

# **The Problems of Establishing Cadastral Boundaries in River Erosion and Accumulation Area, According to The Polish Law\***

**Agnieszka BIEDA, Paweł HANUS and Piotr PARZYCH, Poland**

**Key words:** cadastre, hydrography, land management, positioning

## **SUMMARY**

The finding of boundary points position close to big watercourses is very difficult. There is no international standards regulating this issue. According to the international law, the boundaries of states lying along the rivers are defined by bilateral agreements. Sometimes such the agreement is simply the confirmation of customary boundaries. The literature describes some problems concerning boundaries along rivers, but it usually concerns the boundaries between states. The characteristics of disputing issues and its solutions are often provided there.

The legislation concerning cadastre vary in different countries. The problem of establishing the cadastral boundaries in river erosion and accumulation areas is very complicated and the authors think it should be somehow systematized.

The surveying and cartographic law and water law as well, regulate these issues in Poland. It is defined how to clearly establish the riverbank lines, that according to surveyors should be the same as cadastral boundaries.

Two important issues concern the cadastral boundaries establishment and they may have an influence on setting the position of boundary points. First, the water affects the neighboring area and changes it. The second problem, during boundary establishment process is ambiguity of its position. Despite the detailed instructions in the polish law, it is difficult to set such boundary points.

The legal aspects and results of researches on cadastral boundaries stability along the longest river in Poland – Vistula are presented in the paper. The research area is more than dozen kilometers along Vistula riverbanks and is situated near Cracow. The authors compared the present riverbanks lines with these recorded in cadastre. The results are often astonishing and they prove that that controlling measurements of cadastral boundaries in neighborhood of flowing waters are necessary.

---

\* This work is financed from funds science realized at AGH University of Science and Technology, allocated for the year 2012, no 11.11.150.006

# The Problems of Establishing Cadastral Boundaries in River Erosion and Accumulation Area, According to The Polish Law

Agnieszka BIEDA, Paweł HANUS and Piotr PARZYCH, Poland

## 1. Introduction

Under the Polish law (The Act, 2001), if the inland surface flowing water or waters of the territorial sea or internal sea waters occupy permanently and naturally the land which is not a property of the owner of the water, then the land shall become the property of the owner of the water, and the hitherto owner of the land is entitled to compensation from the owner of the water. Therefore, it is so important to accurately and competently specify the extent of the ownership rights to the land covered with flowing water and to the land which is adjacent to these waters. This takes place in the process of determining waterlines.

According to Polish surveyors, the riverbank lines should coincide with cadastral boundaries. In that case, the cadastral boundaries of rivers and those of properties located in the zone of their influence change continuously (Bieda, 2011). The changes are caused by intense and dynamic action of flowing water. They may lead to difficulties in maintaining stable boundaries across the entire erosion-accumulation zone of water action.

Since the legal regulations concerning the cadastre in the world are not homogeneous, the authors of this article have selected to describe the process of determining riverbank lines, as it is carried out in Poland based on the national legislation.

## 2. Riverbank lines

The concept of the *riverbank line* has existed in the Polish law since 1922 (Kowalski, Kucharzyk, 2009). This was the year in which the Water Act (The Act, 1922) came into force. According to this Act, the riverbank line was established by the water authority. This was the boundary between water bed and adjacent land. If the edge of the riverbank was clear then it constituted the riverbank line. In any other case, the riverbank line was determined by the borderline of the growing grass (if it was lying above the normal water level). The Act allowed for multiple determination of the riverbank line. It may have occurred in the case of changing the water bed.

Procedure for determining the riverbank line was well described in the Regulation of 1923 (The Regulation, 1923). It described in detail the definition from the Water Act and identified how to determine the normal status (average). It said that a clear edge of the riverbank is usually located on the concave edges, which is steep due to the constant destruction by water. The place where it is not clear, it is a convex edge, that is more gently sloping, on which the material carried by the river is deposited. From this record it is clear that the riverbank line will be moving. In the first case it will cut into the land, in the second one, it will be moving towards the center of the riverbed.

The Regulation extended the meaning of the term *grass sward borderline*. This borderline would be the border of permanent terrestrial plant growth. When determined, it was also

necessary to identify the ordinary water level. If it was lying above the borderline of permanent grass sward, the riverbank line became the line of intersection of the water plane with coastal land at the average water level.

