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Sub-Quaternary depression in the Lower Narew Region, its age and origin*

A depression in the sub-Quaternary surface, demarcated by Ostrołęka, Ostrów Mazowiecka and Chorzele, reaches in its bottom 80—120 m b.s.l. and possesses also a branch of the same depth. In the Quaternary substrate there are rocks of the Upper Cretaceous, Palaeogene and Neogene. A significant role for an explanation of the origin of the sub-Quaternary depression is played by a site of fluvial-lake Eopleistocene deposits at Opaleniec near Chorzele. It proves that already during the earliest Quaternary, a well developed fluvial pattern existed in this area and was probably dependent on tectonic foundations. Deep valleys of that time initiated a system of depressions, modified then during the whole Pleistocene. A sub-Quaternary surface is there now a polygenetic surface, developed mainly due to repeated processes of glacial and fluvial erosion. Ice sheet produced deformations played a secondary role in modelling a depression. Glaciotectonic processes were marked particularly at its western and southwestern margins, opposing in general the ice sheet movements.

INTRODUCTION

In the areas adjacent to the Lower Narew Valley, a depression in a sub-Quaternary surface to 50 m b.s.l. has been already presented for a long time (J. Lewiński, J. Samsonowicz, 1918; A. Zierhoffer, 1925). The authors of the first works knew also the elevations of the Tertiary sediments at Kipary and near Chorzele (Fig. 1, 2). But the main role in modelling of the sub-Quaternary surface was ascribed by them to other factors. J. Lewiński and J. Samsonowicz (*l.c.*) put a glacial erosion and glaciotectonics in the first place whereas A. Zierhoffer (*l.c.*) connected the origin of numerous morphologic features of the substrate with an existence of new epeirogenetic movements and paid also attention to long-last-

* Papers marked with asterisk were compiled in March 1966.

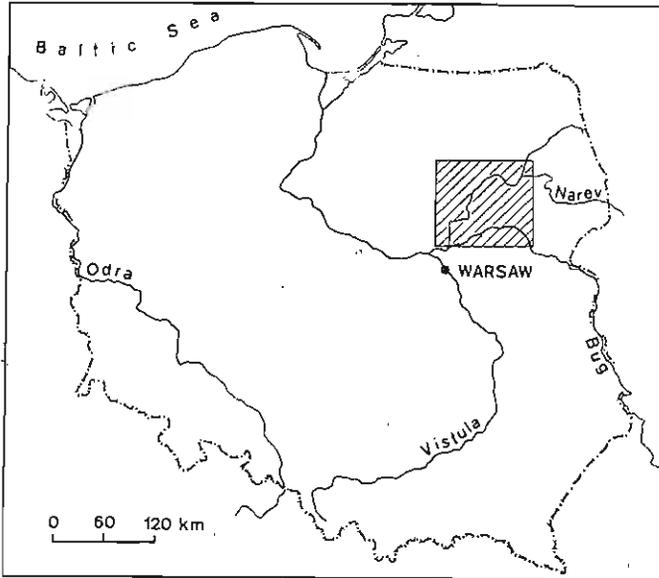


Fig. 1. Location of the investigated area in north-eastern Poland
 Położenie obszaru badań w północno-wschodniej Polsce

ing erosion during the pre-Pleistocene period. A progress in this field was not possible due to a lack of boreholes that passed through the Quaternary sequence.

The General Geologic Map of Poland in a scale of 1 : 300,000 and published in 1953, shows in the Lower Narew Region a slightly differentiated sub-Pleistocene surface, gently sloping southwestwards and located at about 50 m b.s.l. Not before 1956—60, three research boreholes have been done by the Geological Institute near Ostrów Mazowiecka. They proved that the Quaternary substrate occurred at considerably lower altitudes (120 m b.s.l.) and just on the Cretaceous rocks (J. E. Mojski, 1965a). E. Rühle (1965) marked at that time on his map of morphology of the Quaternary substrate, a narrow depression running from south-east through Malkinia, Ostrów Mazowiecka and Łomża northwards. The origin of this feature could not be explained other than by the Eopleistocene erosion (J. E. Mojski, 1965b).

The authoress's investigations in the Lower Narew Region were carried through within the works of the Geological Institute over geologic maps of Poland in scales of 1 : 200,000 and 1 : 50,000. During the seventies 14 research boreholes were done in these areas. They usually passed the whole Tertiary sequence. They proved a low location of the sub-Quaternary surface in a large area, demarcated by Ostrołęka, Ostrów Mazowiecka, Maków Mazowiecki and Chorzele (Fig. 2). Numerous data in this field were brought also by geophysics works (electric logging). In result of all research investigations not only a morphology but also a geologic structure of the Quaternary substrate could be presented. A previous knowledge of them in these areas have been insignificant.

