Appendix no. 2 Szczecin, 08.03.2019

dr. Leszek J. Kaszubowski
Section of Engineering Geology and Hydrogeology
Department of Geotechnics, Faculty of Civil Engineering and Architecture
West Pomeranian University of Technology, Szczecin
70-310 Szczecin, 50 Piastów Street

Summary of Professional Accomplishments

1. Name and Surname

Leszek Kaszubowski

2. Diplomas and academic degrees alongside their subjects, places and times as well as the subject of PhD's dissertation

- Geography MSc, specialisation – Geomorphology and Quaternary Geology, University of Gdańsk, Department of Geomorphology and Quaternary Geology, MSc thesis – Geological structure of the Sarbsk Spit, when: 13.09.1979,
  Thesis promoter – prof. dr hab. Bogusław Rosa

- Geography PhD, Maria Curie-Skłodowska University in Lublin, Department of Biology and Earth Sciences, Earth Sciences Institute, PhD thesis – Paleogeographical development of the area between Sarbsk Lake and Żarnowiec Lake in Holocene in the light of lithological research, when: 20.04.1988,
  Thesis promoter – prof. dr hab. Roman Racinowski

- Diploma from Postgraduate Studies in Geology, Adam Mickiewicz University in Poznań, Department of Geographical and Geological Sciences, Institute of Geology, when: 01.04.2011

3. Information on employment in academic institutions

01.10.1979 – 30.09.1980 University of Gdańsk, Department of Geomorphology and Quaternary Geology, assistant

01.10.1980 – 30.09.1982 Section of Geomorphology and Marine Geology, Maritime Division of the Meteorological and Water Management Institute in Gdynia, assistant

01.10.1982 – 28.02.1985 Section of Mineral Resources, Marine Geology Division of the Polish Geological Institute, senior assistant

01.03.1985 - 30.09.1990 Section of Engineering Geology and Hydrogeology, Water Engineering Institute, Department of Civil Engineering and Architecture of the Szczecin Technical University (presently West Pomeranian University of Technology in Szczecin), assistant

01.10.1990 – 31.12.2008 Department of Engineering Geology and Hydrogeology, Geotechnical Department, Department of Civil Engineering and Architecture of the Szczecin Technical University (presently West Pomeranian University of Technology In Szczecin), lecturer

01.01.2009 – present, Department of Engineering Geology and Hydrogeology, Geotechnical Department, Department of Civil Engineering and Architecture of the Szczecin Technical University (presently West Pomeranian University of Technology In Szczecin), lecturer

4. Scientific achievement being the basis for the habilitation procedure In accordance with Article 16 paragraph 2 of the Act On Academic Degrees and Titles as well as Degrees and Titles In Art. As of 14th March 2003; Journal of Laws nr 65, item 595.

4.1. Title of the scientific achievement:

Title in Polish

Badania geologiczne i sejsmiczne Morza Bałtyckiego

Title in English

Geological and seismic research of the Baltic Sea

4.2. Discussing the goal of the scientific achievement with its most important results, as well as discussing their possible implementation

4.2.1. Introduction

The geological research I have carried out was largely associated with the recognition of the evolution of the South Baltic area, where the most important was the issue of the transgressional characteristics of the Baltic Sea during the last 8.500 years. Which, in turn, gave rise to a question: whether transgression was a continuous process or rather one of cyclical character. As well as the issue of ancient sea levels as one of the most important scientific debates. Especially the matter related to the determination of the old sea levels, which so far, on the Polish coast is still an open question and there are numerous discrepancies about it.

A very complex problem is the issue concerning the main causes of Holocene Transgression of the Baltic Sea. This issue has been dealt with for a very long time, at least since the moment of the rise in interest in the evolution of the Baltic area. Views on this issue have gradually changed along with research methods improving and during the influx of more recent scientific results. Advances in research methods, and in particular the successful use of seismoacoustic research for the study of the seabed and more advanced drilling techniques have greatly contributed to the better understanding of the geological structure of the Baltic seabed. One of my goals in this particular scientific research was to present the characteristics of the course of transgression of the Baltic Sea in the Middle and Late Holocene. I Gould like to present the thesis that both contemporary transgression of the Baltic Sea and previous transgressions have a natural cause, one originating from specific processes related to the activity of the Sun. Generally speaking, the variable solar activity is the root cause of specific climate changes on Earth, and hence the processes of transgression and regression of the World Ocean, including the Baltic Sea. It should also be added that the course of tectonic movements occurring in a specific area is also of high importance.

The greenhouse effect caused by human economic activity, which is considered quite commonly a decisive in the course of contemporary maritime transgression, according to the author, it has only a limited scope, a modifying role if you will, and not a decisive one in this process. Until now, among researchers, there is no uniform position in issues related to the causes and characteristics of transgression of the Baltic Sea during the post-glacial period. Initially, the views prevailed that the transgression of the Baltic Sea in the post-glacial period was continuous, lasting uninterruptedly up to present times. Later, many scholars thought that maritime transgression in the Holocene had a phase character, where at least some of the transgressive phases of the Baltic Sea existed. Geological research of the coastal zone of the Baltic Sea, which I have carried out, made it possible to verify these views, where the processes of transgression and sea regression were clearly cyclical.

Geological research by the form of lithological and lithological research, in the first phase, was carried out as part of the research project MR-I-15 run by the Department of Geomorphology and Quaternary Geology, and in the later phase, under a grant financed by the former Szczecin University of Technology (contract nr 15-0103 / 17-99-00 / RKH), presently the West Pomeranian University of Technology in Szczecin. In such a particular way, under my supervision, 82 drill holes were made in the Polish coastal zone. As part of detailed lithological and lithostratigraphic tests, I made granulometric analysis (over 1000 sediment samples), graniformametric analysis and surface morphology studies of quartz grains using a "JEOL-JSM-S 1" Japanese scanning microscope. In addition to lithological examinations, biostratigraphic analysis (palynological and diatomic analysis) was carried on selected samples as well as samples obtained from organic sediment, which were carbondated. Obtained results of granulometric analysis served as a basis to calculate the basic granulometric indexes which, in turn, allowed characterizing of specific sedimentary environments of the then-cyclical southern Baltic spits.

Seismic research relies on the measurement and analysis of artificially generated seismic waves in geological centers. Seismic waves belong to elastic waves, which transmit vibrations through the researched geological layers. With the help of such tests, the structure and properties of geological centers can be determined. Any change in the geological structure and its properties (e.g. cracking, degree of weathering, faults, change of density) and elastic parameters: Young's modulus, Poisson's coefficient changes the parameters of seismic waves. During measurements, seismic vibrations are generated by various energy sourcese.g. a sledgehammer, a weight drop, a sparker, usage of explosives, vibrators or even other sources (an air gun, a buffalo gun, aboomer). Receivers are used to register ground's surfacevibrations - geophones, accelerometers or hydrophones (under the surface of either sea or lake waters).

Seismic research, which is very important in exploratory geophysics related to the study of deep geological base in search of oil and gas, hard and brown coal, as well as other deposits of mineral resources, is also increasingly important in the studies of shallow subsoil associated with both geological-engineering and geotechnical research. With this second practical aspect of seismic research, I decided to deal with my scientific research leading to a better recognition of geological and geotechnical conditions of the ground substrate being very important in the correlation between ground and building. In geophysical research related to engineering geology and geotechnics, radar and geo-electric research is often used. Especially the latter, related to the study of subsoil composed of Quaternary sediments in the area of northern and central Poland, where there is a very high lithological-genetic variability of sediments; do not always satisfactorily reflect the actual geological structure. Therefore, I decided to implement shallow seismic surveys on a wider scale, also known as seismic engineering, which in a very good way to reflect the physical model of geological layers that build a specific ground substrate.

Seismic engineering implemented on a wider scale in the study of soil substratum is applied in the area of southern Poland, where in a shallower geological substrate there is a high velocity contrast of elastic waves occurring there, which encounter comparatively shallow placed formations of deposits of older soil. This situation is conducive to the correct reflection of the location of the hard ground, from which there is a very strong reflection or a clear surface of the elastic wave slipping under the low speed zone, in which the interpretation of the wave image is more complicated. This type of research in the discussed area is used to determine the roof of a weathered rocky mass such as granites, basalts, limestone or dolomites; boundaries separating the layers of varying degree of weathering, the effectiveness of backfilling of voids and substrate cracks in the areas of shallow mining exploitation; fault zones, cracks and weakening zones, mining voids, caverns and sinkholes, pavements and grooves; recognition of landslide zones and the position of the table of groundwater.

In northern Poland, however, the subsoil is made of quaternary deposits with a high lithological-genetic diversity, where the area was shaped by at least eight Scandinavian glaciations. There is also a relatively low-speed zone. This inconvenient situation, in case of seismic surveys in which the reflective method is applied, caused that the measuring equipment, even the highly advanced one, skips the upper parts of the ground substrate, starting the registration only from a depth of 30-50 m below the surface area. In this situation, the reflective method used in shallow seismic research is completely useless for civil and environmental engineering, or Quaternary geology, where the upper parts of the ground substrate are the most important ones for accurate recognition of ground and water conditions which are taken under consideration when building foundation for certain objects.

In this situation, I decided to adapt for the purpose of research of quaternary sediments and their subsoil, measuring equipment for seismic engineering as used for control tests in coal mines, where the first elastic wave entry is recorded from the very beginning of the time scale. The apparatus, named CS-5G-1, is a high-resolution six-channel seismic timer, which by my initiative was purchased by the Department of Geotechnics of the former Szczecin University of Technology (now West Pomeranian University of Technology in Szczecin). These tests can be performed in several measuring ranges: Z (Measuring range) = 25 ms; Z = 50 ms; Z = 100 ms; Z = 200 ms; Z = 400 ms; Z = 800 ms, which causes elastic waves to reach a depth of 20-1000 m btl. A spacing of 6 geophones is used every 10 m, and the maximum length of a single seismic profile (section) is 50 m. The spacing between profiles is usually from 20-40 m. During field tests, mostly seismic signals gain is used (54-66 dB). The source of the elastic wave is the seismic boomer. Also by my initiative in the Department of Geotechnics, a magnetic recorder was built, which during the field research was to record seismic registrations. The appropriate program allowed for displaying previously recorded wave image records on the computer monitor.

My very next major research goal was to develop interpretation patterns of the recorded wave image associated with the recognition of a specific type of soil, its genesis and even age. The development of specific interpretative patterns by mewas generally aimed at separating specific seismostratigraphic units associated with the deposits of the quaternary cover. It should be noted that the conducted seismic surveys have been repeatedly verified by pre-existing benchmarking boreholes or, if necessary, control boreholes. In the northern Poland, I conducted seismic surveys in Western Pomerania and in the area of the Baltic Sea coastal zone, from Świnoujście to Krynica Morska (in the area of the Vistula Spit), where the total length of seismic profiling was over 40 km.

Seismoacoustic research, however, is carried out in order to identify the geological structure of the seabed where the method of reflected waves is used, where behind the ship there is a source of elastic waves and a hydrophone that receives seismic waves reflected from geological layers. Depending on what the frequency of an excited seismic wave is used, the depth of penetration of the waves into the geological layers and their resolution is determined. There is a rule that the higher the frequency of excited seismic waves, the shallower the penetration of these waves in geological layers, but with a high resolution. In turn, the lower the frequency of seismic waves is, the deeper the penetration of waves, but at a lower resolution. A shallow sea seismoacoustic research, in which the registration of reflected waves takes place continuously, are carried out during the uninterrupted movement of the ship along the assumed profiling grid.

Positioning of research is carried out with the help of modern GPS satellite navigation. In the area of sea basins, the source of seismic vibrations is towed in the near-surface water layer, and in deeper parts of the oceans, seismoacoustic surveys are carried out using profilographs, where the source of vibrations is towed near the ocean floor. Within the Polish seabed, seismoacoustic profiling was carried out using the Huntec M-2A hydro-bougie produced in Canada or using the E.G.G system of US production. It should be added that continuous seismoacoustic profiling in the region of shallower sea basins is carried out using three different generators (sources) of elastic wave oscillations:

• BOOMER (UNIBOOM) - model 230 operates in the frequency range from 500 Hz - 15 kHz, where in this case seismoacoustic waves reach the depth from 150-200 m with a resolution of about 15 cm,

• SPARKER - model 267A (three-electrode) operates in the frequency range from 100 Hz - 2 kHz, where seismic-acoustic waves reach a depth of 1000 m with a resolution of 2 m,

• PINGER - a source of vibrations with very high frequency and very high resolution, but has a small range of penetration depth of seismoacoustic waves.

I would like to point out that with both seismoacoustic studies and their results in the form of wave image registration, I got acquainted earlier, working on a research position in the Department of Geomorphology and Geology of the Sea, Maritime Department of the Institute of Meteorology and Water Management in Gdynia and in the Department of Mineral Resources, Department of Geology of the State Marine Institute Geological in Sopot. In this last place, in addition to the work related to the interpretation of acquired seismoacoustic recordings, I also took part in research cruises heading seismoacoustic surveys in the area of the Baltic Sea bottom. One of my research goals related to seismoacoustic research was to develop specific interpretation patterns of acquired wave images associated with a specific type of soil, their origin or even the age of the seabed. It was also about designating seismostratigraphic units of the Quaternary cover and its base within the bottom of the Baltic Sea.

