Geological Quarterly, 1999, **43** (3): 285–296

Palaeotectonic evolution of the Baltic Syneclise during the Early Palaeozoic as documented by palaeothickness maps

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Modliński Z., Jacyna J., Kanev S., Khubldikov A., Laskova L., Laskovas J., Lendzion K., Mikazane I., Pomeranceva R. (1999) — Palaeotectonic evolution of the Baltic Syneclise during the Early Palaeozoic as documented by palaeothickness maps. Geol. Quart., **43** (3): 285–296. Warszawa.

Analysis of palaeothickness maps of the uppermost Vendian –Lower Cambrian and Middle Cambrian of the Baltic Syneclise has shown that thickness variability of those sediments was controlled by subsidence differentiation and palaeorelief of the buried crystalline basement. During the Late Cambrian–Tremadoc uplifting movements dominated with the exception of the westernmost part of the Baltic Syneclise which was undergoing subsidence. During the Ordovician the Jelgava Depression was the most prominent palaeotectonic element. It embraced the northeastern part of the analysed area. Since the Early Silurian times a distinct subsidence increase had taken place. During the Early Silurian this phenomenon was restricted to the peripheral part of the Pre-Vendian Platform. Later, on in the Late Silurian times this process embraced the whole analysed area.

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Key words: Baltic Syneclise, Lower Palaeozoic, palaeotectonics, subsidence.

INTRODUCTION

A series of palaeothickness maps for the uppermost Vendian–Lower Palaeozoic of the Baltic Syneclise has been compiled within the framework of the international co-operation of the Polish, Lithuanian, Latvian and Russian geologists. The studies embraced the vast area from the Riga Bay in the east to the Island of Bornholm in the west. About 700 deep boreholes are located in this area both on land and in the Baltic Sea. Location of the most important wells is shown on the map (Fig. 1). The descriptions of the borehole sections were used as a basic material for the construction of the palaeothickness maps (Figs. 2–8). The particular maps correspond to the phases of palaeotectonic evolution of the area. The analysis is restricted to thickness changes without detailed tracing of changes of lithologic associations, gaps and unconformities. Nevertheless, the palaeothickness analysis is an important method in palaeotectonic analysis (W. J. Chajn, 1974). It allows to distinguish the uplifted and depressed units and to draw conclusions concerning the evolution of the detected palaeostructures.

The palaeotectonic evolution of the Baltic Syneclise during Vendian and Early Palaeozoic was studied among others by R. M. Männil (1966), F. K. Volkolakov (1973), Z. Kotański (1977) and A. Witkowski (1989). The present reconstruction has been compiled by a group of authors from the Baltic countries who had a relatively most complete borehole data in their disposal.

This paper reports part of the results obtained during the years 1995–1998 in the course of the project entitled “Comparative geologic-geochemical investigations of the Lower Palaeozoic complex in the Polish, Lithuanian, Latvian and Russian parts of the Peribaltic Syneclise”. The project was financed by the National Fund of Nature Preservation and Water Management. Polish geologists from the Polish Geo-

