

REPLY OF J. BADURA ET AL.  
TO COMMENTS OF J. DON AND J. WOJEWODA  
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## POST-ALPINE TECTONICS OF THE UPPER NYSA KŁODZKA GRABEN: A REPLY

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### ABSTRACT

The paper aims to answer the critical remarks presented by Don and Wojewoda (in this issue) related to our papers published in *Acta Montana* (Badura et al., 2002, Badura et al., 2003). Answering those we have noticed that the terms brachysyncline and brachyanticle are improper with regard to the young Alpine rebuilding of the Upper Nysa Kłodzka Graben. In this paper we present the basic reasons for our hypothesis of young tectonic movements in the studied area more widely. Our morphotectonic analyses are based on the digital elevation models (DEM) and the electroresistance survey of the researched area located near Kamienna and north of Długopole Zdrój. The results of our research show that despite of the long history of the geological studies – longer than 100 years, the region is still a very challenging research area. In this paper we point out that application of the DEM and electroresistivity methods gives the new important results. Those should definitely be taken into consideration together with palaeontological research and geological mapping. We really wonder that the authors of the critical paper unequivocally negate the results of our studies and suggest that the continuation of such research and geodetic survey in the area is aimless.

**KEYWORDS:** neotectonics, digital terrain models, Upper Nysa Kłodzka Graben, Kamienna Graben

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### INTRODUCTION

The paper contains a reply to comments by Don and Wojewoda (2004) on our previous papers published in *Acta Montana* vol. 20 and 24 (Badura et al., 2002, 2003).

Our distinguished Adversaries have been so kind to express their opposition to the proposed by us new terminology of traditional tectonic units, as well as their lithostratigraphic logs. They have also questioned the presence of faults and tectonic blocks we proposed, and critically commented on the description of one of our figures. At the same time, they have totally rejected the ideas presented in our two papers, recently published in *Acta Montana*, although the subject of discussion refers only to one of these articles (Badura et al., 2003), and a part of another one (Badura et al., 2002). The aim of the first paper was to propose to cover the Upper Nysa Kłodzka Graben (UNKG) by detailed geodetic and neotectonic studies. Moreover, our Adversaries' paper rejects all the results obtained due to realisation of the Polish Committee for Scientific Research (KBN) grant no. 8 T12B 025 20 (which has recently been evaluated as an outstanding one), without any single

attempt at getting in touch with its results. Critical comments, being restricted to those papers (or their fragments) which concentrate on the Kłodzko Basin area, appear to reflect Authors' willingness to surface on an international forum the discussions presented during local meetings like, e.g., those of the Geological Society of Poland held in Wrocław. We have frequently proposed to our Adversaries both the discussion and field presentation of new results that would lead to novel interpretations of older ideas, but they have persistently refused to join a common field inspection.

Contrary to the opinion of our opponents, we do claim that numerous neotectonic, geomorphic, and morphotectonic problems still remain to be solved, and that it is definitely not true that all geological puzzles of the area in question have been successfully described. This statement is confirmed even by the sole shooting of three short geoelectrical resistivity sounding profiles, accompanied by the results of a few field inspections that disturb the good mood of our Adversaries. Moreover, a few deep hydrogeological wells drilled in the UNKG area (not described by the stratigraphers), cannot be a convincing argument in

favour of the supposedly “good” coverage of the area by drillings, and particularly in the region in question, wherein we do not have any single stratigraphically investigated well, and from among the others, the deepest one is less than 100 m deep. As far as the UNKG area is concerned, nearly 30 wells and prospecting boreholes for mineral waters have been drilled, most of them not exceeding a depth of 20-30 m. No stratigraphic studies accompanied drilling of these wells. We are of the opinion that data obtained from single wells cannot be extrapolated for large areas of such a complicated tectonic setting.

Explanations to geological maps of the Sudetes published in the 1980s clearly show that no stratigraphic studies accompanied mapping, and that all stratigraphic conclusions have been drawn basing on previously published papers. For instance, the Bystrzyca Kłodzka quadrangle (Wroński, 1983) is largely based on an earlier sketch-map by Don and Don (1960), what can easily be verified in the Central Geological Archive of the Polish Geological Institute in Wrocław. Therefore, the map in question cannot support our Adversaries' thesis that it represents an independent confirmation of the Don and Don's (1960) results.

#### TERMINOLOGICAL PROBLEMS

The terms “Długopole brachysyncline” and “Idzików brachyantycline” have been used on purpose, contrary to their nearly one hundred year old nomenclature. We intended to show that these terms have been introduced at the time when the Late Alpine fault tectonics has been poorly recognised. This is confirmed, i.a., by Fig. 3 published by Wojewoda (1997), whereon rotated blocks of Turonian strata are portrayed. This figure explains why we presently see “brachyantyclinal” attitude of beds, which is not a primary feature, but results from block rotation and subsequent erosion. On the other hand, both Don (1996) and Wojewoda (1997) interpret the position of Coniacian strata as a monoclinial one, although these strata taper out already at a distance of 2 km away from the eastern border of the UNKG. A question then arises, whether we are dealing with a monocline or a brachysyncline. In the Don's (1996) paper one can also find another concept that the structure is a tectonic half-graben, asymmetrically rotated during the uplift of the Śnieżnik Massif. We are of the opinion that the terms related to fold tectonics are now only of historical value and that they explain neither the situation of the primary sedimentary basin, nor its Late Cretaceous-Palaeogene modification, nor influences exerted by the Plio-Pleistocene uplift. The problem of inadequate terminology has already been touched upon by Radwański (1961). Further reference to an old concept that the Turonian strata exposed near Bystrzyca Kłodzka and Długopole build a brachyantycline, and those at Idzików a brachysyncline, is not justified.

In this place we would like to remark that the sole term “Upper Nysa Kłodzka Graben” refers to its Cenomanian-Turonian stage of development, and not to the graben that originated some 89 Ma in the Coniacian (Don, 1993, 1996). If it is a younger graben superimposed on the older one, why our Adversaries do not mark erosional-tectonic boundaries between the Turonian and Coniacian strata, but maintain that the latter are in stratigraphic sequence? According to Don (1996), an asymmetric half-graben was formed at the end of the Late Cretaceous, being filled by strata that taper out towards the west. If this half-graben originated only in the second (Don, 1996) stage of development, one should explain its spatial relation to the graben filled with Cenomanian and Turonian sediments. Below the Coniacian strata, the thickness of Turonian and Cenomanian rocks is strongly reduced. Figure 1 published in Don's (1996) paper clearly shows the graben axis wherein the thickness of the Idzików strata should be the greatest. In fact, this axis merely shows the lowest-situated place within a rotated block or - more precisely - a series of blocks. The basin axis could have been placed, for instance, within the subsequently uplifted Śnieżnik Massif.

We would like to kindly remind our Adversaries in this place that the term “flexure” refers to steep dipping of strata bent due to tectonic movements, whereas the term “fault” describes a surface along which the strata have been displaced (e.g., Dadlez and Jaroszewski, 1994). The term “Eastern Flexure” cannot be applied to gneisses, which, in part, are overthrust upon the Upper Cretaceous strata. The terms “Eastern Flexure” and “Wilkanów Fault” are not contradictory, but form a logical entity. Our opponents' remark is even stranger, since the term “Wilkanów Fault” has commonly been accepted in the existing literature (cf. Sroka, 1997).

