasks.

AMK – *On their part, it was probably a constant search for hydrocarbons?*

AG – Yes, although it was clear that our methods were not suitable for searching for deposits, they were necessary to explain the fundamental problems of the Earth's geodynamics. Geophysicists and geologists working in the oil industry understood very well that without this type of research, there would be no progress in hydrocarbon exploration. And such a favorable atmosphere persists to this day.

I started working on regular designated seismic profiles in 1964–1965. In the 1970s, the state of recognition of deep structures of the Earth's crust in Poland was already so advanced (for those times) that these works were fully noticed and appreciated on the international forum. They concerned the territory of Poland and adjacent areas because we managed – in these difficult political conditions – to organize cooperation with institutions in neighboring countries, primarily with the Academy of Sciences of the Soviet Union.

AMK – *In 1969, you completed your PhD and organized the Experimental Seismology Laboratory at the Institute of Geophysics*.

AG – In 1969, I defended my doctoral thesis. My work concerned the dynamics of the seismic wave propagation in the Earth's lithosphere, which is the basis for the proper interpretation of the experimentally recorded seismic wavefield. The work was computational; I used the first "main frame" computers in Warsaw for this purpose. I developed this work during a six-month research internship in 1967/1968 at the Institute of Mathematics of the Academy of Sciences of the Soviet Union in Leningrad, with Professor Petrashen and his colleagues.

In 1970, based on my work, I was invited to a three-year contract at the University of Texas at Dallas. Unfortunately, I did not receive a passport – the authorities of the Polish People's Republic decided that I should not be allowed to go out. In 1971, during the period of another thaw related to the "December incidents" of 1970, I was invited to a conversation at the Polish Academy of Sciences with "sad gentlemen" who told me that these were wrong decisions. – "You can leave, try it". I tried. Unfortunately, the seat reserved for me was already occupied. However, I was invited to the same university in Dallas for one semester in 1971/1972. The stay was too short, but I deepened my knowledge about the study of the deep structures of the Earth's lithosphere. This also interested my hosts, and I established friendly relations that brought fruit in the following years.

AMK – *Seismic data is the "input" for mathematical modeling, for huge numerical calculations. This required – and probably still requires – the fastest computers with enormous memory*.

AG – That's right. It comes down to very complicated calculations. But there was a systematic progress. From the late 1960s to the late 1980s, geophysics experienced a very significant instrumental development, closely related (to this day) to the development of electronics. This

has always been close to the oil industry, the driving force behind the search for new solutions. In the late 1970s, we already had decent equipment of our own design.

In 1979, I was invited by Finnish geophysicists to carry out seismic research on the so-called SVEKA profile in central Finland, based on recordings from our seismic stations. The Finns, in turn, prepared all the equipment. I then established very cordial contacts with the Finnish side, which continue to this day. We took part in virtually all experiments performed in Finland, even in the most difficult period of the 1980s. We still maintain very close cooperation.

AMK – *I understand that the measurement instruments were being modernized, but supercomputers were still lacking in Poland, if only because of the embargo*.

AG – Yes, but the first significant computer capabilities appeared. We used them regularly. In the 1980s we also had access to very decent computers in Finland and from our friends in Norway, as I also had cooperation with Norwegians.

AMK – *The Norwegians were already extracting and further exploring for oil in the North Sea. As you emphasize, the driving force was the search for hydrocarbons, but the second issue was the geodynamics of the vast ocean areas, also for the needs related to submarines*.

AG – There were and are three drivers of geophysical research. One was the oil industry on the continents. The second was that geologists and tectonicists understood that there would be no progress in the fundamental problems related to the evolution of the Earth without a thorough understanding of the structure of the Earth's interior; otherwise, everything would remain at the stage of theories and hypotheses. The third driver was the "impact" on the oceans. It was understood that there would be no progress in geodynamics unless geophysical programs were introduced into vast ocean areas. Of course, a number of research projects were carried out for the needs of the navy, primarily the American one.

AMK – *You also "went out to the sea"…*

AG – We started seismic work related to the sea in 1974. I established close contacts with Professor M.A. Sellevoll from the University of Bergen in Norway. Together with him, with the help of the Polish Navy hydrographic ship ORP "Kopernik" and the Norwegian ship "Sverdrup", we proceeded to study the Earth's interior in the zone of transition from the oceanic crust of the North Atlantic to the continental crust of the Svalbard Archipelago in the Arctic.

AMK – *It was a completely new quality. Before, people walked on ice and made geological maps, but here one enters the interior of the Earth.*

AG – Yes. With the greatest respect for geological research, but without geophysical methods, no significant progress in geodynamic research will be achieved.

ABOUT THE "POLONAISE '97", "CELEBRATION 2000", "SUDETES 2003" AND "ALP 2002" EXPERIMENTS AND THE GEODYNAMICS OF CENTRAL EUROPE

AMK – *Let us come back to the research in the Svalbard area in a moment. Your name is associated with several major geophysical projects, the first, being "POLONAISE '97" and "CELEBRATION 2000"*[3]*. Please comment on these projects.*

AG – In 1991, after the political changes in Poland, I was invited by Professor Karl Fuchs, a geophysicist and seismic explorer from Germany, and Professor David Gee, a Briton working at the Uppsala University, to cooperate in the new program called "EUROPROBE" they were developing, which was funded by the European Science Foundation. The idea was to – after

[3] The name of the "CELEBRATION 2000" experiment came from "Central European Lithospheric Experiment Based on Refraction – June 2000".

previous experiments carried out so far in various countries – finally organize a single, joint geodynamic research program that would cover the entire European continent, since this uniform geodynamic "laboratory", i.e., the European continent is, on the surface, divided by dozens of political borders. By the way, Americans ask – "How can you practice geodynamics in Europe?".

The "EUROPROBE" program started in 1992 and lasted until 2001. I was a member of the Scientific Steering Committee of this program, which covered various geological and geophysical issues for the entire continent. Several dozen working meetings were held. Seismic surveys were the key to everything. Could you find a more interesting place for geodynamics in Europe than Poland, where three great geological systems intersect? This was already known from numerous geological works and our seismic surveys. I then started to organize a series of large, modern seismic experiments.

In Poland, we had neither the resources nor the technology. I came across an excellent American geophysicist, Professor G. Randy Keller from the University of Texas at El Paso[4], who after visiting us said: "OK, let's try to do something together". We managed, with his help, to get in touch with the American IRIS Passcal Instrument Center, a national American center with a large number of state-of-the-art seismic stations.

The Americans then provided us with several hundred seismic stations. The seismic apparatus, which had taken up a sizable part of the room in my youth, was now a small, inconspicuous device. We also received a significant number of modern seismic stations from Canada. And so, in 1997, we embarked on the first experiment, called "POLONAISE ′97", in the area of central and western Poland. The main task was to organize drilling and blasting works, very costly and troublesome, but it was achieved with the help of two very good Polish geophysical companies: Geofizyka Toruń S.A. and Geofizyka Kraków S.A. We performed this experiment in June 1997 – it lasted 24 days and nights, about 300 people took part in it, including the American team. Due to the needs arising from geodynamics, there was a slight extension of the seismic profiles to the areas of Germany and Lithuania. It was the first in a series of very modern – on a European scale – experiments.

The Americans then said: "If it went so well, let's do something else". In this situation, we proposed a new seismic experiment, located in the area of Central and Eastern Europe – from western Russia through Belarus, eastern and southern Poland, Slovakia, the Czech Republic, Hungary, Austria, Slovenia, and south-eastern Germany. It was the "CELEBRATION 2000" seismic experiment, carried out in June 2000 over an area of about 500 000 km^2. For this experiment, we managed to gather a record number of instruments: 1 230 state-of-the-art seismic stations from many countries. At that time, we already had 50 of our own Reftek 125 Texan stations manufactured by Refraction Technology Inc., but the vast majority of the stations used in this experiment were provided to us by the American side – so much so that the last batch of stations manufactured by Refraction Technology Inc. was sent directly to Kraków a week before the experiment began. The stations were also loaned to us by the Canadian institutions. Near Kraków, at the base of the Geofizyka Kraków S.A. company, we organized the main center for managing the entire operation, in which a total of about 1 100 geophysicists, engineers, and technical personnel took part. The shipment of pieces of apparatus for the next stages of the experiment across national borders had to be arranged in advance with the relevant customs services. I am pleased to say that we met with full understanding of these services. The

[4] Later at the University of Oklahoma, Norman, OK.

recorders were buried in the ground along the designated seismic profiles. We recovered all of the stations. Nothing was lost, which doesn't even happen in the US.

The whole operation was amazing: it lasted 28 days and 28 nights. It was necessary to hurry because each day generated significant costs. We managed the entire operation together with my closest associate, Professor Marek Grad from the University of Warsaw. Without mobile telephony, the Internet, and GPS, it would not be possible to carry out an experiment of this type in such a short time. The experiment required tremendous discipline in coordinating activities over an area of about 500 000 km^2, accurate locations of the positions of recording stations, and, above all, time discipline with time recording with an accuracy of 10^{-3} s.

Geophysicists from 15 European countries, as well as the United States and Canada, participated in the "CELEBRATION 2000" experiment. A significant benefit to this research endeavor was the opportunity to collaborate with Russian colleagues. Thanks to this cooperation, the Russian side organized a large shot point at the northern end of the longest seismic profile, about 400 km west of Moscow, generating seismic vibrations recorded at the southern end of this profile at a distance of about 1 400 km, making it possible to reach into the Earth's interior to a depth of about 120 km.

In the report of the European Science Foundation for the European Commission in Brussels, entitled "EUROPROBE" 1992–2000, the "CELEBRATION 2000" experiment was described as "the largest seismic refraction experiment ever carried in Europe, involving geoscientists from twelve European countries, Canada, and the USA". In December 2000, Professor Marek Grad and I participated in the Congress of the American Geophysical Union at the Convention Center in San Francisco. At a meeting of the IRIS (Incorporated Research Institutions for Seismology) organization, it was said that "in 2000, IRIS performed several seismic experiments, but none was as good as the CELEBRATION experiment in Central Europe, performed with Polish precision". I then looked questioningly at Mark Grad to see if this was some kind of joke, but it was said with complete seriousness. We were honored in the magazine "EOS" of the American Geophysical Union (with a circulation of 60 000 copies), which publishes a "feature article" in each issue about the currently most important achievement in the field of Earth sciences. The article about the "CELEBRATION 2000" experiment was titled by the editors: Seismologists Celebrate The New Millennium with an Experiment in Central Europe[5]. Meanwhile, The Oxford Guide to Modern Science recognized this experiment as "one of those that bring science into the 21st century".

Later, Austrian geophysicists asked us to extend this experiment (at their expense) to the area of the Eastern Alps. This was the third experiment, called "ALP 2002", and the fourth was "SUDETES 2003" – a smaller one – in the area of southwestern Poland, the Czech Republic, and southeastern Germany – all with the participation of the American side. The seismic profiles determined from these four experiments, with a total length of approximately 20 000 km, cross the broadly understood geotectonic node of the European continent – from the East European Craton, through the Trans-European Suture Zone in Poland, the Bohemian Massif, the Carpathians, the Sudetes and the Eastern Alps, the Basin Pannonia, the Dinaric Alps, to the Adriatic Sea.

AMK – *Could you kindly summarize the most important thing geophysics has learned from these experiments? What is the striking result, and what does it suggest for future research?*

[5] Guterch, A., M. Grad, and G.R. Keller (2002), Seismologists Celebrate The New Millennium with an Experiment in Central Europe, *EOS Trans. Am. Geophys. Union* **82**, 45, 529 & 534–535.

AG – Based on the aforementioned experiments, about 70 publications have already been issued, multi-authored of course, with more than 50 in leading international journals and monographs of the highest rank. The obtained results were presented as invited papers and special sessions at numerous symposia and prestigious scientific congresses. Young people were earning their doctorates and habilitations. I think that even 20 years from now, the results of these experiments will constitute the basis for further scientific investigations, using methods of interpretation that are being constantly refined.

With the help of these experiments, the deep structure of the lithosphere and its physical properties were determined extremely precisely, up to a depth of 50–60 km, sometimes 120 km, over the entire study area, from the geologically old craton of Eastern Europe to the young structures of Central and Southern Europe. New, well-documented geodynamic models have been defined, e.g., for the Carpathians, showing how complex the geodynamic situation related to the development of the Carpathian Arc is. For the first time, we documented the possibility of subduction of the lithospheric plate from south to north in the Eastern Carpathians. This provided new data on the contact zones of lithospheric blocks occurring in this area and new models of lithospheric evolution. These are data suitable for detailed interpretations, including geological ones. We always invite leading geologists from home and abroad to provide geological interpretation of the obtained results of geophysical research. This was also the aim of the international program "EUROPROBE", which I have already mentioned.

TESZ

AMK – *So this is TESZ...*

AG – First, the concept of the Teisseyre–Tornquist line was formulated, which defined the edge of the Precambrian Platform, i.e., the old East European Craton approximately one billion (10^9) years old, and then this concept was extended to the Teisseyre–Tornquist zone. I presented the deep lithospheric background of this zone for the first time in my habilitation thesis in 1974. In the following years, as a result of further seismic work, we presented even more precisely the geometry and physical properties of this zone, with a width of several dozen (70–80) kilometers. Further progress in the recognition of the Teisseyre–Tornquist zone was made as a result of research carried out in 1992–2003, when the international "EUROPROBE" program was in action. Based on precisely defined physical parameters of the lithosphere – seismic wave velocities up to a depth of 60–120 km – we started to make a geodynamic reconstruction and study the history of the geological evolution of the entire area. During the period of operation of the "EUROPROBE" program, a new concept mentioned in your question has just appeared – the Trans-European Suture Zone (TESZ). This zone runs from Great Britain, through Denmark, the Netherlands, Belgium, northern Germany, central Poland, western Ukraine to the Black Sea. In so defined area, there are numerous lithospheric blocks, differing in physical properties and geological history, including the famed Świętokrzyskie Mountains. The boundaries of the Trans-European Suture Zone cannot be precisely defined. From the northwest, the Variscides with a young Earth's crust enter the TESZ area defined in this way, and from the south there are the Alpides – represented in Poland by the Carpathians – characterized by a completely different structure of the Earth's crust. We have already published several summaries of works carried out over the last dozen years in international journals and monographs, which have received a lot of attention at home and abroad, as evidenced by numerous citations and calls for conference lectures and publications.

The next stage in the development of deep seismic studies of the structure of the Earth's tectonosphere in the TESZ area in Poland is the (just completed) two-year international seismic experiment, the so-called passive experiment, known by the acronym "PASSEQ 2006–2008"

("Passive Seismic Experiment in TESZ"). The leader of this project is Dr. Monika Wilde-Piórko from the University of Warsaw, formerly a doctoral student of Professor Marek Grad. In the years 2006–2008, approximately 200 portable seismic stations were installed in the broadly understood TESZ zone (Poland, Lithuania, Czech Republic, and Germany), to record earthquakes, even from remote areas of the Earth. The collected, extremely rich set of seismic data is the basis for interpretation of the entire upper mantle of the Earth, reaching a depth of about 700 km.

We have currently completed the work of summarizing the entire geophysical knowledge about the deep structures of the Earth's crust in the area of the so-called Southern Permian Basin of Europe, reaching from Great Britain through Belgium, Denmark, the Netherlands, northern Germany to central Poland, that is, practically speaking, in the TESZ area. This study will be included as Chapter 2 (of 16) in a large work (also in size) entitled "Southern Permian Basin Atlas". This project is sponsored by the petroleum industries of the aforementioned countries, and the entire work is addressed to the new generation of petroleum geologists.

AMK – *You mentioned the Świętokrzyskie Mountains. This is the cradle, the core of Polish geology...*

AG – Almost every Polish geologist dealt with the Świętokrzyskie Mountains. There are many papers in the geological literature related to this region, papers that sometimes present quite different views. This is a very complicated problem from the point of view of geology. I think that in the near future, there will be an opportunity to resolve the controversial issues based on deep geophysical research.

ABOUT WORK IN THE POLAR REGIONS OF THE EARTH

a) Svalbard Archipelago

AMK – *Let's return to the polar regions, first to the research with your participation in the Svalbard Archipelago in the Arctic.*

AG – As I have already mentioned, after establishing close contacts with the Norwegians in the 1970s, we managed to carry out, together with them, seismic studies of deep structures of the Earth's crust in the area of the Svalbard Archipelago. We organized three expeditions together, the last of which was in cooperation with the Germans and Americans, in the framework of the Maria Curie-Skłodowska Fund.

During the "Cold War", a Warsaw Pact Navy ship, ORP "Kopernik" – then listed in the annals of NATO as a spy ship – with seismic instrumentation on board, was allowed to conduct research there. Only many years later, Professor M.A. Sellevoll from the University of Bergen told me that after numerous meetings he made a solemn declaration to his authorities that he guaranteed that the ship was not engaged in espionage activities. Thanks to this, I was able to organize three expeditions to the Arctic with the help of the hydrographic ship ORP "Kopernik". For the first time, we have determined what the structure of the Earth's crust of the Svalbard Archipelago looks like: its crustal thickness, velocity distributions, seismic boundaries, or, generally speaking, the geophysical parameters of this archipelago, which occupies a key position in the North Atlantic, as it is directly adjacent to one of the Earth's main structures, i.e., the North Atlantic Ridge. I co-organized subsequent expeditions in cooperation with geophysicists from Germany, Norway, and Japan: the fourth in 1999, the fifth in 2005, and the last in 2007–2008.

The last large and significant seismic experiment in the Svalbard Archipelago was carried out in close cooperation with The Alfred Wegener Institute for Polar and Marine Research in

Bremerhaven, with the University of Potsdam, with two Norwegian universities: in Oslo and Bergen, and with the Norwegian geophysical organization NORSAR. The experiment ran from September 2007 to August 2008 and was our significant contribution to the program of the Fourth International Polar Year (IPY) 2007–2009 – a research project of global significance and scope, in which more than 60 countries participated. Our experiment belonged to one of the most important projects of the 4th IPY, called "Plate Tectonics and Polar Gates in Earth History", or, shortly, "Polar Plates and Gates". The participation of the Polish team in this experiment was financed from extra-budgetary funds – from the Norwegian Science Fund and from funds granted to us by the Polish Oil and Gas Company (Polskie Górnictwo i Gazownictwo S.A.).

I would add that it was a continuation of our previous activities – those started already in the 1970s. The research undertaken in the "Polar Plates and Gates" project falls within the framework of the Polish Arctic and Antarctic Research Program 2002–2010, developed in 2002 by the Committee on Polar Research of the Polish Academy of Sciences.[6]

AMK – *I understand that the "Polar Plates and Gates" 4th IPY program was about both tectonic evolution and biological adaptation...*

AG – First, a correction: the "Polar Plates and Gates" 4th IPY project was exclusively about comprehensive geodynamic research.

The Svalbard Archipelago region is a particularly interesting region in which the structure of the entire tectonosphere needs to be studied down to a depth of several hundred kilometers in order to reconstruct the dynamics of Earth's development in this key region. It is also important for reconstructing the Earth's evolution on a global scale. We operated in the North Atlantic Ridge region, which stretches from the southern hemisphere across the entire Atlantic. In the Svalbard region, two plates, the Eurasian and the North American, diverge intensively; the American continent systematically drifts away from the European continent. We made seismic profiles in the zone of close contact between these plates, where there is virtually no Earth's crust – the Earth's upper mantle is almost at the surface: there is only a thin, approximately 3-kilometer-long crustal cover with poorly consolidated sediments. This means that tectonophysical processes related to the evolution of the Earth's upper mantle are still active there. These are exactly the "plates and gates" of the Arctic.

In September 2007, with the help of the Polish ship Horyzont II, we set up 12 broadband seismic stations of German make. And so the so-called passive seismic experiment began. The idea was to record, for as long a period of time as possible – until August 2008 – all deep tectonophysical processes that generate seismic shocks in this area. On the other hand, during the following summer season (2008), a Norwegian geophysical ship performed seismic reflection studies – a technique used in the oil industry. Let me explain here that reflection profiles are used to very precisely determine the structure of the Earth's crust in the first 10–20 km of its depth. We, on the other hand, with the help of a Polish ship, performed seismic refraction studies, which lead to the precise determination of seismic wave velocities and the boundaries in the Earth's crust to a depth of 50–60 km. On the other hand, a passive seismic experiment, based on recordings of seismic tremors that are constantly taking place here, is used to identify the structure of the Earth's upper mantle to a depth of several hundred kilometers.