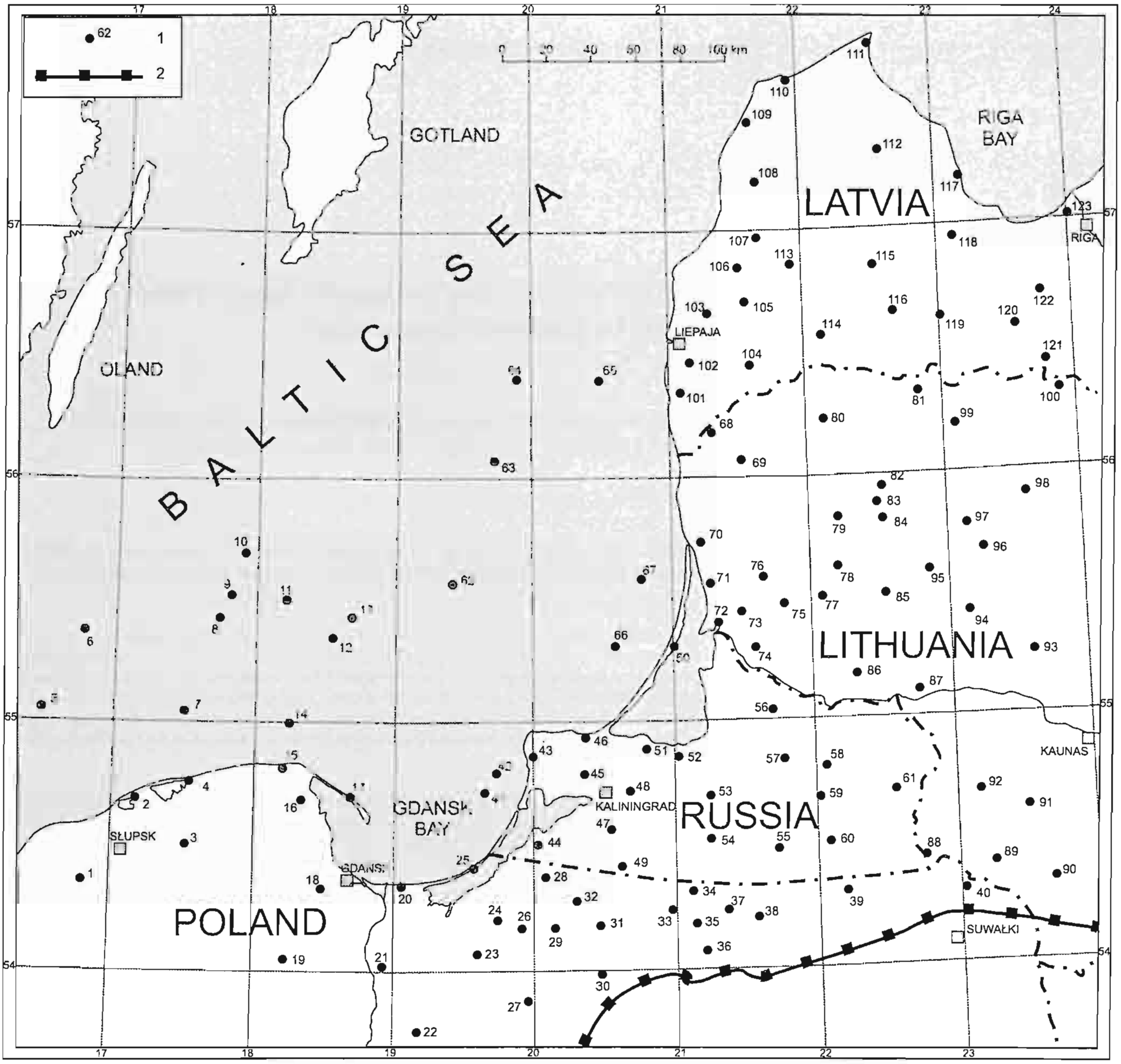

Fig. 1. Location map of the selected boreholes

1 — boreholes: *1* — Słupsk IG 1, 2 — Smołdzino 1, *3* — Lębork IG 1, *4* — Łeba 8, *5* — A8-1, *6* — A23-1, *7* — B16-1, *8* — B6-1, *9* — B6-2, *10* — B4-1, *11* — B3-1, *12* — B7-1, *13* — B8-1, *14* — B2-1, *15* — Żarnowiec IG 1, *16* — Darżlubie IG 1, *17* — Hel IG 1, *18* — Niestępowo 1, *19* — Kościerzyna IG 1, *20* — Gdańsk IG 1, *21* — Malbork IG 1, *22* — Prabuty IG 1, *23* — Pasłęk IG 1, *24* — Młynary 1, *25* — Krynica Morska 2, *26* — Gładysze 1, *27* — Olsztyn IG 2, *28* — Żelazna Góra 1, *29* — Henrykowo 1, *30* — Dobre Miasto 1, *31* — Pieszkowo 1, *32* — Dębowiec Warmiński 1, *33* — Bartoszyce IG 1, *34* — Sępopol 1, *35* — Kętrzyn IG 1, *36* — Klewno 1, *37* — Barciany 1, *38* — Lesieniec 1, *39* — Gołdap IG 1, *40* — Jezioro Okrągłe IG 1, *41* — C7-1, *42* — C8-1, *43* — Jagodnoje 1, *44* — Kulikowo 1, *45* — Siewierno Wiesiołowskaja 5, *46* — Kulikowo 1, *47* — Jużno Kaliningradzkaja, *48* — Uszakowo 1, *49* — Bagrationowsk 1, *50* — Nida 1, *51* — Gajewsk 1, *52* — Sławinsk 1, *53* — Krasnoborsk 1, *54* — Drużbinsk 1, *55* — Dubrowsk 1, *56* — Sławsk 5, *57* — Bolszakowo 1, *58* — Gusiew 1, *59* — Zapadnij Gusiew 1, *60* — Majakowskaja, *61* — Niestierow 1, *62* — D1-1, *63* — E7-1, *64* — E5-1, *65* — E6-1, *66* — D6-1, *67* — D5-1, *68* — Żemyte 1, *69* — Salantai 1, *70* — Klaipeda 1, *71* — Traubai 1, *72* — Sakuciai 1, *73* — Lasai 1, *74* — Stoniskai 1, *75* — Silute 1, *76* — Veiviržcnai 1, *77* — Šilale 1, *78* — Baubliai 1, *79* — Zarenai, *80* — Renava, *81* — Akmene 71, *82* — Tryskiai 74, *83* — Syderriai, *84* — Satrija 1, *85* — Maldunai, *86* — Taurage 81, *87* — Jurbarkas, *88* — Vistitis, *89* — Kalvarija, *90* — Simnas, *91* — Sasnava 6, *92* — Pilviskiai 141, *93* — Getuva 115, *94* — Kunkojai, *95* — Krazante 26, *96* — Romaniskes 54, *97* — Kurtuvenai 161, *98* — Staciunai 8, *99* — Sakyna 27, *100* — Kriukai, *101* — Bernati P21, *102* — Grobina P1, *103* — Vergale R14, *104* — Priekule P11, *105* — Aizpunte P39, *106* — Kuldiga 6, *107* — Edole 69, *108* — Plitene 1, *109* — Ventspils N53, *110* — Ovisni 94, *111* — Kolka 54, *112* — Talsi 55, *113* — Snepele P34, *114* — Skrunda P31, *115* — Kandava 25, *116* — Saldus 5, *117* — Engure 4, *118* — Degole 59, *119* — Dolbele 1, *120* — Kronauce 57, *121* — Eleja P48, *122* — Jelgava, *123* — Riga 1; 2 — present extent of the uppermost Vendian–Lower Palaeozoic deposits