By the *ordinary state* it was understood a level which, in the long run, the water both often exceeds and does not reach. What is meant here is the arithmetic mean of gauge readings within the accepted time frame. These numbers could be read from the hydrographic annals or determined in accordance with the procedures specified in these annals of the accuracy of 0.05 m. Due to the difficulty in getting to the data, the determination of average daily reading was allowed.

The time interval from which the ordinary state was to be determined was 15 years. It could be shorter, but data from the years when droughts or floods occurred had to be excluded. Similarly, it was shortened when the shape of the riverbed changed in the area where the measurements were carried out. The earliest measurement could not come from the time before the change of the riverbed position.

If it turned out, that no more than one reading was available, it could be considered as a normal state, if the precipitation from the year of measurements approached the normal state in terms of distribution and quantity.

It was also stated that the water gauge used to determine the average state had to be reliable. It should be located on the section of the river which has similar flow conditions as the test section.

If there was no such a place, the normal state of the water could be determined by a water expert.

Such a detailed analysis of the first legal norms associated with determining the riverbank line is justified. The subsequent issues of the Water Act and its executive acts drew definitions from these archival legislation. Their publication took place successively in 1962 (The Act, 1962) and 1974 (The Act, 1964). Only the language of the adopted standards was modernized, and the norms were adapted to the surrounding transformed under the influence of the human. Both of the Water Act issues after the Second World War spoke of the riverbank line as the boundary between the land covered with water and the land adjacent to these waters. It was to be an edge of the riverbank or a permanent grass line or a line established according to the normal water level.

In addition to the existing regulations, the ordinance of 1964 (The Ordinance, 1964) contributed with new solutions. They were necessary due to the fact that regulation of the rivers and the construction of various water facilities began. The ordinance introduced the possibility to run the riverbank line along the line connecting the outer edges of the regulatory structures.

During the regulation of rivers, willow plantations were created by their riverbanks. They were to be located within the riverbed. Thus, the riverbank line would run along their borderline from the land side.

Appendix to the ordinance were the guidelines to determine the normal status of water. They repeated the Regulation of 1923 (The Regulation, 1923).

Executive provision to the Water Act of 1974 (The Act, 1974), which is the regulation of 1977 (The Regulation, 1977), did not bring anything new to the definition of the riverbank.

The current Water Act of 2001 (The Act, 2001), defines the borderline for natural watercourses, lakes and other natural bodies of water as an edge of the border or permanent grass sward, or a line which determines the average water level determined by the state hydrological and meteorological ministry for the period of at least the last 10 years.

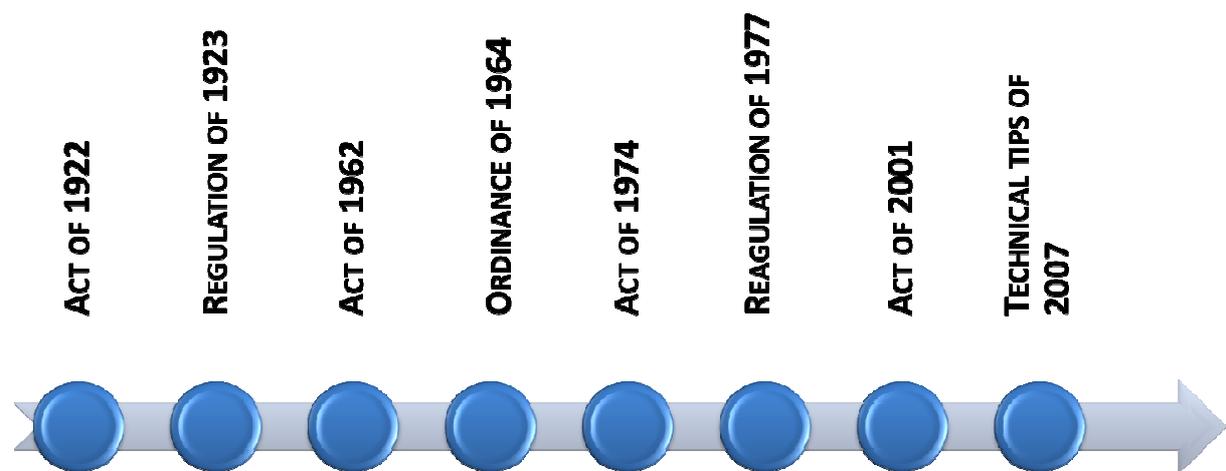
Since there is no regulation on establishing the riverbank line to the current provision, the Act itself specifies the order in which individual circumstances deciding about the riverbank line should be considered :