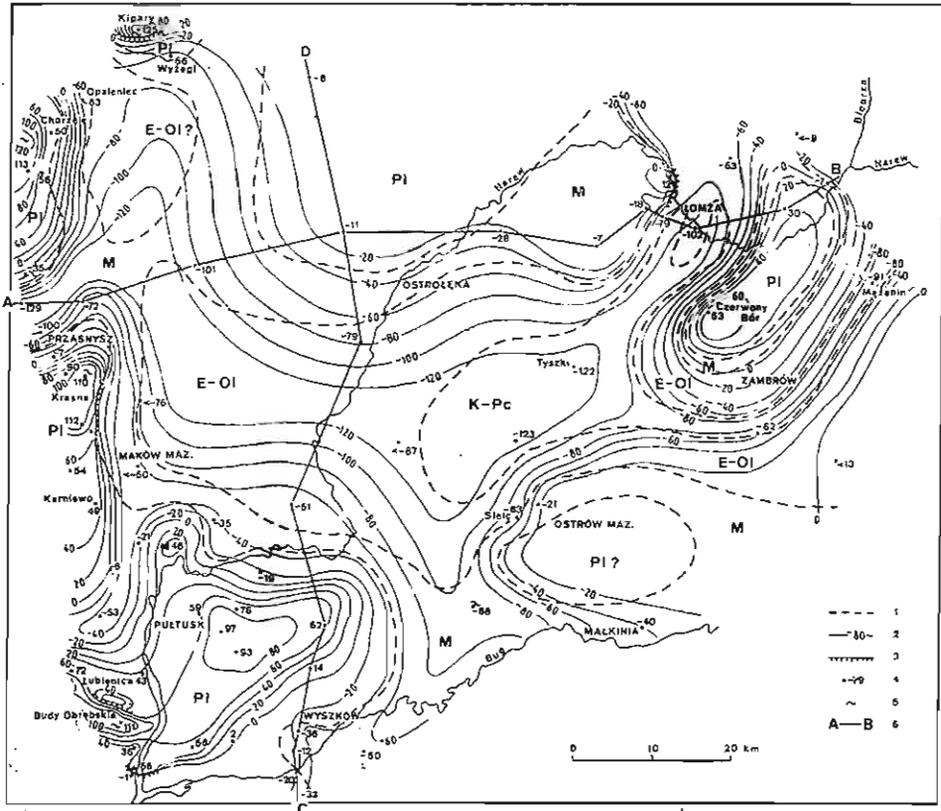


Fig. 2. Geologic map of Quaternary substrate
 Mapa geologiczna podłoża czwartorzędowego

1 — geologic borders; 2 — contour lines of Quaternary substrate (at every 20 metres), 3 — steep slopes and edges; 4 — selected boreholes; 5 — glaciolocations noted in Tertiary deposits; 6 — geologic sections; Pl — Pliocene; M — Miocene; Ol — Oligocene; E — Eocene; Pc — Palaeocene; K — Cretaceous

1 — granice geologiczne; 2 — izohipsy powierzchni podczwartorzędowej (co 20 metrów); 3 — strome zbocza i krawędzie; 4 — wybrane otwory wiertnicze; 5 — zaburzenia glaciotektoniczne stwierdzone w utworach trzeciorzędowych; 6 — linie przekrojów geologicznych; Pl — pliocen; M — miocen; Ol — oligocen; E — eocen; Pc — paleocen; K — kreda

MORPHOLOGY OF SUB-QUATERNARY SURFACE

A vast sub-Quaternary depression of a meridionally elongated basin-like shape in its central part, is at least 60 km long and about 30 km wide. The lowest location of its bottom (123 m b.s.l.) is known from the Ostrów Mazowiecka area. In the western part where the basin turns to the north, the Quaternary bottom is noted at 101 m b.s.l. (Zwierzyniec).

The depression is delimited from the north and southeast by slightly varying surfaces of Tertiary sediments, located at about 0—20 m b.s.l. A high location of Tertiary sediments in this part of the area (30—60 m a.s.l.) is known to the southeast of Łomża only (Czerwony Bór, Janczewo). Bór, Janczewo).

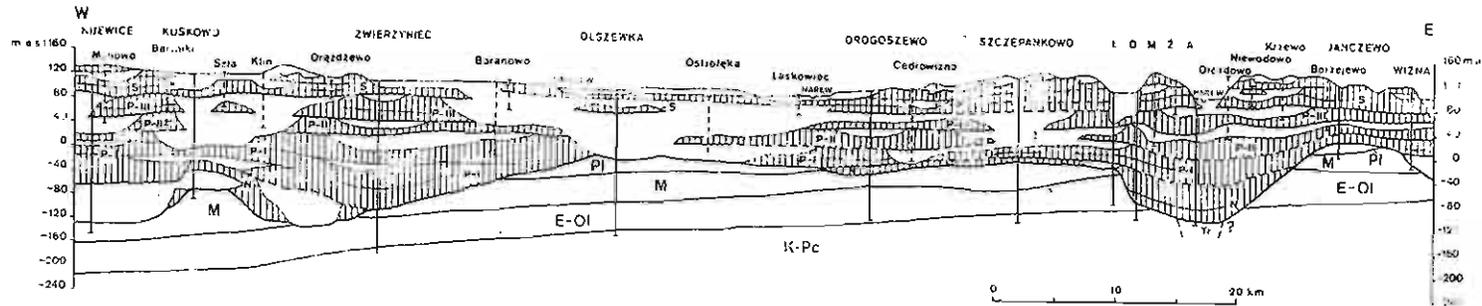


Fig. 3. Simplified geologic section A—B
Uproszczony przekrój geologiczny A—B

Units: N — Oldest (Narew) Glaciation, P-I, P-II, P-III — South-Polish Glaciations, S — Middle-Polish Glaciation; for stratigraphic symbols of deposits of the Quaternary substrate see Fig. 2; projected boreholes are marked by a dashed line