#### GENERAL REMARKS

It is difficult to comment on general remarks comprised in the paper by Don and Wojewoda (2004), since our opponents have not specified the subject of discussion, and because their comments refer mainly to the ideas expressed by J. Šebesta (see Batik et al., 1996). One of our papers (Badura et al., 2002) was devoted to the applicability of geophysical techniques in detection of fault zones buried under fluvial and/or deluvial sediments, and did not aim at solving local stratigraphy or giving an extensive overview of the existing hypotheses on the development of the southern Kłodzko Basin. Our intention was to pinpoint faults hitherto not detected by traditional cartographic methods, and to test a measuring technique that uses both closely-spaced (50 m) electrodes, instead of traditionally applied 250 m or 500 m spacing, and electric-resistivity tomography. We do think that this task has been successfully fulfilled and that such a procedure may be of some use in future studies. In our papers we did document the

presence of new fault zones; therefore, we presented facts and not speculations. Moreover, we are strongly convinced that the results of our studies should be taken into account in further research of a regional extent, instead of being discredited.

The papers published by our predecessors, starting from the 19th century, have had little influence upon our new tectonic findings. We do think that any discussion should be restricted to the structural evolution of the two regions situated within the UNKG. Unfortunately, papers quoted by our Adversaries, do not contain adequate explanation to the existing problems. Moreover, our opponents carefully avoid quotations of those papers that criticize their own opinions, except for one article by J. Šebesta (in: Batik et al., 1996). It means that they consider their conclusions as the only correct ones.

Critical comments addressed to our second paper (Badura et al., 2003) are even less understandable. The paper was not meant as a field documentation, monograph, or synthesis, but aimed at presenting geological constraints that confirm the need to embrace the area by a network of geodetic surveys, extremely helpful in a study of recent tectonic mobility. We are deeply astonished, because a team of geodesists from the Wrocław Agricultural University has been consulting Prof. J. Don in this matter since a long time, trying to obtain his help in a proper placing of necessary benchmarks in the UNKG area.

#### KAMIENNA GRABEN

The Kamienna Graben (Badura et al., 2003), indeed, has been earlier given an unfortunate name "Waliszów Graben" (Badura et al., 2002). This name has subsequently been changed due to its imprecise meaning: in the northern part of the graben distinguished by us, a village called Nowy Waliszów, and not Waliszów, is located. The Kamienna Graben, in turn, is situated in the NE part of the Upper Nysa Kłodzka Graben (Fig. 1). It is a 4.9-km-long and 500-m-wide structure, striking N-S, whose bottom is lowered versus the eastern margin of the Śnieżnickie Mts. by 150-200 m, and by 20-30 m versus the Pasterskie Skalki tors on the western margin (cf. Figs. 1 and 3 in: Badura et al., 2002; and Fig. 2 in: Badura et al., 2003). The graben is bordered in the north by the Krowiarki Massif, and in the south by the Pławna River which flows along a morphotectonic scarp. The present-day outline of the graben has been shaped in several stages, the last one being associated with the youngest, Plio-Pleistocene, episode of tectonic mobility. The proper identification of the youngest displacements will make it possible to reconstruct the earlier-formed structures, i.e., in the Middle Miocene, Late Oligocene - Early Miocene, and at the turn of the Late Cretaceous and Palaeogene. Copying a Late Cretaceous structure to the present-day one is a simplification, frequently adopted by geologists working in this area. Difficulties in identification of tectonic style of the entire UNKG region are easily

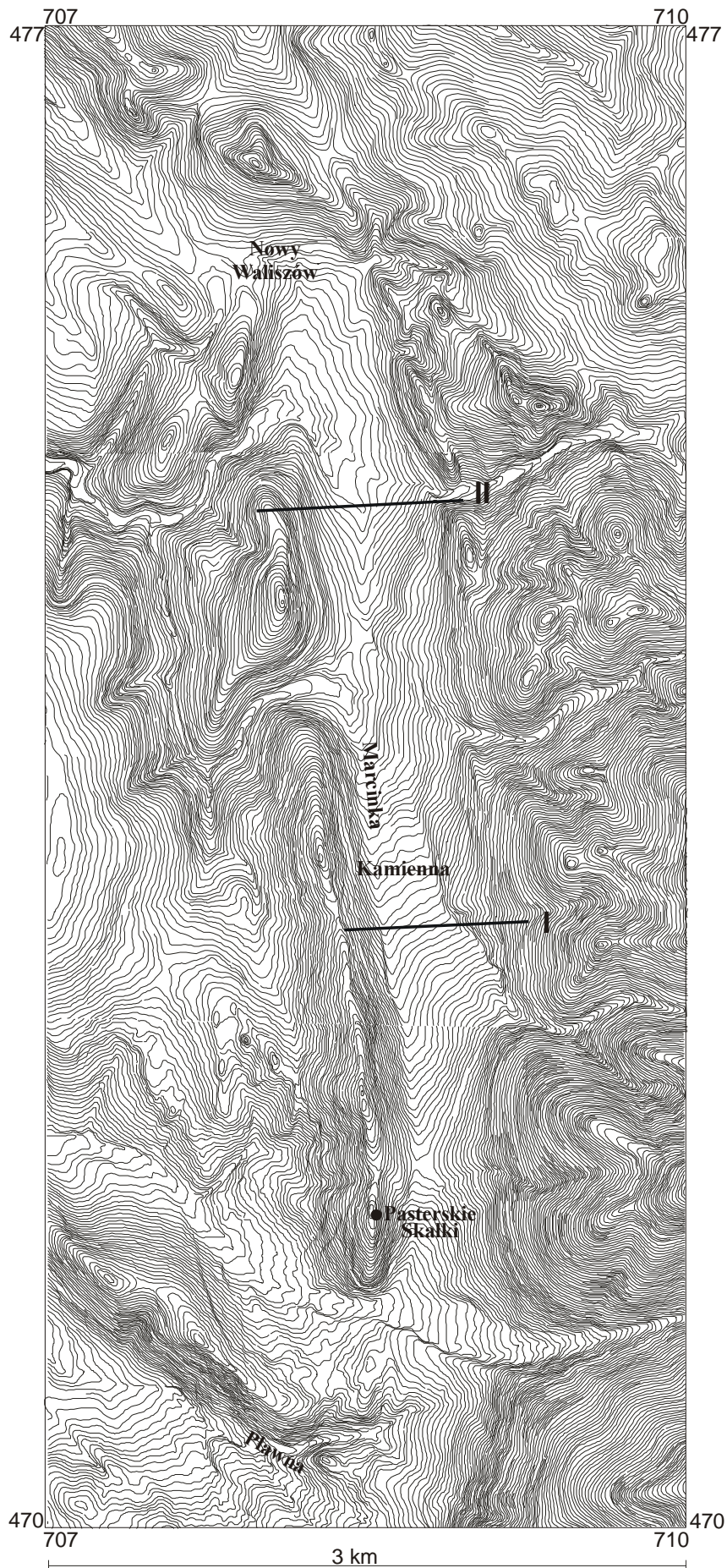
readable not only from the papers of our Adversaries, but also from the existing geological maps. Lines of geological cross-sections carefully avoid "difficult places" like, for instance, those shown on the Bystrzyca Kłodzka and Stronie Śląskie quadrangles, whereupon the Idzików sandstones and conglomerates are exposed (Wroński, 1983; Cwojdzński, 1983). Only synthetic profiles do show a more or less clear situation (cf. Fig. 1 in: Don and Wojewoda, 2004).