1. if the edge of the riverbank is distinct, the riverbank line runs along this edge;
2. if the edge of the riverbank is not distinct, the riverbank line runs along permanent grass sward;
3. if the boundary of permanent grass sward lies above the water level determined by the State Hydrological-Meteorological Survey from a period of at least the last 10 years, the riverbank line runs along the line of intersection of water surface at this level with the adjacent land.

In addition, if waterlines are regulated, the riverbank line runs along the line joining the outer edges of the regulatory structure, and at the willow plantations on the land acquired as a result of the regulation – along the border of the plantation on the land side.

From these provisions (Fig. 1) it is clear that the riverbank line is, and always has been, a borderline between the land covered by surface water and land adjacent to it.

Of course, the cited provisions allow exceptions. Departure from the riverbed is possible when the edge of the riverbank is deemed not to be sufficiently obvious.



**Fig. 1:** The Law of Water in Poland development and dates of its – creation

**Source:** Own study

### 3. Determining the riverbank line

The basis for determining the riverbank line procedure is the Water Act (The Act, 2001). To date, however, no regulation has been issued in this respect. Therefore, there is no existing

executive provision which would precisely regulate the proceedings as well as established specimens of documentation. In this situation, in order to determine the riverbank line, it is necessary to use the Water Act directly. Additionally, in 2007, the Provincial Geodetic and Cartographic Inspector issued instructional guidance - preparation of surveying project documentation of the shoreline of internal sea waters and inland surface waters (Technical Tips, 2008).

The riverbank line is determined by the appropriate public authority by means of a decision. It is carried out at the request of the party having a legal or actual interest.

The basis for determining a riverbank line constitutes a supplied by the applicant project of delimitation of the land covered by the waters from the adjacent land. It consists of two parts (graphic and descriptive) and is one of the key documents prepared during surveying determination of the riverbank line (Wolny, 2008). The costs of the project shall be borne by the owner of the water. In the case of flowing surface water it is the State Treasury (The Act, 2001).

The map for designing a riverbank line is a specialist thematic map. It includes as-built inventory of the regulatory structures or it is an updated copy of the underlying map. One of its main components are the boundaries of land properties that fall within the scope of the study.

The future riverbank line will be entered in the register as a new border of the watercourse (Kowalewski, Majewska, 2010). Therefore, setting the border in the field, at the design stage is the best solution, so that it was included on the map and was in line with the riverbank line to be drawn into it. To achieve compliance in this respect, division of the property is usually performed.

The map is executed in the scale in which draft of inland waters regulation is drawn up, in a scale of 1:5000 or 1:2000. It becomes a project of demarcating the land covered by surface water after marking on it:

- fixed points of horizontal control network with reference to state network,
- borderline of permanent grass sward,
- edges of the banks, alluvia, fluvial deposits and islands,
- the proposed riverbank line.

The descriptive part includes:

- designation of the applicant, indicating his seat and address,
- accepted method of determining the designed riverbank line,
- determining legal status of property covered by the design with identifying owners and indicating their seats and addresses,
- state of water relations on the land adjacent to the proposed riverbank line.

Except for the mapping part of the project, the surveying contractor is required to draw up a statement which complies with the provisions of the Geodetic and Cartographic Law (The Act, 1989). The surveyor submits it for the control along with the design. Only if admitted to the state geodetic and cartographic resource and bears the relevant clauses, the design of demarcation of land covered with water becomes the basis for the issue of the decision.

The decision on the demarcation of land covered by surface water from the adjacent land is final. The parties may appeal from it only before a court. In case the riverbank line changes, the decision may be altered by the issue of a new decision, for a new riverbank line.

In the design procedure, although apparently independent, elements of geodesy and hydrology intertwine (Kowalski, Kucharzyk, 2009). Thanks to the cooperation of the experts in these two fields, it is possible to create a full dossier on the basis of which, without any doubt, the decision will be issued. The main stages of a typical determination of the riverbank line have been presented in Table 1.