Gliny zwałowe: N — zlodowacenia najstarszego (Narwi), P-I, P-II, P-III — zlodowaceni południowopolskich, S — zlodowacenia środkowopolskiego; symbole stratygraficzne utworów podłoża czwartorzędz jak na fig. 2; otwory rzutowane oznaczono linią przerywaną

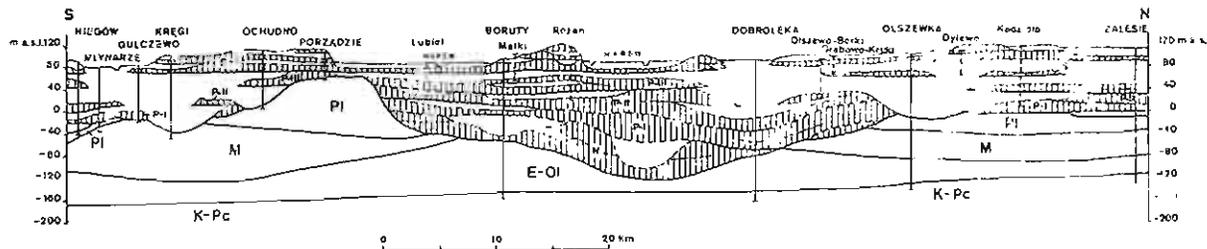


Fig. 4. Simplified geologic section C—D
Uproszczony przekrój geologiczny C—D
Explanations as given in Figs 2 and 3
Objaśnienia jak na fig. 2 i 3

From the west and southwest the depression is surrounded by high elevations, composed of Neogene deposits but frequently glaciotectonically deformed, and locally exposed at the land surface. Near Kipary an elevation of deformed Miocene and Pliocene deposits reaches 125 m a.s.l. and is characteristic for its small extent and well expressed southern slope. An edge of a vast elevation of the Tertiary bedrock runs from Chorzele to Przasnysz and then spreads northwestwards to Działdowo and Olsztyn (A. Bałuk, 1976; W. Słowański, 1976). Near Chorzele the glaciotectonically deformed Pliocene clays outcrop at about 120 m a.s.l. (brickfield Niskie Wielkie). To the south of Przasnysz the sub-Quaternary depression contacts with a broad zone of bedrock elevations. The substrate is there generally located (as far as Ciechanów) at about 60—80 m a.s.l. The elevations at the depression margin reach there 110 m a.s.l. and within their extent the Pliocene clays form outcrops or almost outcrops (Krasne, Dobrzankowo; Z. Michalska, 1961). A high (over 90 m a.s.l.) location of Tertiary sediment is also noted within the junction of the Bug and Narew rivers, from where it spreads southwestwards and comprises the elevation of strongly deformed Pliocene clays, squeezed to 110 m a.s.l. and outcropping in the present land surface (Budy Obrębskie; J. Nowak, 1958, 1969).

The sub-Quaternary depression in the Lower Narew Region is not a closed feature but has deep branches. One of them, located in the Małkinia and Wyszaków area, was probably formed at the junction of two other depressions: one running from the southeast and the other from southwest (J. Nowak, 1969, 1970). A bottom of this feature is defined by values of the Quaternary complex bottom of 50 and 88 m b.s.l. A more narrow and possibly slightly more shallow depression cuts the elevation of Pliocene deposits near Pułtusk and turns to the west (53 m b.s.l.).

Near Przasnysz the depression is open westwards by another deep depression of the lowest, in the whole area, location of the Quaternary sequence bottom (129 m b.s.l., also 100 and 72 m b.s.l.). It runs northwestwards through Mława and Działdowo and continues further in the same direction to Rybno-Lubawa-Ilawa as a row of lowerings in the Quaternary substrate, described by L. Marks (1980). A northwestern part of the depression (in Kipary and Chorzele area) also passes into a narrow depression that, according to W. Słowański (1976), runs northwards as far as Olsztyn and Dobre Miasto.

In the eastern part of the area where a substrate morphology is more monotonous, there is a distinct depression near Łomża (102 m b.s.l.) and in the northeast the depression still connects with another deep sub-Quaternary feature, cut at Mężenin to 91 m b.s.l.

REMARKS ON GEOLOGIC STRUCTURE OF QUATERNARY SUBSTRATE

The problem of origin of depression or rather of the whole presented system of sub-Quaternary depressions, demanded a recognition of substrate deposits in the domain of their lithostratigraphic section as well as morphology of main structural surfaces. A particular attention was paid at the same time to a coincidence of certain irregularities of the bedrock

structure and deep features of the sub-Quaternary morphology.

In the eastern part of the depression (Ostrów Mazowiecka, Tyszki, Męzenin) the Quaternary sediments are simply underlain by the Upper Cretaceous marls (Fig. 2). Microfaunistic analyses defined their age for the Upper Maestrichtian (J. E. Mojski et al., 1985 *a, b*; E. Gawor-Biedowa, 1971). The top layers of the Cretaceous complex are also reached in many boreholes in the remaining part of the area, either under Oligocene or Palaeocene deposits. The Palaeocene deposits have not been noted yet in the Quaternary substrate of the investigated area. Their occurrence is discontinuous as they are only preserved in some zones (Figs 3 and 4).