A concept of distinguishing the young, Pliocene-Pleistocene, Kamienna Graben stems from four constraints: rejection of the idea of erosional origin of the depression, an analysis of digital elevation model, geomorphic observations, and the results of geoelectrical-resistivity soundings.

As has already been mentioned, one of our papers (Badura et al., 2002) aimed solely at presenting the results of geophysical soundings, so we have not referred to the results of other studies. Let us present now a broader context of our hypotheses. It used to be accepted in the past that a depression near Kamienna originated due to fluvial erosion (Pachucki, 1959; Don and Don, 1960). It is highly unlikely that the inferred river valley of a width comparable to that of the present-day Nysa Kłodzka or Biała Łądecka River valleys ceased to exist abruptly. This hypothetical river left no sediments at all, and neither cut wide depressions in the mountainous parts, from which it should have been originated. Therefore, we have decided to look for another explanation. Since the paper by Don and Wojewoda (2004) does not contain any idea on the origin of this landform, we assume that this problem is not interesting to them, or that they uphold the unverifiable "fluvial" hypothesis.

The digital elevation model (Fig. 2 in: Badura et al., 2003) has been constructed by digitizing 1:10,000 topographic maps, system 65. Cartographic representations of this type are commonly considered as most useful for geological analyses, including neotectonic ones. Contrary to the suggestions of our Adversaries, we did not have any other type of data at our disposal. We are of the opinion that a digital map is as important as a topographic map used for geological mapping. However, the DEM itself represents a valuable tool only after including geological data.

Geomorphic observations have shown that the graben bottom is divided into three parts. The longest segment is situated between Nowy Waliszów and Kamienna, south of Kamienna a transversal ridge does occur, and, still farther south, a flat surfaces appears sloping gently towards the Pławna River valley. We propose to call these segments as the northern, central, and southern ones, although this division is not exactly compatible with the geometry of the structure. The bottom of the northern graben segment slopes to the NW. All the streams draining the slopes of the Śnieżnik Massif are deflected to the NNW, whereas a stream draining the Krowiarki Ridge flows south-westwards. At the mouths of valleys draining the mountainous massif, alluvial fans passing into terraces



**Fig. 1** Location of geoelectrical resistivity profiles versus contour map of the Kamienna Graben, based on 1:10,000 topographic map, system 65



can be seen. The streams dissect the graben bottom and flow farther northwards along an escarpment, above which the Idzików sandstones and conglomerates are exposed. The belt of exposures of the Idzików strata is truncated at two places by river valleys that form water gaps. The meandering pattern of these rivers, as well as their course within the Waliszów Graben indicate that these are antecedent gorges, and not those formed due to headward erosion. The occurrence of rapids within the river valley bottoms (Phot. 1) can suggest that the area undergoes recent uplift. The conclusion about recent uplift of the western margin of the Kamienna Graben is also supported by the presence of overhanging tributary valleys (Phot. 2). A vertical character of the boundaries between tectonic blocks is clearly portrayed on geoelectrical resistivity profiles, whereupon such boundaries cut both high- and low-resistivity complexes (Fig. 2a, b). Our Adversaries would be right, should the high-resistivity strata were underlain by low-resistivity ones. However, the results of geoelectrical soundings clearly indicate the presence of (sub) vertical boundaries between rocks of variable resistivity (Fig. 2a, b).

An examination of dip directions of the Idzików marls clearly shows that in the Kamienna Graben the bedding becomes increasingly gentler from the east to the west (Don and Don, 1960; Cwojdzinski, 1983; Wroński, 1983). The bedding becomes steeper again within the conglomerates (Phot. 1 and 3). Structural data should have already caught the attention of geologists working in this area to the presence of another tectonic zone that is buried under slope sediments (Fig. 2 in: Don and Wojewoda, 2004).

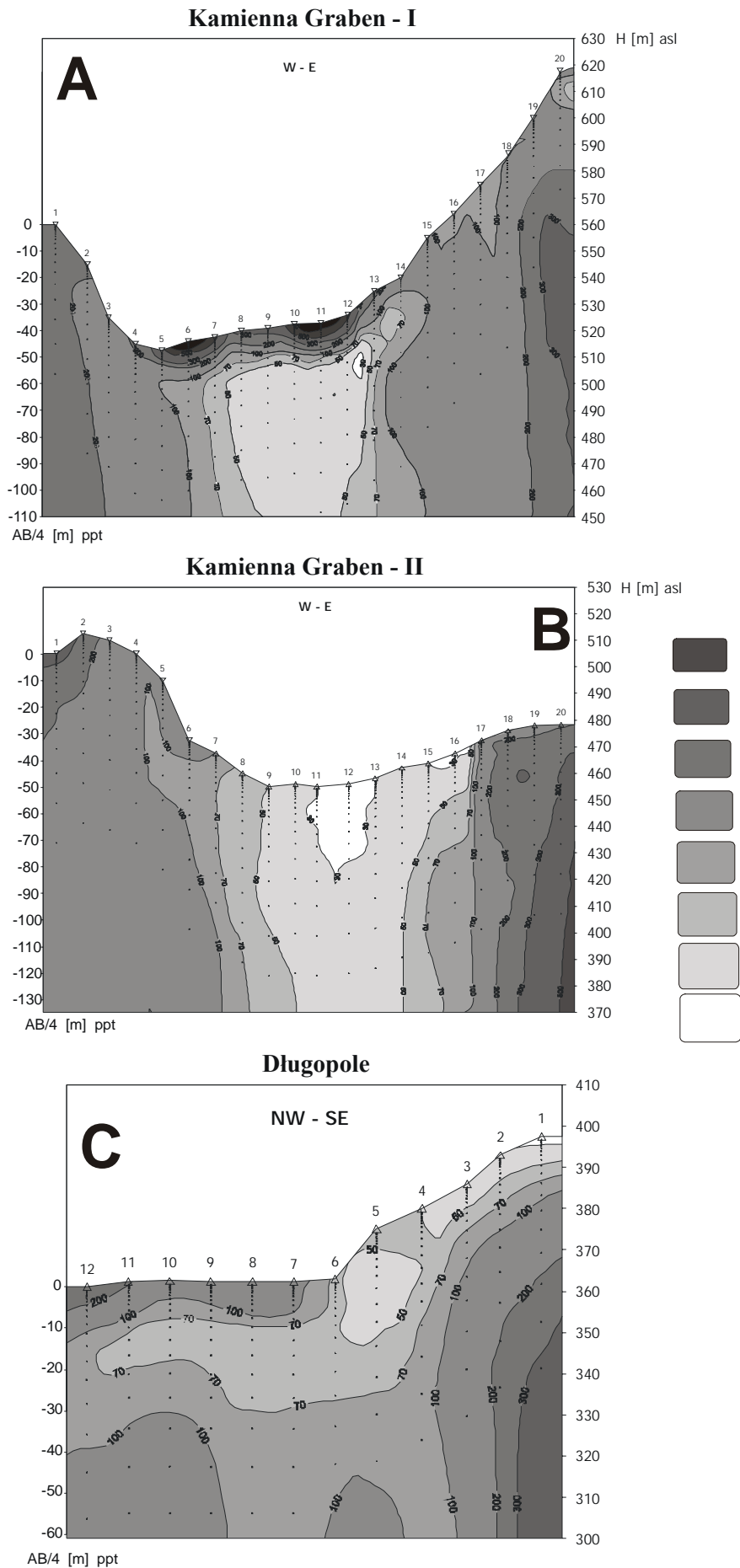
The transversal ridge, forming the so-called central segment of the Kamienna Graben, is not a watershed erosional remnant (as suggested on Fig. 2 by Don and Wojewoda, 2004), but represents a 3rd-, or even 4th-order tectonic unit. The beds dip here both to the east and west (Wroński, 1983).