My research goal related to the area of the Baltic seabed was, based on seismoacoustic research, an accurate diagnosis of geological and geotechnical conditions related to a specific ground substrate. It should be added that the results of seismoacoustic surveys have been repeatedly verified by previously designed control boreholes. On this basis, I have compiled a number of geological maps related to specific seismostratigraphic units of the Quaternary cover and its substrates for selected parts of the Baltic Sea bottom, including structural and volume maps. I also developed a series of seismic and geological sections depicting the geological structure of selected fragments of the seabed. Both a detailed analysis of geological maps of the Baltic Sea bottom in the 1: 200,000 scale previously performed by the Geology Department of the Polish State Geological Institute, as well as analysis of the results of seismoacoustic surveys, with the results of geotechnical investigations carried out in selected parts of the seabed related to the reconstruction and construction of port facilities in the region of Gdańsk and Kołobrzeg, or the results of geological-engineering and geotechnical investigations carried out in the area of Western Pomerania, and in particular in the Baltic coastal zone, contributed to the fact that I could undertake the geotechnical mapping of the Polish bottom of the Baltic Sea.

4.2.2a. List of selected publications related to the research area (geological and seismic research of the Baltic coastal zone)

1. D4 Kaszubowski L.,1988. Holocene sedimentary cover of the Dziwnów Spit – in Polish (Holoceńska pokrywa osadowa Mierzei Dziwnowskiej), Prace Naukowe Politechniki Szczecińskiej nr 378, 53-70. **Polish magazine not included in the score system of MSHE (D)**

2. D6 Kaszubowski L.,1989. Holocene evolution of the Sarbsk Spit in the light of lithological research – in Polish (Holoceńska ewolucja Mierzei Sarbskiej w świetle badań litologicznych), Prace Naukowe Politechniki Szczecińskiej nr 397, Geotechnika V, 203-225 - **Polish magazine not included in the score system of MSHE (D)**

3. A1 Kaszubowski L., 1992. Middle and late Holocene transgressions of the Baltic Sea on the central Polish coast, Journal of Coastal Research vol. 8 no.2, 301-311- **list A of MSHE, Journal Citation Reports – no 5748, Impact Factor 0.92**

4. B5 Kaszubowski L.J**.,** 1994. Experimental microseismic research in the area of the Dziwnów Spit – in Polish (Eksperymentalne badania mikrosejsmiczne w rejonie Mierzei Dziwnowskiej, Inżynieria Morska I Geotechnika nr 3, 113-115 – **list B of MSHE**

5.A2 Kaszubowski L.J.,1996. Geomorphology and Contemporary Evolution of the Western Polish Coast, Journal of Coastal Research vol. 12 no. 2, 484-495 **- list A of MSHE, Journal Citation Reports – no.5748, Impact Factor 0.92**

6.M3Kaszubowski L.J., 2007. Granulometric analysis of deposits of the geological cross-section "Świnoujście II" – in Polish (Analiza granulometryczna osadów przekroju geologicznego „Świnoujście II"). (W:) Z. Meyer (red.) Problemy Ochrony Środowiska. West Pomeranian University of Technology, Szczecin, Tuczno, pp. 63-71 – a chapter in a monograph **(M)**

7. B14 Kaszubowski L.J.,2010.Seismostratigraphic units of the Dziwnów Spit – in Polish (Jednostki sejsmostratygraficzne Mierzei Dziwnowskiej), Inżynieria Morska i Geotechnika nr 3, 387-392 - **lista B MNiSW**

8. K2 Kaszubowski L.J.,2018. Evolutional Trends and the Current Management of the Beach-Dune Systems along the Western Polish Coast (Southern Baltic Sea), Botero C.M., Cervantes O.D., Finkl C.W.(eds.) Beach Management Tools – Concepts, Methodologies and Case Studies, vol.24, Springer International Publishing Switzerland, Heidelberg New York Dordrecht London DOI 10.1007/978-3-319-58304-4_6,pp.101-144 – **a chapter in a book (K)**

4.2.2b. Analysis of selected publication related thematically to the research area (geological and seismic research of the Baltic coastal zone)

1. **D4 Kaszubowski L., 1988. Holocene sedimentary cover of the Dziwnów Spit, Prace Naukowe Politechniki Szczecińskiej nr378, 53-70. Polish magazine not included in the score system of MSHE (D) , number of points according to previous quantification 4; number of citation acc. to Google Scholar – not included, number of citations acc. to Web of Science – not included**

Geological research carried out by me in the area of the Dziwnów Spit [1] was carried out in the form of drilling work within the present-day sea beach over the distance of 12 km. Drilling was carried out with a manual system, on averagedepth of up to 5-6 m below the beach surface. The collected samples were intended for lithostratigraphic studies, and the acquired organic samples were designated for age studies using the C-14 carbon dating method. Sludge from a drilling ridge located in the Dziwnówek region were expended by a thermoluminescent method in the Laboratory of the TL Institute of Earth Sciences UMCS in Lublin. The lithological tests that I conducted in the research area were mainly concerned with the examination of sludge granulometry, for which I calculated the basic granulometric indexes by the central moment method determining M1 (average diameter of grains size), M2 (sediment storting coefficient), M3 (asymmetry of grain size distribution) and M4 (flattening the grain distribution) in the phi scale values. In addition, I also calculated the coefficient of variation, entropy and relative entropy. Based on geological surveys and analysis of archival materials, I found that the substrate of spit deposits are built of Pleistocene and early Holocene deposits. As shown in borehole 1 located near Świętoujście at a depth of 3 m below sea level, there are fine sands, most likely belonging to glacifluvial deposits of the Vartanian Glaciation, of weak sorting. A quite high share of the silty fraction reaching 18% in relation to the whole sludge mass is characteristic here. The analysis of archival materials concerning the area of the Dziwnów Spit showed that in the area of Międzywodzie and on the section from Dziwnów to Dziwnówek there are two large marginal valleys, what is more it is not excluded that they are river valleys. These valleys have been filled in some places with silty sediments accompanied by some organic matter. Similar situation was present in the area 21^{st} borehole on the beach near Dziwnówek. Present there are gray-green mules scattered on floor, found with a thermoluminescent method at 66 ± 10 ka BP, and in the upper part at 54 ± 8 ka BP. It should be assumed that the creations in question are interstadial deposits. The gray glacial tills lying beneath them were dated here at 107 ± 15 ka BP. In the eastern part of the spit, glacifluvial deposits may still occur in the substrate.

Early Holocene sediments representing the Pre-Boreal and Boreal Period occur in the hollows of old valley bottoms and floodplains are represented by silts and fluvial sands. The Holocene sedimentary cover is diverse in terms of thickness and lithological formation. The lowest values of thickness occur in the area of the slope of the Pleistocene plateaus, and the largest in the central part of the spit, where the creations form a twenty-meter series of accumulation. During the research, I found that the middle Holocene represented by the Atlantic Period is already developed by the proper spit structures that create certain transgressive and regressive series of the Baltic Sea. At that time, on the area of the Dziwnów Spit, there is a transgression of the early Littorina Sea in phase L2 (according to author's views in cycle L2) with rapidly progressing shear and surface abrasion, along with fast overtaking of large land areas by sea waters. At this time, a transgressive series consisting of small and medium sands with moderate sorting with the presence of marine fauna is created. In many places, I have found coarse deposits in the form of gravels and coarse sands. In the area of Międzywodzie, I recognized a transgressive series made of medium sands, sometimes small sands with fragments of marine fauna, including the Littorina slug-shaped line, littorea line lying in the -5.1 m above sea level, confirming Littorina transgression in the cycle L3, which covered a large area of today's spit. The upper layer is represented by medium sands, in some cases thick with noticeable marine fauna, belonging to the regression series. The upper layers of marine sediments represented by medium and coarse sands belong to the late Littorina Sea transgression and regression in the cycle L4, confirming another transgression of the Baltic Sea, which, however, had a smaller range towards the south than the previous one. The sediments of this series, which I found in the 1st borehole, are represented by thick sands with a strongly developed histogram of the grain size distribution which indicates poor sorting in the then coastal zone. At the end of the Atlantic period, at the time of the late Littorina regression, a spit of the late Littorina dunes is formed. The scientific achievement of this publication was a good stratification of the transgressive and regressive levels of the Littorina Sea and the recognition of palaeogeographic changes in the area at the time. In the late Holocene, especially in the sub-Boreal period, a coastal peat bog is formed at the back of the marshy area. In the sub-Atlantic period, the Baltic Sea continues to transgress and regress, where it destroys the previously-formed glacial structures, and the coastline moves southwards at a distance of 500 m from the present seashore. During the last regression cycle, a spit of gray dunes is created, which is added to the older structures of the coastal zone.

2. D6 Kaszubowski L., 1989. Holocene evolution of the Sarbsk Spit in the light of lithological research, Prace Naukowe Politechniki Szczecińskiej nr 397, Geotechnika V, 203-225. Polish magazine not included in the score system of MSHE (D), number of points according to previous quantification 4; number of citation acc. to Google Scholar – 2, number of citations acc. to Web of Science – not included

Geological research carried out in the area of the Sarbsk Spit, located on the central Polish coast, concerned the study of the Holocene evolution of this area on the basis of detailed research of lithological sediments. The lithological tests I conducted in the research area mainly concerned the sludge granulometry analysis, for which I calculated the basic graining indexes by the central moments method determining M1 (average grain diameter), M2 (sludge sorting factor), M3 (grain size distribution asymmetry), M4 (flattening grain size distribution) in phi and d1 scale values (grain diameter, which together with larger ones constitutes 1% of sludge weight), d50 (grain diameter, which together with larger ones (smaller) constitutes 50% of sludge mass measured in metric scale (mm). I have also included graniformametric tests made using B. Krygowski's graniformameter, where I presented the results in the form of histograms and calculated grain processing parameters such as, W0 (machining index), M1 (average slope inclination at which streaking of grains occur) and M2 (deviation from the average angle M1). In graniformamometric studies I analyzed the 0.8-0.5 mm fraction, assuming that it is large enough in all types of works that it would allow for proper testing and subsequent comparison of results. The lithological studies carried out in this way were to lead to the knowledge of the course of sedimentation processes in the fossil environments of the spit area and also to allow for paleobatimetric reconstructions of subsequent marine reservoirs of the transgressing Baltic Sea. During the research, I separated two bathymetric zones; bathyzone I (tank depth from 0-2 m) and bathyzone II (tank depth from 2-4 m). In order to better understand the course of some processes of ancient sedimentary environments and inferencing the origin of the source material, I made (on selected samples) analysis of the morphology of quartz grains under the scanning microscope "Jeol" of Japanese production. As geological research has shown, the area of the Sarbsko Spit in the early Holocene developed in overland conditions, where Aeolian and fluvial processes took place, and in the depressions (due to the increase of groundwater level) - biogenic processes. In the river sediments the early Holocene, I obtained interesting results of my studies on the morphology of quartz grains, which indicated that the source material for river sediments were Aeolian sands, where the presence of traces of the dune environment could be observed, but also completely new characteristic microstructures characteristic only for the environment of flowing water. On the scans one can notice clear glacitectonic structures in the form of a smoothed surface grain, on which the Aeolian micro-textures have been completely destroyed due to the traction movements of the grain along the bottom of the river bed.

In small fragments of the grains’ surface, the slightly damaged microtextures of Aeolian relief have survived. An important scientific achievement was the identification of marine sediments of the Littorina Sea transgression in the L2 phase (cycle L2) as the oldest marine fossil environment. In the initial period, the bathyzone I was formed in which small sands with moderate sorting were deposited. A little later, the bathyzone II is formed, within whichstable hydrodynamic conditions are allowing for the sedimentation of sea sludge, the roof of which has been dated at 7590 ± 100 years BP (Miotk & Bogaczewicz-Adamczak, 1987). During the maximum transgression, a sea cliff formed in the sediments of the Marginal Glacial Valley and in river sediments of the early Holocene is located 2 km south of the present-day marine shore. The roof of the early Littorina Sea sediment from the L2 phase was found at a depth of 5.5 m below sea level. During sea regression, a shallow sea bay in the Sarbsko region is gradually cut off and transformed into the oldest coastal lake. When the coastal line moves relatively slowly towards the north, a spit of early Littorina dunes is formed at its back, with significant transversal dimensions reaching up to 1.2 km, which has survived to this day in fossil form. It is built by medium, fine and medium sized sands with characteristic values of the d1 index, which shows small values and a little range of variation. Graniformametric tests showed the dominance of Aeolian material with traces of processing (β1). Faster lowering of the sea level causes that biospecific accumulation in the form of a peat occurring in the back structures of the early Littorina sand dunes. During the transgression of the Littorina Sea in the L3 phase (cycle L3), the early Littorina dunes are subject to deterioration, and a lagoon reservoir with a deposit of fine sands with small *Cardium edule* shells is formed as a result of the decreasing salinity of the water reservoir. In the foreground of the sea tank there are intense Aeolian processes causing the emergence of new dune forming structures built of medium-sized sands with good and moderate sorting, which overlap with the older structures from the L2 phase. When the sea level rises in the area of research, the bathyzone II is created, where fine and medium sands with characteristic moderate sorting are deposited. During the maximum transgression, a cliff is formed in the settlements of the early Littorina spit,located 500 m south of the present day sea coast. During the research, I found that the ceiling of sludge of this transgression is present at 1.8 m below sea level. The sea regression leads to a reduction of the lagoon reservoir, and then it is transformed into a coastal lake. In the area of the retreating sea tank, a regression series is created made up of fine and medium sands, quite diversified in terms of the value of d1. On the surface of these sediments Aeolian processes take place and another spit of early Littorina dunes from the L3 phase is created, made of medium sands with moderate sorting.Analysis of scanning photos from a nearby Osetnik concerning the grains of the same dune level indicates the presence of characteristic features of the aeolian microrelief. The aeolian processes occurring there result in gradual, sometimes more intense penetration of micro-textures of the dune environment into the region of earlier abrasion depressions and into the convex surface zone. Another transgression of the Littorina Sea in the L4 phase (cycle L4) as a late Littorina transgression causes the initiation of biogenic accumulation in the quite extensive deflation basin of the Sarbska area due to the increase of the groundwater level. The base till layer of peat deposits was dated at 5480 ± 90 years BP (Miotk & Bogaczewicz-Adamczak, 1987), indicating the end of the Atlantic period. In this time, the late Littorina Sea does not enter the then land area on which the coastal peatbog continues to develop. The scientific achievement of this publication was the indication of the existence of complex spit structures on the central Polish coast formed during the course of the Littorina Sea transgression. In the late Holocene, biogenic processes in the area of coastal bog develop further throughout the sub-Boreal period, and the Baltic Sea basin does not enter the land area at this time. Yellow sand dunes form in many places that overlap with older furrow structures. At the beginning of the Sub-Atlantic Period, the Baltic Sea again transgresses and gradually enters the land area, where the bathyzone I is formed with the sedimentation of medium sands of moderate sorting. During the maximum transgression at a distance of 100 m south of the present-day sea shore, a sea cliff of biogenic and Aeolian formations is formed. In the foreground of the sea tank there are intense Aeolian processes, where the yellow dunes are largely blown up and widened in the south in the form of extensive Aeolian covers. The dune material of this period examined by me is characterized by certain variability in the W0 index range, where the grains of these deposits have some processing characteristics and belong to the β1 and β2 subtype. During the next sea regression, gray sand dunes are created with a characteristic fordune rich, which is added to older spit structures.