logical Institute — Warsaw, Lithuanian geologists from the Geological Institute — Vilnius, and the Lithuanian Geological Survey, Latvian geologists from the State Geological Survey of Latvia and Russian geologists from the Oil Company Lukoil-Kaliningradmorneft — Kaliningrad had taken part in this international co-operation.

PALAEOTHICKNESS DISTRIBUTION AND ITS INTERPRETATION

LATEST VENDIAN–EARLY CAMBRIAN

There is a continuous transition from the Upper Vendian to the Lower Cambrian in the western part of the Baltic Syneclise (K. Jaworowski, 1979) both onshore and in the Baltic Sea up to the line linking the B8-1 and Olsztyn IG 2 boreholes (Figs. 1, 2). Those deposits together with the Middle Cambrian ones compose a single transgressive-regressive depositional cycle (K. Jaworowski, 1997). A thickness increase has been noticed from NE toward SW in this area in accordance with the dip of the Pre-Vendian Platform slope. The sediments within the Łeba–Kościerzyna Monocline (A. Witkowski, 1989) attain large thickness exceeding 450 m near Słupsk (Fig. 2).

In the eastern part of the Baltic Syneclise the Early Cambrian marine transgression encroached upon a morphologically differentiated crystalline substratum. Long, narrow ridges directed NE–SW have been found to form the palaeorelief over which a reduction of sediment thickness is observed. The most prominent ridges are so-called Zaręby Elevation in Poland and Veiviržėnai–Šilale Elevation in western Lithuania. These elevations are completely devoid of the Lower Cambrian sediments in their central parts.

The Zaręby Elevation in northern part joins the flat Żelazna Góra one. A minor structural depression is observed in between them in the west. An elongated WSW–ENE structural Morąg Embayment stretches to the south of the Zaręby Elevation. Farther east to the north of Suwałki, there is the Gołdap Depression. These two depressed units are located on the crystalline basement composed of metamorphic complexes (S. Kubicki *et al.*, 1972). This may suggest that during the Early Cambrian the rate of subsidence of the metamorphic blocks was greater than that of the Pre-Svecofennokarelian granitoid massifs.

No distinct palaeostructural elements, apart from the above mentioned Veiviržėnai–Šilale Elevation, were distinguished in the remaining area of the eastern part of the Baltic Syneclise. Minimum thickness of the Lower Cambrian sediments is observed at the Lithuanian–Latvian boundary area (south of Riga). Toward NW, W and SW a regional thickness increase is noted.