[6] Guterch, A. (ed.) (2002), *Arctic and Antarctic Research Program of Poland 2002-2010*, Committee on Polar Research, Polish Academy of Science, Warsaw.

We also received from the Norwegians a broadband seismic station, which we set up for a permanent work at the Polish Polar Station in Hornsund in south Spitsbergen. We organized the first work meeting of the entire German Norwegian Polish team, devoted to the interpretation of the collected experimental seismic data, in May 2009 in Zakopane. The first results of seismic modeling are extremely interesting. Interpretive works will last until 2010–2011. The first publications will appear in 2010.

AMK – *I return to my previous question. The program of the 4th International Polar Year also included biological adaptation and even evolution. How can the problems of geophysical or geological evolution and the biological evolution of the Earth be combined qualitatively and in the time scale?*

AG – In the years 1982–1991 I was the coordinator of the entire Polish polar research program, including biological and environmental research. To answer your question, I can only say that everything is treated as one big natural complex. The question you asked is the most difficult one and I am unable to answer it. Geophysics is connected with changes in the environment and ecosystems, even the ones that are very distant in time, as well as with climate change and oceanology. Everything is interconnected, including the evolution of the Earth. Nowhere is this more evident than precisely in the polar regions.

AMK – *Do you have your opinion on climate change, global warming?*

AG – Yes, I have – but for my own use, because I am not a climatologist. I veer towards the opinion of physicists dealing with the physical bases of climatology, who look at climate change not comparatively, but as a great physical process, with full knowledge of what it was like in the Earth's past. This is a cycle that develops and the impact of civilization is limited.

b) Antarctica

AMK – *You also conducted research in Antarctica, on the other, southern side of the Earth…*

AG – I organized the first expedition to West Antarctica in the 1979/1980 season. Later on, there were several geodynamic expeditions, which I already organized with the participation of geologists. Professor Krzysztof Birkenmajer always participated in these expeditions, expressing his appreciation for their achievements. So far, there have been five such expeditions. The fifth, in January 2007, was solely composed of young people who continued seismic research of the Earth's crust in West Antarctica using a Russian ship.

During the next four expeditions, in the years 1979–1991, we carried out an extensive program of seismic studies of deep structures of the Earth's crust in West Antarctica, in a zone that is extremely interesting from a geodynamic point of view, because in the broadly understood contact zone of the Antarctic Plate and the plate of South Pacific. We performed deep seismic refraction studies, using explosives, along profiles with a total length of about 4 000 km, in an area extending over approximately 1 200 km. We also examined the subduction zone of the plate of the South Pacific under the plate of the West Antarctica. I assumed that – instead of sailing by ship and performing seismic profiling in various areas – it would be better to thoroughly study the region of key importance for geodynamics. Thanks to this, there is no other area of Antarctica as thoroughly seismically studied as the area in which we operated.

Then a series of monographs summarizing geodynamic research at the scale of the entire Antarctic was published. These monographs contain chapters with the results of our research. Our works done in the Bransfield Strait, between the Antarctic Peninsula and the South Shetland Arc, deserve particular attention. The results of our works in this extremely important region have challenged the hitherto prevailing views about a thin crust, with a thickness of 10–

12 km, beneath the so-called Bransfield rift structure. We have proven that in this area the Moho boundary – the lower boundary of the Earth's crust with normal physical parameters – occurs much deeper, at a depth of 30–35 km. We have also proven that the crust of West Antarctica is not an anomalously thin crust with thicknesses of 20–25 km, but is a normal crust with thicknesses of 30–40 km. In general, these results are of great importance for the geodynamic reconstruction of the South Pacific.

[…]

ON THE DYNAMICS OF THE EARTH'S INTERIOR

AMK – *Research with your participation shows – as you have already mentioned – that in the area west of the Svalbard Archipelago, the Earth's crust is very thin.*

AG – Yes. During the fourth Norwegian–Polish–German expedition in 1999, we actively entered the ocean floor with very modern equipment, using ocean-bottom seismometers (of Japanese production). As I mentioned before, we made a seismic profile in the northern part of Svalbard, passing through the North Atlantic Ridge, which is one of the most important structures of the Earth, running from the North Pole across the entire Atlantic, along which extremely active processes are still taking place. We have shown that the Earth's upper mantle – what is located at a depth of 40–50 km in Poland – is practically under the ocean floor there, at a depth of about 3 km.

[…]

AMK – *How does geophysical research of the last 30–40 years relate to the studies of tectonic profiles, especially to the maps from geological and tectonic atlases, developed primarily from drillings?*

AG – These are very important facts, without which it is impossible to reconstruct the geological history of the studied area. Geophysics, on the other hand, portrays the modern structure of the Earth. Seismic methods are not perfect yet – I think they are somewhere in the middle of development, just as, for example, elementary particle physics is developing. We have to touch the Earth's structure not directly but through a seismic wave, analyzing and studying the seismic wave field. Our country is located in a special place, where the three great geological systems that make up the European continent intersect.

AMK – *Well, yes, the worst place in every respect! This only reinforces my question, why is the Earth's crust stable here? Maybe some effects cancel each other?*

AG – First of all, let me explain why there are tremors here. Just in 2004, there was a series of quite strong tremors in the Kaliningrad area (5.3 on the Richter scale), felt in the Suwałki region and even in Pomerania. On 16 December 2008, there were tremors in southern Sweden[7]. These are the repercussions of past great processes that took place in the European "object" that is now called the Precambrian Platform of Eastern Europe or the East European Craton. From the south, a young Alpine system enters Poland, represented by the Carpathians, with a completely different structure of the Earth's crust.

AMK – *Can we expect to experience stronger tremors in the future?*

AG – No. These are the death knells of tectonic effects, animated by physical processes. Weak seismic tremors have occurred in the recent past and are also occurring today. These are very

[7] On 16 October 2008, a weak (2.46 on the Richter scale) earthquake occurred near Umeå, in northeastern Sweden; on 23 October 1904, an earthquake with an epicenter near the two Koster islands in Bohuslän, on the west coast of Sweden, was measured at 6.0 on the Richter scale.

important signals, important not only for natural research, but also extremely important for the country's civilization development.

South of this craton there is a large sedimentary basin, reaching – as we have proven in our work – to a depth of up to 20 km. All this rests on a crystalline foundation. However, the fundamental question is: what happened to the material, the sedimentary overburden, that was removed from this craton? How should we recreate the gigantic processes that took place in Earth's history on the old craton 1–1.5 billion years ago?

AMK – *Here, you raised the problem of what happened to the material that was on the East European Craton.*

AG – Yes, this is an extremely important question, it is difficult to answer it for now, but it will be possible to do so, already in the nearest future. Recently, under the supervision of Professor Marek Grad, a large map of the depth of the Moho boundary, that is, the thickness of the Earth's crust, was developed for the entire European lithospheric plate, not just the continent. No such map has been developed before. The work took three years, with a team of over 70 people from Europe and the USA, including our entire group. It was necessary to collect and critically evaluate hundreds of previously published works, sometimes even reinterpreting them, of course in consultation with the authors. I would also like to add that the European lithospheric plate extends from the North Atlantic Ridge in the west to the Urals in the east and from the North Pole in the north to the Mediterranean Sea in the south. In this area, the depth of the Moho boundary, that is, the thickness of the Earth's crust – the outer shell of the Earth in which the history of our planet's evolution is "written" – ranges from about 10 km under the bottom of the Atlantic to 60–65 km under the old East European Craton. The great work was done and published at the end of 2008 under the title The Moho depth map of the European plate[8].

[…]

ABOUT OIL AND ITS EXPLORATION

AMK – *A discussion with a prominent geophysicist cannot leave out one more thing. Oil is still being searched for in Poland, deeper and deeper. I suspect there will be new seismic experiments in 2009 or 2010...*

AG – Hmm... these two voluminous files are just a new project. For the years 2009–2011, we are planning a special seismic experiment – super-deep seismic reflection and tomographic soundings in the area of Southern Podlasie, the Lublin region, and the Polish Eastern Carpathians. The experiment will be very costly, financed exclusively from extra-budgetary funds, i.e., by the National Fund for Environmental Protection and Water Management – at the request of the Minister of the Environment – and by Polish Oil and Gas Company (PGNiG, Polskie Górnictwo Naftowe i Gazownictwo S.A.). To finalize this project, a special scientific and industrial consortium has been established, consisting of: the Institute of Geophysics PAS (consortium leader), PGNiG S.A., and Geofizyka Toruń S.A.. The consortium has already won the international tender for the implementation of this project. The planned experiment will be of great importance not only for the oil industry but also for geodynamic research. This is an exceptionally fortunate example of combining application and research goals. This will be an outstandingly innovative experiment in the full sense of the word. The primary goal of the planned experiment is to solve the fundamental geological problems of the study area and to select an appropriate region for a deep exploratory well. It is expected that the research of this type will be of great importance for new future oil and gas exploration projects at great depths.

[8] Grad, M., T. Tiira, and ESC Working Group (2009), The Moho depth map of the European Plate, *Geophys. J. Int*. **176**, 1, 279–292, DOI: 10.1111/j.1365-246X.2008.03919.x.

ABOUT THE MAGNUM OPUS

AMK – *You have written a number of monographic treatises; you say that a new one will be released soon – that Chapter 2 in the "Southern Permian Basin Atlas". Which of your monographic publications do you consider the most important?*

AG – Under the chief editorship of Professor Gerald Schubert from the University of California, Los Angeles, the Elsevier publishing company issued the 11-volume monograph *Treatise on Geophysics*, which summarized all the most important achievements in geophysics since its beginnings dating back to the late 19th century. We were offered a special chapter in one of the volumes. In it, we included a brief summary of all our experiments, authored by me, Marek Grad, and G. Randy Keller[9]. It was due to Professor Keller that we had free access to American resources of modern seismic stations.

After a special symposium organized in the USA, another American monograph was published: *The Four-Dimensional Earth*. The motto of this symposium and this monograph is "Geological-Geophysical Earth". These disciplines are not separate. There is one Earth. Unfortunately, a division between them is still functioning – which makes no sense, because the Earth is one.

One of the most eminent American geologists, Professor Robert D. Hatcher, said at the beginning of this symposium: "If a geological event occurred 300 or 500 million years ago near Washington, it does not at all mean that it is an event associated only with this area. It was the result of a planetwide process, but we don't yet know what kind of process it was, and in what area and what the interrelationships are". In this monograph, we also have one chapter.

At the most recent The 33rd International Geological Congress Oslo 2008 in August 2008, I was asked to organize a symposium entitled "Reconstruction of the transition zone from the craton of Northern Europe to the Alpine system of Southern Europe". The motto of this symposium was "After all, one geology". There is no geology or geophysics of separate regions or countries, although this scheme still exists. Even the geology of a small area must have its planetary reference. I think our work is a contribution to understanding what the current state looks like, but transposed to the scale of the entire globe.

AMK – *So much happened on this planet... Have you created your own school? You often mention the name of Professor Marek Grad here.*

AG – This is a modest team. Including our colleagues from the University of Warsaw, there are ten of us. What we did was and is in broad international cooperation. There is no division between "those" from the PAS and "those" from the University of Warsaw. Professor Marek Grad started with me as a student on an internship. Later on, he stayed at the University of Warsaw and we have been working closely together ever since. I think it is a very fruitful collaboration.

ABOUT INTERESTS AND COLLECTING

[…]

AMK – *I have heard about your collections of old maps and weapons…*

[9] Guterch, A., M. Grad, and G.R. Keller (2007), Crust and lithospheric structure – long range controlled source seismic experiments in Europe. **In:** G. Schubert (ed.), *Treatise on Geophysics*, B. Romanowicz and A. Dziewoński (eds.), *Seismology and the Structure of the Earth*, Vol. 1, Elsevier, 533–558, DOI: 10.1016/B978-044452748-6.00016-X.

AG – I have a modest collection of maps of Poland and the Grand Duchy of Lithuania. As to military items, it is not a collection but a modest assemblage of some Polish army artefacts from the 18th century to the interwar period. In the early 1970s, I became interested in the weapons and uniforms of Polish soldiers. I then joined the Association of the Lovers of Old Arms and Uniforms. The Association was founded in 1933 as the Association of Friends of the Polish Army Museum in Warsaw. After World War II, there was no possibility to reactivate it, but already in 1957, at the National Museum in Kraków – due to efforts of prominent art historians – it became possible to establish the Society of the Lovers of Old Arms and Uniforms, which in 1960 was transformed into the nationwide Association of the Lovers of Old Arms and Uniforms. Currently, the Association operates in nine cities in Poland and has about 300 members. It included a number of prominent figures associated with World War II and the resistance movement. For many years, the President of the Association was Professor Zdzisław Żygulski Jr., an outstanding art historian from Kraków. For twelve years I had been the president of the Warsaw Branch of the Association. Since 2000, I have had the honor of being elected nationwide president of the Association of the Lovers of Old Arms and Uniforms at the National Museum in Kraków. Since 1972, the Association has been included among the scientific associations affiliated with the Polish Academy of Sciences. The scientific achievements of the Association include hundreds of publications and monographic treatises on the weapons and uniforms of Polish soldiers over the centuries. In 2007, we celebrated the 75th anniversary of the Association – on this occasion, we organized a ceremonial scientific session in Warsaw at the National Museum and the Polish Army Museum. The talks presented at the session were published in the "Commemorative Book". We also celebrated the anniversary by minting a commemorative medal. The Association is funded solely by its membership fees.

To give an example of curiosities of my assemblage – in the 1970s, in an antique shop in Kyiv, I purchased an old Swiss key-wound pocket watch, running perfectly, with a silver chain and a silver coin attached to it – "5 Polish zlotys", and on the reverse of the coin the inscription "Kingdom of Poland" and the coat of arms with the Eagle and the Pogoń and the date "1831"; on the edge of the coin there is the inscription "God Save Poland". What was the journey of this item since the November Uprising? Moving....

ABOUT THE POLISH ACADEMY OF ARTS AND SCIENCES (POLSKA AKADEMIA UMIEJĘTNOŚCI, PAU)

AMK – *How do you perceive the Polish Academy of Arts and Sciences?*

AG – Polish Academy of Arts and Sciences is a unique institution for me. Being elected a PAU corresponding member was one of the most important events in my life. I very much regret that, living in Warsaw, I cannot systematically participate in the extremely interesting lectures organized by the PAU in Kraków. Various actions undertaken by the PAU Executive Board deserve special recognition, such as revising and reviewing school textbooks. I think that PAU could very effectively and objectively influence the shaping of the country's scientific policy if the relevant ministerial authorities were willing to accept such activity. Born in the former Galicia, I also feel a strong emotional bond with the Polish Academy of Arts and Sciences.

Talks in Warsaw on 18 December 2008 and 8 April 2009; text authorized on 30 September 2009.

Aleksander Guterch, Ph.D. in physical sciences; Ph.D. in the field of Earth physics; Prof. at the Institute of Geophysics PAS; head of the Department of Seismic Lithospheric Research at this Institute; president of the Association for Deep Geological Research; ordinary member of the PAS; ordinary member of the Warsaw Scientific Society; member of the Academia Europaea, London; long-time chair-

man and vice-chairman of the Committee on Polar Research of the PAS; chairman of the National Committee on Polar Treaties of the PAS ("Arctic Council" and "Antarctic Treaty"); chairman of the National Committee on the 4th International Polar Year 2007–2009; member and vice-chairman (2006–2009) of the European Polar Board at the European Science Foundation (ESF), Strasbourg; member of the EUROPROBE Scientific Steering Committee (1992–2001) at the European Science Foundation (ESF), Strasbourg; member of the American Geophysical Union; honorary member of the Association of Hungarian Geophysicists; president of the Association of the Lovers of Old Arms and Uniforms at the National Museum in Kraków. Elected to the PAU as a corresponding member on 19 June 1999.

Translated by Bartosz Woźniak

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We Were Olek's Friends for Over 60 Years

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The three authors of this note led most of their lives side-by-side with Olek Guterch and his wife Basia. We studied at the same faculty and worked at the same Institute. We were also friends all the time. We met so long ago (see young Olek in Fig. 1) that many of our companions have already passed away. Sadly, Olek is not with us either. We present here few remarks about Olek and also express our deep and hearty condolences to Basia, their two daughters and grandchildren.

MAGDA RECALLS

I am very sad and, at the same time, very proud to be able to write a few words concerning one of our most outstanding geophysicists-seismologists who, unfortunately, recently passed away. Sad – because he is no more with us, and proud, because I may add something about him. As I am not a seismologist and never worked with Olek, I will not write about his numerous scientific achievements, but I will say a few words about the circle of friends – students of geophysics, physics, and astronomy – that formed during the years of our study and to which he belonged. In our leisure time, we gladly participated in dance parties organized in the Hoża 69 building (Faculty of Physics, University of Warsaw) and at our private homes. Later on, we sometimes talked with Olek about dances in the garden of the house I lived.

After obtaining a master's degree with a very good result, Olek got a post at the University, and after 2 years moved to the Institute of Geophysics, PAS. All other friends also started working after graduation, but our group kept meeting several times a year, especially during the name days or birthdays of its members. In a short time, the weddings began – Olek married Basia Weber, a geophysicist who came from Poznań – and then the children were coming. I remember very well the party devoted to bathing their first baby-girl that Olek and Basia organized for friends in their first home. There was a very touching request from one of our common friends who asked Olek and me to stand as godparents to their son.

Olek and Basia were very interested in history, especially old arms and maps, as well as Hucul handicrafts. In their home, one could see numerous items connected with those hobbies.

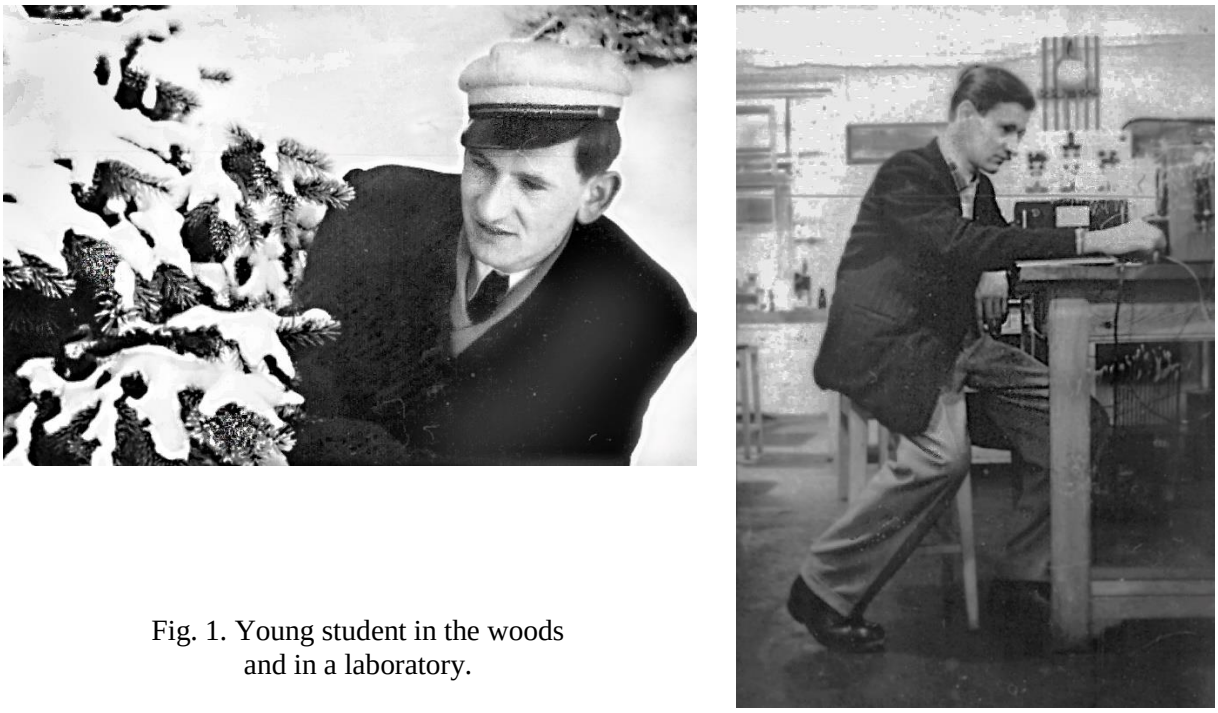

Fig. 1. Young student in the woods and in a laboratory.