3. A1 Kaszubowski L., 1992. Middle and late Holocene transgressions of the Baltic Sea on the central Polish coast, Journal of Coastal Research vol. 8 no.2, 301-311.List A of MSHE, Impact Factor 0.92, the score - 20, number of citation acc. to Google Scholar - 17, number of citation acc. to Web of Science - 8

In the next publication I presented the characteristics of the course of individual transgressions of the Baltic Sea [3] in the central and late Holocene in the region of the central Polish coast. The research area, which I characterized, stretched over a distance of 40 km, between the Sarbsko Lake and the Żarnowiec Lake. In the publication, I pointed out that the issue of transgression of the Baltic Sea is a very complex issue, where there is a group of scholars claiming that maritime transgression was a continuous process, sometimes interrupted by short intervals of stabilization of sea levels and a group of scholars, including the author, clearly indicating separate transgressions and regressions sea. The scientific achievement of this publication was the morphological analysis of the seabed adjacent to the central Polish coast at the level of the Sarbsko Lake on the basis of a seismoacoustic cross-section of 9 nautical miles made by the former Department of Geomorphology and Geology of the IMWW in Gdynia where the author previously worked. The analysis of this seismoacoustic section was of great importance as it allowed to characterize the course of early Littorina Sea transgression in the L1 phase (cycle L1), which ran in the far foreground of the current coastal zone of the Baltic Sea. This transgression took place in five transgressive subphases from L1a - L1e (currently considered by the author as micro cycles). At that time, in each subphase the coastline moved southwards to a distance of about 2 km, and the sea level rose from the ordinate -26.0 m above sea level, to -13 m above sea level. From the research I carried out, I determined that it was the fastest maritime transgression of the Baltic in the entire history of the Middle and Late Holocene. In the area adjacent to the central Polish coast, the coastline has shifted from 8-14 km to the south. At the bottom of the then marine tank there were deposited sandy sediments with varying thickness reaching up to 5-6 m. Another transgression of the early Littorina Sea in L2 phase, as I mentioned earlier in the Sarbska region causes deposition of fine sands with moderate voluming covered by a layer of sea mules expended at 7590 ± 100 years BP (Miotk & Bogaczewicz-Adamczak, 1987). The palynology analysis carried out on these sediments showed the presence of plant sequences characteristic of the early Atlantic period, and diatomic analysis indicates the presence of euchalobian species of marine plankton characteristic of waters with 20% salinity (Miotk & Bogaczewicz-Adamczak, 1987). At that time, in the Lubiatowo region, the transgressive series is composed of medium sands with moderate volume. During the maximum transgression, sea water rises to 7 meters above sea level and it was also a very fast maritime transgression, where the coastline moved southwards in the area of the central Polish coast on average from 2-10 km. Marine regression from the L2 phase causes that the oldest spit of early Littorina dunes with significant lateral dimensions is created in the research area. Another transgression of the Littorina Sea in the L3 phase is not as fast as the previous transgression, where sea water destroys older structures. A transgressive series composed of medium sands with medium sorting is created. During the maximum transgression, sea water raises to a height of 3 meters below sea level. Marine regression from the L3 phase results in the creation of another spit of early Littorina dunes, which is being added to the older structures of the coastal zone. The next transgression of the Littorina Sea in the L4 phase as a late Littorina transgression gradually enters the land area destroying older spit creations, where the coastline moves southwards in some places from 100-200 m. In the Sarbsko area, as I mentioned earlier as a result of this transgression is initiated biogenic accumulation in a coastal fen, where the lower parts of peat formations were dated at 5480 ± 90 years BP (Miotk & Bogaczewicz-Adamczak, 1987). During the maximum transgression, sea water rises to a height of 1.7 meters below sea level. During sea regression another spit is formed, this time the late Littorina dunes, which are also added to the previous structures of the coastal zone. The scientific achievement of this publication is the presentation of the curve of sea level fluctuations of the Littorina Sea, but also fluctuations in the sea levels of the Baltic Sea during the sub-Atlantic period. The palaeogeographic maps I have prepared for the period of early Littorina Sea area of the central Polish coast, which synthetically represent the evolutionary changes of the area under the influence of sea transgression and regression, are also of great importance. Some scientific value (presented in tabular terms) has stratigraphic division of marine sediments of the Baltic Sea according to various researchers with the author's proposal. In the first half of the late Holocene, in the sub-Boreal period, the research area develops inland conditions, where coastal bogs develop further, and in some regions the yellow dunes. In the early sub-Atlantic period there is still a relatively rapid transgression of the Baltic Sea, where sea water destroys the older coastal zone creations and the coastline moves southwards at a distance of 100-200 m. During the maximum transgression, the sea level rises to a height of 0.5 meters below sea level. The scientific achievement was that for the first time I recognized that the transgressions of the Baltic Sea in the late Holocene were cyclical with a period of 300 years. Later maritime regression caused the creation of gray sand dunes with a characteristic front dune.

4. B5 Kaszubowski L.J., 1994. Experimental microseismic research in the area of the Dziwnów Spit, Inżynieria Morska i Geotechnika nr 3, 113-115. List B of MSHE, the score - 4; a number of citation acc. to Google Scholar 16, a number of citation acc. to Web of Science – not included

The experimental micro-seismic research carried out in the coastal zone of the Baltic Sea focused on the spit in the Dziwnów area [4]. Shallow seismic research, also known as seismic engineering, is sometimes also called micro seismic research due to the not too large depth range of elastic waves. The seismic experiment carried out in the area of Dziwnów Spit, dealt with the measurements along the designated profile of the CS-5G-1 apparatus in three measuring ranges; Z = 25 ms, Z = 50 ms and Z = 100 ms, so that the system of geological layers can be traced along with the increasing depth of seismic wave penetration. An additional element of the experiment was the extension of the seismic profile into the shallow sub-sea zone to a depth of 2 m below the sea level, in order to achieve the embankment-beachmeasurement continuity. The location of the source of excitation of elastic waves in the area of the shore waterfront (edge of the beach) resulted in the correct reception of seismic waves reflected from individual geological layers. The scientific achievement of a successful seismic experiment was to present a continuous system of geological layers from the shallow waterfront, through the beach, further on covering the area of coastal dunes. It should be added that the seismic surveys carried out by me in the shallow waterfront at that time were precursory throughout the entire Polish coast. In this way, in the ground substrate, I separated the following geological layers (seismostratigraphic units):

A - Aeolian sands of coastal dunes (after Littorina period),
B - sands and gravels of marine sedimentation (late arterial and after Littorina),
C - glacial tills of Szczecin Stadial of the North Polish Glaciation (currently Vistulian Glaciation)
D - glacifluvial sands and glyphs of Vartanian Glaciation
E - tills of the Vartanian Glaciation,
F - river and glacifluvial sands and gravels, and late Jurassic deposits,

It should be noted that carrying out research in three measuring ranges enabled verification of the correctness of the wave image of the investigated soil substrate, as well as thorough examination of the entire quaternary deposits of the Dziwnów Spit.

5. A2 Kaszubowski L.J., 1996. Geomorphology and Contemporary Evolution of the Western Polish Coast, Journal of Coastal Research vol. 12 no. 2, 484-495. List A of MSHE, Impact Factor 0.92, the score - 15; number of citation acc. to Google Scholar 3, number of citation acc. to Web of Science 3

My next publication concerns the geomorphological characteristics and contemporary evolution of the west coast of Poland [5]. I have expressed the view that the modern coastline of the west coast of Poland is the result of complex evolution of the Baltic Sea during the entire post-glacial period. A new classification of sea coasts in the analyzed area of research has been presented here. The main pillar of this classification is the origin of sediments that build the coastal zone and, additionally, the hypsometric criterion. Therefore, I have identified five main types of sea shores: glaciogenic shore, glaciofluvial shore, limnic shore, alluvial shore and spit shore. In terms of hypsometrics, the west coast of Poland was divided into high banks (> 20 m above sea level), medium banks (20-10 m above sea level) and low banks (<10 m above sea level). This allowed for a better understanding of the lithogenesis of sediments building the coastal zone, as well as the correct recognition of the shore supply methods, as well as determining the directions of development of actively operating coastal processes. Characterizing the geomorphological conditions of the west coast of Poland and presenting specific lithogenetic types of the sea coast, I have also marked out the current development trends of the coastal zone in the form of a calculated average rate of erosion or accumulation over a given period of the 20th century. For this purpose, I conducted comparative analyzes related to the old German geological maps on a scale of 1: 25,000 and new Polish topographic maps on a 1: 10,000 or 1: 50,000 scale. I carried out cartographic measurements along stable linear objects, such as old roads. In the initial part of the article, I presented the geological structure of the research area stating that the Quaternary cover lies on the Mesozoic sediments represented by the Cretaceous and Jurassic formations. Jurassic sedimentsreach a large thickness of up to 2000 m and are represented in the lower part by sandstones lined with marine mudstone and in the upper part by siltstones and marls. The late Cretaceous deposits are less volumic and represented by mud-sand sediments. The upper Cretaceous reaches a thickness of up to 1000 m and is made of silts and sandstones as well as marls and limestone. The former Tertiary sediments (Paleogene and Neogene) occur in the eastern part of the research area near Koszalin. There are siltstones and Oligocene silts that underlie Miocene sandy sediments. The quaternary cover is represented by several levels of boulder clays of various Scandinavian glaciations separated by layers of glaciofluvial deposits in the form of sands and gravels. Locally, there may be present lacustrine mud. Holocene sediments are represented by pit sands and sand-peat deposits of river origin. I started the analysis of the geomorphological characteristics and contemporary development trends of the west coast of Poland from the section located to the west, the alluvial-spit coast of the Świna Gate (Świnoujście region). Present here are low banks built of alluvial-spit sediments, where at least three generations of dune banks occur on the surface. As a result of the analysis, I found that the accumulation processes with the highest pace in the central part prevail here, where the shore is added at the speed of 2.1 m / year. The next section concerns the glaciofluvial-glaciogenic coast of the Międzyzdroje region.There are the highest seashores reaching in some places over 90 meters above sea level. Present here areglaciofluvial sands and gravels in the upper parts, while boulder clays of various Scandinavian glaciations are present in the lower parts. Almost the entire coastline is abrasive, where in the central part the erosion rate is 1.53 m / year. Slightly further to the east there is the Dziwnówo Spit coast, built of older and younger structures of the marine Holocene sediments. For the most part, there are low banks built of sands of marine and dune origin along which abrasive processes predominate, where the average rate of erosion ranges from 0.38-0.77 m / year. The next section is the glacigenous coast of the Pobierowo region, where the average height sea shores are made of boulder clays covered in the upper parts with Aeolian sand cover. There are small marine abrasion processes here, where in the central part the average rate of shore erosion is only 0.13 m / year. A little further to the east there is a glacial coast of the Rewal region devoid of the aeolian sands cover. Most of these are medium shores built of boulder clays, which are also abraded. The average rate of shore erosion ranges from 0.36-0.45 m / year. The next section is the Mrzeżyno coast. The medium shores dominating here are built of sea and dune sands of the Holocene age and are quite strongly abraded, where the average rate of coastal erosion in the area of Pogorzelica is 0.9 m / year, and on the eastern side of Mrzeżyno even 0.98 m / year. The next section is connected with the limnic coast with the Aeolian sands cover of the Kołobrzeg region. Low banks built of silts and muds of lake origin dominate there, where even tilled clay can occur. A bit further there are the low shores of the glacial coast of the Bagicza region. Further to the east lies the glacigenous coast with the Aeolian sands cover of the Ustronie Morskie region, where the medium banks built of boulder clay prevail. The next section is the glacigenous coast of the Sarbinowo region with the advantage of low banks built also of boulder clays. To the east there is a spit coast of the Jamno Lake and Bukowo Lake made of gravel and sea sands as well as dune sediments of the Holocene age. The most-abundant banks here are the most abraded in the western part of the Jamno Lake, where the average rate of coastal erosion is even 1.26 m / year. From the analysis, I found that the strength of abrasion processes decreases towards the east, where on the eastern side of the Bukowo Lake it is only 0.27 m / year, and near Darłówek there are slight accumulation processes with an average rate of 0.27 m / year. The scientific achievement of this publication was to propose a new classification of sea shores in the area of the west coast of Poland and to present contemporary development trends of the coastal zone there.