Two depressed structural elements are located in offshore area, namely the Darłowo–Gotland Depression and Sambia–Hel Embayment. They are separated by the Klaipeda–sea broad swell, the origin of which, according A. Witkowski (1989), might have been controlled by the Öland–Tielsza and Hanö–Liepaja lineaments.

MIDDLE CAMBRIAN

During the Middle Cambrian times the whole area of the western part of the Baltic Syneclise (Fig. 3) was occupied by the vast Kościerzyna Embayment (K. Lendzion *et al.*, 1990). It is a depressed unit elongated in a more or less meridional direction. Its axis runs from the B2-1 borehole in the Baltic Sea towards Kościerzyna town. It shows two depocentres — one in the Baltic Sea, and another onshore. The maximum thickness of sediments attains 310 m in the Kościerzyna IG 1 borehole.

East of Vistula River thickness of the Middle Cambrian sediments is highly variable. The following structural elements can be distinguished there (Fig. 3): the Dębowiec Warmiński Depression, the Sępopol–Bartoszyce Depression and the Zaręby and Braniewo elevations. The minimum thickness of less than 50 m has been noted near Pieszków in the Zaręby Elevation. At the culmination of this structure the Middle Cambrian sediments rest directly on the crystalline substratum.

Farther east the Middle Cambrian sediments wedge out on the slope of the palaeotectonic Mazury–Augustów Elevation (K. Lendzion *et al.*, 1990).

In the northeastern part of the Baltic Syneclise (the Kaliningrad area, Lithuania, Latvia) the general trend of thickness changes is similar to that of the Lower Cambrian. The thickness increases from E and NE toward W and SW. The course of isopachs is disturbed, as in the case of the Lower Cambrian, by narrow palaeoridges trending NE–SW with a definitely smaller sediment thickness. A particularly strong thickness reduction attaining several tens of metres has been noted on ridges built of crystalline basement rocks.

In the Baltic Sea adjacent to Latvia the structural Liepaja Embayment is very distinct. It shows SE–NW direction and is limited from the south-west by the structural Klaipeda Nose.

LATE CAMBRIAN–EARLY TREMADOC

This stage of palaeotectonic evolution includes the Pakerort stage according to the Baltic subdivision. A continuous cover of sediments of that age is preserved only in the western part of the area (Fig. 4). On the contrary, in the eastern part the Late Cambrian and Early Tremadoc sediments are preserved but fragmentarily and their thickness is small.

The discussed sediments belong to successive Lower Palaeozoic transgressive-regressive cycle (K. Jaworowski, 1997). The most complete sections can be found in the western part of the area in question. Onshore they are limited probably to the entire Upper Cambrian, from *Agnostus pisiformis* up to *Acerocare* horizons (K. Lendzion, 1983). The horizons *Leptoplastus* and *Protopeltura praecursor* are not palaeontologically documented. Sedimentologic studies by K. Jaworowski (pers. comm.) suggest, however, that there was no sedimentary gap, despite of lack of index fossils. In