So every visit finished with a very interesting guided excursion. Following his historical interests, Olek was a member of the Association of Lovers of Old Arms and Uniforms (Stowarzyszenie Miłośników Dawnej Broni i Barwy), and its Chairman over the years 2002–2016.

All friends of Olek and Basia will remember him forever.

ANNA RECALLS

When Olek passed away, many pictures came into my mind. I got acquainted with him in my first year of study: while attending a geophysical lecture, I noticed a new student sitting with us, a small group of future geophysicists. It was Olek, who joined our group somewhat later than all of us, because of his long recovery from a traffic accident. Since then, I remember his nice, friendly smile.

Time went on, Olek got married to our good friend Basia, graduated from the University, engaged in earth sciences, and soon joined the Institute of Geophysics, PAS. Basia also worked at the Institute through her whole professional life; she was preparing seismological bulletins from Polish seismological stations and analysed the seismicity of our country. The knowledge about other interests, abilities and hobbies of Olek has been disclosed gradually. My first surprise came when I visited the Guterch's place and noticed a small piece of wood furniture, very nice and useful in a tiny apartment. "Where have you bought it?" I asked. „It was made by Olek" – answered Basia. And so I learned that Olek, in addition to his scientific talents I knew, was a gifted carpenter.

We once met in Leningrad, USSR, sometime in the 1960s. We talked for a long time, but his longing for his family and home overwhelmed the conversation.

We also met upon his return from his stay in Dallas, USA; he showed me some old Indian artefacts he bought – so I learned about his historical interests. It was really unusual at those times to bring from the USA things like that, while more practical items were badly needed in our communist country. But not for Olek, who was already completing his private collection, although not Indian, but rather from his native area.

My admiration for Olek's historical knowledge was enhanced when, while being in Cracow at the meeting of the Academy of Arts and Sciences (I accompanied my husband), he advised us to go to the exhibition about Galicia, the region he was born. He guided us through this exhibition, providing very interesting remarks, so we learned a lot. Unfortunately, I didn't have an opportunity to visit his recent home collection.

I saw Olek in July 2023 when the Institute celebrated its 70th anniversary. He looked happy and healthy, with the same smile as during our first meeting some 67 years ago. I never expected that it would be our last meeting.

MAREK RECALLS

I studied together with Olek at the University of Warsaw, but most reminiscences associated with him come to me from a later period, when I participated in scientific expeditions under his guidance (Fig. 2). He demonstrated extraordinary energy and efficiency in organizing geodynamic investigations of the Earth's crust in the northern and southern polar regions (Spitsbergen and West Antarctica). Firmly believing in the importance and need for such research, Olek engaged researchers from Norway and Germany and was able to secure adequate financing and co-financing (e.g. from foreign sources), and then establish and manage the complex logistics of the work. The Institute of Geophysics, PAS, assembled a group of participants, including me, because I already had experience in doing research in polar conditions. Under Olek's guidance, I participated in three geodynamic expeditions to West Antarctica (1979/1980, 1984/1985, and 1990/1991) and also three to Spitsbergen (1976, 1978, 1985).

The research involved recording and analyzing seismic waves generated by underwater explosions. It was necessary to select measurement regions and find transportation adapted to polar conditions. Each measurement site had to be manned by at least two geophysicists, who had to be provided with accommodation and recording equipment. The idea of measurements was innovative on a world scale.

Olek perfectly controlled everything, despite the fact that he had to operate in a difficult political and financial situation in Poland. He headed the entire project, establishing cooperation with appropriately specialized Polish institutions, such as the Marine and Land Geophysics Enterprise "Geofizyka Toruń", the Hydrographic Service of the Navy (ORP "Kopernik"), and the Polish Ship Salvage (tugboat m/s "Jantar"). The research often required active cooperation with institutions from other countries.

Fig. 2. Olek Guterch (right) explains something to the author.

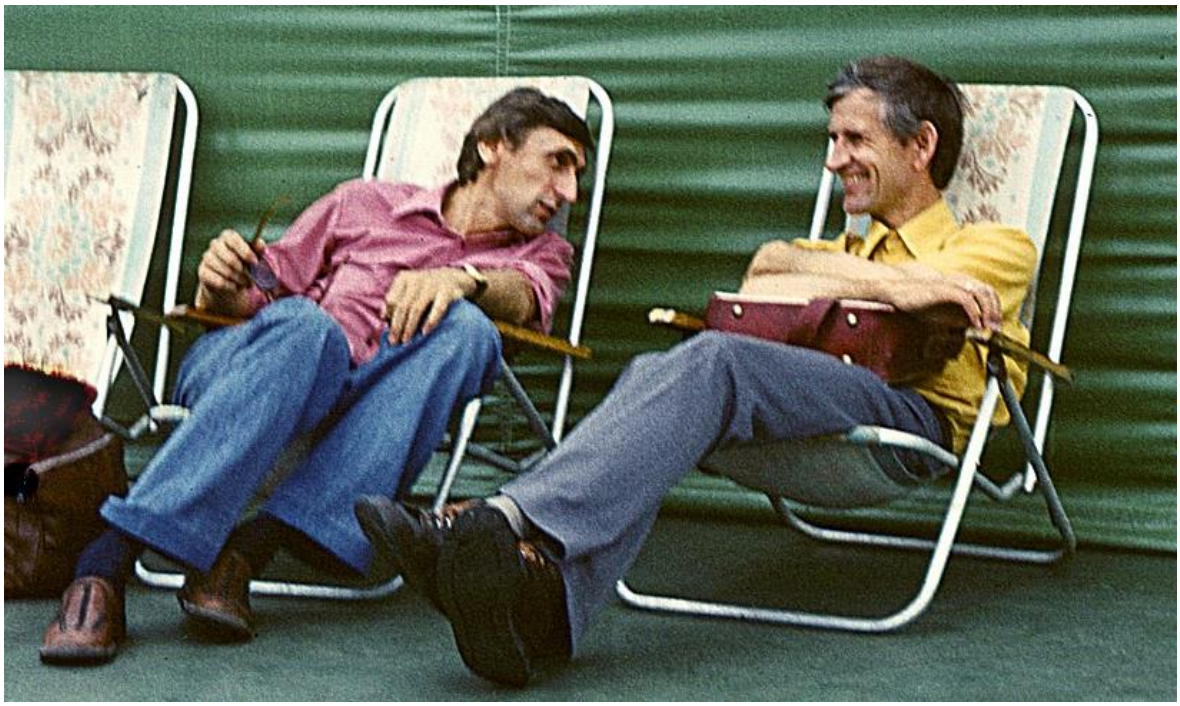

Fig. 3. Andrzej Zawada (left) and Olek Guterch (right) resting on a cruise to Spitsbergen during the First Expedition.

Fig. 4. In those days, collecting antlers was legal. Standing after the return from the First Spitsbergen Expedition are its participants (from left): Edward Perchuć, Marek Górski, Aleksander Guterch, Jan Pajchel, Jacek Kowalski, and Zbigniew Czerwiński.

In addition to gathering the technical equipment and designing the scientific program, it was necessary to assemble several teams, consisting of competent people, to select measurement sites, install the instruments and acommodation, and conduct the measurements. Before the first expedition to Spitsbergen, Prof. Roman Teisseyre, Deputy Director of the Institute and a famous geophysicist, advised Prof. Guterch to add to this expedition the well-known Himalayan explorer Andrzej Zawada, an experienced organizer of expeditions to the world's highest peaks, who at that time was working at the Institute's Department of Seismology (see Fig. 3).

The innovative research of Olek Guterch and his colleagues has received much international acclaim and provided excellent data, which are described in other chapters of the book. For the participants of the expeditions (see Fig. 4) they were an excellent opportunity to gain experience in field research under extreme conditions. They also provided the background for further development and improvement of research at Polish polar stations and the next extensive geodynamical projects.

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Aleksander Guterch's Family Background. How the Natural Resources of Oil Shaped Individual Lives

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FOREWORD 1

by Anna Dziembowska, co-editor of the publication

Looking over the family tree of Aleksander Guterch it's no surprise why he chose the field of science he did. His interest in the mysteries of the Earth's crust must have been inherited from his ancestors since nearly all of them were engaged in oil exploration. The smell of oil around must have added to it. We are presenting here some information about the families of Aleksander's mother and father, focusing on their work in oil exploration not only in their neighborhood but also in other continents.

FOREWORD 2

by Barbara Guterch, Aleksander's wife

Half a year after the death of my husband Aleksander, I drove to Sękowa, the place of his birth and burial. The seat next to me in the car was empty but in my memories Aleksander was telling me about his childhood, his family, about the hard work on the farm, about the fields smelling of hay and oil, and about the bullets cluttering the ground, mute witnesses of the Great Gorlice Battle (2 May – 22 June 1915).

I was asked by the Editors to gather materials about Aleksander's family. It was not easy, especially concerning the ancestors of his father. The parents' generation is known only fragmentarily, and the grandparents' generation is drowning in general forgetfulness. Aleksander has never met any of his grandparents. The average life expectancy in Eastern Galicia[1], at the turn of the 20th century, was 27 years, and salaries were up to 85% lower than in other countries in Europe at that time. Józef Rączkowski (1969), born in Siary in 1885, a poet, writer, and member of the Parliament of the Second Polish Republic, describes in his memoirs the hard life of peasants of these abandoned Gorlice villages and their extremely poor diet. Time was counted by the rhythm of the sun and great cataclysms. The Great Battle of Gorlice left behind a completely devastated town, burned villages, and a destroyed oil industry that has never again

[1] Part of the southern lands of Poland seized by Austria in 1772, called Galicia, was ruled by the Habsburg Monarchy (until 1804), Austrian Empire (1804–1867), and Austria-Hungary Monarchy (1867–1918); *added by the editors*.

recovered to its former glory. Agriculture was the main source of livelihood. The mountainous terrain and heavy, clay soil required great effort, but people were extremely attached to their homeland. They always dreamed of extending their property, and some of them, fortunate enough to get well-paid contracts, were able to realize this dream. After 1852, when oil in the Outer Western Carpathians started to be exploited on an industrial scale, the life of Gorlice village people changed essentially. Most of them started to work twice as much as before. They found employment in the oil industry and tried to run their usual farming duties as before.

I asked Aleksander's distant relatives to help me and be co-authors of the text. Szczepan Mikruta from Siary has been collecting and publishing information about the people of the region for decades (Mikruta 2021). Agata Rączkowska from Sękowa has been carefully listening to and recording the stories told by her great-grandmother Helena Gutterch, née Haluch, and her grandmother Barbara Szloch, née Gutterch.

FAMILIES OF ALEKSANDER'S PARENTS, HELENA NÉE HALUCH AND JAN GUTTERCH[2]

Helena née Haluch and Jan Gutterch came from two neighboring villages. The Haluch family was from the village named Siary, located along the Siarka Creek, and the Gutterch family was from the village Sękowa, located along the valley of Sękówka River, a tributary to the Ropa River (in Polish, "ropa" means "oil"). The two villages formed one parish. It was the southernmost Roman Catholic parish in the area; farther south the population was Greek Catholic.

I. The Haluch family

The Haluch family lived in the village Siary, mainly the Upper Siary (Siary Górne) and its abutment called Empty Field (Puste Pole). The forest adjacent to it is called Empty Forest (Pusty Las).

In the Upper Siary, oil has been present always. It leaked spontaneously from rock crevices and the ground, flowed into streams, painted rainbow circles on the water surface, made well water peculiar in taste and smell, and gave it an undesirable greasiness. At places where oil leaked and flowed into larger depressions, the water was frothy, forming an abundant thick foam. When needed, artificial depressions or ditches were dug and oil was drawn from them by various vessels. When these shallow resources were depleted, people began digging shallow wells, known as oil wells, from which the oil was drawn by buckets, suspended on hemp ropes (Pabis 2001; Pudło and Sęp 2010). The Haluch family exploited oil wells in the Empty Field and the nearby Empty Forest as early as the 18th century.

So little is preserved in human memory. It is only individuals who stand out for their creativity, impressive to others, that emerge from the common oblivion. Aleksander's great-grandfather Franciszek was certainly such a person.

Franciszek Haluch, born in 1813, known as a "Peasant from Siary" (Włościanin z Siar), or "Oiler" (Ropiarz or Ropniak). According to reports from local oilmen, he was selling oil as far away as Sieradz and Poznań, as well as to nearby Slovakia and Hungary. Franciszek Haluch founded one of the stone statues on the fence of the Corpus Christi collegiate church in Biecz (Fig. 1), which indicates that he was a wealthy person. It is said that Ignacy Łukasiewicz, pioneer of the oil industry in Europe and inventor of the kerosene lamp, was using his oil for his experiments (Pabis 1996).

[2] The surname Guterch was spelled without any rule: Gutter, Guter, Gutterch, Gütterch, or Guterch. It seems that each person producing a formal document wrote down the name as he/she heard it.

Fig. 1. Stone figures of 12 Apostles on the fence of the Corpus Christi collegiate church in Biecz. Inscription on the statue of St. Andrew the Apostle: "Founder Franciszek Haluch from Siary 1868".

After 1852, when Prince Stanisław Jabłonowski established an oil shaft in the Empty Field (on the border between Sękowa and Siary) and acquired a significant oil yield, interest in oil and an influx of rich entrepreneurs grew rapidly. This proudly named oil shaft, probably the first oil shaft in the world, was in fact an 11.5-fathom[3] deep oil well dug like a water well, and embanked with wood. People began digging everywhere, predominantly in places where spontaneous oil flow was observed in the past. The Haluchs lived in the center of these events, so it's no surprise that Franciszek Haluch, having the experience and finances, started the oil exploitation already on an industrial scale.

In the year 1874, the area of Siary alone was a site of 155 shafts (Windakiewicz 1875). Franciszek Haluch owned 8 of them, which was the greatest number of shafts possessed by a local peasant. As mining proceeded, the depths of exploitable oil were rapidly increasing: from 12–20 fathoms in the 1850s to 50–70 fathoms in 1874. In the 1870s, deeper digging was not possible, even with the use of dynamite, so drilling was more and more common.

A survey of oil areas in Galicia in 1881 done by Stanisław Znamirowski (Pabis 1996) showed that Franciszek Haluch stopped investing but kept exploiting the wells already in existence.

Józef Haluch (1839–1917), son of Franciszek. From an early age, worked on digging oil wells and then oil shafts; many oilmen underwent practical training with him. He was regarded a specialist among oilmen of the time. He did not exploit the oil wells himself but was leasing the land he owed.

[3] A fathom (sążeń) is a unit of length; in our case, a Viennese fathom = 1.90 m is applicable.

Jan Haluch (born in 1875), son of Józef. Gained experience in the oil industry from a young age, was hired as a qualified driller to work in the Netherlands Indies, and employed on Sumatra in the early 1920s. Having returned from Sumatra, he invited his neighbors to an inn to celebrate this happy event, and bought a big bag of sugar for his home. To the peasants of these Gorlice villages, this bag of sugar was, at those times, an incredible luxury, as memorized by Aleksander's mother.

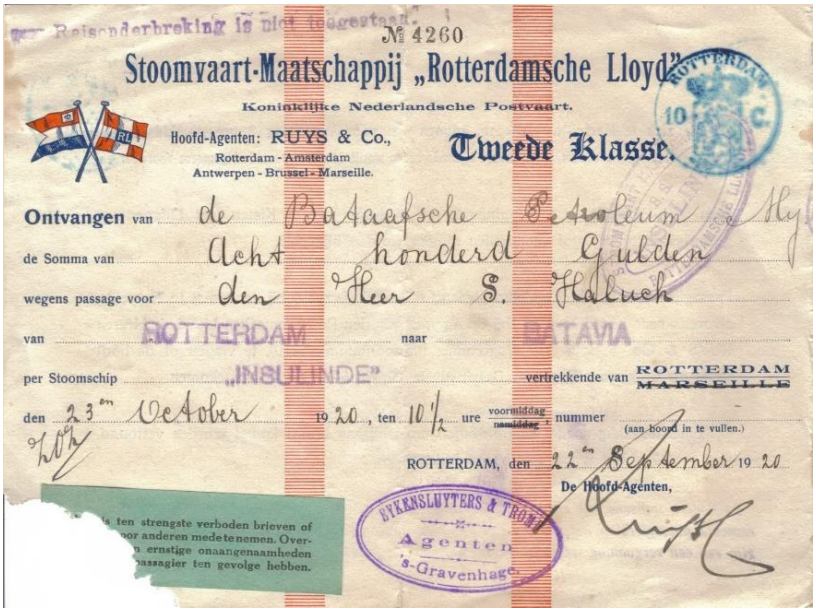
Józef Haluch (1865–1921), son of Szymon Haluch and Anna née Gutter. As an experienced driller, he was employed by a Dutch company in Borneo. With the money he earned, he bought some land in Siary and built, in 1904, a large brick house, impressive for that time. Not far away, an ancestral, wood-cased oil well was still present, making it possible to draw a small amount of oil as late as 1995.

Stanisław Haluch (1878–1958), son of Józef. At the age of 16, he started working in the oil industry in Borysław, receiving a drilling master's diploma in 1903. Drafted into the Austro-Hungarian army, took part in World War I in the rank of non-commissioned officer. In 1916–1917, he served in the Józef Piłsudski Staff of the Polish Legion. In 1920–1928, he worked in Borneo and Java, Netherlands India (see Figs. 2a,b, and 3). With the money he earned, he revitalized the inactive oil wells on his property in Siary and set up a private oil mine "Halina". Arrested by the Gestapo in 1943, he was imprisoned in Jasło. As a prisoner, he took part in the Home Army's action to liberate political prisoners. He was an active participant in the country's social and political life. He was interested in agriculture and, cooperating with the Jagiellonian University in Kraków, conducted agricultural and horticultural experiments on his farm. Before 1939, he graduated from the Higher Agricultural Courses named after Stanisław Staszic (Haluch 2024; Pabis 1996).

Michał Haluch (1883-1935). Having started as a yard worker, he later became a drill assistant. In 1914, mobilized into the Austro-Hungarian army, he was taken prisoner by the Russians. After the return from captivity, in 1919, he went to Ecuador to work in oil prospecting. After several years, he returned to his country and became employed as a driller in Borysław, then in Kryg (Pabis 1996).

Franciszek Haluch (1894–1963), son of Piotr Haluch and Ludwika née Mikruta. Born in Siary, but when he was nine the whole family moved to Borysław, where his father began working in the oil industry. Franciszek was brought up and educated in Borysław. He was a co-initiator of the action to establish a Great Borysław. He was a member of the Mining Workers' Union authorities, holding various positions, including that of the Secretary. He was a delegate to the International Mining Congresses and a member of their executive committee. A leading activist of the Polish Socialist Party in the Borysław oil district and the Society of Workers' Universities.

After the Soviet Army invaded Poland in September 1939, he was arrested by the Soviet Secret Service (NKWD) and jailed in the Drohobycz prison. Deported to Siberia, he worked in a gold mine in Kolyma. Upon the agreement between the Polish government in London and the USSR, he was released from the gulag and joined the Polish Army formed in the USSR in 1942, with which he went to Iraq. In 1942–1944, on behalf of the Polish Government-in-exile, he was in charge of organizing the care of Poles arriving in Iraq from the USSR, creating schools and hospitals, and reactivating Polish cultural life. Since 1944 worked at the Ministry of Labour and Social Welfare at the Polish Government-in-Exile in London (Belczyk 2010; Mikruta 2011).