6. M3 Kaszubowski L.J., 2007. Granulometric analysis of deposits of the geological cross-section "Świnoujście II". (W:) Z. Meyer (red.) Problemy Ochrony Środowiska. West Pomeranian University of Technology in Szczecin , Tuczno, pp. 63-71. A chapter in a monograph (M), the score acc. to MSHE 4; number of citation acc. to Google Scholar – not included, number of citation acc. to Web of Science – not included.

My next publication [6] is related to the granulometric analysis of sediments of the "Świnoujście II" geological cross-section. I prepared the geological cross-section for the eastern area of the Świna spit, where I made 7 geological drillings to a depth of 15-18 meters below sea level. In this publication, the granulometric analysis for borehole No. 14 was presented. The cross-sectional line was located perpendicularly to the line of the present-day seashore, so that a detailed analysis of the most important sedimentation processes of the research area in the middle and late Holocene was possible. Granular tests, which were mostly conducted on sandy material, were made using a sieve method with intervals of sieves diameters in intervals of 0.33 phi. For the tests I took samples with a mass of 200g and a twofold screening time: for Aeolian sediments time equals to 40 minutes and for sediments of other genesis 25 minutes. For individual sludge samples, I calculated the basic graining indices by the central moments method, such as M1 (average grain diameter), M2 (sorting index), M3 (coefficient of grain size distribution), M4 (Kurtosis-indicator of graining distribution). Drill hole No. 14 was located at a distance of 550 m from the sea shore at 3.5 m above sea level and reached a depth of 15 below sea level. In order to characterize the oldest part of the central Holocene in terms of granulometry, I presented the results of the analysis of the sample 19 from the drill hole No. 18. As it results from the geological cross section prepared by me, under organic mud deposits there are fine sands associated with the regression series of the Littorina Sea L1 cycle. The sediments of this level are moderately sorted, where the M3 index presents the grain size distribution as moderately skewed negatively from the upper range, which proves the high dynamics of the retreating coastal zone (former sea beaches). The M4 index indicates the grain size distribution as moderately peak. The base layer of the drill hole No. 14 belongs to the deposits of the transgressive series of the Littorina Sea of the L2 cycle. The analysis carried out showed that there are fine sands with moderate sorting characteristic of marine sediments of the shallow waterfront. The M3 index indicates the grain size distribution as highly oblique negatively (values <-2) showing the sedimentation environment with very high dynamics. Kurtosis (index M4) indicates similarly as before to a moderate peak distribution. A very similar granulometric characteristic relates to sediments of the transgressive Littorina Sea level of the L3 cycle, where only the values of the sorting index of sediments do slightly increase, but still in the same range. The next transgressive level of the Littorina Sea of the L4 cycle is still represented by fine sands of moderate and good sorting. The M3 index is in the range (from -1 to -2) indicating the moderately skewed negative distribution. My scientific research, which found good sorting of sediments from the transgressive series as quite unusual, may indicate that the transgressive Littorina Sea was destroying the spit of early Littorina massive dunes, whose material had already been well sorted. The M4 index still indicates the moderately peak distribution. The last transgression of the Littorina Sea in the L5 cycle creates a transgressive level with similar granulometric characteristics, but with a smaller thickness (up to 1.5 m). Above it there is the regressive series of the L5 late Littorina Sea built of beach facies, where numerous marine fauna *Cardium edule* and *Macoma baltica* occur in sediments, as well as increasingly inferior sludge sorting. The upper part of the geological profile is composed of late Littorina brown dunes represented by fine sands with good and very good sorting. The M3 index shows a negatively slanted distribution, as quite unusual for dune environments.These values indicate that then there must have been quite a dynamic growth of the Aeolian sedimentation environment. Kurtosis still indicates a moderately peak distribution. The layer of river sediments found during the research differs in terms of granulometry, because these are medium sands with moderate sorting and small negative values of the M3 index, where the (M4) Kurtosis already represents a normal distribution. During the research, I found that the accumulation of brown dunes in the southern and central part of the research area is the final stage of development of the central Holocene morphogenetic processes. The next transgressive cycles of the Baltic Sea falling into the late Holocene are already taking place only in the northern part of the Świna Gate area. The scientific achievement of this publication was that on the basis of detailed granulometric analysis of the sediments of the research area, it was possible to show the differences that existed in different sedimentary environments, and even show different processes in the shallow marine sub-sea environment during the early-stage Littorina Sea (greater dynamics) and late-stage Littorina Sea (less dynamics).

7. B14 Kaszubowski L.J., 2010. Seismostratigraphic units of the Dziwnów Spit, Inżynieria Morska i Geotechnika nr 3, 387-392. List B of MSHE, the score 4; a number of citation acc. to Google Scholar 7, a number of citation acc. to Web of Science – not included

The seismic research, which was carried out in the area of Międzywodzie near Lake Dead [8], was aimed at specifying proper seismostratigraphic units characteristic of the ground base of the Dziwnów Spit. I carried out these tests at the request of the Polish Geological Institute, Pomeranian Branch in Szczecin. The length of seismic profiling was 1200 m. A detailed analysis of the seismic record of the ground wave image allowed me to separate the following seismostratigraphic units:

N - anthropogenic deposits,

A - sands and gravels of modern transgression of the Baltic Sea,

A1 - sands and gravels of grey sand dunes from the transgression and regression of the sea of the Mya Sea,

A2 - sands and gravels of the bright-yellow-grey sand dunes from the transgression and regression of the Limnaea Sea Lm2 (upper level),

A3 - sands of the yellow sand dunes from the Limnaea Sea regression (Lm2),

B1 - organic muds of the central Holocene,

C1 - sands and gravels of the transgression of the Limnaea Sea (Lm2) sea and the late Littorina Sea,

C2 - sands and gravels of the early Littorina Sea,

D1 - glacifluvial sands and gravels from the transgression of the Vistula Glaciation,

D2 - river sands and gravels of the Eemian Interglacial,

E1 - glacial tills of the Vistula Glaciation,

E2 - boulder clays of the Vartanian Glaciation,

F - mudstones, claystones and sandstones of the lower Jurassic.

The scientific achievement was the discovery by me of various age zones of vertical movements of the ground, which essentially influenced the development of this part of the Dziwnów Spit. It turned out that in the southern part of the area, the vertical movements of the ground expired at the end of the Subboreal period, and in the northern part continued throughout the sub-Atlantic period, significantly affecting the range of transgression of the Mya Sea and the current location of the sand dunes. Another scientific achievement was the finding of the present occurrence of vertical movements in the substrate in the coastal zone of the spit area, where quaternary sediments are displaced along the fault, including the characteristic seismic record of river sediments of the Eemian interglacial and glacial sediments of the Vistula Glaciations. Seismic surveys have shown that in some areas of the research area, the layer of organic mules has been shifted down by 10 m. This is another example that modern vertical movements of sediments may occur in the ground substrate.

8. K2 Kaszubowski L.J., 2018. Evolutional Trends and the Current Management of the Beach-Dune Systems along the Western Polish Coast (Southern Baltic Sea), Botero C.M., Cervantes O.D., Finkl C.W.

(eds.) Beach Management Tools – Concepts, Methodologies and Case Studies, vol.24, Springer International Publishing Switzerland, Heidelberg New York Dordrecht London DOI 10.1007/978-3-319-58304-4_6, pp.101-144. A chapter in a book (K), West Pomeranian University of Technology quantification the score 20

As a result of prof. Botero's proposal for the publication in the book entitled "Beach Management Tools - Concepts, Methodologies and Case Studies", I prepared and published my chapter [10] related to evolutionary trends and modern management of beach and dune systems along the west coast of Poland. In the first part of my chapter I presented the evolutionary trends of the development of the coastal zone of the west coast of Poland, with particular emphasis on the area of the Świna Gate during the last 8,500 years. Based on the analysis of scientific literature (eg. Uścinowicz 2003), geological maps of the Baltic Sea bottom, analysis of seismoacoustic surveys, I was able to present the paleogeographic development of the area currently located within the bottom of the Pomeranian Bay. However, I was able to present the development of the current area of the Świna Gate to the vicinity of Nowe Warpno and Szczecin based on the analysis of available archival materials and the results of my own geological surveys carried out in the form of drilling and laboratory tests and dating of organic sediments using the C-14 radiocarbon method. The idea was to present the pace of changes in the shorelines that were influenced by particular transgressions of the Baltic Sea during the middle and late Holocene. Both the analysis of seismo-acoustic materials concerning the area of the present bottom of the Pomeranian Bay as well as seismic surveys carried out in the Polish Baltic Sea areas confirmed the complex geological structure of the quaternary sediment cover. Geological cross-section "Świnoujście II" presented by me is a good example, where I have specified the following geological layers:

1- sediments from the Littorina Sea transgression (L1, early Atlantic Period),
2- sediments from the Littorina Sea transgression (L2, early Atlantic period),
2- sediments from the Littorina Sea regression (L2), brown sand dunes spit (early Atlantic period),
3- sediments from the Littorina Sea transgression (L3, early Atlantic period),
4- sediments from the Littorina Sea transgression (L4, late Atlantic period),
5- sediments from the Littorina Sea transgression (L5, late Atlantic period),
5- sediments from the Littorina Sea regression (L5), sand spit dunes (late Atlantic period), and peat cover in the event (sub-coastal and sub-Atlantic period),
7- sediments from the Limnaea Sea transgression (Lm2, early subboreal period),
7- sediments from the Limnaea Sea regression (Lm2), yellow sand dunes (early subboreal period),
10- sediments from the Limnaea Sea regression (Lm5), spit bright-yellow-gray dunes (late subboreal period),
11- sediments from the Mya Sea regression (My3), spit of gray dunes (late sub-Atlantic period),
14- sediments of modern maritime transgression (late sub-Atlantic period).

The scientific achievement of this chapter was the establishment of average speed of individual maritime transgressions, the calculated values of the average pace of erosion of the then sea coasts, a present-day important engineering issue related to the design of specific hydrotechnical constructions securing the shallow seafront, beach and its facilities. Presenting in my chapter the geological history of the west coast of Poland, I have detailed the following stages of evolution:

• the period of the early Littorina Sea - about 8200 years ago, the area develops during the fastest transgression of the Littorina Sea (L1), where the average sea water rise speed was 47 mm / year, with a total displacement of the coastline towards the south by 88 km. About 7900 years ago, the area develops under the influence of Littorina Sea transgression (L2), where the average sea water lift speed was 40 mm / year, and the average rate of shore erosion was 45 m / year with spit area abrasion 14 km and cliff area 7 km. About 7000 years ago there was a transgression of the Littorina Sea (L3), where the average sea water rise speed was 17.5 mm / year, and the average rate of shore erosion was 19 m / a with a total abrasion of the spit area 6 km and the cliff area 3 km,

• the period of the late Littorina Sea - about 6200 years ago, the area develops during the transgression of the Littorina Sea (L4), where the average sea water rise speed was 11.1 mm / year, and the average rate of shore erosion was 15 m / year with the total abrasion of the area 4.7 km and the cliff area 2.3 km. About 5,800 years ago there was transgression of the Littorina Sea (L5), where the average speed of transgression was 10 mm / year, and the average rate of coastal erosion was 12 m / year with a total abrasion of the cross-section 3.7 km and the cliff area 1.8 km,

• the period of the early Limnaea Sea - about 4,200 years ago, the area develops during the transgression of the Limnaea Sea (Lm2), where the average sea water rise speed was 19.6 mm / year, and the average edge erosion rate was 12.9 m / year with total abrasion area a 4 km long brook and 2 km cliff area,

• the period of the late Limnaea Sea - about 2,600 years ago, the area develops during the transgression of the Limnaea Sea (Lm5), where the average transgression speed was 4.8 mm / year, and the average rate of shore erosion was 6.4 m / year with a total abrasion of the 2 km span area and the cliff area 1 km,

• the period of the late Mya Sea - about 800 years ago, the area develops during the transgression of the Mya Sea (My3), where the average speed of transgression was 3.5 mm / year, and the average rate of shore erosion was 3.8 m / year with a total abrasion of the span area 1.2 km and the 0.6 km cliff area.

In the second part of the chapter I analyzed the methods of protecting the Polish coasts with particular reference to the West Coast, giving examples of technical solutions to this issue (various types of structures and hydrotechnical constructions). Another scientific achievement of this chapter, but not related to my main research area, was the definition of the tourist attractiveness indicator of the coastal zone of the oceans $I_{TA(CZ)}$, which consists of three components: a natural indicator of tourist attractiveness I_{NTA}, a cultural indicator of tourist attractiveness I_{CTA} and a technical and infrastructural tourist attractiveness index I_{TI}. The defined index of the tourist attractiveness of the world coast allows for the calculation of their tourist value and mutual comparing, important for the hosts of specific areas, and above all for the commonly understood tourism.