Another debatable question is the origin and age of the Idzików conglomerates. Since their bordering fault has not been identified by our predecessors, they have assumed that the Idzików sandstones, conglomerates, and marls of Early Coniacian age are in stratigraphic sequence. However, the geoelectric resistivity profile points to a discordance inbetween these rocks. Taking into account that this portion of the UNKG lacks palaeontologically studied sites, we have decided to adopt another stratigraphic concept by assigning the low-resistivity rocks to the Turonian, and not Coniacian, clays. We consider the lower Coniacian strata as enriched in numerous sandstone intercalations, hence, their specific resistivity should be of the order of 70-150 Omm. Such resistivity values occur below the high-resistivity conglomerates (Fig. 2a, b).

Moreover, we are not at all certain about the hitherto-accepted structural position and origin of the Idzików conglomerates. The latter build a few metres-

wide belt of exposures, orientated roughly N-S, whose southern part of occupied by a group of tors, called the Pasterskie Skałki tors. These rocks are composed of 0.5-3.0-m-thick layers of polymictic conglomerates which are flexurally bent, and dip westwards at 70° to 90°. In some of the tors, overturning of beds can be seen (Phot. 3). Such a strong fold-like bending of the conglomerates must have occurred before the uplift of the western graben margin, or taken place at the contact with the Śnieżnik Massif gneisses (cf. Jerzykiewicz, 1971). Nearly vertical bedding is also to be seen in the Marcinka (Panna, cf. Radwański, 1960) River gorge (Phot. 1). The vertical position of the Idzików sandstones within the valley bottom has been marked neither in a paper by Don and Don (1960), nor on a geological map by Wroński (1983). Don and Don (1960) accepted that the dip of conglomerates exposed in the Pastedskie Skałki tors is lower by 35° in respect to the real one. They based their conclusion on observations carried out on one of the upper sandstone beds near Idzików, and copied it to the lowest-situated conglomerate layer (see Figs. 2 and 3 in: Don and Don, 1960). The presence of numerous slickensides, and an impression that Fig. 3 is a compilation of field photograph and author's interpretation, and not genuine field observation, lead us to uphold a conclusion that the Pasterskie Skałki tors are built up of vertical and, at places, overturned, beds. One cannot compare situation shown on Fig. 1 by Don and Don (1960), portraying sediments deposited in a quiet environment, with that existing during high-energetic, turbulent deposition of conglomerates that build the Pasterskie Skałki tors. Tectonic conclusions presented by Don and Don (1960) were not confirmed by Radwański (1961).

Our Adversaries conclude that we are not familiar with abundant literature references pertaining to the stratigraphy of the study area. It has to be pointed out that in the area close to the fault described by us, no stratigraphically-investigated sites exist, being situated farther westwards. Our hypothesis of another, possible stratigraphic sequence of the strata in question resulted, i.a., from discrepancies observed between the geoelectrical resistivity profiles and the hitherto-published maps. Such a situation is very well portrayed by Phot. 2 on Plate I by Don and Don (1960). The sandstones and conglomerates build exclusively the topmost part of the so-called "Idzików brachysyncline". Nearly half of the cuesta (op. cit.) is built up of the Coniacian clays. On the other hand, in the Marcinka River water gap, sandstones and conglomerates do occur in the river bed, i.e., at the base of the scarp (Phot. 1). Should the referred to map view were correct, at dips ranging between 40° and 55°, the geoelectrical resistivity profiles would reveal low-resistivity complexes occurring below the high-resistivity ones, and the boundary between them would have run diagonally, dipping westwards instead of being vertical. Another indication of the presence of a fault between the clays and sandstones are



**Fig. 2** Geoelectrical resistivity profiles: A - Kamienna Graben I (southern portion), B - Kamienna Graben II (northern portion), C - Długopole Zdrój. Sounding spacing amounts to 50 m; ppt - below groundsurface



**Photo 1** Rapids within the water-gap segment of the Marcinka River bed



**Photo 2** Overhanging valley of a tributary of the Marcinka River valley, in its gap segment cut into the Idzików sandstones





**Photo 3** Vertical attitude of conglomerates in the Pasterskie Skalki tors



**Photo 4** Polymictic conglomerates exposed in the Pasterskie Skalki tors

bedding attitudes shown on the Stronie Śląskie quadrangle (Cwojdzński, 1983). The lower Coniacian clayey-sandy complex appears to dip eastwards, i.e., similarly as indicated by geophysical profiles.

The critical comments to our papers contain as well references to the petrography of the Idzików conglomerates. However, the articles quoted by our Adversaries do not present a full petrographic analysis of the clasts in question. The presence of a relatively high share of gneisses does not necessarily indicate deposition at the present-day contact between the Śnieżnik Massif and the UNKG. For unknown reasons, the provenance of other rock types and their possible transport routes have not been mentioned. The petrographic and size differentiation of conglomerates building the Pasterskie Skalki tors are well portrayed on Phot. 4. Such a petrographic composition suggests delivery of the bulk of the material from the north and the northern part of the Śnieżnik Massif. The former drainage basin could have embraced porphyries of the Kłodzko region and the Intrasudetic Basin margins, as well as greywackes of the Bardo Mts. Large quartz and lityte clasts could have even originated from the Palaeozoic cover of the northern part of the Praded Massif. Such an extensive alimentary area was certainly functioning in Cenomanian times, at the beginning of the Late Cretaceous marine transgression. In the Coniacian, block tectonics affecting the northern and eastern margins of the UNKG restricted the alimentary area to the Krowiarki and Śnieżnik Massifs, i.e., the area referred to by Don and Wojewoda (2004). At the end of the Late Cretaceous, there were few possibilities of eroding crystalline basement, due to the presence of relatively thick cover of the Upper Cretaceous marine strata. We assume, therefore, that we are dealing here with another tectonic zone that cuts the "Eastern Flexure". We have assumed in our interpretation that the Idzików conglomerates are underlain by a relatively shallow, previously unrecognised, block of the crystalline basement. The Idzików conglomerates represent the Cenomanian transgressive marine strata which are thrust upon the Turonian clays, and form another tectonic zone whose strike is parallel to that of the "Eastern Flexure". A similar interpretation can be found in a paper by Grocholska and Grocholski (1958). The results of other geophysical surveys performed in the UNKG area do also confirm strong tectonic dismembering of its bottom (cf. Jodłowski, 1999), as do independent geomorphic analyses, recently presented by Ranozek (1999, 2001).