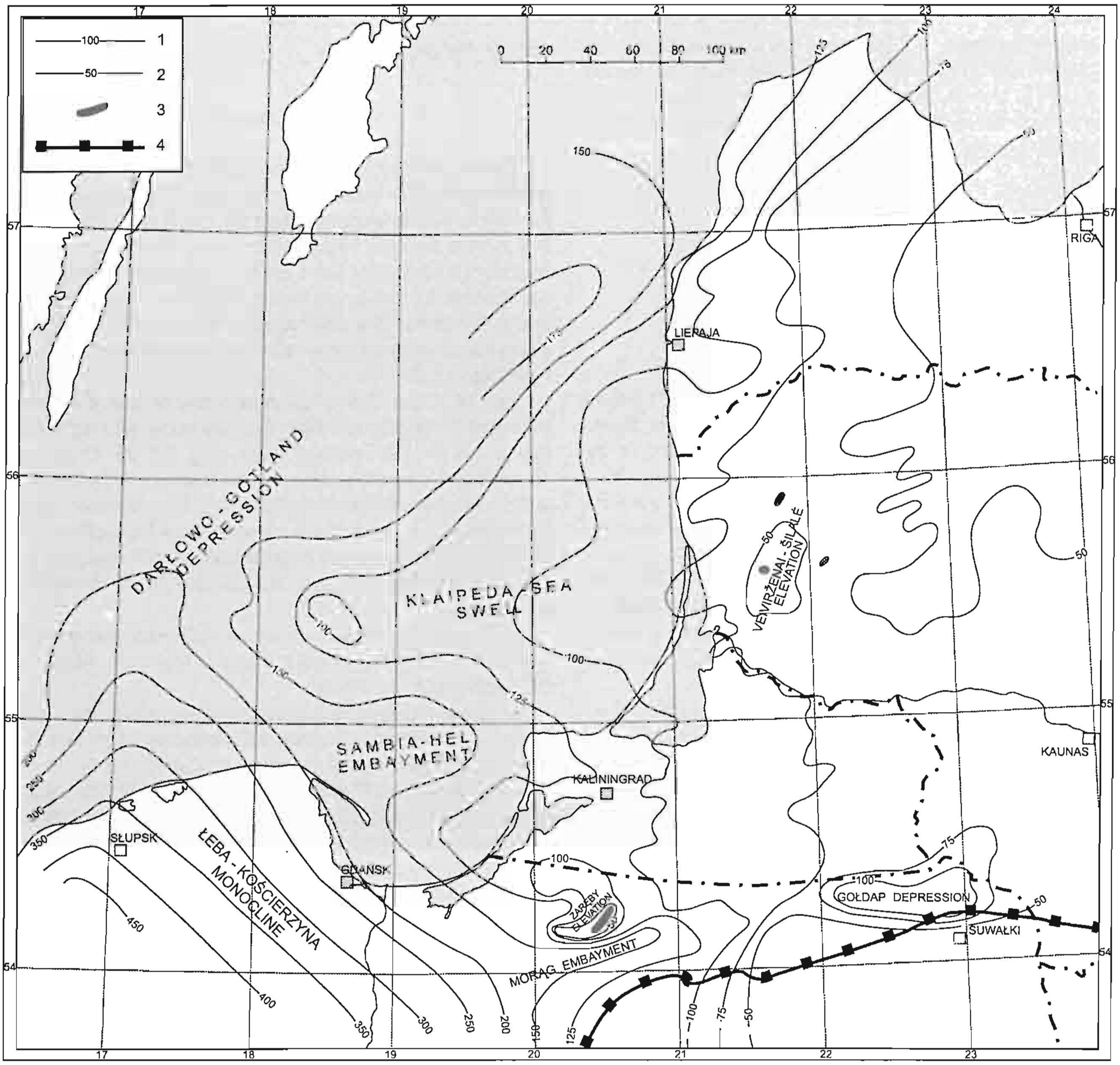

Fig. 2. Palaeothickness map of the uppermost Vendian–Lower Cambrian deposits and location of the most important palaeostructural units

Isopachs of the uppermost Vendian–Lower Cambrian deposits (in metres): 1 — interpolated, 2 — reconstructed; 3 — eroded area; 4 — present extent of the Lower Cambrian deposits

the offshore areas sections show also the Lower Tremadoc sediments in a continuity with the Upper Cambrian. They are represented by the horizons ranging from *Rhabdinopora flabelliforme desmograptoides* up to *R. flabelliforme flabelliforme* (Z. Modliński, 1988).

Among of the palaeotectonic elements only the east-west trending Słupsk Bank Depression (Fig. 4) is clearly discernible. In its near-axial part the thickness of sediments attains several tens of metres.

In the eastern part of the Baltic Syneclise the Upper Cambrian–Lower Tremadoc sediments are preserved only locally in a form of isolated patches. The Cambrian sediments are documented by trilobite finds (A. A. Kaplan *et al.*, 1973; M. N. Korobov *et al.*, 1985; B. Szymański, 1977). The so-called "Obolus Beds" containing remains of inarticulate brachiopods, graptolites and conodonts are assigned to the Lower Tremadoc (E. M. Laskov *et al.*, 1993; B. Szymański, 1984). As there is no continuous cover of these sediments there is no basis for drawing both isopachs and conclusions concerning palaeotectonic subdivision. It may be supposed that remnants of the sedimentary cover are preserved mainly in depressed palaeotectonic elements (B. Szymański, 1984). In the Kalin-