The top surface of Cretaceous-Palaeocene rocks in these areas is quite regularly inclined southwestwards i.e. in agreement with a general tectonic pattern of a sedimentary cover on the slope of the Mazury Anteflexure. But near Łomża where Palaeocene and Upper Cretaceous sediments were noted by several boreholes at similar altitudes of about 70–80 m b.s.l., one of the boreholes has not reached them to 105 m.b.s.l. (Fig. 3).

Eocene and Oligocene deposits form the sub-Quaternary surface in the western part of the depression, in its bottom and slopes (Figs 2–4). Amongst them, five lithostratigraphic sequences can be distinguished. They represent different facies and changeable sedimentary conditions in a marine environment. Glauconite sands predominate, with rare and poorly preserved faunistic remains. Microfaunistic analyses have not resulted in data for a closer definition of the age. On the other hand, a palynologic analysis of coaly inserts (I. Grabowska, 1975) as well as a correlation of distinguished sequences with similar units in the neighbouring areas (E. Ciuk, 1970, 1972, 1974; J. Nowak, T. Uberna, 1976; E. Odrzywolska-Bieńkowska et al., 1979), indicate here a presence of deposits of the Middle and Upper Eocene as well as of the Lower and Upper Oligocene age.

The top surface of Oligocene sediments is inclined southwestwards and in general concordant with Cretaceous-Palaeocene surface but with a more varied morphology. A gentle elevation of the Oligocene top surface is marked in the central part of the area and corresponds in its extent approximately with the sub-Quaternary depression (Fig. 4). A thickness of the Eocene-Oligocene complex was the greatest primary in this elevation (about 100 m) and its lithostratigraphic section was the most complete.

At Łomża (to the north from the section A-B) there is over 40 m high altitude difference in the Oligocene top surface. A presence of a similar morphologic lowering in the surface of compact, Cretaceous-Palaeocene rocks and in the same time a coincidence of these deformations with a deep sub-Quaternary depression, induce to look for a connection among all these elements. An existence of a tectonic graben in Cretaceous and Tertiary rocks in the Łomża area seems to be particularly probable.

Strongly deformed Tertiary deposits, the Oligocene ones inclusive, were noted by the authoress in the Opaleniec section, in the northwestern part of the area. A palynologic index analysis of I. Grabowska (1975) proved a higher location of coaly sediments of the Middle Oligocene than of the Upper Miocene age there.

At slopes and in branches of the sub-Quaternary depression there are

Miocene deposits, more or less degraded. A broad meridional zone of their total destruction corresponds with a central part of the depression. An inland sedimentation of the Lower Neogene is best represented by sections from the areas, in which a series of this age is preserved under a cover of the Pliocene variegated clays. In the northern area (Równina Kurpiowska), the Miocene deposits are about 50 m thick and their top is located at 35 m b.s.l. They can be subdivided into 4 lithologic sequences, some of them are of sedimentary cycle characteristics. They are usually composed of quartz sands with a considerable admixture of mica. The colour is lightgray, gray-white or brown and black if with admixture of coal silt. Sands are accompanied by interbeds of silts and inserts of brown coal. In all the research sections known to the authoress, these sediments were horizontally and regularly thinly laminated. Palynologic investigations prove their Lower and Middle Miocene age (I. Grabowska, 1975).

Miocene deposits from the northwestern margin of the depression show a large thickness, about and over 100 m. In this area their top surface is also particularly high, at 60—70 m a.s.l. These elevations should be connected with the area of high location of the Miocene top surface at Olsztyn, Nidzica and Wielbark, known already for a long time (E. Rühle, 1955; E. Ciuk, 1966). But in this zone there is near Przasnysz an almost 130 m deep lowering of the Miocene surface. It runs further northwestwards through Mława and Działdowo that is similarly as the mentioned sub-Quaternary depression.

Pliocene clayey sediments are preserved only at margins of the depression what proves their primary presence in the whole investigated area. These sediments form the highest elements of the sub-Quaternary surface in the western and southwestern part of the area. A patch of Pliocene deposits to the north of Ostrołęka (Olszewka, Zalesie) occurs at an almost flat substrate (about 35 m b.s.l.) and its known thickness is not over 30 m. This area shows in general a regular arrangement of Pliocene deposits and corresponds with a zone of large deformations in the Tertiary structure. In the already mentioned borehole from Opaleniec, the Pliocene clays reach 63 m b.s.l. in the top. In the 90 m long section of this borehole and particularly in its deeper part, there is many a time repeated succession of fissured and polished Pliocene clays as well as coaly silts and sands of the Upper Miocene and Middle Oligocene age.