#### **DLUGOPOLE ZDRÓJ AREA**

Judging from a description related to the Długopole area, one should infer that our Adversaries try strongly to show that the geophysical cross-section (Fig. 2c) has been shot in an unknown place and that its authors confabulate on the flexure and an unknown to them exposure. One should expect that such good specialists should have read from our sketch (Fig. 3,

in: Badura et al., 2002) that the location shown by us determines the place situated close to the northern exposures of crystalline rocks near Długopole Zdrój. We are also astonished by the fact that such experienced geologists, so well familiar with this area and related literature, have not realised that the questioned site and its tectonic interpretation have already been described by Leppla (1900). His map shows in this place a well-documented fault. On the other hand, a description of a quarry completely irrelevant to tectonic problems, and suggesting that in this area tectonic disturbances do not exist at all, is a total nonsense. In this way, one can easily negate the presence of, for instance, the Sudetic Marginal Fault.

We cannot comment on the other remarks by our opponents, since they bring nothing new to the existing state of knowledge. Our adversaries have equally seriously treated both the really important subjects, and the less important ones as, e.g. geological sketches. The latter ones' aim is to show the reader the general position of the study object and its geological context. The important research has been done on detailed maps and other source materials.

#### **SUMMARY**

Detailed structural and stratigraphic observations carried out both in the UNKG, and in the areas of occurrence of the Upper Cretaceous strata in the Czech Republic, frequently verify the results of previous studies or present interpretations entirely different from those accepted by Don and Wojewoda (2004) (see, for instance, Batik et al., 1996; Grygar and Jelinek, 2003; Kozdrój and Cymerman, 2003), what confirms once again that solving geological problems requires different attitudes. It should also be remembered that the truth lies inbetween and that every scientist has his share in solving the problem, irrespectively of the hypothesis he proposes. Confrontation of different views leads to a new hypothesis; provided that every participant shows a willingness to join the discussion.

Judging from previous discussions, mainly held with Dr. Jurand Wojewoda, and careful reading of our Adversaries' paper, we infer that its Authors are not really interested in solving geological problems. All the above-listed questions could have easily been resolved even on one phone call. The lack of willingness of a direct dialogue, and simultaneous eagerness to carry it via the Editorial Board of *Acta Montana*, we do interpret as a desire of media-centred presence. We are deeply astonished by such a strong opposition to carry our further research in the UNKG area, and by supporting this attitude by literature references, supposedly confirming that all the debatable questions have already been solved. Perhaps, our adversaries try to contest in this way that geologists of different field experience and using other methods of research obtained - relatively quickly - different results and posed new working hypotheses.

In general, we consider the remarks pertaining to our papers as completely unjustified, and not conformable with the reliability of university workers. The research program realized in our proposal included: morphotectonic and morphometric analyses, experimental geophysical soundings, drillings, digging artificial cuts, and a broad range of petrographic and heavy mineral analyses, as well as age determination and geochemical studies of young basalts. All these tasks have been totally discretided, without any single attempt at getting in touch with the source data and their interpretation. It should be reminded in this place that the results of our team have been presented at numerous national and international conferences, and have been published in refereed journals, including altogether 20 items.

Since the decisively strong critical comments have been addressed to the Polish Committee for Scientific Research (Komitet Badań Naukowych) before waiting for our reply, we conclude that the Authors abused the freedom of speech by drawing their conclusions without close examination of the existing facts; a procedure contradictory to a sound scientific discussion. Our feeling is that the Adversaries, lacking adequately strong scientific arguments, decided to use *Acta Montana* as a forum to criticize the procedures applied by the Committee for Scientific Research (KBN) by sending - in this strange way - a report that looks like a message addressed to the secret police department. Insinuations contained in our Adversaries' paper are humiliating to our team and to those geologists who reviewed and finally evaluated this research proposal, as well as they cast a shadow on the Editorial Board of *Acta Montana* and anonymous Referees of our papers.