**Tab. 1:** Determination of the shore line by (Kowalski, Kucharzyk, 2009)

<b>Stages of determination of line river bank</b>	<b>Detailed range of activities</b>		
	<b>Surveying part</b>	<b>Hydrologic part</b>	<b>Administrative part</b>
<b>Preparing materials for project of water delimitation</b>	-	Determination of information range necessary to map updating	-
	Map for project updating	-	-
<b>Preparing project of water delimitation</b>	-	Project of line river bank course	-
	Work out of line bank river course	-	-
	Making a map of project of delimitations lands covered by waters from adjoining lands	Preparing descriptive part of project of delimitation lands covered by waters from adjoining lands	-

<b>Giving administrative decision, fixing line bank river</b>	-	-	Giving administrative decision, fixing line river bank
---	---	---	--

**Source:** Own study

#### **4. Analysis of the Vistula riverbank line near Kraków**

In order to determine changes which may occur within the erosion-accumulation activity of rivers, a comparison of the current property cadastre with the current field situation was made. The object of the study (Bieda, 2011) was a section of the largest Polish river - the Vistula. In administrative terms, this section is located on the border of the communes: Liszki, Czernichów and Skawina, in the district of Kraków, Malopolska province. It is located west of Kraków. Meandering of the Vistula River at this point is clearly limited by natural barriers, such as: the threshold of the Carpathian Foothills (south) the edge of the Malopolska Upland (north). The location of the research object with respect to Krakow has been presented in Figure 2, the analyzed fragment has been shown in Figure 3.



**Fig. 2:** Location of researched object

**Source:** Own study based on (Geoportal)



**Fig. 3:** Object of researches

**Source:** (Geoportal)

The length of the analyzed section is approximately 13.5 km. The average width - about 50 meters. The Vistula River at this point is regulated..

Patchwork of land shown on orthophoto map (Fig.3) suggests the former riverbed location and numerous changes in the riverbank line. The currently binding real estate cadastre in Poland was established in the 70s of the 20<sup>th</sup> century. This suggests that the river may have strongly interfered into its environment since the boundaries were determined, resulting in a need to correct the boundaries.

Cadastral boundaries in the digital version were compared with the photogrammetric measurement of the riverbank line. The measurement was performed stereoscopically on aerial photographs taken in mid-April 2009. Their field pixel was 0.20 m.

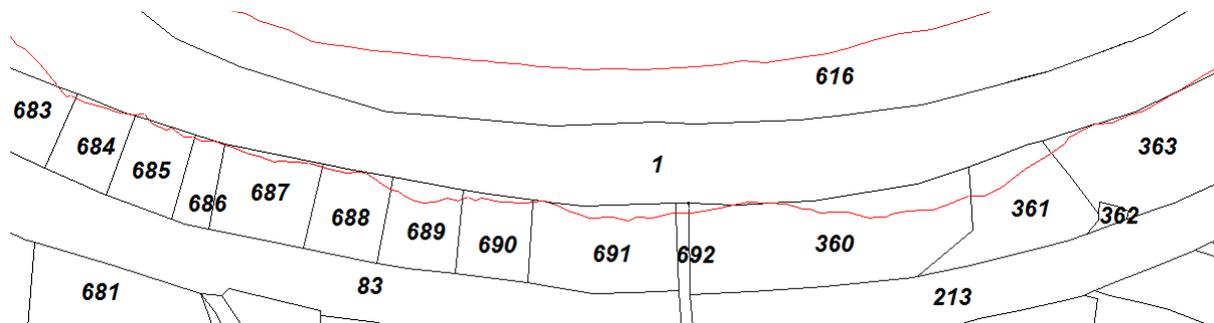
The entire length of the test section of the riverbank line was the top part of the slope forming the riverbed. Since the photos were taken in spring, the vegetation on the riverbank was not developed enough yet to interfere with the conducted surveys. But there were places where the line was veiled by the flora or the shadows cast by it (Fig. 4).