Irregularities in the Tertiary structure, difficult to be explained, are presented by the section from Wyzęgi (Fig. 2) where the Lower Palaeocene deposits are simply overlain by Pliocene clays, 72 m thick (E. Ciuk, 1971). A location of the clays at 64 m b.s.l. is there unusually low, similarly as at Opaleniec, and their bottom occurs about 100 m deeper than at Zalesie, 17 km aside (Fig. 4). According to E. Ciuk (1971), the section from Wyzęgi can indicate an erosive feature of the Upper Miocene age, filled with clayey sediments during the Pliocene. It seems possible that Pliocene clays from Opaleniec and Wyzęgi show no spatial connection with highly located occurrences of these sediments at Kipary and near Chorzele.

The zone of Tertiary deformations spreads further westwards. Strong deformations expressed by high angles of the layers dip and also, as at Opaleniec, by a reversed location of Miocene and Oligocene deposits, we-

re noted by E. Ciuk (1971) in the Szkotowo section near Nidzica, to the southwest from the known elevation of Neogene deposits at Orłowo (E. Ciuk, 1968). But as far as the author sees glacial influence at Orłowo, he finds an explanation of deformations at Szkotowo by glaciotectionics hard to be accepted.

Occurrence of Pliocene deposits around the sub-Quaternary depression is characterized by a high hypsometric variability, connected with a differentiation of their upper surface as well as varying altitudes of the Miocene complex top surface. Maximum thickness (110 and 113 m) of Pliocene clays near Pułtusk (Karniewo, Żubienica) corresponds with a depression of the Miocene bedrock to 60—70 m b.s.l.

EOPLEISTOCENE STAGE IN EVOLUTION OF SUB-QUATERNARY DEPRESSION

The occurrence of Eopleistocene deposits in this area is of particular significance for a consideration over the origin of depression. These deposits were noted in the section from Opaleniec on the basis of palynologic investigations (L. Stuchlik, 1975). Fluvial-lacustrine sediments of the earliest Quaternary age occur there at 26—63 m b.s.l., at the foot of western depression slopes. The whole Eopleistocene series from Opaleniec is characteristic for a horizontal and regular stratification of its sandy-silty deposits and lack of any deformations within them. A quiet arrangement of these sediments strikingly stands in contrast with the above described, strong deformations of the Tertiary substrate in the same section. A glaciotectionic origin of the deformations cannot be here taken into account. Their explanation as the effect of landslides existing close to Tertiary elevations is also doubtful: a thickness of deformed sediments is large (90 m) and the Eopleistocene sediments do not contain any inserts of Tertiary deposits as could be expected close to unstable slopes of a deeply incised valley of that time.

In the light of the presented data, the Opaleniec site is one more locality that delimits the zone of Tertiary deformations in the north-western part of the area. The origin of deformations can be only partly explained by a deforming action of ice sheets (Orłowo, Kipary). It seems to be mainly connected with a pre- or Early Quaternary phase of neotectonic movements, described already by many authors (among others M. Klimaszewski, 1958; M. D. Baraniecka, 1981). Consequently, the earth crust movements must have intensified the relief-modelling processes and particularly, the erosion of rivers.

A location of the Opaleniec section within the sub-Quaternary depression allows to distinguish the earliest, Eopleistocene phase in the evolution of this feature. A hypsometric position, considerable thickness (37 m) and lithofacial composition of Eopleistocene sediments prove that the Early Quaternary river valley existed there. It was incised over 100 m into the Tertiary substrate and partly filled with alluvia. This valley belonged probably to a fluvial pattern that was already well developed in this area.

A consistent southwestward inclination of the Cretaceous-Palaeocene and main Tertiary surfaces suggest a similar direction of a fluvial dis-

charge during the Eopleistocene. Therefore, the leading valley seems to have been meridionally running in that time. This earliest valley marked probably a morphologic axis of the later depression, modified through the whole Pleistocene but all the time preserving its primary, almost meridional pattern.

A connection of some sub-Quaternary depressions with certain irregularities in the structure of older bedrock was already underlined in this paper. A coincidence of these elements noted in the Łomża area can indicate a tectonic foundation of a sub-Quaternary depression in this area. A similar conclusion can be drawn from the analysis of the Miocene top surface from the Przasnysz region. A depression in this surface can result from the pre-Pliocene erosion, dependent also on tectonic processes. They were the ones that decided about directions of runoff of Tertiary waters from higher areas in the east. In the beginning of the Quaternary this old water tract could renew its activity, developing a row of sub-Pleistocene depressions from Przasnysz through Mława and Działdowo, and further to Rybno, Lubawa and Ława (A. Bałuk, 1976; L. Marks, 1980). Tectonic foundations left a distinct impress, expressed by a consequent almost linear arrangement at a distance of many dozen kilometres.

The above considerations suggest that deep features of the sub-Quaternary morphology in the Lower Narew Region initiated intensive erosion during the Eopleistocene. A well developed fluvial pattern of that time was here predisposed mainly by tectonic foundations. The intensity of erosive processes in the earliest Quaternary could be influenced by vertical movements of the earth crust. A location of the depression within a gentle but distinct elevation in the Oligocene surface is symptomatic. If this elevation is due to uplift then a slow rise of the area must have been accompanied by an incessant bottom erosion. Therefore, an erosion would play the initial and in the same time the predominant role during the earliest phase of development of the sub-Quaternary depression.