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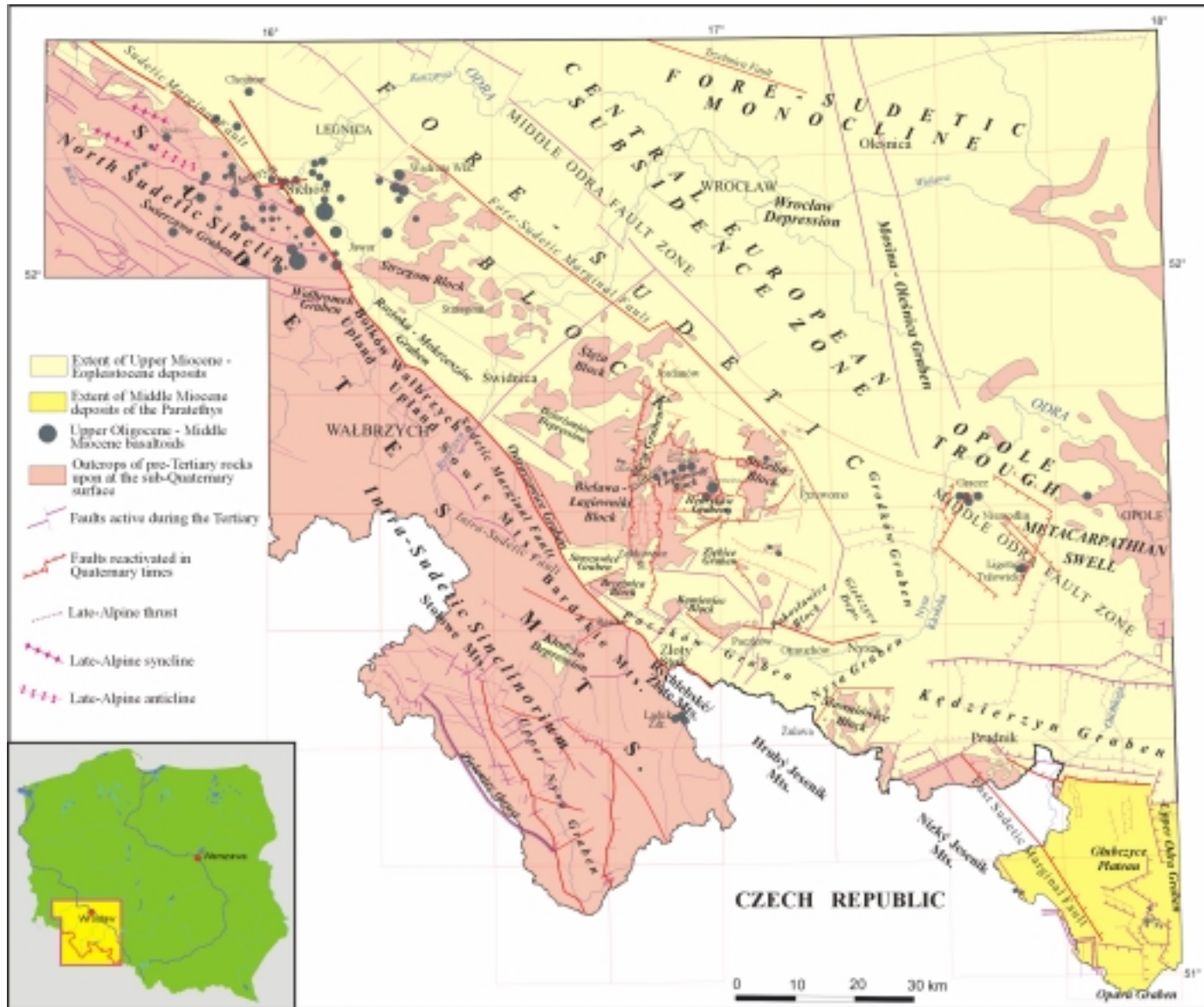
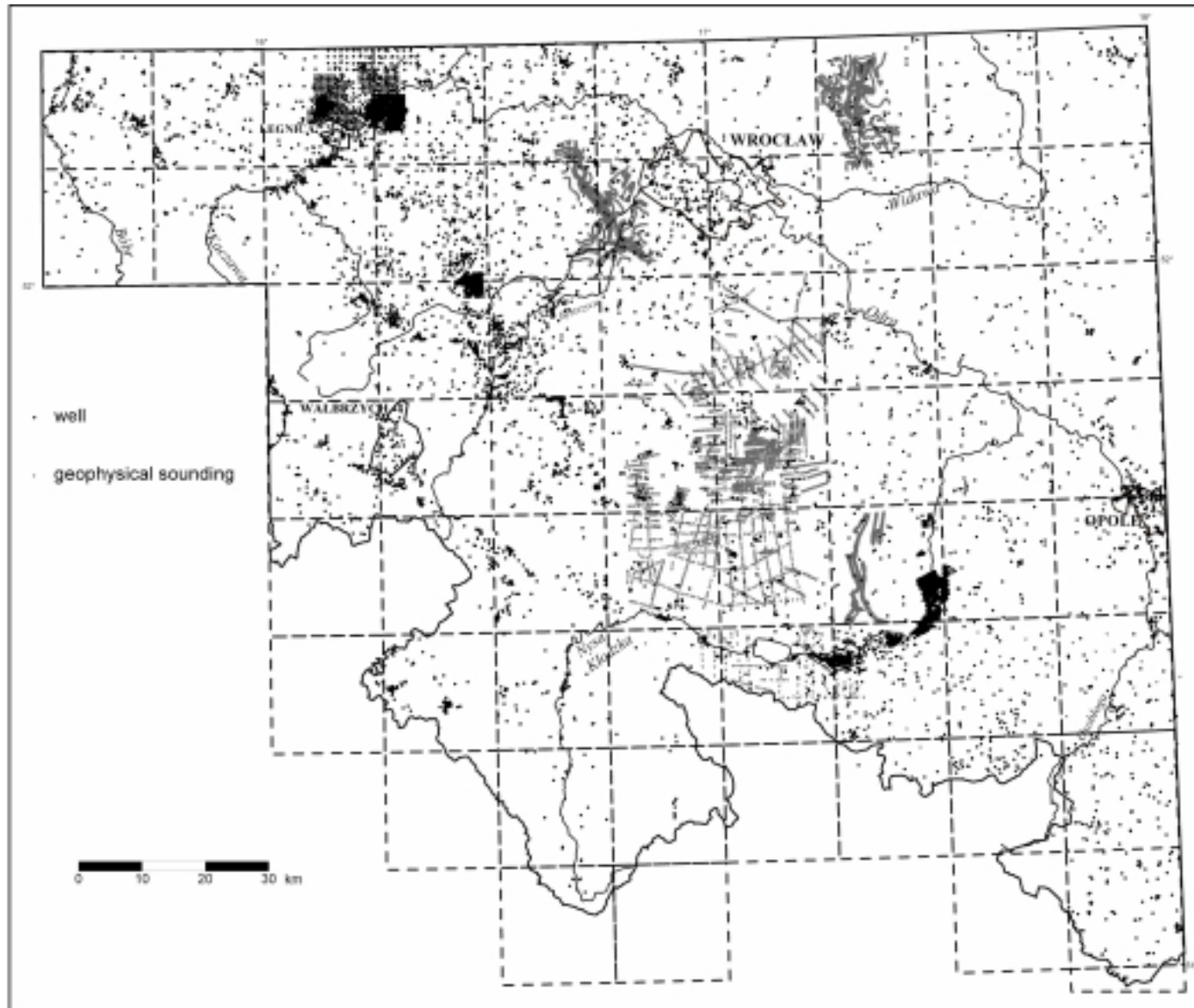
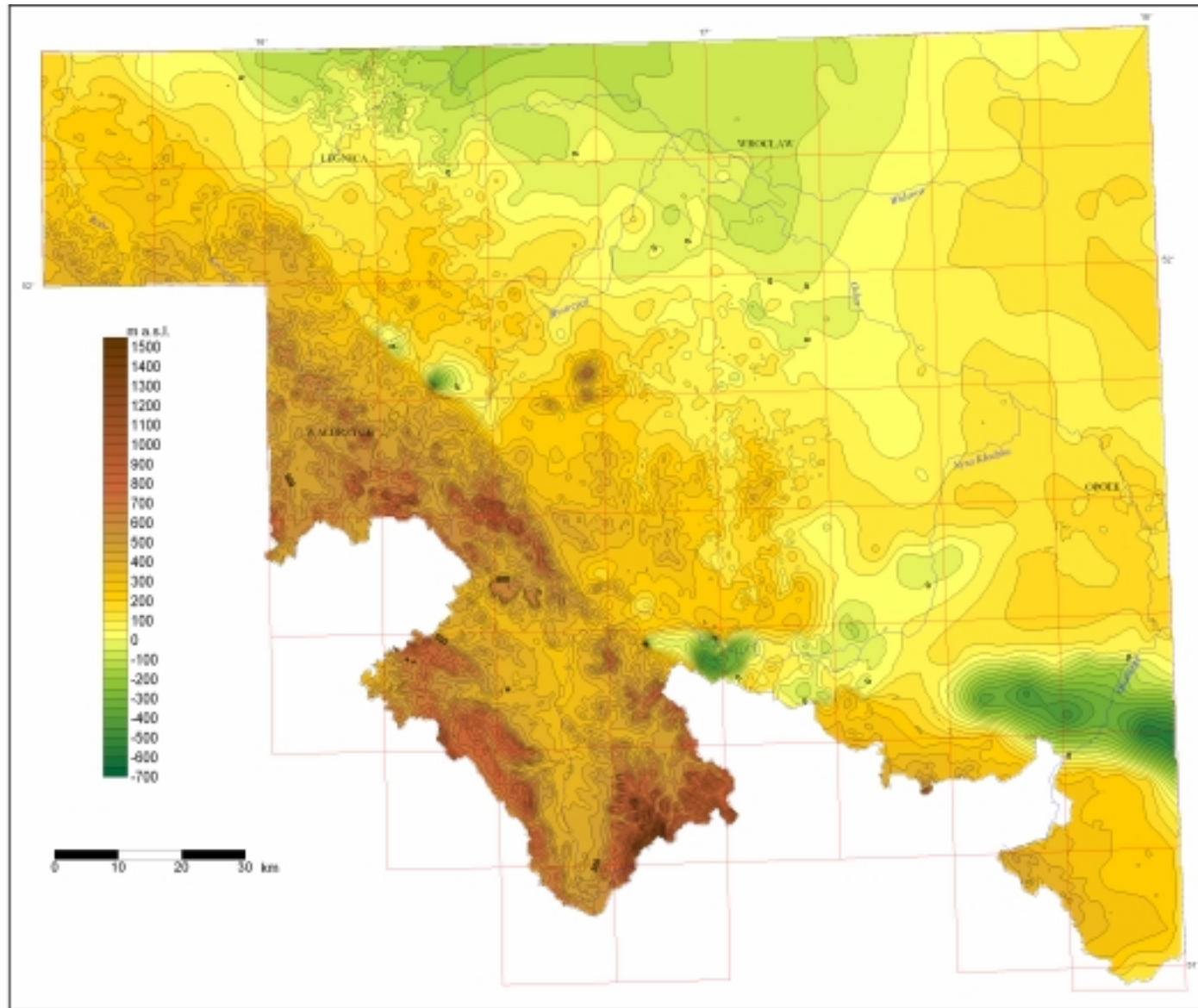