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№ 4260

Ontvangen van de Batavaasche Petroleum Mij

de Somma van Acht honderd Gulden

wegens passage voor den Heer S. Haluch

van ROTTERDAM naar BATAVIA

per Stoomschip „INSULINDE" vertrekkende van ROTTERDAM MARSEILLE

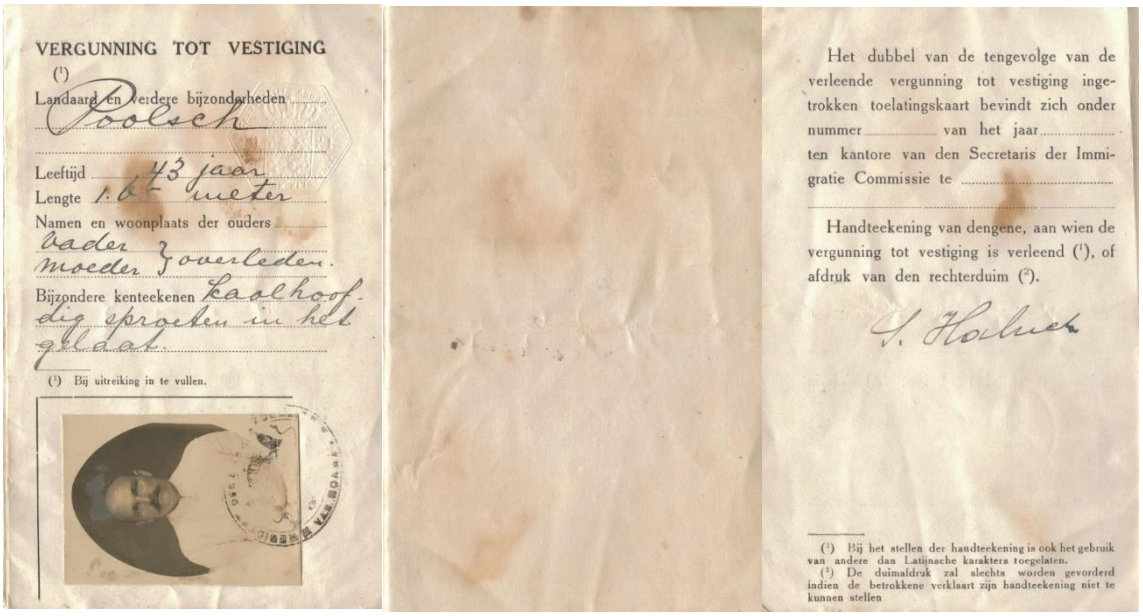
den 23 October 1920, ten 10½ ure voormiddag nummer

ROTTERDAM, den 22 September 1920

De Hoofd-Agenten,

EYKENSLUYTERS & TROMP Agenten 's-Gravenhage

(a)



VERGUNNING TOT VESTIGING

(1)

Landaard en verdere bijzonderheden Polsch

Leeftijd 43 jaar

Lengte 1.6 meter

Namen en woonplaats der ouders vader overleden moeder overleden

Bijzondere kenteekenen kaalhoofdig sproeten in het gelaat

(1) Bij uitreiking in te vullen.

Het dubbel van de tengevolge van de verleende vergunning tot vestiging ingetrokken toelatingskaart bevindt zich onder nummer ..... van het jaar ..... ten kantore van den Secretaris der Immigratie Commissie te .....

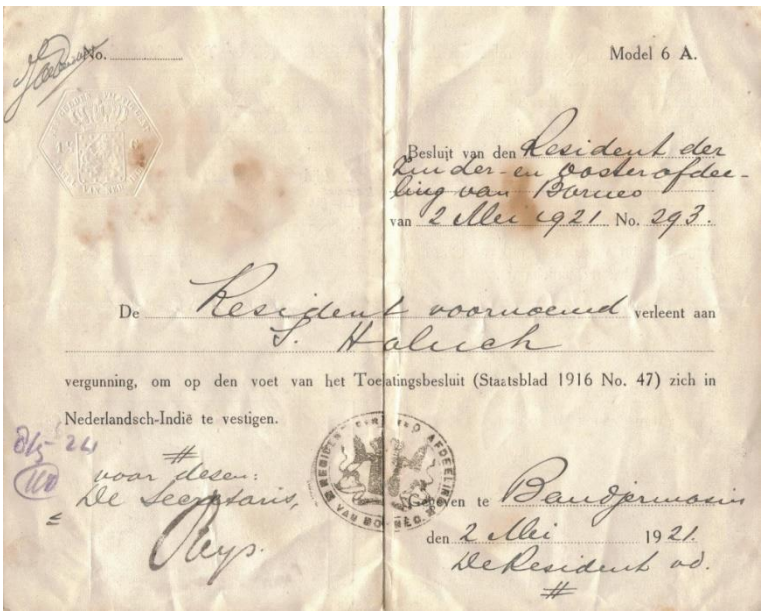
Handteekening van dengene, aan wien de vergunning tot vestiging is verleend (1), of afdruk van den rechterduim (2).

S. Haluch

(1) Bij het stellen der handteekening is ook het gebruik van andere dan Latijnsche karakters toegelaten.

(2) De duimafdruk zal slechts worden gevorderd indien de betrokkene verklaart zijn handteekening niet te kunnen stellen

(b)



No. .....

Model 6 A.

Besluit van den Resident der Zuider- en Oosterafdeeling van Borneo van 2 Mei 1921 No. 293.

De Resident voornoemd verleent aan S. Haluch

vergunning, om op den voet van het Toelatingsbesluit (Staatsblad 1916 No. 47) zich in Nederlandsch-Indië te vestigen.

Voor dezen: De Secretaris, Reys.

Gegeven te Bandjermasin den 2 Mei 1921.

De Resident voornoemd.

Fig. 2. Stanisław Haluch's travel documents, including: (a) ticket for his trip from Rotterdam to Batavia (now Jakarta) in 1920, and (b) visa issued at the Nederlands India (part of this document is stained with oil).

Fig. 3. Polish management of a mine in Borneo. Stanisław Haluch is sitting in the center, accompanied, most probably, by Kacper Sternal (on the left) and Józef Haluch (on the right). Local servants are standing behind the table (the photo from the archives of Bogusław Haluch, provided by Aleksander Gucwa).

II. The Guterch family

The history of the Guterch family is much less known, even concerning its members relatively close to us. The generation of Jan Gutterch (Aleksander's father), is known only fragmentarily. The Guterchs lived in Sękowa, where spontaneously flowing rock oil was also observed, but not in such quantities as in Siary. The oil deposits were deeper, and it was only after the year 1852 that the oil industry developed there rapidly.

Jan Gutterch (1885–1941), Aleksander's father, came from a large farm. The family had 11 children. At least four of Jan's brothers worked in the oil industry, and two emigrated to the US. Jan Gutterch (Fig. 4) was a farmer and petroleum worker, like most of the farmers there. He inherited the farm from his father. Daily chores were mainly handled by the wife and children, there were no Sundays or vacations for them. The sight of a 12-year-old or even a 10-year-old boy with a sickle or scythe at harvest surprised no one. Jan worked in the oil industry at all levels, starting from auxiliary work on the construction of oil wells and their operation in

Fig. 4. Jan Gutterch, photo taken in Borysław (family collection).

Sękowa and Harklowa to the position of a driller in Borysław (Fig. 4). The labor certificate of Jan Gutterch, issued by the Galizische Naphta-Gewerkschaft "HARKLOWA" in Harklowa on 18 June 1918 is presented in Fig. 5. There was also a drilling shaft at Jan's field. With the money he earned in oil industry, he built a brick house, one of the first in Sękowa. His last will expressed to his wife Helena was a request to educate their youngest son Aleksander, which she fulfilled with great determination. Aleksander memorized his father, already seriously ill, embracing him and showing German army units marching from Slovakia to Poland in September 1939. This was how Jan's life came to a dramatic end and Aleksander's conscious life began.

Jan was married twice: to Bronisława née Zielińska (1890–1921) and Helena née Haluch (1895–1984). All children of Jan except of Bronisław and Aleksander were traditionally farmers. At the same time, men worked all their lives in the oil industry, even starting at the age of 15. Women took care of the house and farm.

Children of Jan and Bronisława, Aleksander half-siblings:

Władysław Gutterch (1910–1990), a driller (Sitek 2014) with extensive professional experience. Called up to the Polish Army, took part in the fighting in Podkarpacie in September 1939. Taken prisoner of war and deported to Germany, where he was forced to work for a German farmer.

Katarzyna Kret née Guterch (1912–1997). Franciszek Kret, Katarzyna's husband, was a farmer, who owned horses and shared them with the neighbors in need. Thanks to people like Franciszek, others were able to work in industry and run small farms.

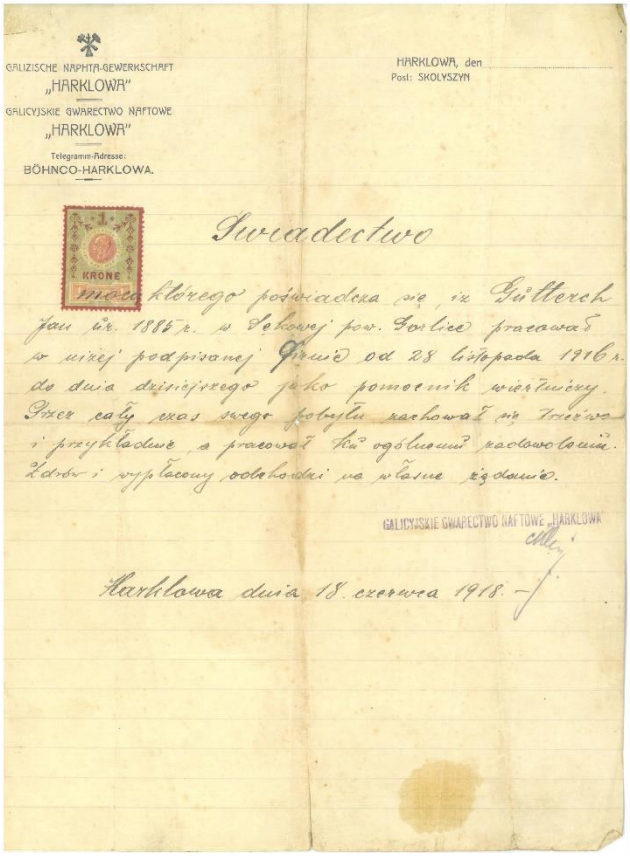

GALIZISCHE NAPHTA-GEWERKSCHAFT
„HARKLOWA"
GALICYJSKIE GWARECTWO NAFTOWE
„HARKLOWA"
Telegramm-Adresse:
BÖHNCO-HARKLOWA.
HARKLOWA, den
Post: SKOLYSZYN
KRONE
Świadectwo
którego poświadcza się, iż Gütterch
jan ur. 1885 r. w Sękowej pow. Gorlice pracował
u niżej podpisanej Spółki od 28 listopada 1916 r.
do dnia dzisiejszego jako pomocnik wiertniczy.
Przez cały czas swego pobytu zachował się rzetelnie
i przykładnie a pracował ku ogólnemu zadowoleniu.
Zdrów i wypłacony odprawiony na własne żądanie.
GALICYJSKIE GWARECTWO NAFTOWE „HARKLOWA"
Harklowa dnia 18. czerwca 1918.

Fig. 5. Jan Gutterch's work certificate issued by Galizische Naphta-Gewerkschaft "HARKLOWA" in Harklowa on 18 June 1918 (family collection).

Julia Tokarczyk née Guterch (1915–2013). Władysław Tokarczyk, Julia's husband, worked in the Borysław Oil Basin for 30 years, and then in the oil mines in Sękowa. Aleksander enjoyed visiting his sister's home, listening to Władysław's stories about the world, and borrowing books from him. Their son Krzysztof continued the family tradition, and worked for 35 years at the Glinik Machine and Drilling Equipment Factory in Gorlice.

Kazimierz Gutterch (1917–2002) a drilling manager at Jasło Drilling Company (Sitek 2014). During the German occupation of Poland, he set up a camouflaged oil distillery in the house where he lived to obtain kerosene for his family and friends. This was an extremely dangerous practice, because of the threat of fire and, if exposed, the death penalty. Czesław Guterch, his son, continued the family tradition; he was a drilling manager at the Jasło Drilling Company (Sitek 2014).

Mieczysław Gutterch (1919–1998) a drilling manager at Jasło Drilling Company, enjoying great prestige among his superiors and crew (Sitek 2014). In September 1939 he was a soldier in the National Defense Battalion in Gorlice and took part in the fighting in Podkarpacie. Taken prisoner, escaped from a transport to Germany and returned home. During the German occupation, he was a soldier in the Peasant Battalions, which carried out sabotage actions in the area. They set out to help fighters in the Warsaw Uprising, but turned back upon hearing of the ceasefire in Warsaw.

Bronisław Gutterch (1921–2002) was a practical skill teacher and ran Workshops at the Ignacy Łukasiewicz Mechanical School Complex in Gorlice.

After the tragic death of his wife Bronisława, Jan Gutterch married, in 1924, Helena, a daughter of Józef Haluch and Anna nee Mikruta, who raised his six small kids and gave birth to four more, the youngest being Aleksander (her photo with Aleksander is in Fig. 6).

Children of Jan and Helena, Aleksander siblings:

Barbara Szloch née Guterch (1925–2013). The property of Barbara and Edward Szloch was, in part, a site of the "Appolówka" oil mine, and the house hosted the mine's office. Edward worked in the oil industry only in the 1940s. He had horses and shared them with the neighbours who needed it. Barbara was the person who memorized most of the family stories, and the biggest beneficiaries of her storytelling were her daughter Halina Godkowicz and granddaughter Agata Rączkowska.

Józef Guterch (1927–2010), a driller, working, since 1965, at the Glinik Drilling and Mining Machinery Factory in Gorlice, in the Quality Control Department. He was an outstanding technician, often called by coal mines in Silesia for activating or repairing the underground mining equipment. He has also been assigned for extended stays abroad for deploying Polish-made drilling equipment and training crews on-site.

Michał Guterch, Józef's grandson, is now the only one to continue the family's petroleum traditions, having graduated from AGH University of Science and Technology, Faculty of Drilling, Oil and Gas, majoring in Mining and Geology. Then he was employed as an assistant drilling rig manager at the Exalo Drilling Orlen Group.

Fig. 6. Helena Gutterch with her son Aleksander on the day of his First Holy Communion, Sękowa, May 1944 (family collection).

Tadeusz Guterch (1929–1997), a driller who possessed the title of first-degree miner. From 1965 to 1976, he worked at the Glinik Drilling and Mining Machinery Factory in Gorlice.

EPILOGUE

Back in the 1970s, bread was baked in every Sękowa home, usually from the own grains. Groceries were bought only as an absolute necessity. Cows, pigs, chickens and sometimes sheep were raised, while goats were never kept. The local store did not even sell products such as dairy, bread, eggs, and vegetables. Since men commonly worked in the mining and prospecting industries, the farms were mainly attended by women and children, once they grew enough to be useful.

Currently, the land is no longer cultivated by anyone. The fields are only mowed and the grass is sold. The sight of a grazing cow arouses amazement and curiosity. Old houses are becoming empty, and new residents, primarily from the cities, seeking quiet and scenic beauty, are building modern houses that meet all the requirements of modern technology. Sękowa has become a village of typically recreational character.

Oil exploration in the Carpatian region in Poland became a history. In Gorlice, on the site of a former oil mine, there operates the Magdalena Oil Industry Open-Air Museum, collecting memorabilia related to oil production in the Gorlice Oil Industry Basin. Siary and Sękowa are on the way of the Carpathian-Galician Petroleum Tourist Route, which begins in Gorlice and continues east through Jasło and Sanok into Ukraine, to Borysław and Drohobycz.

Yet oil reminded of its existence once again. On 20 April 2019, the field belonging to Tadeusz Rączkowski in Sękowa experienced an eruption, a mixture of brine, gas, and oil from the formerly operated well "Franciszek", which was shut down and plugged in 1995. The leak continues to be active and is under constant monitoring by the services. All of the old shafts, with special attention to dug pits, have been closed down and protected for safety reasons (Wais 2014).

On a gloomy January day, when we escorted Aleksander out of St. Joseph's Church in Sękowa, which was built up from the funds obtained from oil production nearby, a rainbow appeared in the sky, like a joyful welcome to Aleksander returning from a long journey.

In March 2024, the elementary school in Sękowa got the name of "Pioneers of the Oil Industry" (Wieści Gminne 2024).

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Our Father

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Growing up, we knew that Warsaw, our hometown, was a city that our Dad first arrived to when he was 18 years old, but we also learnt that his journey started much earlier.

We loved to listen to Dad's story of how his older brother gave him a ride in a horse wagon to Gorlice, where, for the first time in his life, he boarded a train and departed to begin his studies at the University of Warsaw. This was still before his second major surgery, when his mobility was significantly restricted by the complication from the accident and surgery a few years earlier. After an entire night spent in a crowded train, when he finally reached his destination, he found himself for the first time in a large city, uncertain where to go. We followed Dad's story eagerly and anxiously, and we shared in his feeling of relief when he realized that the University's welcome committee greeted new students and helped them find their way to the dormitories. For us, it was a story about a journey into the unknown. Having listened to it many times, we knew that it was worth it to cope with difficulties and uncertainty in order to discover the world.

No matter how his world expanded, Dad would cherish and return to his roots. He often reminisced how, as a young boy, he would climb the hills surrounding Sękowa and wistfully admire the towers of the town hall of Biecz. This medieval (13th century?) town some 17 km away from Sękowa was beyond the reach for the country kid. Later, Biecz became Dad's favorite destination when he traveled back to Sękowa.

Dad's scientific career focused on discovering the world in a very literal sense – he conducted research to explore the structure of the Earth. For us, his daughters, what mattered most was his passion to pursue the mystery he was telling us about: what is hidden under the Earth's crust?

As Dad was pursuing the answers, we loved to listen to stories from his travels. The essence of the unknown was the Antarctic, the place of magic beauty. With the attention to detail of a true storyteller, Dad recounted the trials he had to go through when crossing the equator, in order to receive baptismal rites from the hands of the Neptune and Persephone. With awe, we watched the images on the slides of icebergs at sunset, which Dad displayed on the walls of our living room. Most of the iceberg is hidden under the water, he always made sure to stress.

This hidden part of the world he would access not only through science but also through poetry. Our parents often reminisced how Dad started their life together with a suitcase full of poetry books, little yellow collection of Polish and international poets, issued by "Nasza Księgarnia".

Figuratively, this collection began in Dad's native village of Sękowa, long before Dad's journey to Warsaw. It started with the poetry of Stanisław Kret, local poet and Dad's relative, and with the books Dad borrowed on a regular basis from the neighbors' library. He read constantly, our grandmother told us, even when doing chores, like when he had to guard cows to make sure they didn't cross over into the neighbors' land, hiding with his books under a tarp when it rained. With solemn emotion and admiration, Dad reminisced frequently about his teachers in Marcin Kromer High School in Gorlice who introduced him to the world of history, literature, and geography: Prof. Sikorski, Prof. Dniestrzańska, and Prof. Motyka who when describing to his pupils the battle of Thermopylae and the death of the brave Leonidas, always pulled a checkered handkerchief and loudly wiped his huge nose.

Dad's journey was made possible thanks to the support of his entire family. Our grandmother told us that Dad's older sister Basia would deliver handmade bread and cheese to Dad's landlady in Gorlice, in lieu of the fee. It was probably just a small example of the daily challenges and perseverance needed to obtain a high school diploma and enrol at a university at the time when each pair of hands was needed to work the land.

And now let's return to the train station in Warsaw "Warszawa Główna". A couple of years later, Basia Weber, a student from Poznań, arrived at the same station. Mom and Dad got married in 1962, and spent together the next 62 years of their lives. In the early years of their marriage, marked by the post-war poverty and the communism's oppression, they found their joys and passions, inspired each other with interests in art and history, and continued to discover the world, for themselves, and later, for us.

Memories of the stories they shared with us are mixed up with our own memories. There were their treks in the Tatra Mountains and Orla Perć trail. The most challenging ridge of the Tatras, its difficulty magnified by Dad's physical disability, and by meager food supplies, consisting of powdered soup fixed on melted snow. There were Mom's tears of joy when she crossed with Dad the bridge in Venice, her first trip beyond the iron curtain, and the exhilaration of a car trip through Italy. We remember them when young and beautiful, they returned from a trip to Paris, bringing back Parisian food specialties, as well as our first pairs of jeans.

Passion and courage. We remember Dad kayaking with us, hiking, biking, playing badminton, always present and engaged, giving it his all, putting aside for us his busy career, and overcoming challenges of his physical limitations. Some of those memories we share with our children and his grandchildren.

Kindness and caring. He made it his priority to ensure that everyone is taken care of and comfortable and all arrangements always made on time.

Warmth. Always busy with serving endless cups of tea and bringing more treats. Checking on his children, and later, grandchildren, if they are warm at night. Those small gestures, which may sound insignificant, were all part of his presence in our lives. When he was already in the hospital, in and out of consciousness, he would still welcome his grandchildren when they visited them, and would apologize that he was "in such a state", unable to take care of them properly…

Our Dad.