The fact of finding the Eopleistocene sediments in a single site from Opaleniec only, at its common absence in the central part of the depression, can be explained by repeated erosive processes during the earliest Quaternary. The early phase of erosion should be connected with the mentioned phase of tectonic movements whereas the final one with a drop of the base of erosion before a development of the first glaciation. A drop of a sea level, corresponding with a growth of a continental ice¹, must have decisively influenced a rate of erosion at the end of the Eopleistocene, before the following ice age. Existing valleys got deeper in that time and their alluvia were mostly destructed. Thus, a direct contact of the oldest glacial deposits with the Cretaceous-Tertiary bedrock in the bottom of the depression, does not deny the erosive origin of this feature but only proves that there were no favourable conditions for accumulation of alluvia within deep valleys before the oldest glaciation.

¹ A drop of a sea level at the end of the Eemian Interglacial was evaluated for 60–70 m (W. Dansgaard, J. C. Duplessy, 1981).

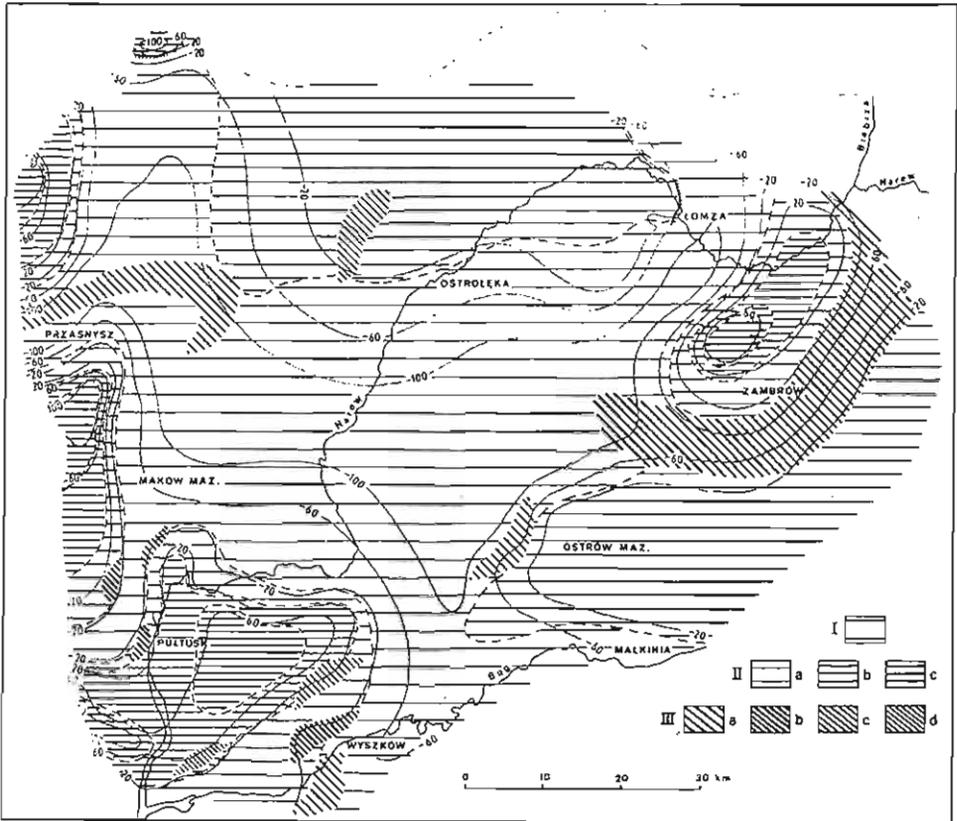


Fig. 5. Sketch of Quaternary substrate in the age-genetic approach

Szkic powierzchni podczwartorzędowej w ujęciu wiekowo-genetycznym

Areas of Quaternary substrate formed mainly: I — in the Eopleistocene (fluvial erosion, denudation) and during the Oldest Glaciation (glacial and glacialfluvial erosion); II — during glaciations (glacial and glacialfluvial erosion): a — first South-Polish Glaciation, b — two younger South-Polish glaciations, c — Middle-Polish Glaciation; III — during interglacials (fluvial erosion): a — first N/P-I, b — second P-I/P-II, c — third P-II/P-III, d — fourth P-II/S (Mazovian)

Strefy powierzchni podczwartorzędowej ukształtowane głównie: I — w eoplejstocenie (erozja rzeczna, denudacja) i podczas zlodowacenia najstarszego (egzaracja, erozja glacialfluwialna); II — w okresach zlodowaceń (egzaracja, erozja glacialfluwialna): a — pierwszego zlodowacenia południowopolskiego, b — dwu młodszych zlodowaceń południowopolskich, c — zlodowacenia środkowopolskiego; III — w interglacjalach (erozja rzeczna): a — pierwszym N/P-I, b — drugim P-I/P-II, c — trzecim P-II/P-III, d — czwartym P-II/S (mazowieckim)

EVOLUTION OF DEPRESSION DURING THE PLEISTOCENE

The sub-Quaternary surface in the Lower Narew Region in its present shape is firstly a result of repeated (during the whole Pleistocene) processes of glacial and fluvial erosion, and to a smaller degree of denudation and glaciotectionics. Various fragments of this surface: around the depression, in its bottom and slopes, are of different age and origin. In many cases a defining of these factors was possible on the basis of stratigraphic analysis and palaeogeomorphology (Fig. 5).