4.2.2c. List of selected publications related to the research area (geological and seismoacoustic research of the Baltic Sea bottom)

1. B3 Kaszubowski L.,1989. Quaternary of the Koszalin Bay in the light of seismoacoustic research.(Czwartorzęd Zatoki Koszalińskiej w świetle badań sejsmoakustycznych), Studia i Materiały Oceanologiczne nr 56, Wyd. KBM PAN, 115-126 **- list B of MSHE**

2. B7 Kaszubowski L.J.,1997. Thickness of Quaternary sediments of the Gdańsk Basin in the light of seismoacoustic research(Miąższość osadów czwartorzędowych Basenu Gdańskiego w świetle badań sejsmoakustycznych),Inżynieria Morska i Geotechnika nr 1, 65-72 **- - list B of MSHE**

3. B8 Kaszubowski L.J.,2000. Tectonics and Quaternary of the area of the southern Baltic (Tektonika i czwartorzęd obszaru południowego Bałtyku), Inżynieria Morska i Geotechnika nr 3, 123-128 **- list B of MSHE**

4. M10 Kaszubowski L.J., 2015. Seismic and geological research of the Bornholm Basin seabottom (Badania sejsmiczne i geologiczne dna Basenu Borholmskiego). (W:) Z. Meyer (red.) Regionalne Problemy Inżynierii Środowiska. Wyd. Zachodniopomorskiego Uniwersytetu Technologicznego w Szczecinie, Szczecin, pp. 43-53**- a chapter in a monograph (M)**

5. K1 Kaszubowski L.J.,2016.Seismic profiling of the seabottoms for shallow geological and geotechnical investigations, Finkl C.W., and Makowski C. (eds.) Seafloor mapping along continental shelves, vol.13, Springer International Publishing Switzerland, Heidelberg New York Dordrecht London, pp.191-243 **– a chapter in a book (K)**

4.2.2d. Analysis of selected publication related thematically to the research area (geological and seismoacoustic research of the Baltic Sea bottom)

1. **B3 Kaszubowski L., 1989. Quaternary of the Koszalin bay in the light of seismoacoustic research. (Czwartorzęd Zatoki Koszalińskiej w świetle badań sejsmoakustycznych), Studia i Materiały Oceanologiczne nr 56, Wyd. KBM PAN, 115-126. - list B of MSHE, the score 5; number of citations acc. to Google Scholar 6, number of citations acc. to Web of Science – not included**

Seismoacoustic research, which was carried out in the area of Koszalin Bay [1], was commissioned by the Polish Geological Institute, Marine Geology Department in Gdańsk, and being a research worker of this Institute I was the manager of the sea trip. Directly, these studies were carried out by PGNiG SA, "Geofizyka" Section in Toruń. In marine research, the continuous seismoacoustic profiling (CSP) method based on the EGG measurement system manufactured in the USA was used. In order to obtain the best wave image resolution, a high frequency wave source was used - boomer, where the frequency band (1.4-7.0 kHz) and 200J pulse energy were used. Seismoacoustic seismic tests in the discussed area were made along the planned profiling grid. The scientific achievement of this research and this publication was the specification on the basis of the seismic record of the acquired registrations of the following litho-genetic types forming the cover of quaternary sediments of the bottom of the Koszalin Bay:

1) fine and average sands of marine accumulation, the age of Littorina and Post-Littorina (Holocene),
2) tills of the Baltic Glaciation (today the Vistula Glaciation, Pleistocene),
3) boulder clays of the damaged frontal-moraine zone of the Vistula Glaciation (Pleistocene),
4) outcrops of older sediments as Neogene silt-clayey sediments.

The above separations that I extracted from the seismic records were also confirmed by the boreholes. The result of the seismoacoustic studies and interpretative works carried out was a map of surface sediments of the Koszalin Bay prepared by me. Another achievement was the correlation of the former frontal-moraine zone of the Vistula Glaciation (now destroyed), located at the bottom of the Koszalin Bay, and with the same zone located on land near Kopań Lake. In geotechnical aspectsthe seams and gravel occurring in the area of marine genesis, usually of averagely compacted and well-compacted with diversified thickness, are a good basis for marine construction. The area of the former frontal-moraine of the Vistula Glaciation and the flat sea bottom of the former bottom moraine composed of glacial clays outside the demersal layer, which is plastic or soft plastic, provides a sufficient base for marine construction where glacial clays in the hard plastic state occur.

2. B7 Kaszubowski L.J., 1997. Thickness of Quaternary sediments of the Gdańsk Basin in the light of seismoacoustic research, Inżynieria Morska I Geotechnika nr 1, 65-72. List B of MSHE, the score 4; a number of citations acc. to Google Scholar 6, number of citations acc. to Web of Science – not included

Seismoacoustic research, which was carried out in the area of the Gdansk Basin [2], was commissioned by the Department of Geomorphology and Geology of the IMGW in Gdynia where I previously worked on the subject of MR-I-15, and conducted by PGNiG SA, "Geofizyka" Section in Toruń. In marine seismoacoustic research, a high-frequency wave excitation source was used - a boomer in the range of operating frequencies from 1-2 kHz, and single-pulse energy ranging from 150-300 J and a low-frequency source - sparker in the frequency range from 0.2-0.6 kHz with single energy 500 J. The research was carried out along a densely designed seismic profiling grid with the use of the AD-2 phasing system during navigation. Over 2000 km of current seismic profiles were made during this time using continuous seismoacoustic profiling. The scientific achievement of this publication was to create a map of the shape of the sub-Quaternary surface and a map of the thickness of Quaternary sediments of the Gdańsk Basin. In terms of the shape of the surface of the sub-Quaternary ground, I divided the area of the Gdansk Basin into three parts:

• Northern area, where the sub-quaternary area is located deepest (130-156 m.a.s.l), where the sculpture of the analyzed area is the result of an intense glacial scouring and a specific geological structure of this ground associated with the creations of the Jurassic,

• Middle area with significant spatial dimensions and the most even sculpture due to considerable resistance of the Upper Cretaceous rocks to destruction, where the sub-quaternary surface occurs at a depth of 104-130 m.a.s.l.

• Southern area with a very large variation of the sub-quaternary sculpture resulting from being less resistant to destruction of Paleogene and Neogene formations (the former Tertiary), where the sub-quaternary surface occurs at a depth of 26-100m.a.s.l.

The map of the Quaternary sediments I have made is also dividing the area of the Gdansk Basin into three parts. In the northern area relatively homogeneous, the thickness of the sediments varies from 24-42 m, and in the central area the thickness variation is the smallest and ranges from 18-30 m. The largest variety of sediments and the largest thickness variation occurs in the southern area, where these values range from 20 -80 m, and in the area of the Vistula Spit reach the value of even 100 m. I would like to add that two resulting maps prepared by me for the Gdansk Basin were precursory at the time and are still of great value to this day due to their high accuracy.

3. B8 Kaszubowski L.J., 2000. Tectonics and Quaternary of the area of the southern Baltic, Inżynieria Morska i Geotechnika nr 3, 123-128. List B of MSHE, the score 4; a number of citations acc. to Google Scholar 6, a number of citations acc. to Web of Science – not included

Numerous seismoacoustic studies carried out by the former Geomorphology and Sea Geology Institute of the IMGW in Gdynia in the area of the Polish Baltic Sea and the analysis of their results [3] were the basis to characterize the structure of quaternary sediments resting on the bottom of the southern Baltic. In the first part of the article, based on the analysis of scientific literature, I discussed the tectonic characteristics of the southern Baltic area. It could be said that in the tectonic and geological terms, the Baltic Sea is an internal sea (intracontinental) characterized by the fact that the geological structure under the seabed is closely related to the construction of adjacent land areas. The Polish area of the Baltic seabed is divided into two parts: the eastern and western part. The eastern part of the Polish Baltic belongs to the rigid, Archaic-Proterozoic craton of the Eastern European Platform, whereas the western part belongs to the mobile Paleozoic West European Platform. In the area of these two large tectonic units one can distinguish smaller units in the form of the following blocks: Wolin block, Gryfic block, Kołobrzeg block, Darłowo block, Słupsk block, Żarnowiec block, Łeba block, Kurlandzki block and Gdańsk block. The scientific achievement of this article is a synthesis I made with a summary of the current results of seismoacoustic and geological research on the geological structure of the Quaternary of the Polish bottom of the Baltic Sea. Therefore, analyzing the current scientific achievements in this area, I was able to draw the following conclusions:

• Thickness of the Quaternary sediments varies and ranges from 1-300 m. The smallest values of thickness of Quaternary sediments is found in the area of deepwater basins, where during the Pleistocene the processes of glacial extermination prevailed. Small thicknesses occur in the area of the bottom and the southern slopes of the Słupsk Furrow and in the southern part of the Gotland Basin. On the other hand, quite considerable thickness occurs in the shallow-water zone and in the area of the coastal zone,

• Pleistocene deposits were most accurately identified in the area of deepwater basins. There is only one level of glacial clays in the region of the bottom of the Słupsk Glacial and its southern slopes. In turn, on the northern slopes of the Słupsk Furrow, in the Bornholm Basin and the Gdańsk Basin there are two glaciogenic levels. There are two levels of glacial clays found in the area of the Baltic Sea near the Dziwnów Spit, during the micro-seismic and TL dating, where the glacial clays of the Vistula Glaciation and the glacial clays of the Vartanian Glaciation were separated. A similar system of glacial clays was found in the research of the coastal zone around Niechorze. On glacial clays in the area of deep-water basins, there are clays and silts and varic clays and silts of the Baltic Ice Lake, finishing the sedimentation of the late Pleistocene. In shallow water zones, Pleistocene deposits are more diverse, where there are several levels of glacial clays, glacifluvial deposits, glaciolimnic sediments, delta sediments and biogenic sediments,

• Holocene sediments in the Baltic Sea area are seismically subdivided and in the area of deepwater basins the lower level is represented by mules and clays of the Yoldia Sea and mules and loams of Ancylus Lake, where sedimentation of the early Holocene occurred. The upper level is made of organic loams, muds and silts (organic muds) of the Littorina and post Littorina Sea, where sedimentation occurred during the middle and late Holocene periods. In the shallow water area the lower Holocene is built by limestone, delta and lagoon deposits, while the upper Holocene is composed of sand-gravel sediments of the Littorina and post Littorina Sea.

4. M10 Kaszubowski L.J., 2015. Seismic and geological research of the Bornholm Basin seabottom. (W:) Z. Meyer (red.) Regionalne Problemy Inżynierii Środowiska. Wyd. Zachodniopomorskiego Uniwersytetu Technologicznego w Szczecinie, Szczecin, pp. 43-53. A chapter in a monograph (M), the score 4; number of citations acc. to Google Scholar – not included, number of citations acc. to Web of Science – not included

Seismoacoustic research [4], conducted by the former Department of Geomorphology and Sea Geology of the IMGW in Gdynia, in the area of the Bornholm Basin floor, was an attempt to characterize the geological structure of the sub-Quaternary ground and quaternary sedimentary structure resting on the seabed in this Baltic region. In seismoacoustic studies the E.G.G system was used (USA production) and the high frequency source of wave excitation - boomer in the working frequency range from 1-2 kHz, and the energy of a single pulse was then from 150-300 J. The method of reflected waves was used during the research. The research was carried out along a densely designed seismic profiling grid. The scientific achievement of this research and this publication was a good recognition of the geological structure of the Quaternary sediment substrate as well as the structure of the Pleistocene and Holocene sediments.

The detailed analysis of the lower parts of the seismoacoustic records carried out by me allowed me to state that in the eastern part of the Bornholm Basin the substrate is made of Silurian rocks, which are represented by clay shale with graptolites. I found that the quaternary surface is here at a depth of 100-101m.a.s.l In the western part of the analyzed area there is a clear contact of chalk sediments with Silurian deposits. The research, which was carried out in the area of the Bornholm Basin, proved that the upper Cretaceous is composed of layered muds in which very distinct seismoacoustic reflections occur. In the wave image it can be observed that the deposits of the upper Cretaceous in this region are folded, which are in tectonic contact with Silurian deposits. In the seismic record it could be noted that in the depressions of the Upper Cretaceous deposits there are Paleogene deposits probably represented by sandstones, mudstones and quartz-glauconitic sands with parallel stratification, which indicate a clear acoustic contrast with the sediments of their substrate.Analyzing the records of seismoacoustic studies, I found that in the lower parts of the Quaternary sediment profile of the Bornholm Basin there are sometimes two levels of glacial clays, but in many cases only one glacial level due to subsequent intensive erosion processes. The lower glacial level formed in the Pleistocene and belongs to the Vartanian Glaciation sediments and reaches a thickness of 6.5 m. The thickness of the upper glacial clays, which belong to the Vistula Glaciation sediments, is not large and usually amounts to 4 m. In my scientific experience, as in other areas of the Baltic seabed, here also the levels of glacial clays on seismoacoustic recordings are marked as unstructured layers with a disorderly internal structure and a very diverse acoustic signature (various reflections) depending on the granulometric composition and the degree of plasticity. The texture of the seismic record is also clearly darker, which is associated with numerous strong reflections of the seismic wave from the heterogeneous glacial material. Analysis of the seismoacoustic record suggests that the upper glacial clays contain horizontal level of sediment deposits formed in the late Pleistocene represented by mules and clays, sometimes by fine and silty sands with a thickness of up to 4 m. Similarly to other areas of the Baltic seabed in the seismoacoustic record of this level is unstructured (very poorly reflective), where the texture of the wave image is very bright due to the occurrence of very small non-consolidated deposits there, which absorb the seismic waves to a large extent.The Pleistocene sediments' stratum was formed by the waves formed at the end of the Pleistocene during the Baltic Ice Lake with a thickness of 4-7 m. On the seismoacoustic record, this level distinguishes a distinct horizon of parallel, strongly reflected acoustic reflections from the hard layers of iron monosulphides. A good confirmation of the occurrence of the layer of pole clays in these regions is the core 30R13 collected in these regions, in which the layer is located at a depth of 1.4-1.8 m below the seabed.