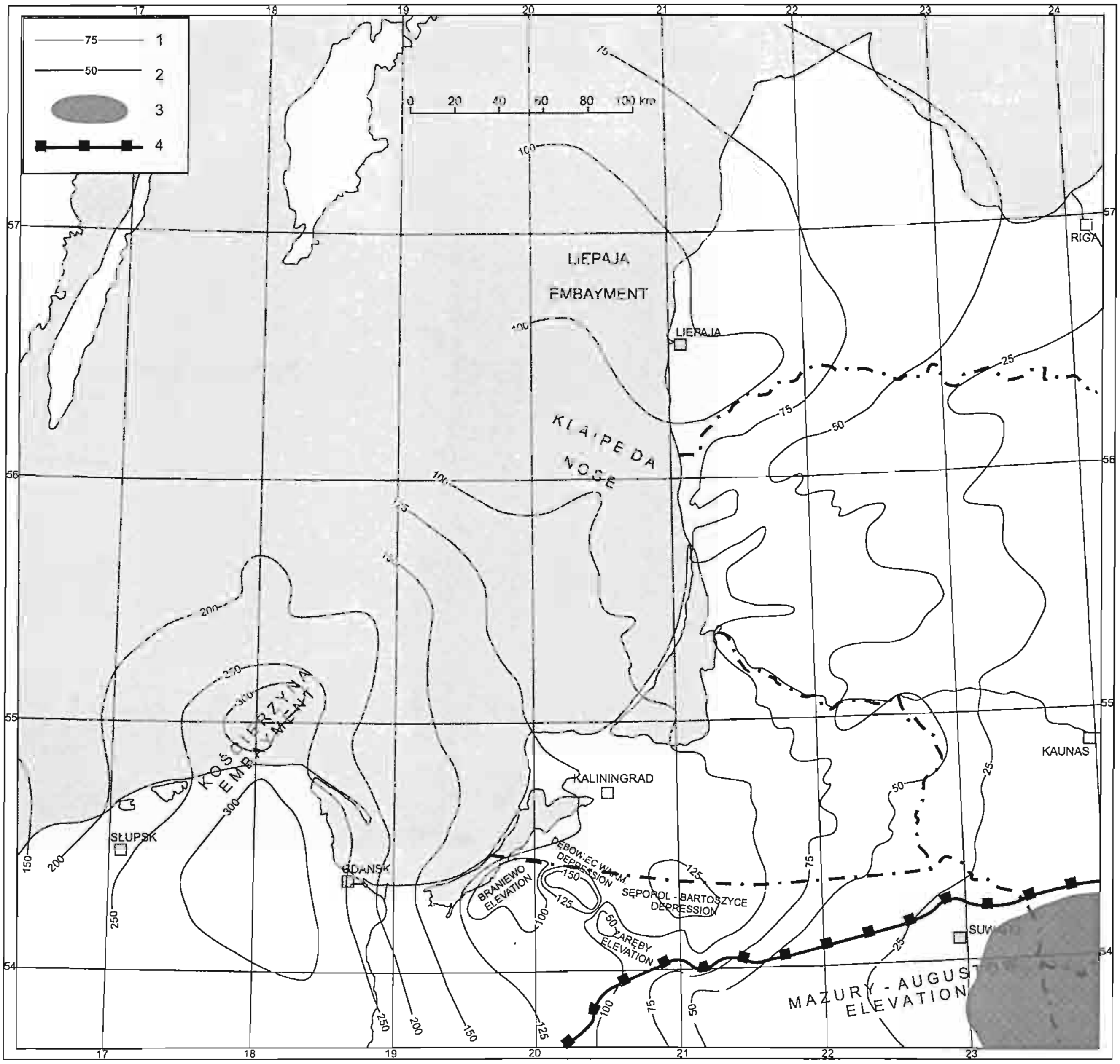

Fig. 3. Palaeothickness map of the Middle Cambrian deposits and location of the most important palaeostructural units

Isopachs of the Middle Cambrian deposits (in metres): 1 — interpolated, 2 — reconstructed; 3 — eroded area; 4 — present extent of the Middle Cambrian deposits

ingrad area they are associated mainly with the Kaliningrad–Gusiew dislocation zone. In Latvia the existence of the Lower Tremadoc sediments near Liepaja and Riga may point to the origin of incipient Jelgava Depression which, later on, became a distinct tectonic unit (Figs. 5, 6).