Fig. 1 Fault pattern and tectonic units in SW Poland

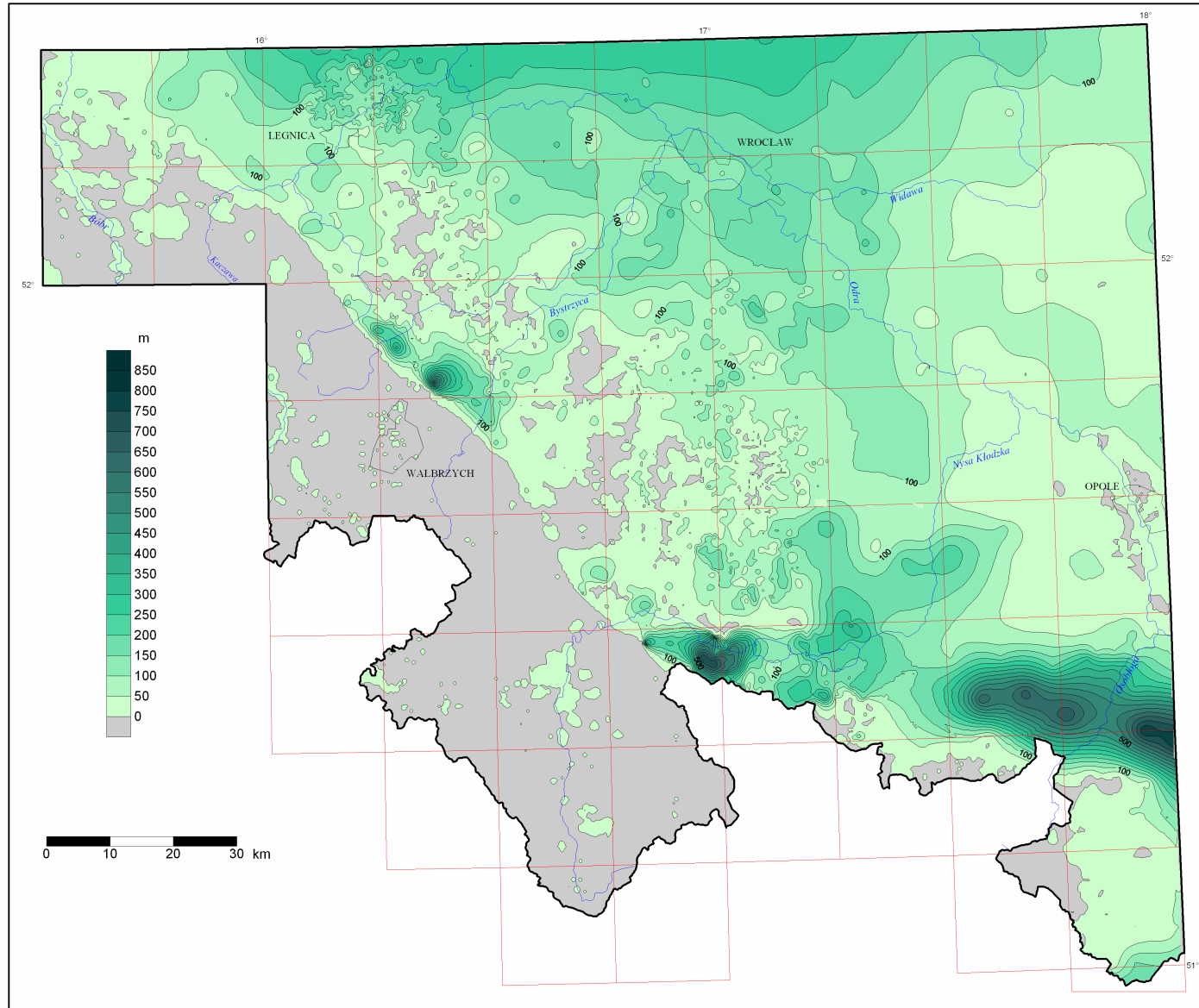




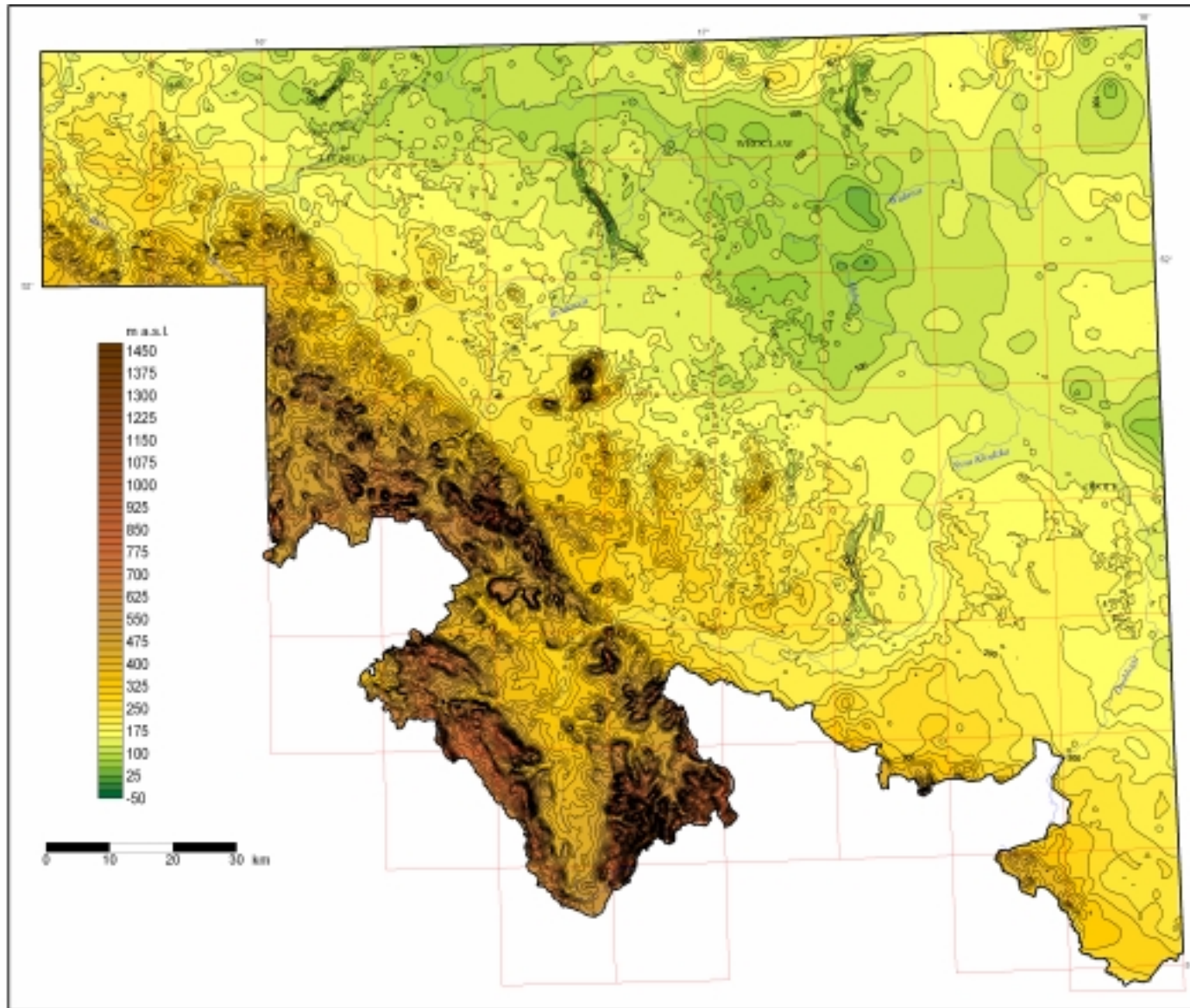
**Fig. 2** Map showing location of wells and geophysical sounding profiles used in this study



**Fig. 3** Topography of the