Early Holocene is represented by mules and clays of the sea of Yoldia and Ancylus Lake. Sediments of this level reach a thickness of 1.5-3 m, and in the moraine-frontal area only 1.5 m. On the seismoacoustic record the highlighted levels are not acoustically separated due to the high similarity in the lithological composition of sediments. In the wave image, it can be noticed that the sediments are layered in parallel, where there are clear reflections associated with iron sulphide laminates. In fragments of the recording, where mules are very saturated with water, the structure of the wave image is transparent acoustically with a bleached texture.

Middle Holocene deposits were created by the transgression of the Mastogloia Sea and the Littorina Sea as the next development stages of the Baltic Sea, which are represented by pale and gray silt and olive-colored sediments with olive tint. The upper parts of the Holocene are the late Holocene sediments represented by the transgression of the Limnaea Sea and the Mya Sea, where deep water basins still have sedimentation of gray and light gray clays and a significant amount of organic matter. On seismoacoustic recordings, the levels of the middle and late Holocene listed are not acoustically separated due to the high similarity in the lithological character of the sediments. In the seismic record, it can be seen that these sediments are stratified in parallel. In relation to the sediments of the early Holocene, the ground parts are inaccessible in contact with the erosive surface.

5. K1 Kaszubowski L.J., 2016. Seismic profiling of the seabottom for shallow geological and geotechnical investigations, Finkl C.W., and Makowski C. (eds.) Seafloor mapping along continental shelves, vol.13, Springer International Publishing Switzerland, Heidelberg New York Dordrecht London, pp.191-243. A chapter in a book (K), WPUT in Szczecin quantification the score 25; number of citations acc. to Google Scholar 3, number of citations acc. to Web of Science – 2

As a result of the proposal of prof. Finkl from the Atlantic University of Florida, USA, editor-in-chief of the Springer International series under the name "Coastal Research Library" to prepare a chapter in the book entitled "Seafloor Mapping along Continental Shelves", I prepared and published my chapter [5] related to seismic surveys of the seabed used in shallow geological and geotechnical studies. This chapter has a monographic character and concerns the whole of marine seismic surveys carried out within the Baltic Sea bottom, with particular emphasis on the Polish bottom of the Baltic Sea. In the first part, I presented the methodology of marine seismic research with the division into deep and shallow research, popularly known as seismoacoustic studies. In the section on deep seismic research, I have listed and described the more important sources of wave induction and recording devices, as well as the data processing and interpretation techniques. Deep seismic surveys are usually carried out in order to search for oil and natural gas, where in the Polish Baltic area these tasks were performed by PGNiG SA, "Geofizyka" Section in Toruń. In the section on seismoacoustic research, I also mentioned and described more important sources of wave excitation and hydrophones recording reflected seismic waves, as well as Huntec's Canadian and EGG (manufactured in the USA) measurement systems. I would like to add that the Huntec measurement system was purchased by the Department of Geomorphology and Sea Geology of the IMGW in Gdynia, where in the 1970s and 1980s, it was the only Polish performer of seismoacoustic research in the area of the Polish Baltic Sea. Later, in the 90's and 2000's, the EGG system was used, and the contractor for this research was the "Geofizyka" Section in Toruń. In the further part of my chapter I presented the ways of interpreting acquired seismoacoustic materials from the area of the Polish Baltic Sea. I have analyzed in detail the interpretation of seismoacoustic surveys carried out using the Huntec system in the area of Odra Bank (Wajda 1982), where the seismic record clearly separates the Pleistocene glacigenous substrate from the sand-gravel sedimentation cover. In places, the clearly reflective record of the wave image of the sand-gravel cover allowed the separation of smaller seismostratigraphic units of the marine Holocene. I also presented the methods of interpretation of seismoacoustic surveys made by the EGG system in the Bornholm Basin region. In seismic records, an older substrate made of sandy Cretaceousmulch was separated, and in the quaternary a layer of glacial clays, clays of the Baltic Ice Lake, creations of the Yoldia Sea and the Ancylus Lake were separated, and in the ceiling the sand of the Littorina and post Littorina Sea (Uścinowicz, 2003). A very interesting situation occurs in Quaternary soil in the area of Słupsk Furrow, where in the wave image there are present high-resolution clayey shales of the Sylurian with visible folded structures. You can notice the contact of these sediments with the Lower Permian river formations (Rossa & Wypych, 1981). On the beveled surface of the Quaternary substrate there are plastic Pleistocene clays, and the ceiling parts are filled with semi-liquid Holocene silts. In the further part of my chapter I presented the participation of seismic research, including seismoacoustic research in the recognition of deeper and shallower geological structures of the bottom of the Baltic Sea. It is characteristic that in the northern and north-eastern part of the Baltic Sea, the archaic-proterozoic crystalline substrate made of igneous and metamorphic rocks occurs shallowly or directly on the seabed and almost completely reflects seismic waves creating a completely non-reflective image.Then I presented the situation related to the geological structure of the Paleozoic-Mesozoic sediments, in which there are sometimes characteristic high-reflection seismic records associated with a large variation of sedimentary conditions in specific periods or geological eras of the Baltic area. In this regard, I also presented on the basis of a detailed analysis of new seismoacoustic materials of the former Geomorphology and Sea Geology Institute of the IMGW in Gdynia, the construction of the Quaternary floor and Quaternary sediments in the Gulf of Gdansk, the Gdansk Basin and the Bornholm Basin. Analysis of the seismic record allowed me to separate the Upper Cretaceous sediments in the Gulf of Gdansk and the Gdańsk Basin, which from the north were in contact with the upper Jurassic deposits as a result of the clear fault zone there. In the Quaternary sediment cover, based on the wave image analysis, I specified the lower level and upper level of glacial clays, poorly reflective level of silt-block mounds of late Pleistocene, characteristically reflective level of the Baltic Ice lake (late Pleistocene), low reflectivity level of the Yoldii Sea and Ancylus Lake (early Holocene), in the parts of the roof, mules and organic silts, in places in the southern part of the Bay of Gdansk, the sands and gravels of the Littorina and post Littorina Sea (middle and late Holocene). Analysis of the seismic record in the Bornholm Basin, as well as geological drilling carried out as part of the geological map of the Baltic Sea bottom in scale 1: 200,000, allowed me to separate the upper Cretaceous sediments there in the north-eastern part, which contact poorly reflective strongly weathered level of Silurian clay shales. In the quaternary sediment cover, similarly to the area of the Gdańsk Basin, the seismic level and upper level of glacial clays, the level of late Pleistocene block clays, the Baltic Ice Lake (late Pleistocene), clay and sea salt of the Voldia and Ancylus Sea (early Holocene), mules and organic muds of the Littorina and post Littorina Sea (middle and late Holocene), which in many places have smaller thickness compared to the area of Gdańsk. Then, based on a dense network of seismic profiling in the area of the Gdansk Basin, I analyzed the map of the surface structure of the Quaternary subsoil I made on which I presented the upper range limits of the Upper Jurassic, Upper Cretaceous and Paleogene-Neogene deposits. Scientific significance is also given to the map of the thickness of

Quaternary sediments, which shows the variability of this phenomenon in the area of the Gdańsk Basin up to the shores of the Gulf of Gdansk. In the last part of my chapter I presented the possibilities of using seismoacoustic research in recognizing the geotechnical conditions of the seabed substrate, where I found that their role is very large, because in a large-scale manner and with the assumed accuracy they can determine the boundaries of specific types of soils that have specific physical and mechanical properties . In addition, the determination of the speed of seismic-acoustic waves in specific geological layers indicates their volume density as one of the important geotechnical parameters of the land. An important aspect is also to determine the thickness of geological layers, or to determine their arrangement in a horizontal, monoclinic or folded way, which also influences the assessment of the geotechnical conditions of the analyzed seabed. An important scientific aspect was to present in this part of the chapter, prepared by me in co-authorship studies, colorful geotechnical maps of the Polish Baltic Sea bottom as well as the ground substrate occurring at a depth of 10 and 20 m below the seabed. On the basis of detailed analysis of geological maps of the Baltic Sea bottom, numerous seismoacoustic studies, or direct geotechnical investigations of selected bottoms in the area of reconstruction of ports in Gdańsk and Kołobrzeg, taking into account geological factors such as land type, genesis and age, and such geotechnical parameters treated here as approximate (interval) values as, degree of compaction(I_D) , degree of plasticity(I_L), internal friction angle (Φ), cohesion (c), shear strength (τ_f), resistance for compression(R_c) and edometric modulus of primary compressibility (M_0) I was able to specify the following types of subsoil:

• very good ground for maritime construction (R_c > 1000 kPa) - it does not apply to the direct bottom of the Polish Baltic Sea, because there is no outcrop of rocky land there. In the ground, at a depth of 10 and 20 m, there are Silurian clay shales, Devonian limestone, Permian sandstones, Triassic claystones and mudstones, Jurassic limestones, siltstones, claystones and chalk limestones,

• good ground for marine construction (τ_f 300-1000 kPa) - at the bottom, made of sea sands and gravels, Eemian interglacial, glacifluvial sands and gravels, fluvial sands and gravels of the late Pleistocene and early Holocene as well as sands and gravels of the Littorina Sea and the post Littorina Sea, of the middle and late Holocene. In the substrate at a depth of 10 m there is also a layer of Neogene sands. However, in the substrate at a depth of 20 m there is only a layer of Neogene river sand, a layer of sand and gravel of the Eemian Sea and a layer of sands and gravels of the late Pleistocene and early Holocene,

• a sufficient floor for maritime construction (τ_f 100-300 kPa) - on the bottom built of glacial clays of the Vartanian Glaciation and of the Vistula Glaciation, of Pleistocene. In the substrate at a depth of 10 m, there is also an additional layer of Neogene lake mules and silts. However, in the substrate at a depth of 20 m there is only a layer of silts and lake loams of Neogene and glacial clays of the Vartanian Glaciation,

• bad ground for maritime construction (τ_f 50-100 kPa) - on the bottom built of mists and silt clays of late Pleistocene, mules and clays of various stages of the Baltic Sea of the late Pleistocene and early Holocene, Aeolian sands of the Baltic Pleistocene Ice Lake, lake mules and silty sands of the early Holocene, spherical sands of the late Holocene. In the substrate at a depth of 10 m there is only a layer of lateral Holocene sands. However, in the substrate at a depth of 20 m there is only a layer of mules and clays of various stages of the Baltic Sea of the Late Pleistocene and early Holocene,

• very bad substrate for maritime construction (τ_f <50 kPa) - on the bottom and in the ground at a depth of 10 m built of clay, mules, silts and organic impurities of the sea of the Littorina and post Littorina Sea, of middle and late Holocene. In the substrate at a depth of 20 m, this type of soil does not occur.

4.2.2e. Publications cited in the analysis of scientific achievements

1. Dobracki R., Zachowicz J., 1998.Geodynamic map of the Polish Baltic zone - in Polish (Mapa geodynamiczna polskiej strefy Bałtyku). Centralne Archiwum Geologiczne Państwowego Instytutu Geologicznego, Oddziału Pomorskiego, Szczecin

2. B6 Kaszubowski L.J.,1995.Transgressive cycles of the Baltic Sea.Prace Państwowego Instytutu Geologicznego CXLIX, 122-125

3. F17 Kaszubowski L.J., Coufal R., 2010. Geological structure of the Kopań Lake Spit – in Polish (Budowa geologiczna mierzei jeziora Kopań). (W:) Z. Meyer (red.) Regionalne Problemy Inżynierii Środowiska, Szczecin, pp. 45-51

4. F18 Kaszubowski L.J., Coufal R., 2012. Geological structures of the Wicko Lake Spit – in Polish (Struktury geologiczne mierzei jeziora Wicko). (W:) Z. Meyer (red.) Regionalne Problemy Inżynierii Środowiska, Szczecin, pp. 69-75

5. Miotk G., Bogaczewicz-Adamczak B., 1987. Marine transgressions on the basis of investigations of subfossil biogenic sediments in the Sarbsk Bar, Southern Baltic. Quaternary Studies in Poland, Warszawa-Poznań, 66-72

6. Rossa W., Wypych K .,1981. Seismostratigraphy of the Southern Baltic bottom – in Polish (Sejsmostratygrafia dna Bałtyku Południowego). (W:) Subotowicz W (ed.) Geological-engineering studies of the coast of the bottom of the South Baltic, Gdańsk, 48p

7. UścinowiczSz., 2003. Relative sea level changes, glacio-isostatic rebound and shoreline displacement in the Southern Baltic. Pol Geol Inst Sp Papers 10, Warszawa, p 80

8. Wajda W.,1982. Recent geological investigations of the Odra Bank -(Banka Odry po rezultatam nowych geologicheskich isledowany). Peribalticum II, 171–183

9. Williams G.E., 1986. The solar cycle in Precambrian time. Scientific American, 255, 2, 88-96

4.2.3. Summary

As a scientific achievement constituting a significant contribution to the development of the specialty of sea geology in the discipline of Earth and environmental science, I presented an analysis of my selected scientific achievements associated with the research area entitled "Geological and seismic research of the Baltic Sea". In the first part, I analyzed the selected scientific achievements associated with my geological and seismic research of the coastal zone of the Baltic Sea. When studying the shore zone I was aware that I was studying the geological history of the Baltic Sea during the middle and late Holocene period. The most important geological events (evolutionary changes) associated with the sea reservoir were recorded in very complex accumulation and sedimentation structures of the southern Baltic spits. My geological and seismic research of this area allowed me to understand the complex mechanism of sea transgression and regression processes in the Baltic Sea. The scientific achievement of my research was that the transgressive and regressive phases of the Baltic Sea of irregular duration, described by many researchers as of irregular duration, I demonstrated and recognized them as cyclical processes with a regular period of 300 years. For the first time in publications (A1 Kaszubowski, 1992, B6 Kaszubowski, 1995) I separated the transgressive cycles of the Baltic Sea, which took place in the late Holocene along the central Polish coast. I would like to point out that in the study of the old Precambrian lake sediments in Australia, a regular climate cycle of 314 years was discovered (Williams, 1986), which may be one of the scientific facts confirming the cyclical changes of the Baltic Sea I recognized. Subsequent studies of the Polish coastal zone of the Baltic Sea assured me that not only the transgressions and regressions of the late Holocene, but also transgressions and regressions of the middle Holocene were also cyclical. A detailed analysis of the transgressive and regressive cycles of the Baltic Sea in the last 8500 years allowed concluding that the middle Holocene is the period in the history of the development of the South-Baltic region in which the morphological changes in the research area took place. They were caused by the great littoral transgression of the Baltic Sea, which proceeded in five transgressive cycles, of which the first three L1, L2 and L3 were in the early Littorina period, and the last two L4 and L5 in the late Littorina.