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The Outstanding Contribution of Professor Aleksander Guterch to the Association of the Lovers of Old Arms and Uniforms

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✉ Andrzej Novak-Zemplinski<tulowicedwor@o2.pl>

ANDRZEJ NOVÁK-ZEMPLIŃSKI WRITES:

Many years ago, when I was in the studio of the brilliant graphic artist, Jan Maciej Kopecki (1945–2016), I saw fresh prints of a copperplate ex-libris, depicting an image of the map of the Kingdom of Poland of 1632 and, against its background, a 1917 Polish saber – this "victorious saber" of the Polish–Soviet War of 1920. It turned out that it was Aleksander Guterch's ex-libris and its symbolism was an excellent expression of the Professor's interests, as stated in the membership declaration of the Association of the Lovers of Old Arms and Uniforms, submitted on 1 June 1982. This area of the Professor's special interests in the field of militaria concerned military cartography and Polish white arms (Fig. 1).

Fig. 1. Aleksander Guterch's ex-libris made by Jan Marcin Kopecki (left) and hand-colored by Zygmunt Jagodziński (right).

His activity in our community was evident from the very beginning of his membership. He devoted a lot of attention to the history of Polish cartography in terms of its usefulness in warfare and, since he was an outstanding scientist in the field of geophysics, cartography was particularly close to his heart. He was also collecting old Polish maps. Alongside, he was passionate about white arms and other military items, which clearly explains the choice of symbolic motifs for the ex-libris described above.

At our monthly meetings of the Warsaw Branch of the Association of Lovers of Old Arms and Uniforms, the topic of military cartography and its practical application in various aspects of military operations and periods of our difficult history recurred many times. Overall, the Professor gave a dozen or so very interesting lectures on the use of cartography in military operations as well as its designing and remarkable Polish achievements in this field. He devoted his first speech (1984) to the military cartography of Polish lands from a historical perspective, presenting selected objects from his own collections. Subsequent speeches dealt with the times of the Napoleonic Wars and the November Uprising[1]. Extremely interesting was a lecture on the cartographic service of the Home Army[2], delivered in 1988. The following year, he devoted attention to the early military cartography of the Grand Duchy of Lithuania and, in 1991, to advances in mapmaking for military purposes in 1775–1795, i.e., the times of attempts to reform the army during the reign of the last king of the Polish–Lithuanian Commonwealth. In 1993, in connection with the 130th anniversary of the January Uprising, he delivered a paper on the role of military maps in the warfare of this uprising. In the following years, the topic of military cartography returned repeatedly and concerned museum and collector's cartographic collections as well as various episodes related to cartography in the history of the Duchy of Warsaw[3] and the national uprisings. He devoted special attention (in 2001) to the phenomenon of creating a quartermaster map of the Kingdom of Poland, as an outstanding achievement of the era in the field of cartography. There were also topics devoted to these problems in World War II operations, and on the next anniversary (2013), the topic of military cartography of the January Uprising returned. The Professor also touched on other topics from the history of the Polish military, but cartography was always the leading subject. He also gave lectures on the above topics at the friendly Club of the Lovers of Old Polish Militaries in Warsaw and at other branches of the Association of the Lovers of Old Arms and Uniforms.

After five years of activity in our community, he became the President of the Executive Board of the Warsaw Branch and held this position for the next six terms, i.e., in the years 1987−2001. In 1998, he became a member of the Main Board of the Association of the Lovers of Old Arms and Uniforms [Stowarzyszenie Miłośników Dawnej Broni i Barwy (SMDBiB)]. In 2001, he was elected President of the Association's Main Board for the next five terms in the years 2001−2016. By virtue of his functions, he was the initiator and organizer of several nationwide scientific sessions devoted to the history of arms and uniforms:

– 1988: On the occasion of the 70th anniversary of Poland's regaining its independence, he organized the XIV session of the Association in the National Museum in Warsaw;
– 1990: On the 70th anniversary of the Polish–Soviet War, he convened the XVI session of the Association, also in the National Museum in Warsaw;

[1] For those who are not familiar with the Polish history: The main Polish rebelions against the Russian Empire: Kościuszko Uprising (1794), November Uprising (1830), and January Uprising (1863) (*added by the Editors*).

[2] The Home Army [Armia Krajowa] was the dominant resistance movement in German-occupied Poland during World War II (*added by the Editors*).

[3] The Duchy of Warsaw [Księstwo Warszawskie] was an independent Polish state created by Napoleon (*added by the Editors*).

– 1994: To celebrate the 200th anniversary of the Kościuszko Uprising, he convened the XVIII session of the Association at the Museum of Independence in Warsaw;
– 2003: The 70th anniversary of establishing the Warsaw Society of the Friends of the Army Museum and the 45th anniversary of establishing the Association of the Lovers of Old Arms and Uniforms, as well as the 75th and 50th anniversaries of these Associations in 2007, were celebrated at the XXIII and XXV sessions of the Association.

The usually two-day meetings presented the research achievements of the Association members as well as invited guests, related to the anniversary topics; some of the talks were then published in "Studies in the History of Old Arms Uniforms", issued by the National Museum in Kraków. There were also nationwide sessions organized in cooperation with the Club of the Lovers of Old Polish Military. Such a session took place in 2013 at the headquarters of the Polish Craft Association in Warsaw in connection with the 150th anniversary of the outbreak of the January Uprising. At that session, the Professor delivered a talk on insurrectional cartography. Another session, held in 2014 at the Museum of Independence, was devoted to the 100th anniversary of the outbreak of World War I. In 2017, a session was organized at the Warsaw Garrison Club in cooperation with the Polish Army Museum and the Office for War Veterans and Victims of Oppression on the occasion of the 150th anniversary of the birth of Marshal Józef Piłsudski. In addition to the nationwide sessions, ceremonial meetings of the Warsaw Branch were also organized, related to important historical anniversaries. In all these events, the Professor, serving as the President of the Warsaw Branch and later as the President of the Main Board of the Association, made a very significant contribution, in terms of both, the scientific content and the organization.

In 1994, Aleksander Guterch was awarded the Association' Golden Badge and, in 2016, the title of Honorary Member. In our community relations, the Professor behaved with an outstanding personal culture and the ability to maintain a proper distance in various aspects of organizational activities. He always kept an appropriate restraint in words and particular kindness, in both private contacts and official speeches. He will remain in our memory with an inseparable smile on his face. He passed away on 28 December 2023.

MAREK DUTKIEWICZ WRITES:

I met Prof. Aleksander Guterch in the late 1980s, during one of the annual General Meetings of the Association of the Lovers of Old Arms and Uniforms [Stowarzyszenie Miłośników Dawnej Broni i Barwy (SMDBiB)] which were held in Kraków. We represented, as delegates, the local branches of the Association. We talked mainly about the problems concerning activity and exchanged experiences and comments. Already then I noticed that the Professor talked little about himself and listened to others with great attention and kindness. In 1998, the Professor became a member of the Main Board, and in 2001, he was elected President of SMDBiB. He served in this position for five consecutive terms until 2016.

Since 1995, I have served as the Chairman of the Audit Comission, and for this reason, we met additionally at meetings of the Main Board. In 2013, when the Main Board of SMDBiB was being formed, the Professor approached me with a proposal to accept the position of Vice President. Thus, our contacts became very frequent. Then, in the following terms of 2016–2019 and 2019–2022, I was elected President and, in turn, I asked the Professor to become Vice President and support me with his experience and advice. In 2022, before the next election, he notified me that his health does not allow him to engage in more extensive activities. Nevertheless, until the end of his days, he kept in touch with me and took a keen interest in the Association's activities. These many years of lively contacts and conversations were a great joy and satisfaction for me.

The Professor was an extremely cordial person with a nice smile, characterized by tremendous personal culture. Although he was a prominent scientist of international standing, he always behaved with modesty and politeness.

The Professor's interests were not limited to the professional sphere (he was a member of many domestic and foreign societies) but extended far into the area of broadly understood history. In addition to his activities in the Association of the Lovers of Old Arms and Uniforms, in 2014, he and his wife were accepted as members of the Józef Piłsudski Institute for Research in Modern History of Poland. The Institute is an association of people interested in the cultivation of the ideas of Marshal Józef Piłsudski and research in Polish history. The Professor actively participated in the meetings and activities of the Institute and, among other things, in 2017, he co-organized (together with SMDBiB and the Polish Army Museum) a scientific session dedicated to the 150th anniversary of the birth of Marshal Józef Piłsudski. With his attitude and activities, he fully implemented the Marshal's pro-state idea.

Translated and edited by Bartosz Woźniak and Anna Dziembowska

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The Funeral Speech by the Mayor of Sękowa

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Professor Aleksander Guterch was a well-known, highly respected scientist dealing with the structure of the Earth's crust and upper mantle, the father of seismic surveying of the lithosphere. He was a pioneer of this type of research in polar regions and in many European countries, as well as an initiator of large-scale seismic programs. Professor Guterch was a mentor and guide to many generations of geophysicists. The results of his research have been presented in more than 250 publications. This outstanding geophysicist was employed at the Institute of Geophysics of the Polish Academy of Sciences.

Fig. 1. Funeral Mass for Aleksander Guterch at the Church of St. Joseph at Sękowa, January 3, 2024 (photo by Edward Gaczyński).


Akt Nadania

Rada Gminy Sękowa uchwałą
Nr XXXVI/309/2013 z dnia 12.08.2013 r.
nadaje

Aleksandrowi Guterchowi

tytuł
Honorowego Obywatela Gminy Sękowa

za wybitne osiągnięcia naukowe,
wspieranie lokalnych inicjatyw
oraz rozsławianie rodzinnej miejscowości.

Wójt Gminy Sękowa

Rada Gminy Sękowa

Sękowa, sierpień 2013 r.

Fig. 2. The act of granting the title of Honorary Citizen of the Sękowa Municipality to Prof. Aleksander Guterch.

He was a member of many prestigious national and international Scientific Committees, Societies and Expert Panels. He was also the winner of many awards and honors, just to name a few: Knight's Cross of the Order of Polonia Restituta, the Officer's Cross of the Order of Polonia Restituta, and the Bene Merito Badge of Honor.

In addition to his successes in science, Aleksander Guterch made significant achievements in promoting and enhancing the tradition of Polish arms and uniforms.

As a tribute to his outstanding scientific achievements, his great contributions to Polish and world geophysics (notably seismology), but also for his great interest in the local problems of Sękowa and support for its initiatives, the Municipality Council, on the occasion of the 650th anniversary of the location of the village of Sękowa, granted Professor Guterch, in the year 2013, the title of **Honorary Citizen of the Sękowa Municipality**. He was a true ambassador of our municipality and the village of Sękowa; he was proud of his birthplace, maintained close contact with the residents and was interested in local issues.

With his life and activities, he was making his homeland famous, bringing us honor and satisfaction. We are proud of him!

I will remember Professor Aleksander Guterch as a very charming and modest man. The contact with him was always very special; he demonstrated great class and a natural personal culture. He was friendly, open to others, and full of kindness and warmth.

He will forever be part of the history of the Sękowa Commune, to which he has returned after many years.

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Annex 1.

Aleksander Guterch's Curriculum Vitae

This Annex contains CV prepared by Aleksander Guterch himself in 2018, translated into English and slightly updated. The next Annex provides his full bibliography.

Born – February 16, 1936, Sękowa near Gorlice, Podkarpacie.

Employment – Institute of Geophysics, Polish Academy of Sciences (IG PAS), Ks. Janusza 64, 01-452 Warsaw.

Scientific field, education, and positions

Geophysics: seismology, structure and physics of the Earth's interior, geodynamics

1961 – master's degree – University of Warsaw, Faculty of Physics, Mathematics and Chemistry with a specialization in geophysics; employed as a research assistant;

1963 − 2023 – employed at IG PAS;

1969 – PhD in physical sciences, assistant professor, Department of Geophysics, PAS, Warsaw;

1972 – appointment as an independent researcher, IG PAS;

1974 – habilitation, AGH University of Science and Technology, Cracow, Poland;

1981 – appointment as associate professor, IG PAS;

1990 – appointment as full professor, IG PAS;

1969−2012 – Head of the Independent Deep Structures Unit and then the Department of Seismic Research of the Lithosphere at the IG PAS;

2013−2023 – Professor at the IG PAS.

Foreign scientific fellowships

1967/68 – Institute of Mathematics of the Academy of Sciences of the USSR in Leningrad, studies on the theory of seismic wave propagation;

1971/72 – Department of Earth Sciences, University of Texas, Dallas, USA, research on the structure and physics of the lithosphere;

1972−2016 – numerous short-term visits abroad.

Elective membership in scientific societies

1987 – Warsaw Scientific Society, corresponding member;
1994 – Warsaw Scientific Society, full member;
1989 – Polish Academy of Sciences, corresponding member;
1998 – Polish Academy of Sciences, full member;
1999 – Polish Academy of Arts and Sciences, corresponding member;
1992 – European Academy – ACADEMIA EUROPAEA, London;
2002 – Hungarian Society of Geophysicists, honorary member.

Prizes and awards

1970 – Award of Division III of the Polish Academy of Sciences;
1974 – Team award of the Polish Academy of Sciences (team leader);
1976 – State Award of the first degree in science, team (team leader);
1980 – Badge of Merit for Oil and Gas Mining, awarded by the Association of Oil and Gas Mining;
1980, 1983, 1986 – Awards of the Polish Academy of Sciences, team (team leader);
1997 – Award of the Minister of Environmental Protection, Natural Resources and Forestry;
2003 – The Prime Minister's Award for outstanding scientific achievements;
2006 – Award of the President of PAS granted for scientific and organizational activity while managing the works of the Polar Research Committee;
2009 – Certificate of Appreciation awarded by The World Meteorological Organization and the International Council for Science "to Aleksander Guterch – Chairman of the Polish Committee for the 4th International Polar Year 2007–2008, with thanks for his activity and enthusiasm in the activities and implementation of the objectives of the 4th International Polar Year 2007–2008";
2013 – Medal of the 60th anniversary of the IG PAS awarded for scientific and organizational activities;
2016 – Medal of the Tadeusz Kościuszko Foundation in Kraków – In Memoriam – for upholding the Kościuszko tradition and the history of the Polish Army;
2016 – Memorial badge of the Polish Army Museum for services to the Museum;
2018 – Professor Adam Dziewoński Medal awarded for outstanding achievements by the Order Jury at IG PAS, under the honorary patronage of the Minister of Education and Science.

State awards

1973 – Knight's Cross of the Order of Polonia Restituta;
1998 – Officer's Cross of the Order of Polonia Restituta;
2015 – BENE MERITO Badge of Honor awarded by the Minister of Foreign Affairs of the Republic of Poland "in recognition of his merits in promoting and strengthening the position of the Republic of Poland in the international arena".

Participation in Scientific Committees, Associations and Specialized Panels – national and international

1968−2023 – Committee on Geophysics, PAS, 1968–80 – Scientific Secretary;

1977−2023 – National Committee for Cooperation with the International Union of Geodesy and Geophysics, 1983–1989 Chairman;

1976−1988 – Vice-President of the Sub-Commission for the Explosive Seismology, European Seismological Commission;

1980–2023 – Committee for Polar Research at the Presidium of the PAS; 1991–1999 Vice-Chairman, 1999–2007 Chairman of the Committee, member of the Presidium;

1991−2001 – member of the top management of the European Geodynamic Research Project EUROPROBE, covering the entire European continent from the Atlantic in the west to the Urals in the east, with the participation of teams from 30 European countries, Canada and the USA. Member of the EUROPROBE Scientific Steering Committee and Member of the EUROPROBE Management Committee, ESF, Strasbourg;

1993−2005 – Chairman of the Geological Council at the Ministry of Environmental Protection, Natural Resources and Forestry;

1995−1998 – Member of the Earth Sciences Panel for TRR Networks, European Commission, Brussels;

1995−2010 – Founder and President of the Association for Deep Geological Investigations of Poland (ADGIP). Non-profit organization, founded with the participation of the PAS, the Polish Geological Institute, and PGNiG S.A.;

2000−2007 – National Committee at the Presidium of the PAS on Scientific Committee on Antarctic Research and International Arctic Scientific Committee, Chairman;

2001−2016 – Representative of PAS to the European Polar Board, European Science Foundation, Strasbourg, European Union, Brussels (European Polar Council), 2004−2007 – Vice President;

2003−2012 – National Committee for Cooperation with the European Science Foundation (ESF) at the Presidium of the PAS, 2007–2012 – Vice-chairman;

2006 − National Committee for Polar Treaties at the Presidium of the PAS (Arctic Council, Antarctic Treaty), Chairman;

2006−2011 – Polish National Committee for Fourth International Polar Year 2007–2009 at the Presidium of the PAS, Vice-chairman;

2006−2010 – Steering Committee of the international program "Plate Tectonics and Polar Gateways in Earth History", 4th International Polar Year, Cluster 77, Heads of the Arctic and Antarctic IPY, member;

2011 – The POLAR TASK FORCE working group, Legal and Treaty Department of the Ministry of Foreign Affairs of the Republic of Poland (integration of activities of economic ministries, the Ministry of Science and Higher Education and PAS in the polar regions of the Earth), member;

2015 – The Audit Committee of the PAS, member;

1978 – Member of the Association of Old Arms and Colours at the National Museum in Kraków (Scientific Association), 2000–2016 – President of the Association, currently an Honorary Member;

2014 – Member of the Józef Piłsudski Institute in Warsaw.

Participation in Scientific Councils

1972−2023 – Member of the Scientific Council at the IG PAS;

1981−2007 – Member of the Scientific Council at the Polish Geological Institute, 1995–2007 Vice Chairman of the Council;

2000−2008 – Member of the Scientific Council at the Institute of Geophysics, UW;
1994−2023 – Member of the Editorial Committee of the Polish Polar Research.

Didactic activity

- Promotion of five PhDs at the IG PAS;
- Popular science lectures in high schools and in the framework of the Common Knowledge Society School "Wszechnica Polska" as well as at the Warsaw Scientific Society meetings;
- Lectures at the University of Silesia and several lectures at the Doctoral School of the IG PAS.

Polish and international scientific programs and projects (selected examples)

1982−1991 – Coordinator of the PAS Interdepartmental Nodal Problem – "Polar Research", and then of the "Central Polar Research Program" No. 03.03 of the PAS – Research of Living Resources, Lithosphere and Environment of Polar Regions;

1976−2008 – Organizer and/or leader of five geophysical expeditions to the Arctic (1976, 1978, 1985, 1999, and 2008) and five geodynamic expeditions (geophysics, geology, paleontology) to West Antarctica (1979/80, 1984/85, 1987/88, 1990/91, 2007), including four international expeditions, with the participation of scientific teams from Norway, Germany, and Japan;

1975−2010 – Chairman of the Organizing Committees and Coordinator of Polish and international seismic experiments. International experiments: VII, VIII, LT-7, TTZ, POLONAISE'97, CELEBRATION 2000, SUDETES 2003, GRUNDY 2003, co-organizer of ALP2002;

The seismic experiments POLONAISE'97, CELEBRATION 2000, ALP2002, and SUDETES 2003 carried out in the area of Central Europe with the participation of 35 institutions from 13 European countries, the USA, and Canada, using a record number of the newest seismic instruments (mainly from scientific centers in the USA and Canada), are among the largest research projects of this type in the history of world geophysics. The leading role in these scientific projects was kept by the Polish side. The costs of the Polish participation in the aforementioned research projects were covered to a significant extent (more than 70%) from off-budget and foreign funds;

Active participation in other international experiments in Europe, such as SVEKA'91, EUROBRIDGE'95 and 96, TOR (1996–97), DOBRE'99, VRANCEA2001, PASSEQ 2006, PANCAKE (DOBRE-3) 2008, and other projects;

2000−2010 – Management of several grants of the Committee for Scientific Research at the Ministry of Science, including Targeted Ordered Project KBN-PCZ-006-21 (2000–2003) established at the request of the Ministry of Environment;

Management of the interdisciplinary Ordered Research Project PBZ-108-KBN-MNiI/2004, in the field of polar research (geodynamics, natural environment, biology) established by the Ministry of Science and Information Technology;

2010 – Organizer and manager of the POLCRUST01 deep seismic reflection research project carried out by the Scientific and Industrial Consortium with the participation of the Institute of Geophysics PAS (leader of the Consortium), PGNiG S.A., the Ministry of the Environment (NFOŚiGW), GEOFIZYKA Toruń. The project (very expensive) was carried out exclusively with non-budget funds.