sub-Cainozoic surface in SW Poland

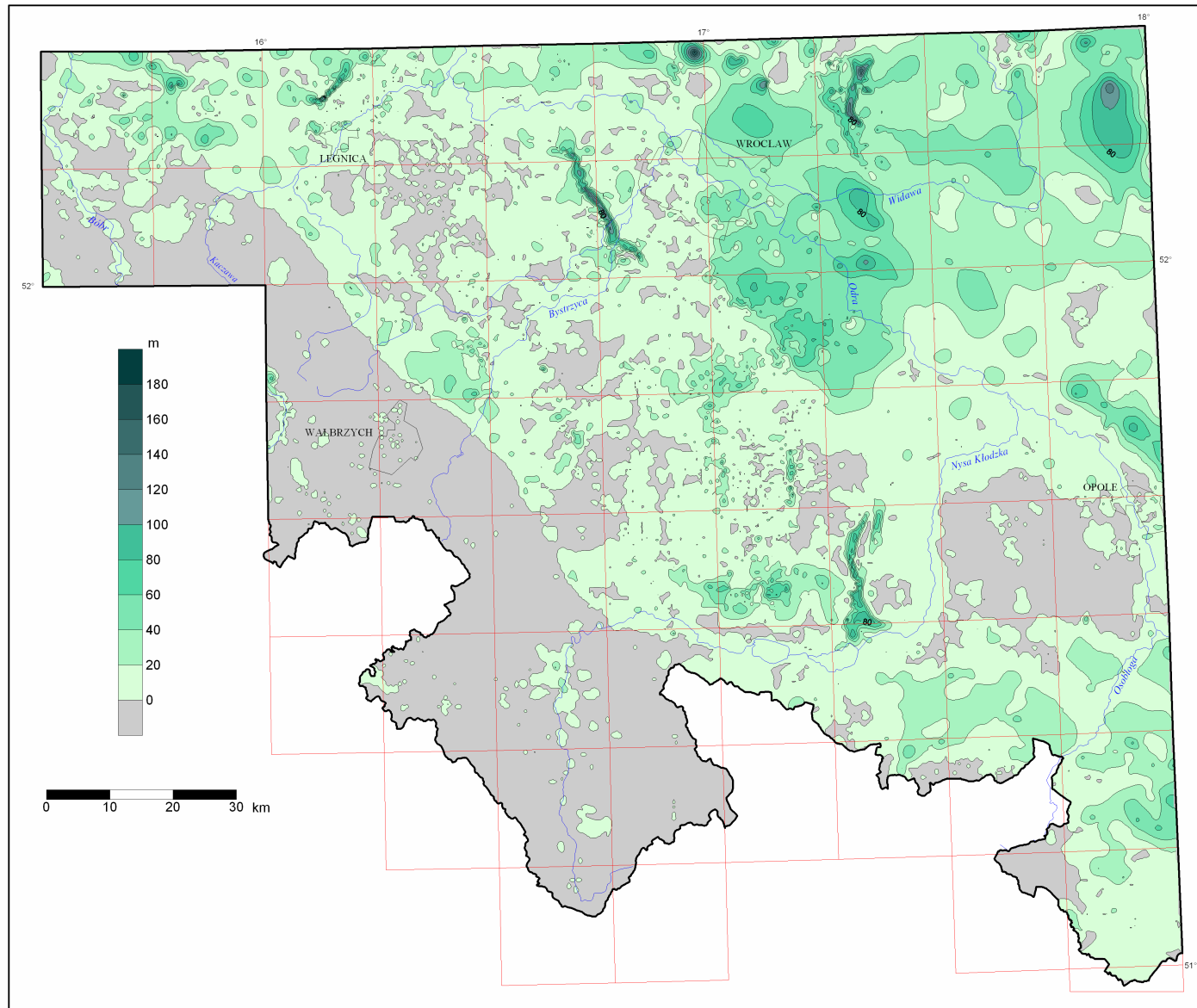


**Fig. 4** Thickness of Cretaceous strata in SW Poland



**Fig. 5** Topography of the sub-Quaternary surface in SW Poland





**Fig. 6** Thickness of Quaternary sediments in SW Poland