Pleistocene deposits in this area are composed of five glacial complexes separated by interglacial series. All stratigraphic sequences are particularly well developed within the sub-Quaternary depression.

The ice sheet of the oldest (Narew) glaciation took advantage of the existing system of the Eopleistocene valleys and depressions and in general, has not left traces of intensive deformational processes. A quiet contact of the oldest tills with the substrate is underlined in some sections by a thin layer of dark decalcified clay that may come from destructed older weathering mantles. These tills possess a considerably high content of glauconite and some heavy minerals, typical for Palaeogene deposits. This feature speaks for a presence of Palaeogene deposits in the bottoms of depressions used by the oldest ice sheet and in the same time proves that the Neogene series had been removed earlier from there.

An extent of sediments of the oldest glaciation (Fig. 5) enables from one side to reconstruct approximately a system of the Early Quaternary depressions but from the other, to demarcate the zone on the sub-Pleistocene surface that was finally formed due to glacial and meltwater erosion during this glaciation. Such zone corresponds with the central part of the depression and its branches, and is located from their bottom i.e. from 120—80 m b.s.l., to about 40—15 m b.s.l.

During the oldest interglacial a valley of a large river cut locally completely the oldest glacial complex. In the eastern part of the area it reached the Cretaceous rocks at 90 m b.s.l. whereas in the west, at about 130 m b.s.l., the Miocene series. This river modelled probably the sub-Pleistocene erosive feature from Tyszki to Meżenin and in the Przasnysz area (Kijewice) deepened a bottom of the Early Quaternary depression. The valley was probably accompanied by a vast lowland area, including also the smoothed (by erosion) Tertiary sediments. New elements in the morphology of the sub-Pleistocene surface appeared during the oldest interglacial also near Ostrów Mazowiecka (Sielc, 63 m b.s.l.) and Wyszaków (Niegów, 34 m b.s.l.).

The next glaciation i.e. the first one of the three South-Polish glaciations, the sediments of which can be distinguished in these areas, formed the final shape to the Tertiary surfaces to the north and east from the depression. The same ice sheet formed also the higher fragments of slopes that surround the depression from the west and south to the altitude of about 10—40 m a.s.l. Glaciotectonic deformations of this time as well have not exerted a greater influence on a relief of the sub-Pleistocene surface. At the end of the first South-Polish Glaciation, the rest of the ancient depression has almost entirely disappeared. Before, that depression predominated in the paleorelief of the region. Nothing but Tertiary outliers were preserved, elevated over a smoothed surface of the area.

Bedrock elevations around the depression were subjected to various destructive processes, occurring since the beginning of the Quaternary in changeable climatic conditions. A further degradation of the outliers continued during younger glaciations as well as interglacials. A glacial and meltwater erosion occupied gradually higher and higher fragments of Tertiary elevations. The ice sheet of the Middle-Polish Glaciation

(the last one in this area) smoothed and entirely covered with its sediments all the relics of Tertiary elevations. They left no traces in the present relief.

Although the deep sub-Quaternary depression in the Lower Narew Region was filled with deposits and smoothed already in the beginning of the Mesopleistocene, this area has acted as a lowland during the whole Pleistocene. Successive interglacials represented the periods when a fluvial pattern developed, usually similar to one another as valleys renewed in the same zones of deep bedrock depressions near Wyszaków, Pułtusk, Przasnysz, Mężenin and Ostrów Mazowiecka. During interglacials these depressions were widened and deepened due to erosion of larger rivers (Fig. 5). The work of rivers of the oldest interglacial was particularly significant on that score. On the other hand, a fluvial erosion during the Mazovian Interglacial has not played already any greater role in further modification of ancient discharge routes.

Zones of repeated occurrence of valleys of different age are indicated by buried multicyclic alluvial series of a great thickness (usually several dozen metres), frequently put one into another. A reconstruction of the same outflow trains in various Pleistocene periods is an indirect but very important evidence for an existence of a similar valley pattern also during the Eopleistocene. A palaeorelief during the oldest interglacial is probably particularly corresponding to a morphology of the area in that time. The present data on development of the lowland fluvial pattern indicate then a similarity of the Eopleistocene and first interglacial valleys (R. Galon, 1970; E. Rühle, 1973). Taking into account the shape of the sub-Quaternary depression and its branches, it cannot be excluded that already during the Eopleistocene it acted as a hydrographic centre.

ROLE OF GLACIOTECTONICS

Neither a characteristic of Pleistocene deposits within the depressions nor a structure of their Tertiary substrate authorize to consider the sub-Quaternary basin in the Lower Narew Region as a glaciodepression-like feature, according to the approach of H. Ruszczyńska-Szenajch (1976) and Z. Lamparski (1983). A subsidence of the oldest glacial lobes in easily deformable Tertiary substrate resulted, according to Z. Lamparski, in a complete squeezing of its sediments and development of vast glaciotectonic depression. The latter were accompanied by elevations as interlobal squeezed features, composed of diapirized, strongly deformed and displaced Tertiary deposits.