Participation in major symposia, conferences, and congresses

The research achievements were presented at numerous scientific meetings at home and abroad, including prestigious symposia in Europe, the USA, and Japan. Some examples:

- Presentation of "The Results of Seismic Surveys of Deep Structures of the Earth's Lithosphere in the Area of Central Europe" (seismic experiments POLONAISE'97 and CELEBRATION 2000), at the World Exhibition EXPO 2000, Hannover, Germany. The oral and poster presentation was one of the four scientific presentations invited from Poland;
- Symposium on "Challenges for Earth Sciences in the 21st Century", Karlsruhe, Germany, 2002 (invited lecture);
- Crafoord Symposium "Earth and Planetary Dynamics", Royal Swedish Academy of Sciences, Stockholm, 2003 (invited lecture, symposium organized on the occasion of granting the Crafoord Prize by the Swedish Academy of Sciences and the King of Sweden);
- "4-D Framework of the Continental Crust – Integrating Crustal Processes Through Time", International Basement Tectonic Conference, Oak Ridge, Tennessee, USA, 2004 (invited lecture);
- International Symposium on "Deep Seismic Profiling of the Continents and Their Margins" – SEISMIX 2008, Saariselkä, Finland. Invited lecture: "European Crust and Moho Discontinuity: One Hundred Years Since the Discovery of the Crust-Mantle Boundary".

Publications

Author or co-author of about 250 publications[1] (https://publikacje-zsbl.igf.edu.pl/) mostly in international journals, including *Tectonophysics*, *Journal of Geophysical Research*, *Tectonics*, *Physics of the Earth and Planetary Interiors*, *Geophysical Journal International*, *Annales Geophysicae*, *Journal of Geodynamics*, *Geophysical Prospecting*, and in international monographs, including:

- *Geological Evolution of Antarctica*, Cambridge University Press, 1991;
- *Palaeozoic Amalgamation of Central Europe*, Geological Society, London, Special Publication No. 201, 2002;
- *Antarctica – Contributions to Global Earth Sciences*, Springer-Verlag, Berlin, New York, 2006;
- *Treatise on Geophysics. Vol. 1. Seismology and Structure of the Earth*, Elsevier, Amsterdam, Boston, London, New York, Oxford, Paris, San Francisco, Sydney, Tokyo (1st ed. 2007 – A. Guterch, M. Grad, G.R. Keller; 2nd ed. 2015 – A. Guterch, M. Grad, G.R. Keller, E. Brückl). Volume editors: B. Romanowicz and A. Dziewoński (The monograph presents a summary of the most important results of research achieved in the field of geophysics from the end of the 19th century to the present);
- *Petroleum Geological Atlas of North-Western and Central Europe. Millennium Atlas No. 2*, EU, 2010 (Chapter 2 – A. Guterch, S. Wybraniec, M. Grad, A. Chadwick, Ch. Krawczyk, P. Ziegler, H. Thybo, W. De Vos), which provides a synthesis of all geophysical research done up to now in North-Western and Central Europe.

Citations (SCOPUS): >5000 **Hirsch Index:** 49 (according to SCOPUS)

[1] Such a number was given by the author in 2018. As you may see in the next, Annex 2, https://pub.igf.edu.pl/files/Pdf/Arts/709.pdf?t=1732722512, after our careful search and updating, this number exceeded 380.

Organization of scientific meetings

1968−2000 – convening tens of workshops, national and international conferences and symposia. To give an example, it was only in the years 1991−2000 that seven international meetings were organized in Poland (Jabłonna, Warsaw, Kielce, Książ near Wałbrzych, Kraków–Zakopane, Suwałki, Zakopane) in the framework of the European EUROPROBE Project, ESF.

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Annex 2.

Aleksander Guterch's Bibliography 1963–2023

This bibliography was compiled at the Department of Lithospheric Research and is also available on the Department's website, in the tab https://publikacje-zsbl.igf.edu.pl/.

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1965

Wojtczak-Gadomska, B., **A. Guterch**, and J. Uchman (1965), Glubinnyje seismiczeskoje zondirowania w Polsze. **In:** *1 Miežđunarodnyj Simpozjum po Głubinnomu Zondirowaniu, 3–13 ferval 1965, Brno*, 83–91 (in Russian).

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Annex 3.

Measurement
(photographs)

Selected by Tomasz JANIK

INSTRUMENTS

Fig. 1. Setting up the equipment during measurements on Spitsbergen, 1976. Modular equipment, specially adapted to be carried in a backpack.

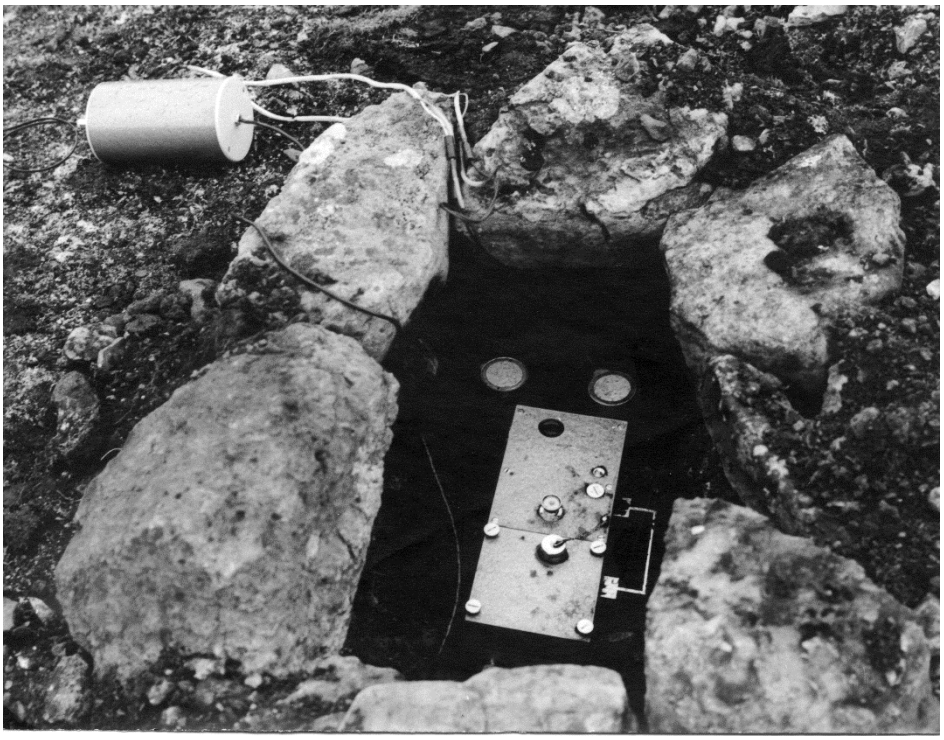

Fig. 2. Setting up the equipment and seismometer (1 s) of the IG PAS design, during research on Spitsbergen in 1976.

Fig. 3. Zbigniew Czerwiński performs recordings using the first model of analogue equipment with simultaneous recording on photosensitive paper and magnetic tape, with manual operation. Antarctica 1979, Keller Peninsula (King George Island).

Fig. 4. Seismometer designed by IG PAS, manufactured by ZUD-GIG (SPI-70) (1 s), measurements in Antarctica.

Fig. 5. Prototype of the PCM station placed in a hus in Spitsbergen, 1985. Operator, Tomasz Janik.

Fig. 6. SM-3, Soviet Union-made seismometer (1 s) during measurements on Spitsbergen, 1985.

Fig. 7. Engineer Andrzej Skrzyński, MSc, securing the seismometer site during measurements on Spitsbergen, 1985.

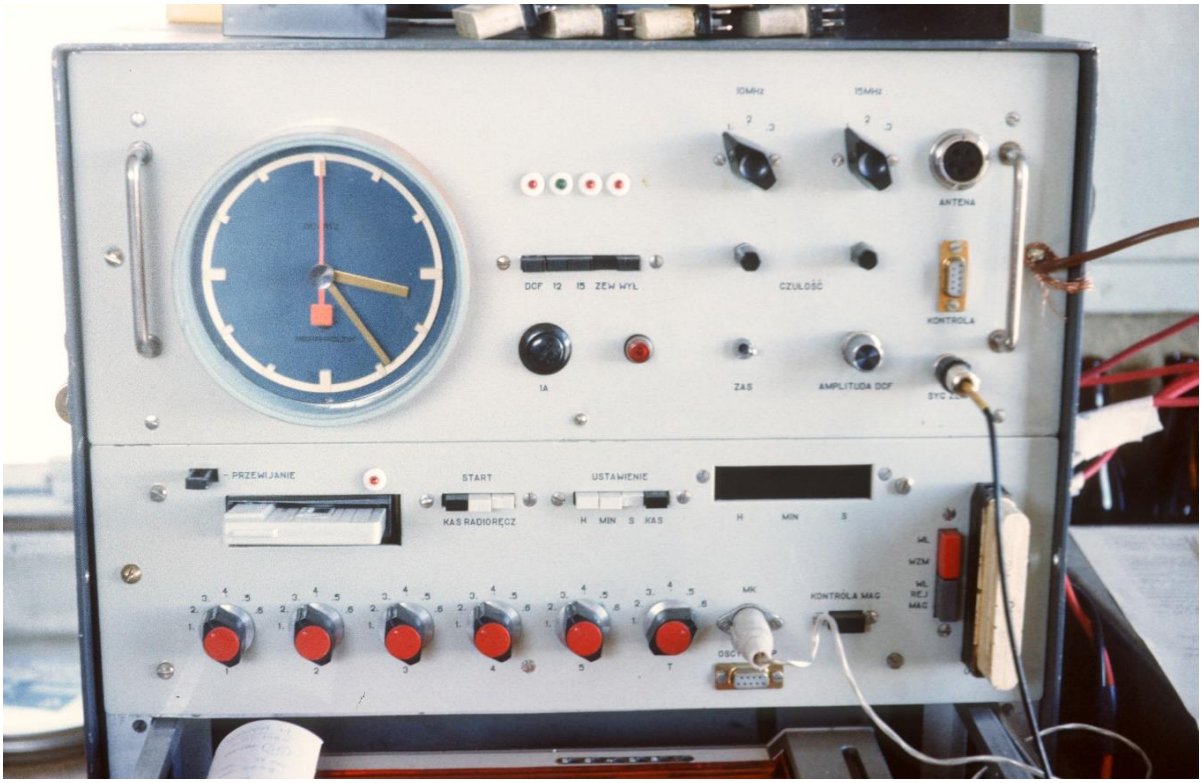

Fig. 8. PDM analogue equipment with parallel recording on photosensitive paper (Japanese ECG recorder) and on magnetic tape, with manual operation.

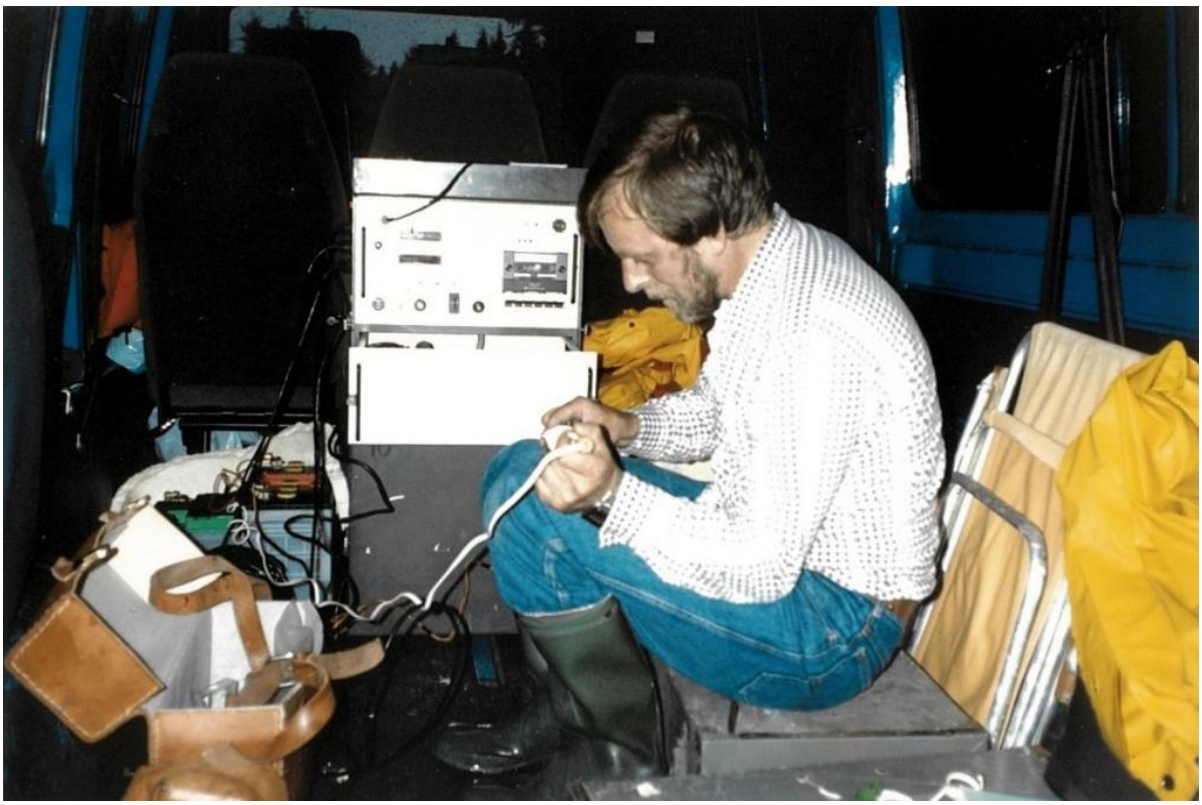

Fig. 9. Zbigniew Czerwiński at the PCM equipment, digital recording on magnetic tape. Parallel analogue recording on photosensitive paper. Measurements in Pomerania, 1991, LT-7 project.

Fig. 10. Tomasz Janik, measurements in Tuchola Forests (Bory Tucholskie) 1997, POLONAISE'97 project. Finnish digital equipment with recording on magnetic tape, with manual operation.

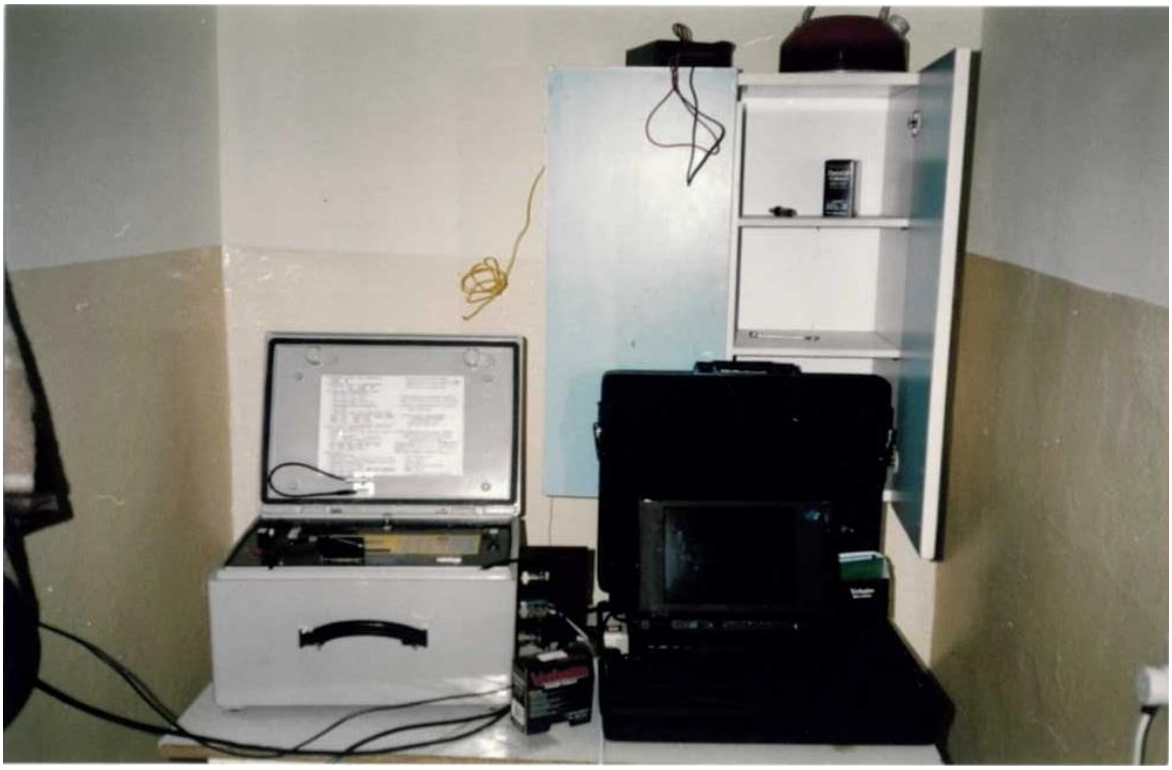

Fig. 11. PSS equipment (field seismic station) MK-3 with digital recording, 1992.

Fig. 12. MK-4P equipment with digital recording and the ability to connect a laptop. Measurements on the EB'95 profile, Lithuania 1995. From the left: Jerzy Krajczyński, Eng. Jan Wiszniowski, MSc, two Lithuanian students, and Eng. Mieczysław Rekowski, MSc.

Fig. 13. Tomasz Janik setting up a Canadian-made 3C, Mark–L4C geophone, used alternatively with SM-3 seismometers for measurements with the MK-3 and MK-4P devices. Measurements during the SVEKALAPKO passive experiment, Finland, 1998.

Fig. 14. Reftek 72 broadband devices. The main base of the POLONAISE'97 project in Toruń.

Fig. 15. Reftek 125 Texan short-period devices – preparations for measurements. The main base of the CELEBRATION 2000 project in Kraków.

Fig. 16. Canadian PRS short-period devices – preparations for measurements. The main base of the CELEBRATION 2000 project in Kraków.

Fig. 17. Transcase with 15 Reftek 125 Texan field seismic short-period devices. Used by our team since 1997 until now. Initially only rented, and since 2000 also owned.

Fig. 18. Reftek 125 Texan (recorder) with geophone (4.5 Hz).

Fig. 19. Drilling holes in the rock bed for the geophone pins of the Reftek 125 Texan. Profile UPPLAND (BASIC), southern Sweden, 2017 *(photo Dariusz Wójcik)*.

Fig. 20. Loading data from the memory of Reftek 125 Texan and CUBE recorders after an experiment performed on the GEORIFT 2013 profile, Kyiv, Ukraine. From the left: Jarosław Grzyb, Wojciech Czuba, Mariusz Majdański, and Dima Gryn'.

Fig. 21. A set of 100 short-period CUBE 3C field seismic stations with three-component geophones. Used since 2013.

Fig. 22. Eng. Dariusz Wójcik, MSc, and his trainee set up a 3C (4.5 Hz) geophone with a CUBE recorder during measurements on the TTZ-South profile, 2018.

Fig. 23. Preparation of the "interior" of the Japanese OBS for measurements onboard Neptunia. Hajime Shiobara (left) and Tomoo Watanabe, West Antarctica 1991 *(photo Marek Grad).*

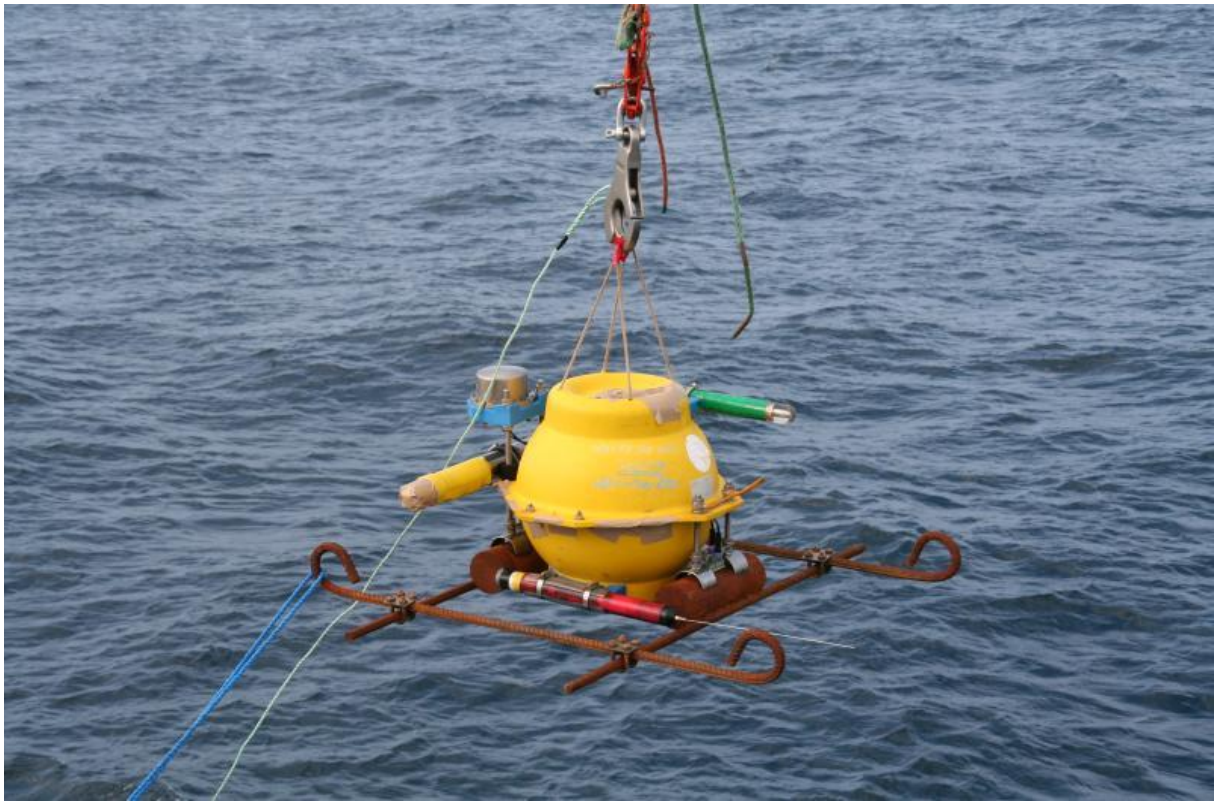

Fig. 24. Deploying of a Japanese OBS during the Horsted experiment, 2005 *(photo Wojciech Czuba).*

Fig. 25. Preparation of Güralp OBSs for measurements, North Atlantic (Norwegian research vessel G.O. Sars). Standing from the right: Szymon Oryński, Weronika Materkowska, Wojciech Czuba (leader), Julia Rewers, Jarosław Grzyb. KNIPSEIS project, 2019 *(photo Dariusz Wójcik)*.