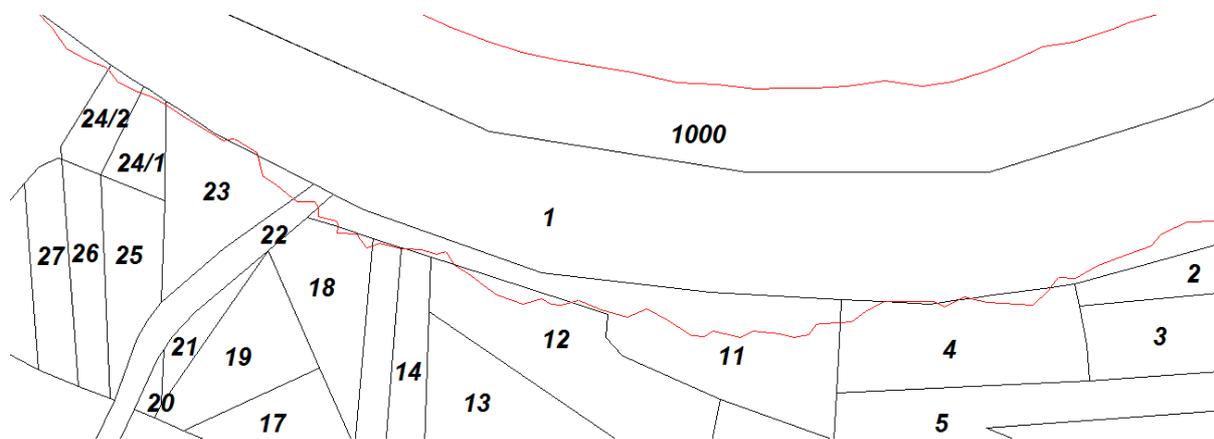
**Fig. 4:** Examples of the shoreline is difficult to identify

**Source:** Aerial photos from 2009

When comparing the existing cadastral boundaries (black) with the current riverbank line in the field (red) one can notice significant discrepancies. In total, on the test section, the Vistula broke into 50 cadastral parcels. The examples of the observed changes that occurred over the last 30 years have been presented in Figures 5 and 6.



**Fig. 5:** An example of line river bank changes  
**Source:** Own study



**Fig. 6:** An example of line river bank changes  
**Source:** Own study

From the drawings it is evident how much force has flowing water (even flowing so slowly as Poland's largest river in the analyzed section). Over the years, working systematically, the Vistula scooped up from the owners of plots located in its immediate neighborhood, an area corresponding to a few, several, or even several dozen per cent of their surface.

After determining the boundary line of the analyzed section, similar to the photogrammetrically designated in the study, the changes which were entered into the cadastre may lead to a reduction even by half of the cadastre surface (Figure 6, record parcel no.11). This situation will take place in case of a very unfavorable location of the plot (in the middle of the meander) and its unfavorable shape (elongated, long side directly adjacent to the river). The changes that occur in the surrounding of the river are also those related to configuration of plot boundaries located not only in the immediate vicinity of the river.

## 5. Summary

In conclusion, the Authors would like to highlight the key issues of the subject:

1. The Polish law specifies procedures which must be followed in cases where it is necessary to determine the riverbank line.
2. Determining riverbank line requires the cooperation of specialists associated with the fields such as administration, surveying and hydrography.
3. The surveyor who conducts the process of determining the boundary line, apart from the knowledge of legislation and technical guidance related to his profession, must have experience in the conducted surveying and the ability to conduct substantive discussions at any stage of the work.
4. Flowing waters act with so much force that they can affect not only the boundaries of cadastral parcels located in their immediate vicinity. They may also cause changes in the configuration of boundaries at some distance from the existing boundaries of plots under rivers.
5. The changes caused by flowing water may constitute two kinds of modifications. The water may exceed the existing cadastral boundaries in the direction of the neighboring plots as a result of lateral erosion, or by deposition of the rock material, to "build up" the riverbank line and move it towards the center of the river. Changing riverbank lines of the rivers located on the national borders may require regulation by international treaties.
6. The case discussed at work is an example of a large river, on a wide section, where the water flows calmly. Larger changes in the configuration of cadastral boundaries would probably be observed in the case of mountain streams.