Glaciotectonic processes of similar intensities have not occurred in the Lower Narew Region. If the sub-Quaternary depression in this area was the effect of a long-lasting pressing or squeezing of bedrock sediments by a large lobe of the oldest ice sheet, then a distinct elevation of the top surface of the Oligocene sequence have not been certainly preserved. It does not seem possible either that successive lithofacial sequences of Tertiary series could be preserved in their primary stratigraphic pattern in a zone of intensive glaciotectonic deformations. On the other hand, they can be correlated between distant sections and their sediments are

usually horizontally and regularly stratified.

A resistance of the rigid Cretaceous bedrock, dipping opposite to the ice sheet movement, was an important factor that favoured a development of glaciotectonic depressions described by H. Ruszczyńska-Szenajch (1976). In the described area a similar action of the solid Cretaceous - Palaeocene rocks has not occurred as this surface is dipping south-westwards i.e. generally in agreement with a direction of advancing ice sheets. In the vicinity of the sub-Quaternary basin no squeezed moraines occur. According to H. Ruszczyńska - Szenajch such moraines are usually associated with glaciodepressions and composed of Tertiary sediments, coming from them and piled.

H. Ruszczyńska-Szenajch (1976) as well as Z. Lamparski (1983) pay attention to a filling of glaciodepressions by redeposited Tertiary sediments interbedded with till, mixed and deformed. Therefore, there is no similarity with the Lower Narew Region in this point as well. Sub-Quaternary depression is there filled with monolithic tills, well developed polycyclic alluvial series as well as glaciofluvial and ice-dam deposits of vast, regular extents.

It seems probable that a considerable influence on the shape of depression was exerted by the ice sheet of the first South-Polish Glaciation. In that time a characteristic asymmetry of its margins could be accentuated and fixed. There are relatively low and smoothed northern and eastern margins and highly rising western and southwestern ones. This variation should be explained by another action of the ice sheet on northeastern slopes, usually dipping in agreement with the ice movement, than on southwestern slopes, opposing to this movement. The first ones got cut and smoothed whereas the others were in many places glaciotectonically deformed (also due to action of younger ice sheets). Glaciotectonic processes in western and southwestern margin of the depression can represent a particular type of glaciotectonics, the so-called valley-side glaciotectonics, connected with an ice sheet press perpendicular to slopes and described by M. Brykczyński (1982).

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Alicja BAŁUK

DEPRESJA PODCZWARTORZĘDOWA W REJONIE DOLNEJ NARWI — JEJ WIEK I GENEZA

Streszczenie

Obniżenie powierzchni podczwartorzędowej między Ostrołęką, Ostrowią Mazowiecką, Makowem Mazowieckim i Chorzalami sięga 80—120 m p.p.m. i ma równie głębokie odgałęzienia boczne. W podłożu czwartorzędu występują tam osady górnej kredy, paleogenu i neogenu (fig. 2—4). Dla wyjaśnienia genezy depresji podczwartorzędowej istotne znaczenie ma stanowisko rzeczno-jeziornych osadów eoplejstocenijskich w Opaleńcu koło Chorzeli. Świadczy ono o istnieniu na tych terenach już w najstarszym czwartorzędzie dobrze rozwiniętej sieci rzecznej, uwarunkowanej prawdopodobnie założeniami tektonicznymi. Głębokie, ówczesne doliny dały początek systemowi obniżeń, modyfikowanemu następnie przez cały plejstocen. Powierzchnia podczwartorzędowa jest tu w swej dzisiejszej postaci powierzchnią poligenetyczną, uformowaną głównie wskutek powtarzających się procesów egzaracji lodowcowej i erozji wód płynących (fig. 5). Deformacyjna działalność lądolodów miała drugorzędne znaczenie w kształtowaniu depresji. Procesy glacitektoniczne zaznaczyły się zwłaszcza na jej zachodnich i południowo-zachodnich obrzeżeniach, na ogół przeciwnych ruchowi lądolodów.

Алиция БАЛУК

ПОДЧЕТВЕРТИЧНАЯ ДЕПРЕССИЯ В РАЙОНЕ НИЖНЕЙ НАРВИ — ЕЕ ВОЗРАСТ И ГЕНЕЗИС

Резюме

Понижение подчетвертичной поверхности между местностями: Остроленка, Острув Мазовецка, Макув Мазовецки и Хожеле достигает 80—120 м п.у.м. и имеет боковые отрасли той же глубины. В подчетвертичном основании находятся осадки верхнего мела, палеогена и неогена (фиг. 2—4). Для выяснения генезиса подчетвертичной депрессии основное значение имеет местонахождение речно-озерных эоплейстоценовых осадков в Опаленьце около Хожели. Оно свидетельствует о том, что на этой территории уже в самом древнем четвертичном периоде находилась хорошо развитая речная сеть, обусловлена вероятно тектоническими предпосылками. Глубокие тогдашние долины дали начало системе понижений, модифицированной потом в течении всего плейстоцена. Подчетвертичная поверхность в своей современной форме является полигенетической поверхностью, сформированной главным образом вследствие повторяющихся процессов ледниковой экзарации и эрозии текущих вод (фиг. 5). Деформационная деятельность континентального ледника играла второстепенную роль в формировании депрессии. Глищитектонические процессы обозначились на ее западных и юго-западных окаймлениях, обычно противоположных движению континентальных ледников.