During the early Littorina period, the sea basin was moving very rapidly southward reaching the highest sea water rise rate in the entire history of the central and late Holocene of the Baltic Sea (47 mm / year, L1). I want to add that the speed of transgression (transgressive cycle) was calculated taking into account the location of the former abrasive platforms during the maximum transgression, taking into account the isostatic movements (K2, 2018) and thus the determined difference in the position of the former sea levels was the basis for determining the rate of sea water rise. The average speed of sea water rise in the L2 transgression cycle was 40 mm / year and in the L3 cycle it was 17.5 mm / year. The average rate of erosion of sea coasts was then 24-9 m / year, and the total abrasion of the land in the area of the Pleistocene uplands varied from 7-3 km. The early Littorina regression from the L2 cycle is particularly important for the present transitional regions of the South-Baltic region. During the slow regress of the sea and shifting its shoreline towards the north, a fairly large area of the early Atlantic brown sand dunes, about 2 km wide, arises, and in some places even of more significant relative heights. These dunes constitute the basic pedestal of the current spit area. In terms of lithology, the brown dunes differ very clearly from other types of dunes, which was a very good exploratory method among the Aeolian sediments analyzed in the drilling profiles. First of all, brown dunes are usually less sorted (moderately sorted) and have a negative skewness (the grain size distribution is slightly slanting negatively). This testifies to the more radical conditions of the environment at the time (greater transportation force of the wind and in this the greater dynamics of settling processes). It may also be related to the less-sorted source material, especially in the case of the formation of brown dunes older (early Littorina). Along the poorly leveled sea shore there was a movement of the shore material in the shallow part of the coast of the then coastal zone.

In the late Littorina period, maritime transgression is slower. Transgression of the littoral sea in the L4 cycle ran at an average speed of 11.1 mm / year, and in the L5 cycle 10 mm / year. The average sea coast erosion rate was then 5.5-5.0 m / year, and the total abrasion of the land in the area of the Pleistocene uplands varied from 1.7-1.5 km. During marine regression, a complex of brown late-Atlantic dunes (late Littorina) is created, which is added to previously destroyed older structures. During the regression of L5, which later merges with the great early Sub-Boreal regression, a broad spit of the late-Atlantic and early-Baltic brown dunes along the entire Polish coast is created. In the area of the Gate of the Świna, the preserved transverse structures of brown dunes have a width of approx. 2 km. In comparison with early-Atlantic sand dunes, these sediments are better sorted. Presumably, it may be related to the source material, which at this time is definitely better selected than it was before. At that time, there are lagoon reservoirs and coastal lakes in the central and west coast of Poland. The late Holocene is clearly bifid. In the first part called the Subboreal period, transgressive cycles are still running at quite high speed. The cause should be found in slightly larger ice sheets of the northern hemisphere and major fluctuations of the Antarctic ice sheet. During the transgression of the Limnaea Sea in the Lm1 cycle, sea water rises with an average speed of 3.2 mm / year. However, the largest transgression at this time falls on the Lm2 cycle, where the average sea water rise speed is then 19.6 mm / year. During the Lm3 and Lm4 transgressions, the average rate of sea water rise was 9.6 mm / year. In turn, Lm5 transgression runs at an average speed of 4.8 mm / year. During this period, the average rate of sea coast erosion ranged from 1.6-8.0 m / year, and the total abrasion of the land in the area of the Pleistocene uplands varied from 0.5-2.5 km. The maritime regression from the transgressive cycle Lm2 creates a spit of yellow dunes clearly visible (high altitudes) in the current sculpture of the South Baltic area. A characteristic feature of the yellow sandstone structures is that those are sediments with good and very good sorting. The M3 index is specific here, which takes positive values describing the grain size distribution as slightly slanting positively. It can be assumed that during the formation of the sand dunes, the calmer sedimentary and accumulation conditions prevailed in the then coastal zone, compared with the formation of the spit of brown dunes, where the M3 index assumed negative values. On the other hand, as a result of sea regression from the Lm4 and Lm5 series, a spit of bright-yellow-gray late-Subboreal dunes is created, which is added to the yellow sand dunes. The spit of bright-yellow-gray dunes was found both on the area of the central and west coast of Poland. Sandy-yellow-gray dunes are usually well sorted and what is characteristic of this age range, they reach negative values of the M3 index (the grain size distribution is slightly skewed negatively). It should be assumed that during the regression from the

Lm4 and Lm5 cycles there was a greater dynamics of the sedimentation environment in the then coastal zone than during the Lm2 regression, where yellow dunes were formed.

In the second part of the late Holocene, in the sub-Atlantic period, there are smaller fluctuations in the sea levels of the Baltic Sea, which are gradually approaching the modern location. This phenomenon is also matched by lower speeds of individual transgression cycles. Most of the evolutionary changes of the Baltic Sea are taking place at the time of today's bottom of the Baltic Sea. During the transgression of the Mya Sea in the My1 cycle, the average sea water rise rate was then 2.0 mm / year. On the other hand, My2 transgression proceeded at an average speed of 2.2 mm / year. The fastest transgression of the sub-Atlantic period falls on the My3 cycle, where the average speed of sea water rise is then 3.5 mm / year. The average rate of sea shore erosion ranged from 1.0-1.7 m / year, and the total abrasion of the land in the area of the Pleistocene uplands was from 0.3-0.5 km. Marine regression from the My3 cycle causes the formation of gray sand dunes very clearly visible in the current sculpture of the coastal zone of the South Baltic area. This spit is added to the spit of light-yellow-gray dunes. The shafts of gray dunes (the front bank of coastal dunes) are commonly found in the area of the present coastal zone of the Baltic Sea. The gray dunes are well and very well sorted, and at the same time they achieve a positive M3 index (grain size distribution slightly slanting positively). The M3 indicator indicates the occurrence of weaker dynamics of sedimentation processes in the then coastal zone, similar to the formation of the yellow sand spit. It should be concluded that sea regression at this time is relatively slow, as shown by fairly high dune embankments. Contemporary transgression of the Baltic Sea as the My4 cycle manifests itself in the increased erosion of sea coasts along almost the entire Polish coast. If we assume that the average speed of sea water rise is 1.5 mm / year, the mean aggregate abrasion of the sea coast should be 0.2 km, and at 2 mm / year this value will be about 0.3 km. I would like to add that the significant scientific success of my research achievement is the agreement signed by me in March 2018 with the American scientific publication CRC Press Taylor & Francis Group for the publication of a book entitled "Geological History of the Baltic: Transgressions and Regressions Caused by Tectonic Movements and Cyclical Climate Change" (date of delivery of the manuscript is set for 16/06/2020), which in fact does closely coincide with my area of scientific research.

The scientific event was mine full implementation of the CS-5G-1 apparatus for the recognition of geological and geotechnical conditions of the ground bed as a seismic timer, in particularly difficult conditions which is the complex and thicker cover of the Quaternary sediments of northern Poland. On the basis of the acquired rich scientific experience through numerous seismic surveys conducted by me on the land area, and in particular the coastal zone of the Baltic Sea, repeatedly verified by geological drill holes, I could develop the following interpretive patterns as precursors for this research method and concerning the above-mentioned area, where I presented the range of variation of such parameters for a seismic wave as; H - height, A - amplitude and T - wave period:

• river-side sands and gravels, loose, of the late Holocene with very small wave amplitude (H = 20-100 mV, A = 10-50 mV, T = 1-3 ms),

• sea sands and gravels, loose, of the late Holocene with very small wave amplitude (H = 20-80 mV, A = 10-40 mV, T = 1-3 ms),

• dune sands, loose, late Holocene sands with very small and little differentiated amplitude (H = 50-80 mV, A = 25-40 mV, T = 1-2 ms),

• organic sediments (peats, organic silts) of the late and middle Holocene, almost unamplified in the seismic record,

• sea sands and gravels, of medium density, middle Holocene with small wave amplitude (H = 150-250 mV, A = 75-125 mV, T = 2-3 ms),

• river and glaciofluvial sands and gravels, of medium and higher density, late Pleistocene with an average and sometimes high amplitude (H = 300-450 mV, A = 150-225 mV, T = 2-5 ms),

• the Vistula Glaciation clays , plastic or hard plastic with a moderate amplitude and a significant wave period, without a ceiling of sand-gravel culmination of the seismic record (initial amplitude jump) (H = 300-400 mV, A = 150-200 mV, T = 10-12 ms)

• interglacial sands and gravels, medium compacted and compacted, Pleistocene, with very high amplitude and low wave period (H = 500-900 mV, A = 250-450 mV, T = 0.5-2 ms),

• glacial-lake and glacial silts, almost unamplified in the seismic record,

• tills of the Warta Glaciation, usually hard plasticity, with a medium amplitude and a significant wave period with a characteristic initial amplitude jump (H = 180-300 mV, A = 90-150 mV, T = 5-10 ms)

• tills of the Odra Glaciation, hard plasticity, of considerable thickness and low amplitude without initial amplitude jump (H = 100-200 mV, A = 50-100 mV, T = 5-10 ms),

• tills of the San River II Glaciation, hard plasticity, with low amplitude and initial amplitude (H = 100-200 mV, A = 50-100 mV, T = 5-10 ms).

I would like to add that the interpretation patterns of seismic surveys developed in this way allow for a good recognition of geological and geotechnical conditions occurring in a specific ground soil. By recognizing the types of land, their origins and age, and the mutual location of these layers in relation to each other, it gives us an answer to the geotechnical conditions there, for example with a degree of compactness of non-cohesive soils or with the degree of plasticity of cohesive soils. The scientific achievement of seismic surveys carried out in northern Poland, especially in the Baltic coastal zone, was the discovery of contemporary vertical movement zones causing the formation of dangerous soil compaction zones, in which geotechnical parameters change which have a significant impact on the substrate - building cooperation. Seismic research has shown that soil compaction zones are heterogeneous, where there may be several subzones with different rates of land movement. The phenomenon of soil compaction is an opposing process of compaction, which is nowadays under the influence of vertical movements of the ground, where it comes to the so-called their loosening, which is then associated with the increase in their porosity. The discussed zones belong to micro-sized local structures of small size in the horizontal plane (from 30-80 m), but of considerable size in the vertical plane and may be present in a variety of places within the ground substrate itself.

In the second part, I analyzed the selected scientific achievements related to my geological and seismic research of the Baltic Sea bottom. Numerous seismoacoustic registrations related to the study of the Baltic Sea bottom have made it possible to develop the following interpretation patterns of the Quaternary cover of the Baltic Sea:

• Quaternary sediment deposits in the form of limestones, sandstones, siltstones and claysinterchanging with carbonate deposits, usually constitute a very clear reflective picture in the seismic record, where the reflections are arranged inconsistently angularly with the sub-Quaternary surface. There is usually a very pronounced acoustic contrast between the sill of Quaternary deposits and their substrate,

• Pleistocene deposits in the lower parts of the Quaternary cover are composed of one or two levels of glacial clays, where usually the lower level belongs to the sediments of the Vartanian Glaciation, and the upper one to the sediments of the Vistula Glaciation. Glacial clays (geotechnical as sandy loams or clays) on seismoacoustic recordings are unstructured with a chaotic internal structure and a very diverse acoustic signature (various reflections) depending on granulometric composition and degree of plasticity, where there is a darker texture of the recording and the presence of characteristic diffraction waves,

• Late Pleistocene sediments in the form of silty clays and sandy clays, sometimes interlaced with very fine and muddy sands on seismoacoustic recordings, present a characteristic unreflective seismic record with a lightened texture of the wave image due to the occurrence of very lightly consolidated sediments that absorb passing seismic waves to a large extent. In some places there is a slightly darkened texture of the seismic record caused by greater lithological variation of the glaciolimnic sediments. Higher layered proglacial clays created during the Baltic Ice Lake show in seismic records a clear level of parallel, strongly reflected acoustic reflections caused by the presence of hard laminated iron mono-sulphides of clearly distinctive acoustic properties,

• Early Holocene sediments in the central part of the Quaternary cover represented by homogeneous clays and mules formed during the sedimentation of the Yoldia Sea and Ancylus Lake have a non-reflective seismic record, which shows that seismoacoustic waves are of high penetration here, which causes a very bright texture of the wave image. Sometimes it can be noticed that these deposits are simultaneously stratified, where there are more pronounced reflections associated with iron sulphide laminates,

• Middle and Late Holocene sediments made of clay, mules and organic sediments of the Littorina and post Littorina Sea, form the upper part of the quaternary layer, also seismically reflection-free, where in seismoacoustic terms they constitute one level that differs from the older Holocene sediment by incompatible placement. Sometimes it is possible to see parallel stratification, especially where sandy sand deposits mark their presence.