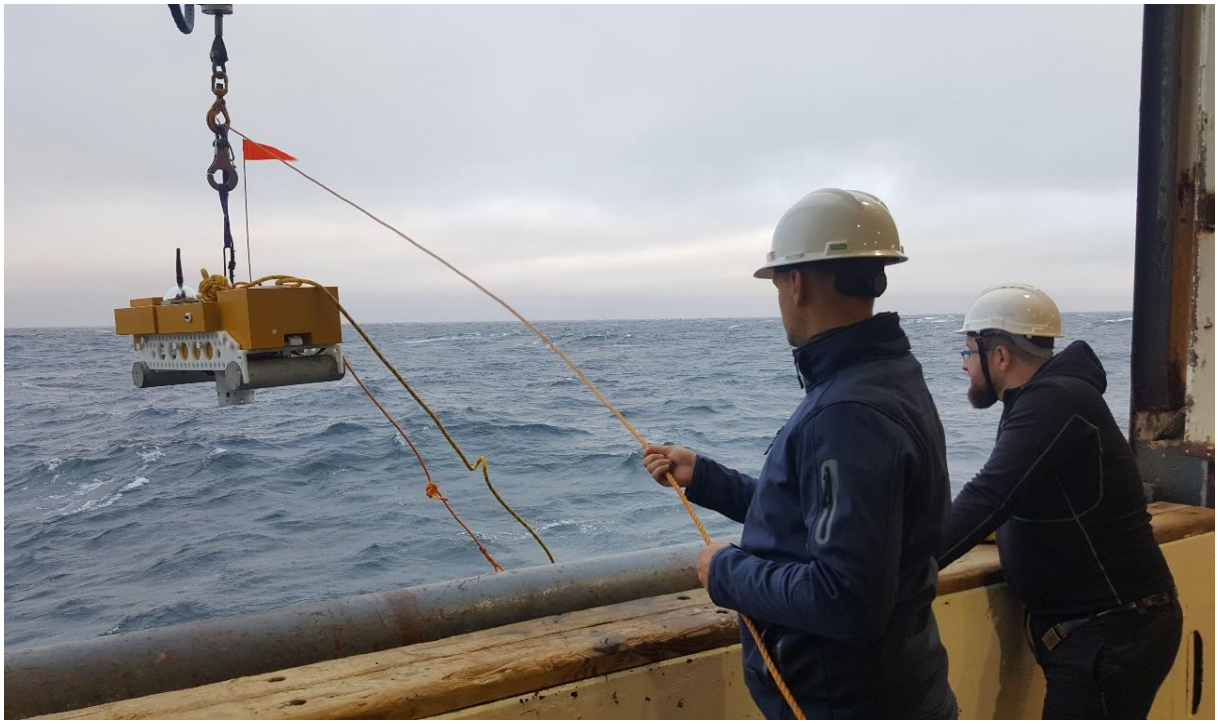

Fig. 26. Deploying a Güralp OBS, Jarosław Grzyb and Szymon Oryński, KNIPSEIS project, 2019 *(photo Dariusz Wójcik).*

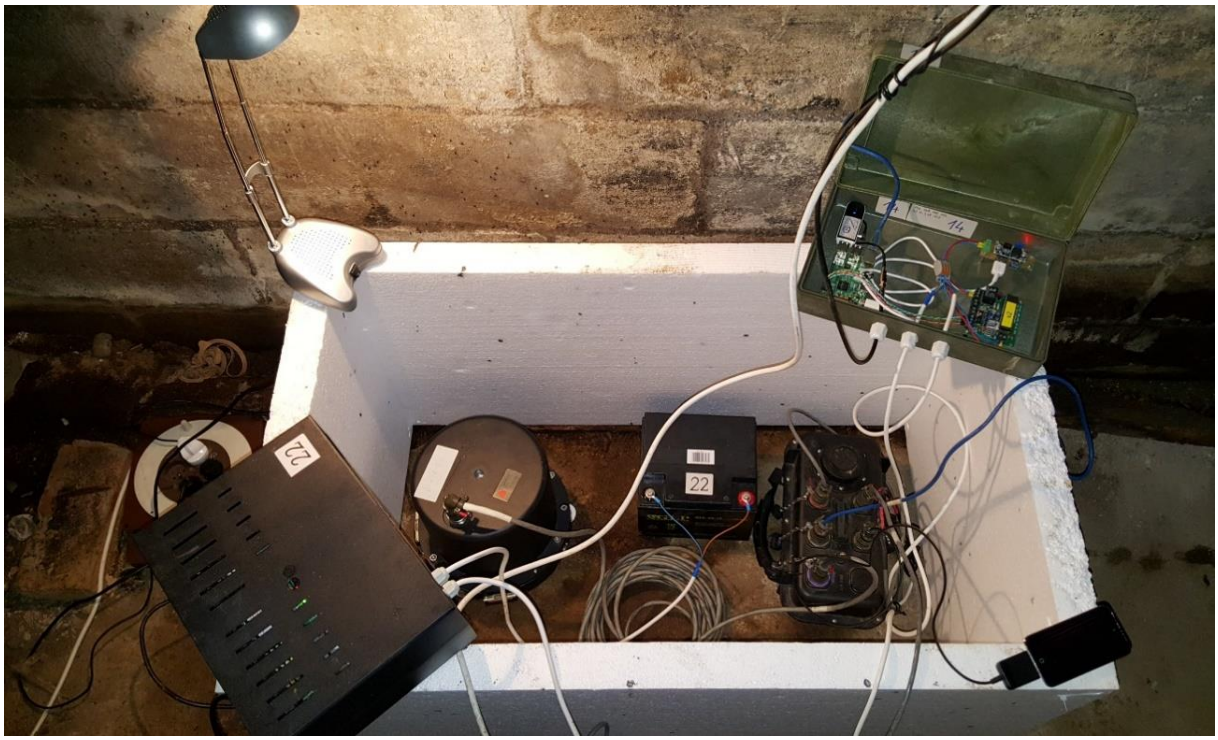

Fig. 27. AniMaLS passive project – Installation of Reftek 130 broadband seismic equipment, 2017 *(photo Piotr Środa).*

Fig. 28. Piotr Środa installs broadband equipment at one of the measurement stations of the AniMaLS project, 2017.

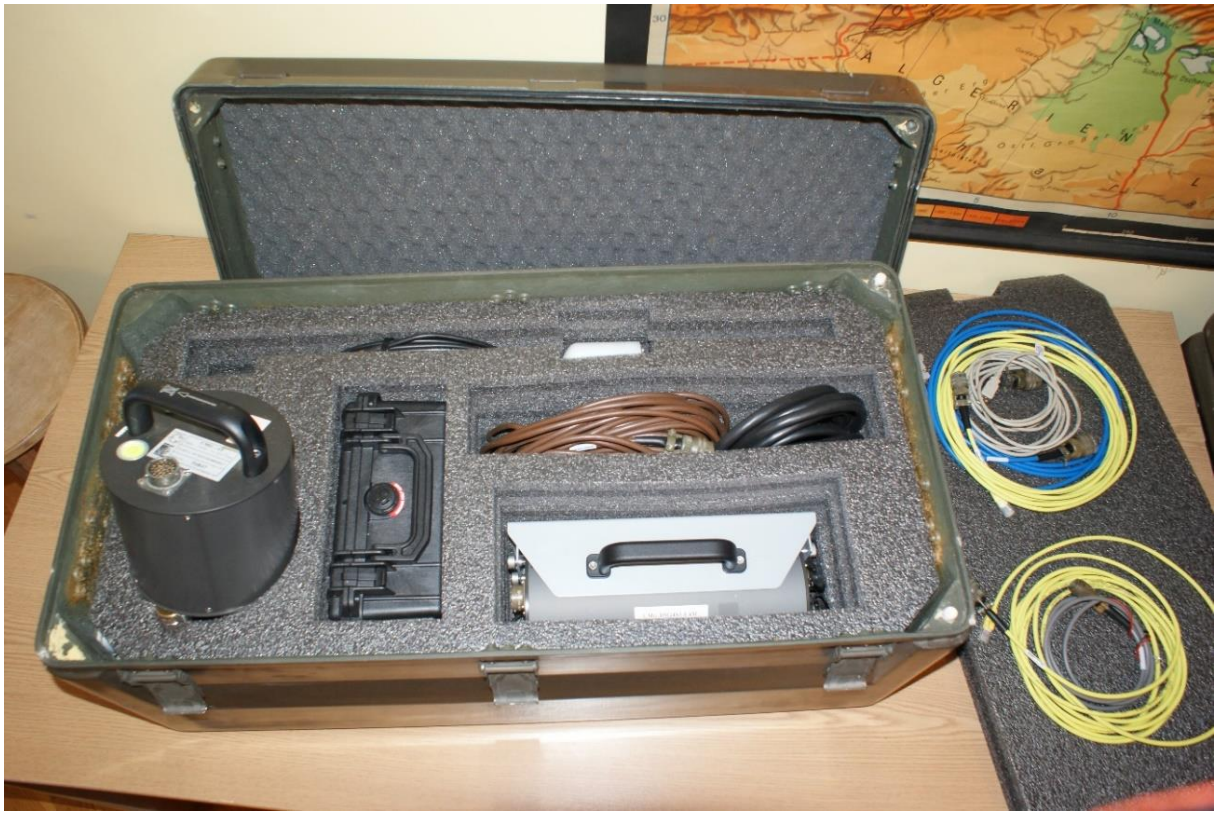

Fig. 29. Güralp CMG-40T broadband seismic apparatus (30 s), 2017.

ACTIVE SOURCES OF SEISMIC ENERGY

Fig. 30. Drilling works at one of the shooting points in the Carpathians (Ukraine), on the PANCAKE profile, 2008.

Fig. 31. One of the Geofizyka Toruń vibrators working on a deep reflective profile POLCRUST-01, 2010.

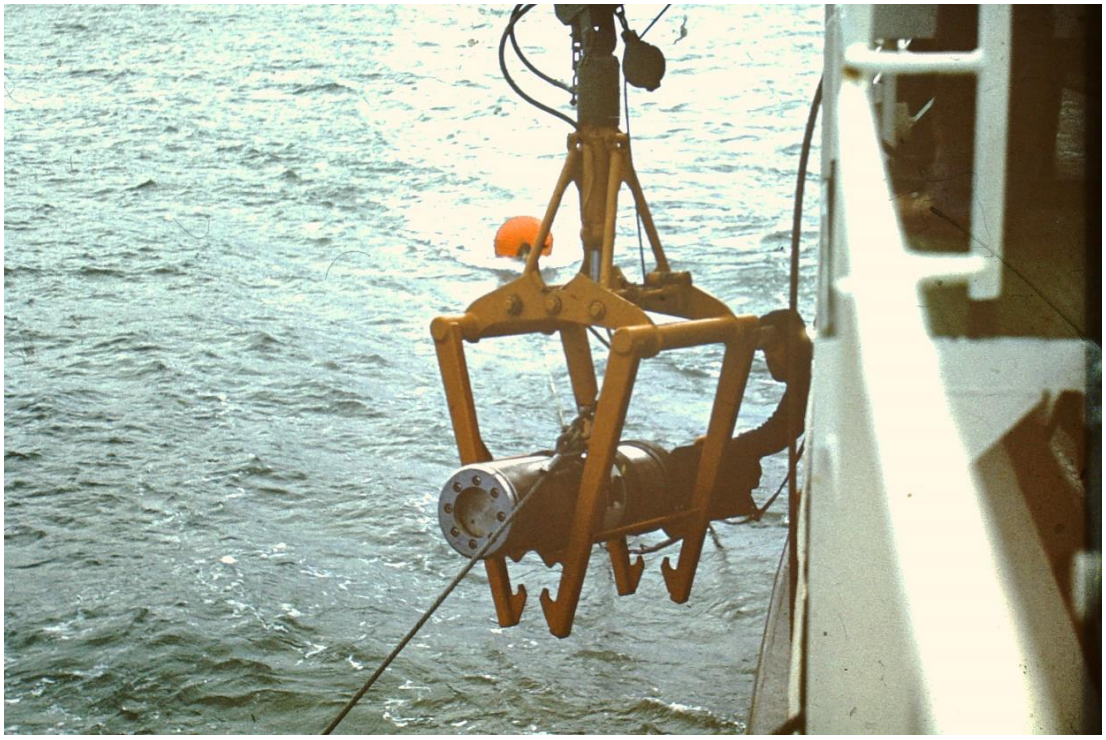

Fig. 32. Lowering one of the Bolt airguns forming a 34-liter array from the deck of ORP "Kopernik" during tests in Isfjorden (Spitsbergen) in 1978 *(photo Jan Pajchel)*.

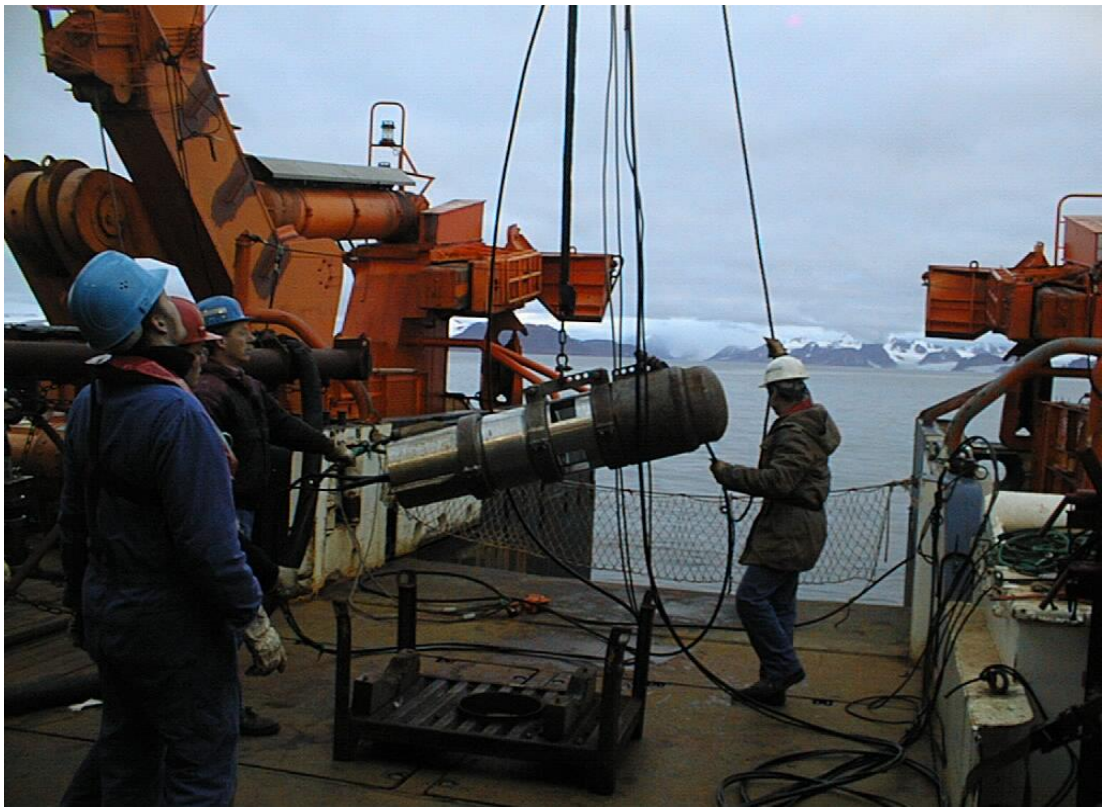

Fig. 33. Preparations for operation of a 30-liter Bolt airgun on board the German ship "Polarstern", during an expedition to the North Atlantic in 1999 *(photo Wojciech Czuba)*.

Fig. 34. The team performing blasting work on the “Jantar’s” lifeboat. Each box contained 25 kg of TNT, the detonations of which were used as a source of seismic energy. 2nd Geodynamic Expedition to the West Antarctica 1984/1985.

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Annex 4.

People
(photographs)

Selected by Tomasz JANIK

Fig. 1. Norway, on the way to Spitsbergen, 1976. From the left, standing: Andrzej Zawada, unknown person, Aleksander Guterch, Jan Pajchel, and Zbigniew Czerwiński.

Fig. 2. DSS measurements on Spitsbergen in 1976. One of the measurement bases.

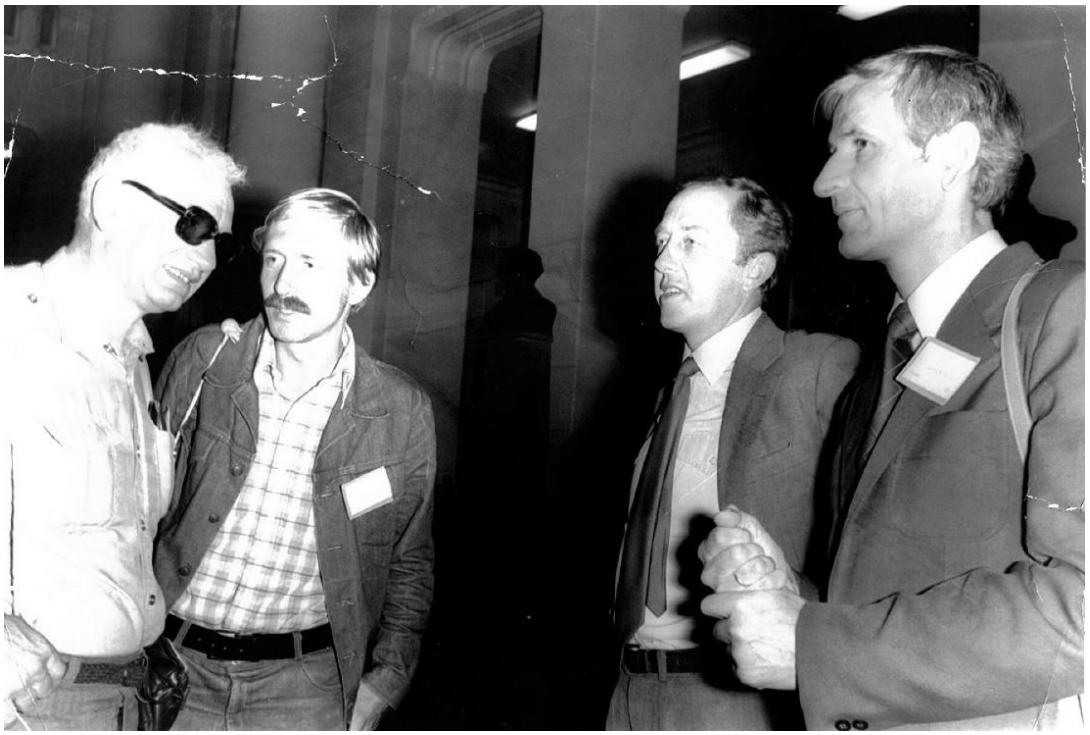

Fig. 3. Participants of an unidentified conference in the ca. 1980s. From the left: Roman Teisseyre, Edward Perchuć, Sławomir Gibowicz, and Aleksander Guterch.