## REFERENCES

- [1] Bieda A.: *Weryfikacja granic administracyjnych prowadzonych wzdłuż rzek w aspekcie aktualizacji katastru*, The doctoral dissertation AGH, Krakow 2011, unpublished, Language: Polish, English title: *Verification of administrative boundaries run along rivers in terms of updating cadastre*
- [2] <http://maps.geoportal.gov.pl/webclient> (Geoportal)
- [3] Kowalewski K., Majewska A.: *Nowy użytek?*, Magazyn Geoinformacyjny Geodeta, nr 1/2010, Language: Polish, English: *New grounds?*
- [4] Kowalski K., Kucharzyk S.: *Geodezyjny aspekt ustalania linii brzegu*, Gospodarka Wodna, nr 9/2009, Language: Polish, English title: *Geodetic aspect of shoreline determination*
- [5] Rozporządzenie Ministra Robót Publicznych z dnia 25 kwietnia 1923 roku *w przedmiocie oznaczenia stanu zwyczajnego (średniego) wody i linii brzegu* (Dz. U. z 1923 r., nr 80, poz. 632), Language: Polish, Regulation of 1923: Designation of the average balance of water and bank of river
- [6] Rozporządzenie Rady Ministrów z dnia 5 sierpnia 1977 roku *w sprawie granic wód, linii brzegu, urządzeń nad wodami oraz klas wód śródlądowych żeglownych* (Dz. U.

- z 1977 r., nr 26, poz. 110, z póź. zm.), Regulation of 1977: boundaries of the waters, bank of river, the device on the waters, class of inland water quality
- [7] Ustawa z dnia 17 maja 1989 roku – *prawo geodezyjne i kartograficzne* (Dz. U. z 1989 r., nr 30, poz. 163, z póź. zm.), Language: Polish, English: The law on geodesy and cartography
- [8] *Ustawa wodna* z dnia 19 września 1922 roku (Dz. U. z 1922 r., nr 102, poz. 936, z późn. zm.), Language: Polish, English: Act of 1922 – The Water Law
- [9] Ustawa z dnia 30 maja 1962 roku – *prawo wodne* (Dz. U. z 1962 r., nr 34, poz. 158, z póź. zm.), Language: Polish, English: Act of 1962 – The Water Law
- [10] Ustawa z dnia 24 października 1974 roku – *prawo wodne* (Dz. U. z 1974 r., Nr 38, poz. 230, z póź. zm.), Language: Polish, English: Act of 1974 – The Water Law
- [11] Ustawa z 18 lipca 2001 roku – *prawo wodne* (Dz. U. Nr 115, poz. 1229, z póź. zm.), Language: Polish, English: Act of 2001 – The Water Law
- [12] Wolny B.: *Sporządzanie geodezyjnej dokumentacji projektowej linii brzegu morskich wód wewnętrznych oraz śródlądowych wód powierzchniowych*, Przegląd Geodezyjny, nr 4/2008, Language: Polish, English title: *Development of surveying design documentation of a costal line of sea inland waters and inland surface waters*
- [13] Wskazówki instruktarzowe: *Sporządzanie geodezyjnej dokumentacji projektowej linii brzegu morskich wód wewnętrznych oraz śródlądowych wód powierzchniowych*, Zachodniopomorski Urząd Wojewódzki w Szczecinie, 2007, Language: Polish, English: *Instructional tips - documentation to determine the shoreline*
- [14] Zarządzenie Prezesa Centralnego Urzędu Gospodarki Wodnej z dnia 10 stycznia 1964 roku w sprawie ustalenia linii brzegu na wodach śródlądowych (M. P. z 1964 r., nr 7, poz. 34), Language: Polish, English: Ordinance of 1964 – determine the line edge

## CONTACTS

Dr. Agnieszka Bieda  
AGH University of Science and Technology  
30 Mickiewicza Av. C-4 building, room 303  
30-059 Krakow  
POLAND  
Tel. + 48 12 617 22 67  
Fax + 48 12 617 45 88  
Email: [bieda@agh.edu.pl](mailto:bieda@agh.edu.pl)  
Web site: [home.agh.edu.pl/~bieda](http://home.agh.edu.pl/~bieda)

Dr. Paweł Hanus  
AGH University of Science and Technology  
30 Mickiewicza Av. C-4 building, room 303  
30-059 Krakow  
POLAND  
Tel. + 48 12 617 22 67  
Fax + 48 12 617 45 88

Email: phanus@agh.edu.pl  
Web site: home.agh.edu.pl/~phanus

prof. Piotr Parzych  
AGH University of Science and Technology  
30 Mickiewicza Av. C-4 building, room 307  
30-059 Krakow  
POLAND  
Tel. +48 12 617 22 78  
Fax + 48 12 617 45 88  
Email: parzych@agh.edu.pl