Interpretation patterns of seismoacoustic research developed in this way allow for a good diagnosis of geological conditions occurring in the bedrock of the Baltic Sea. Another scientific achievement was the preparation of geotechnical maps of the Polish Baltic Sea bottom, which allow specifying the following types of soil substrates characterized for the needs of maritime construction:

• very good bottom for maritime construction (R_c > *1000 kPa)* - it does not apply to the direct bed of the Polish Baltic Sea, because there is no outcrop of rocky land there. In the ground at a depth of 10 and 20 m there are Silurian clay shales, Devonian limestone, Permian sandstones, mudstones and Triassic clays, Jurassic limestones, siltstones, Cretaceous claystones and limestones,

• good bottom for maritime construction (τ_f 300-1000 kPa; M_0 80-500 MPa) - on the bottom built of sea sands and gravels, Eemian interglacial, glacifluvial sands and gravels, fluvial sands and gravels of the late Pleistocene and early Holocene as well as from sands and gravels the Littorina Sea and the post Littorina Sea of the middle and late Holocene. In the substrate at a depth of 10 m there is also a layer of Neogene sands. However, in the substrate at a depth of 20 m there is only a layer of Neogene river sand, a layer of sands and gravels of the Eemian Sea and a layer of sands and gravels of the late Pleistocene and early Holocene,

• sufficient bottom for maritime construction (τ_f 100-300 kPa; M_0 40-80 MPa) - on the bottom built of glacial clays from the Vartanian Glaciation and Vistula Glaciation of Pleistocene. In the substrate at a depth of 10 m, there is also an additional layer of Neogene lake mules and silts. However, in the substrate at a depth of 20 m there is only a layer of silts and lake loams of Neogene and glacial clays of the Vartanian Glaciation,

• bad bottom for maritime construction (τ_f 50-100 kPa; M_0 5-10 MPa) - on the bottom built of proglacial clays and silt clays of the late Pleistocene, mules and clays of the Baltic Ice Lake, the sea of Yoldia and the Ancylus lake of the late Pleistocene and the early Holocene, from aeolian sands of Baltic Ice Lake of the late Pleistocene, of lake mules and silty sands of the early Holocene, spit sands of the late Holocene. In the substrate at a depth of 10 m there is only a layer of lateHolocene sands. However, in the substrate at a depth of 20 m there is only a layer of mules and clays of the Baltic Ice Lake, the Yoldia Sea and the Ancylus Lake of the late Pleistocene and the early Holocene,

- very bad bottom for maritime construction(τ_f < 50 kPa; M_0 < 5 MPa) - on the bottom and in the substrate at a depth of 10 m built of loams, mules, silts and organic impurities of the Littorina Sea and post Littorina Sea from middle and late Holocene. In the substrate at a depth of 20 m, this type of soil does not occur.

I would like to add that the other geotechnical parameters, such as, I_D, I_L, ϕ, c i R_c, which I took into account in characterizing the various types of soil that build the seabed and its subsoil, were given in tabular formulas and these are estimates. Geotechnical maps made by me of the Polish Baltic Sea, the first in the entire Baltic Sea area, can be used in the design of all types of marine structures and constructions (eg when designing deep foundations of solid oil and gas exploration and production platforms, construction of wind farms, or also in the design of port breakwaters, as well as when planning the route of passage of oil and gas pipelines and submarine telecommunications cables).

Numerical list and point list of my scientific achievements

Publication type	**Before PhD**			**After PhD**			**Number of publications**	
	Number	Points IF	Points MSHE	Number	Points IF	Points MSHE	Polish lg (co-written)	English lg (co-written)
Journals having Impact Factor (baza JCR)	-	-	-	2	1.83	35	-	2
Journals with none Impact Factor	2	-	8	20	-	90	15 (5)	2
Polish journals not included in MSHE	3	-	12	9	-	36	12	-
Authoring a chapter in a book	-	-	-	2	-	45	-	2
Authoring a chapter in a monography	-	-	-	14	-	51	9(3)	2
In reviewed post-conference publications	2	-	4	58	-	217	6(10)	31 (11)
Total	**7**	**-**	**27**	**104**		**474**	**42(18)**	**39(11)**
	Total ImpactFactor – 1.83							
	Total points CSR/MSHE - 505							
	Total number of publications - 114							
	The number of citations acc. Google Scholar – 215; without self-citations 50							
	The number of citations acc. Web of Science - 47							
	The number of citations acc. Research Gate 68							
	Hirsh's Index acc. Google Scholar H = 7							
	Hirsh's Index acc. Web of Science H = 10							

5. Other scientific and research achievements

5.1. The remaining scientific achievements

My other scientific activity, apart from the previously mentioned main research area, concerned issues related to geological-engineering and geotechnical studies of the ground, where numerous works were published in scientific journals included in the Ministry of Science and Higher Education and papers published in international and national conference materials.

5.2. Research and research works of a utilitarian nature

My scientific and research activity also concerned the utilitarian activities carried out as part of the commissioned work of the Department of Geotechnics of the former Szczecin University of Technology (now West Pomeranian University of Technology in Szczecin). The most important studies include:

- Racinowski R., Machaliński E., Kaszubowski L.J., 1986. Technical research of the ground substrate regarding the rail crossing in Chojna. (Techniczne badania podłoża gruntowego dotyczące przejazdu kolejowego w Chojnie). Archiwum ZUT

- Racinowski R., Machaliński E., Kaszubowski L.J., 1986. Geotechnical opinion on a single-family building in Moryń at Plac Wolności 2 (Opinia geotechniczna dotycząca budynku jednorodzinnego w Moryniu przy Placu Wolności 2). Archiwum ZUT

- Racinowski R., Machaliński E., Kaszubowski L.J., 1986. Geotechnical opinion on the modernization of a single-family building in in Mieszkowice at Dąbrowszczaków 10 Street. (Opinia geotechniczna dotycząca modernizacji budynku jednorodzinnego w Mieszkowicach przy ul. Dąbrowszczaków 10). Archiwum ZUT

- Racinowski R., Machaliński E., Kaszubowski L.J., 1986. Geotechnical opinion on the modernization of a single-family building in Trzcińsko Zdrój, Rynek 8 (Opinia geotechniczna dotycząca modernizacji budynku jednorodzinnego w Trzcińsku Zdroju, Rynek 8). Archiwum ZUT

- Racinowski R., Baraniecki J., Kaszubowski L.J., Grotowski A., 1986. The program of comprehensive protection of shores of the Dziwnów Spit, stage 1 (Program kompleksowego zabezpieczenia brzegów Mierzei Dziwnowskiej, etap 1). Archiwum ZUT

- Racinowski R., Baraniecki J., Kaszubowski L.J., Grotowski A., 1986. The program of comprehensive protection of shores of the Dziwnów Spit, stage 2 (Program kompleksowego zabezpieczenia brzegów Mierzei Dziwnowskiej, etap 2). Archiwum ZUT

- Racinowski R., Kaszubowski L.J., Seul C., 1987. Analysis of the variability of the composition of the shore material of the West Pomeranian coast (Analiza możliwości zmienności składu materiału brzegowego wybrzeża zachodniopomorskiego). Archiwum ZUT

- Racinowski R., Machaliński E., Kaszubowski L.J., Seul C., 1987. The program of comprehensive protection of shores of the Dziwnów Spit, stage 4 (Program kompleksowego zabezpieczenia brzegów Mierzei Dziwnowskiej, etap 4). Archiwum ZUT

- Racinowski R., Kaszubowski L.J., Seul C., Baraniecki J., Meyer Z., 1987. The possibility of using longitudinal analysis of granulometric variability and mineral composition of shore material of the West Pomeranian coast (Możliwość wykorzystania analizy wzdłużbrzegowej zmienności granulometrycznego i mineralnego składu materiału brzegowego wybrzeża zachodniopomorskiego). Archiwum ZUT

- Moreover, as part of the Polish Society of Friends of Earth Sciences, West Pomeranian Branch in Szczecin, I have completed over 40 engineering-geological studies (documentations and opinions)

5.3. National and international cooperation

My activity was also focused on scientific cooperation in the country, first of all with the Pomeranian Branch of the Polish Geological Institute in Szczecin and with the Geology Department of the Polish State Geological Institute in Gdańsk. As part of this cooperation, I carried out large-scale seismic surveys of the Baltic Sea shore zone from the beach in Świnoujście on the west coast to Krynica Morska on the east coast, where this type of research was carried out for the first time. As part of international cooperation, I am an active member of the American Scientific Association called the Coastal Education and Research Foundation based in Florida, USA. In the years from 1990 to 1995, I represented Poland as the chairman of the Polish working group as part of the international program IGCP-274 Late Quaternary Coastal Records and Rapid Change. I have been a member of the New York Science Academy since 1994 and now I am an active member of the International Union for Quaternary Research - Commission (Coastal & Marine Processes).

5.4. Scientific internships

As part of acquiring further qualifications and scientific experience, I completed the following scientific internships:

• A scientific internship at the Pomeranian Branch of the Polish Geological Institute in Szczecin
• A scientific internship at the Szczecin Department of the Maritime Institute
• A scientific internship at Lund University, Engineering Geology Department in Sweden

5.5. Awards and prizes

For the scientific activity I received the following awards:

• the Szczecin University of TechnologyRector’s Award for creative scientific achievements in 1992
• the Szczecin University of Technology Rector’s Award for creative scientific achievements in 1994

6. Didactic activity

As part of didactic activity, I developed the content of the chapter on "Geological and engineering analysis based on detailed geological maps" in the following university scripts:

• Racinowski R., 1990. Engineering geology with elements of petrography and hydrogeology. Ed. Szczecin University of Technology
• Racinowski R., Coufal R., 1999. Engineering geology. Ed. Szczecin University of Technology

As part of students’ supervision in 1992, I was the head of the scientific camp concerned with the seismic research of Dziwnowska Spit. In the field of Environmental Engineering, full-time studies (S1) I have developed program content for my lectures and exercises for the subject Fundamentals of Earth Science. As part of the newly created Geotechnics Specialty in the field of Construction, second-degree full-time studies (S2), I developed program content (lectures and exercises) for the following subjects:

• Geodynamic processes
• Lithodynamics of the coastal zone
• Land dynamics (auditorium exercises)

In addition, I have been taking an active part in didactic activities conducted at WBiA as part of the Erasmus plus program, where I developed (in English) the program content for my lectures and exercises for the following subjects:

• Hydrogeology

40

• Fundamentals of Earth Science

I was also the promoter of the following diploma theses in the field of Construction, first-cycle full-time studies (S1):

- Adamczyk Franciszek 2013. Foundation of a multi-family residential block at 91 BohaterówWarszawy Street, in Szczecin, taking into consideration water and soil conditions.(Posadowienie budynku mieszkalnego wielorodzinnego przy ul. Bohaterów Warszawy 91 w Szczecinie przy uwzględnieniu warunków gruntowo-wodnych).

- Wojciechowski Abraham 2014. The founding method of a multi-family residential building at Inowrocławska Street in Szczecin. (Sposób posadowienia budynku mieszkalnego wielorodzinnego przy ul. Inowrocławskiej w Szczecinie.)

- Szulc Karol 2015. The founding method of a multi-family residential building at 18b Zygmunta Chnielewskiego Street in Szczecin.(Sposób posadowienia budynku mieszkalnego wielorodzinnego przy ul. Zygmunta Chmielewskiego 18b w Szczecinie.)

7. Organizational activity

My organizational achievements were the organization of the following national scientific symposia at the Faculty of Civil Engineering and Architecture at the former Szczecin University of Technology:

• 1989 - I Pomeranian Geoforum on "Research and utilitarian problems of the Pomerania and the South Baltic Sea geosphere"

• 1992 - II Ecological Council on "Principles of introduction, organization and functioning of the clochemethod for the Szczecin agglomeration"

In addition, my organizational activity was also reflected in active cooperation with scientific organizations and associations in Poland, where I perform the following functions:

• President of the West Pomeranian Branch of the Polish Society of Friends of Earth Sciences in Szczecin

• Membership in the Polish Committee of Engineering Geology and the Environment

• Membership in the Szczecin Branch of the Polish Geological Society

• Membership in the Commission of Lithology and Genesis of Quaternary Sediments of the Quaternary Research Committee of the Polish Academy of Sciences

• Membership in the Neotectonic Committee of the Quaternary Research Committee of the Polish Academy of Sciences

Leszek Kaszubowski