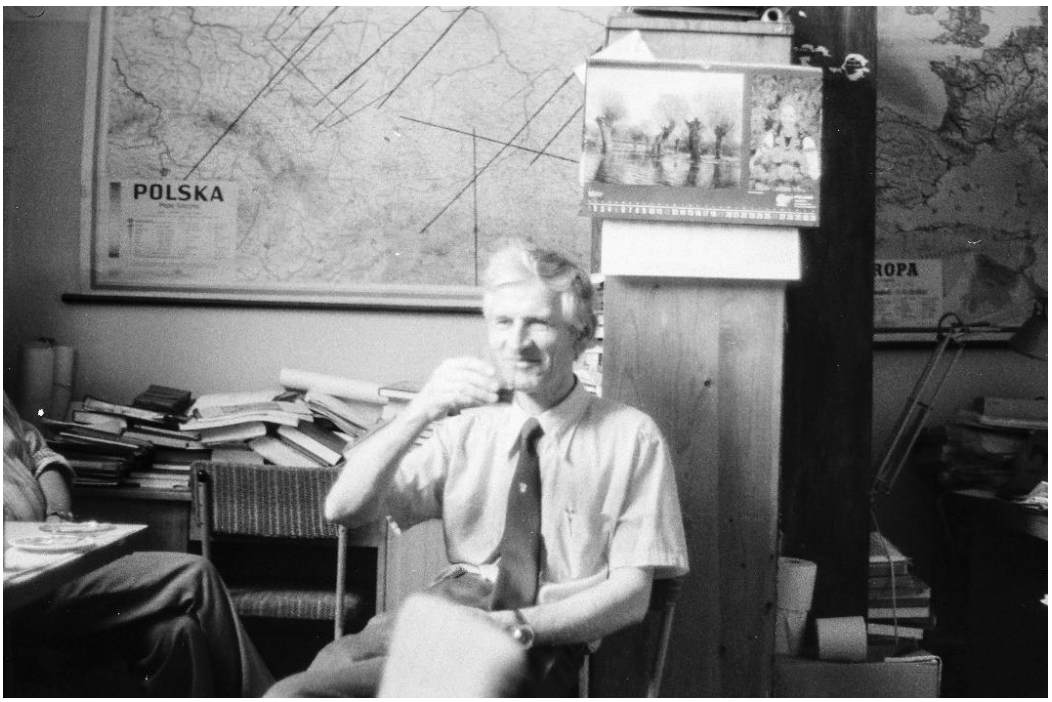

Fig. 4. Aleksander Guterch in the DSS laboratory of the Institute of Geophysics, PAS, at the headquarters located in the historical building called PASTa, Zielna street 39, ca. 1980s.

Fig. 5. Farewell meeting before setting off on the 1st Polish Geophysical Expedition to Western Antarctica, Navy officers' casino in Gdynia, December 1979. Aleksander Guterch speaks, second from the right, Prof. Zdzisław Kaczmarek, vice-president of the Polish Academy of Sciences.

Fig. 6. Farewell ceremony before setting off on the 1st Polish Geophysical Expedition to Western Antarctica, Kościuszko Square in Gdynia, December 1979. One of the Navy commanders speaking, from the left are sailors from ORP "Kopernik", the fifth is the ship's commander, Commander Franciszek Wróbel; in the back are representatives of the Polish Academy of Sciences and the city of Gdynia; Aleksander Guterch is standing behind the journalist.

Fig. 7. ORP "Kopernik" in Admiralty Bay, King George Island, December 1979.

Fig. 8. Landing of one of the survey groups on Deception Island. Aleksander Guterch carries batteries. In the background, one may see ORP "Kopernik", 1979.

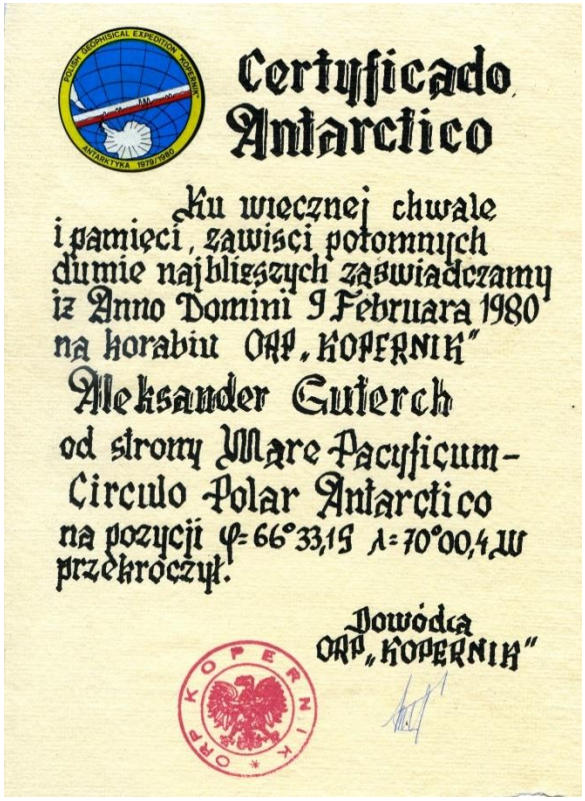

Fig. 9. Diploma certifying Aleksander Guterch's crossing the Southern Arctic Circle, certified by the commander of ORP "Kopernik".

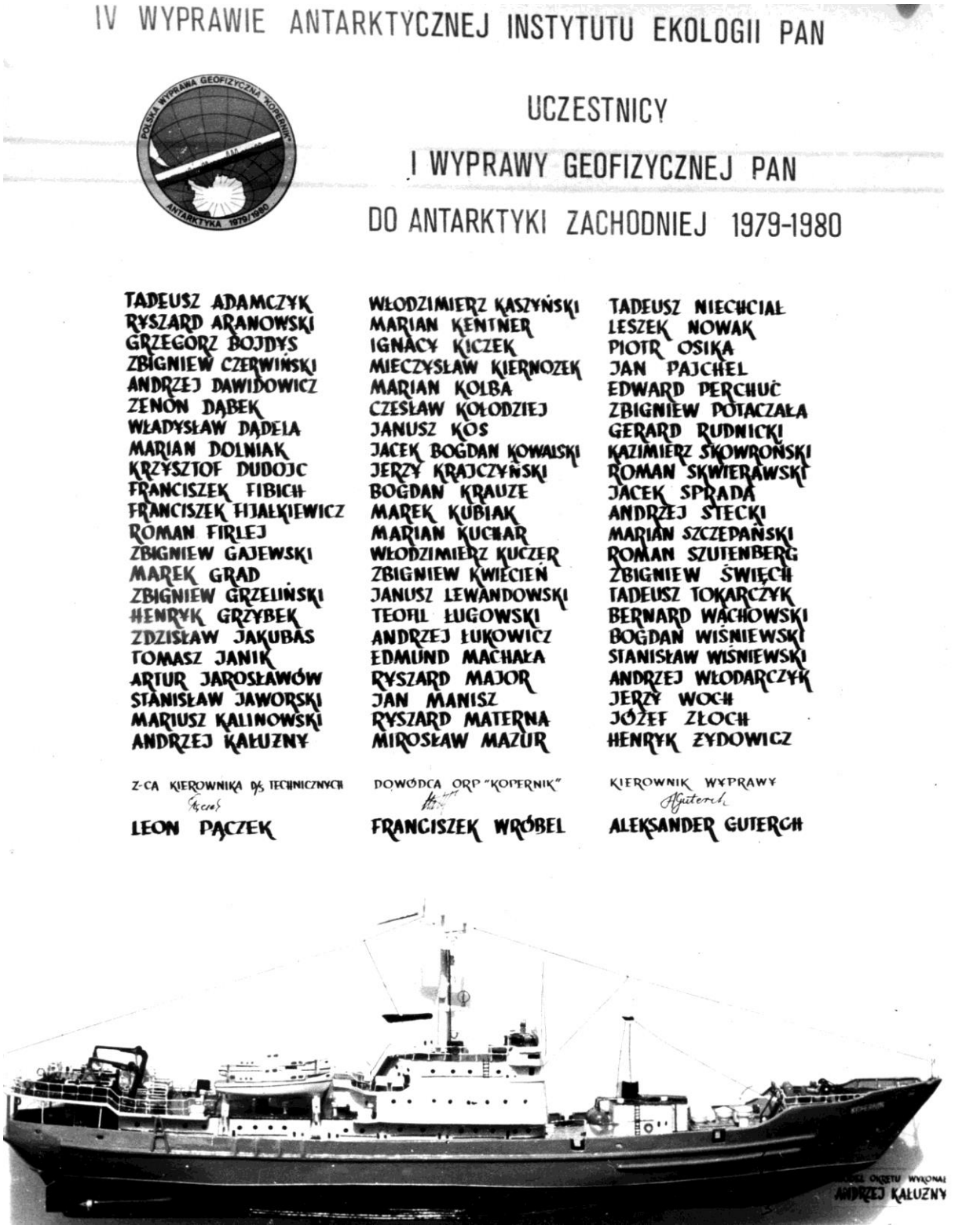

Fig. 10. A gift given to the 4th Antarctic Expedition of the Institute of Ecology to the station named after Henryk Arctowski by the participants of the 1st Geophysical Expedition to Western Antarctica, 1979/1980. It was a large display case made of thick plexiglass, containing a list of all the expedition participants and a beautiful model of the ORP "Kopernik" made by Andrzej Kałużny. Unfortunately, years later, it turned out that the display case had gone missing.

Fig. 11. “Jantar” near the Antarctic Peninsula during the 2nd Geodynamic Expedition to West Antarctica, 1984/1985.

Fig. 12. Unloading equipment from “Jantar” for one of the measurement groups located on Danco Island during the 2nd Geodynamic Expedition to West Antarctica, 1984/1985.

Fig. 13. The leader of the expedition, Aleksander Guterch, goes on the “Neptunia” lifeboat to a meeting with the management of the polar station where the next measurement group is to be placed. The 4th Polish Geodynamic Expedition to West Antarctica in 1991.

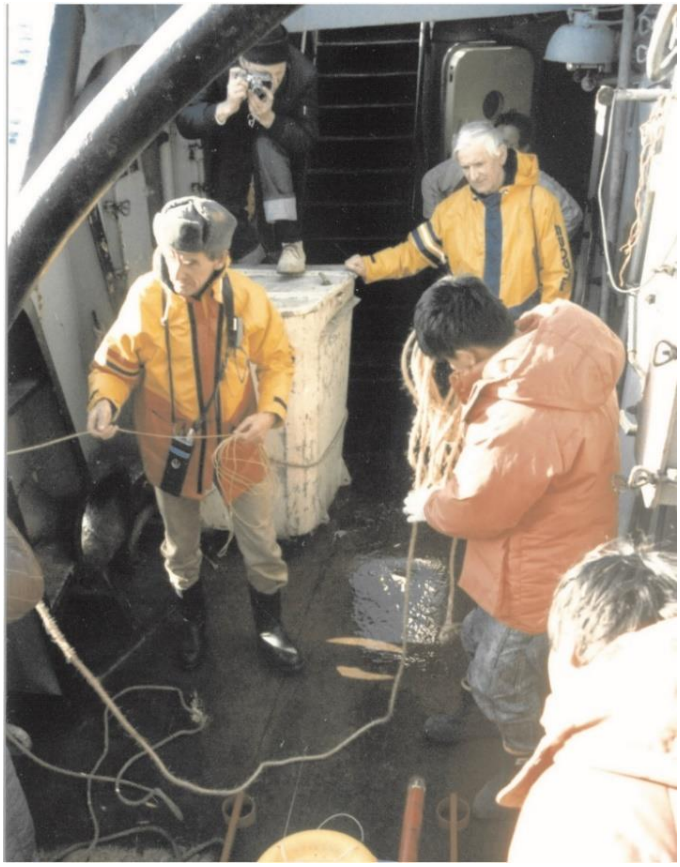

Fig. 14. The operation of lifting the Japanese OBS from the bottom of the Bransfield Strait. Janusz Niewiadomski in a yellow storm jacket on the left, and Aleksander Guterch on the right. The 4th Polish Geodynamic Expedition to West Antarctica, 1991.

Fig. 15. The ceremony at the end of the 2nd Polish Geodynamic Expedition to West Antarctica, "Jantar" mess, 1985. Seated from the left: Eng. Leon Pączek, Prof. Krzysztof Birkenmajer, Prof. Aleksander Guterch, Captain Jan Boruta, Dr. Maciej Zalewski, and Wiesław Wiórkiewicz, representative of PAS. At the back, on the right side, Dr. Marek Górski.

Fig. 16. The ceremony at the end of the 4th Polish Geodynamic Expedition to West Antarctica, "Neptunia" mess, 1991. Seated from the left: chief engineer, Prof. Krzysztof Birkenmajer, Prof. Krzysztof Kwarecki (Military Institute of Aviation Medicine), Prof. Aleksander Guterch (speaking), and Captain Zbigniew Kułaga.

Fig. 17. Group photo taken aboard “Jantar” in Buenos Aires, 1985. Aleksander Guterch in the central part, under the penguin.

Fig. 18. Argentina, visiting Disneyland during forced two-week internment on the way back from Antarctica, 1985. Aleksander Guterch and Tomasz Janik.

Fig. 19. Aleksander Guterch, disembarkation from “Neptunia”, transfer to a plane, Montevideo, 1991.

Fig. 20. DSS laboratory in the PASTA building, Zielna street 39. Standing from the left: Aleksander Guterch, guest Andrzej Kijko, Tomasz Janik, Zbigniew Czerwiński, Edward Gaczyński, Rufin Materzok, crouching Edward Perchuć, ca. 1986.

Fig. 21. The ceremony of awarding the honorary doctorate from the University of Silesia to renowned glaciologist Jon Ove Hagen. From the left: Prof. Tadeusz Niedźwiedź, Prof. Aleksander Guterch, Prof. Wojciech Zieliński – Rector of the Silesian University of Technology, and Prof. Julian A. Dowdeswell. Auditorium of the Faculty of Earth Sciences in Sosnowiec, May 1992.

Fig. 22. The main base of the POLONAISE'97 experiment at the headquarters of Geofizyka Toruń, May 1997. Project management; Aleksander Guterch (standing) and Marek Grad (sitting behind the desk).

Fig. 23. Aleksander Guterch in the old town of Toruń with participants of the POLONAISE'97 project, Prof. Randy Keller and Prof. Hans Thybo, 1997.

Fig. 24. The main base of the SUDETES 2003 experiment in Brzeg Dolny. Prof. Aleksander Guterch together with Eng. Adam Opak from Geofizyka Toruń.

Fig. 25. SUDETES 2003 experiment. Standing from the left: Steven Harder, Aleksander Guterch, Wojciech Czuba, and Robert Pietrasiak.

Fig. 26. Annual reports of the IG PAS, 2008. Aleksander Guterch on the left.

Fig. 27. The staff of the Department of Lithospheric Research, 2013. Standing from the left: Andrzej Górszczyk, Michał Malinowski, Aleksander Guterch, Ewa Mazurek, Tomasz Janik, Piotr Środa, and Jarosław Grzyb. Seated from the left: Mariusz Majdański, Anna Adamczyk, Wojciech Czuba, and Edward Gaczyński.

Fig. 28. Workshop of the PASSEQ passive research project, Jachranka 2013. In the front row: Marek Grad and Aleksander Guterch.

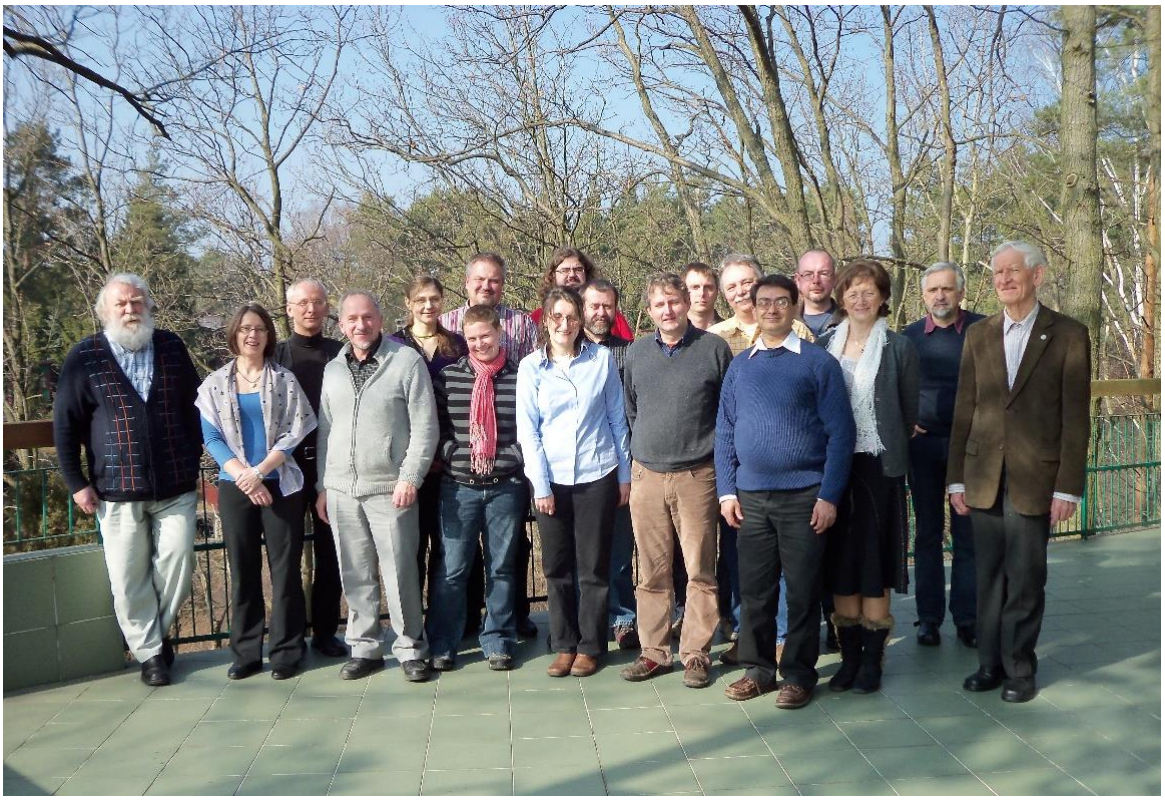

Fig. 29. Group photo of participants of the PASSEQ project Workshop, Jachranka 2013. First from the left – Marek Grad, first from the right – Aleksander Guterch.

Fig. 30. Visiting Siena, in free time, during the 7th International Symposium on Antarctic Earth Sciences, 10–15 September 1995, Siena (Italy). Aleksander Guterch with his wife Barbara and Marek Grad on the steps of the cathedral.

Fig. 31. Aleksander Guterch, resting during a break from the conference “The Scotia Arc: Geodynamic Evolution and Global Implications” in Grenada, Spain, 2013.

Fig. 32. Celebration of the 65th anniversary of the IG PAS, Staszic Palace, 2018. During this ceremony, Prof. Guterch received the Adam Dziewoński Medal for outstanding achievements, awarded by the IG PAS chapter. The decorated person is seated first from the left, and then the laudators, Prof. Randy Keller, Prof. Tomasz Janik, and Prof. Ewald Brückl.

Fig. 33. A group photo from the celebration of the 70th anniversary of the IG PAS, University of Warsaw, 2023. Aleksander Guterch supported by crutches, his wife Barbara next to him.

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E – Hydrology (formerly Water Resources)

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Every volume has two numbers: the first one is the consecutive number of the journal and the second one (in brackets) is the current number in the series.

This volume is an expression of respect for the **Outstanding Man of Science, Professor Aleksander Guterch**, our long-time boss and colleague. We have tried to outline his professional path and recall his greatest achievements, presenting at the same time the history of the deep seismic soundings in Poland, inextricably linked to him. We pointed out his significant, innovative contribution to this type of research conducted on a large scale in international cooperation in Europe and the polar regions. In addition to Aleksander's professional accomplishments, we paid a lot of attention to his non-professional life, strong ties with his homeland and memories of his closest relatives and friends.

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Aleksander Guterch at the 2002 AGU Meeting in San Francisco; photo by Ewald Brückl.