EARLY ORDOVICIAN

The analysed stage of palaeotectonic evolution embraces Late Tremadoc–Arenig and Early Llanvirn, i.e. the Ceratopyge up to the Kunda stages. At the Cambrian–Ordovician boundary a considerable structural rearrangement had taken place as a result of multiphase uplifting movements (B. Szymański, 1984). These movements interrupted the subsidence and led to erosional processes. They were most intense at the Tremadoc–Arenig boundary, whereas pre-Tremadoc movements although well pronounced in the eastern part of the Baltic Syneclise, did not influence its western part.

The thickness pattern of the Lower Tremadoc was controlled not only by variable subsidence but also by the palaeotopography of the pre-Arenig substratum. This pertains first of all to some areas in the eastern part of the syneclise.

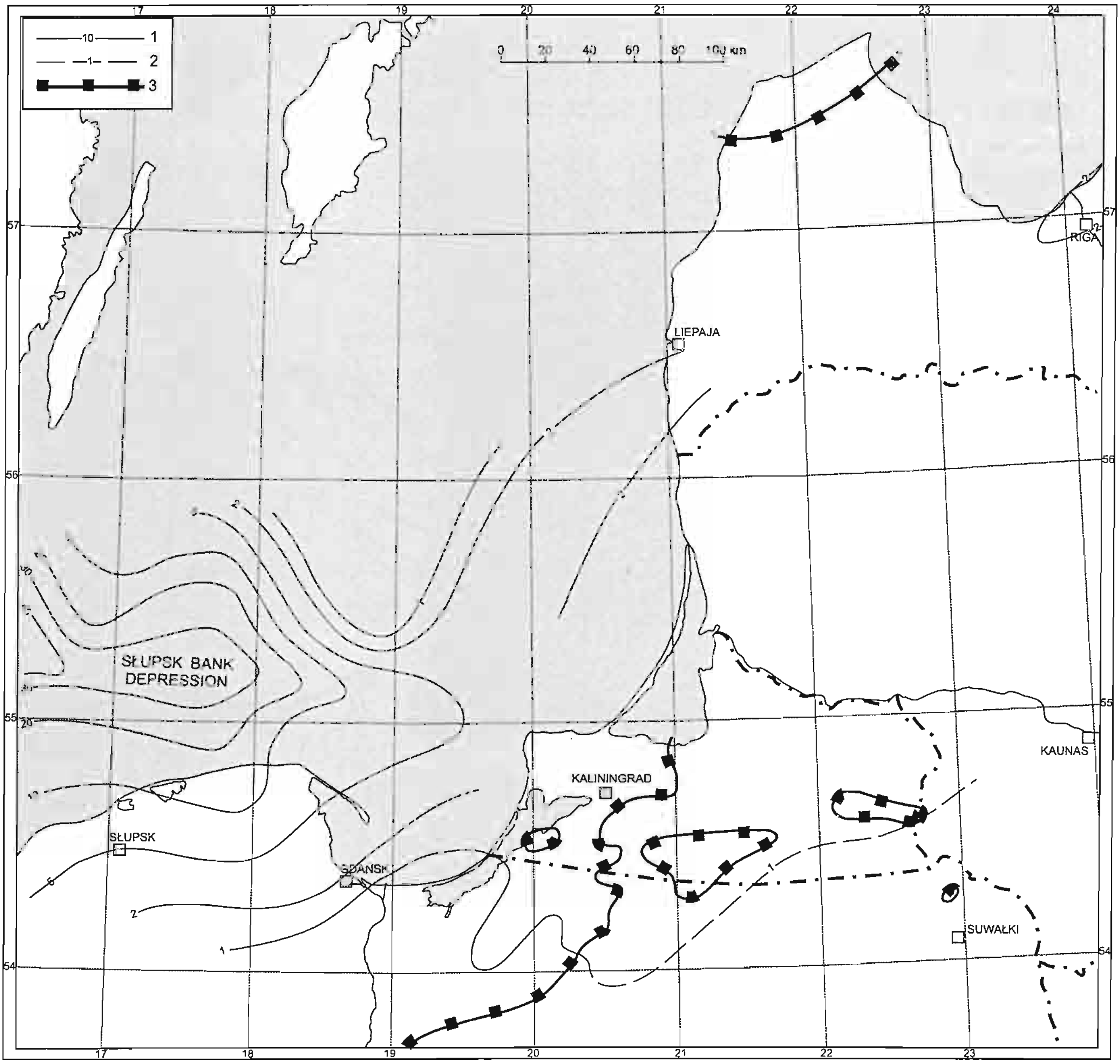

Fig. 4. Palaeothickness map of the Upper Cambrian–Lower Tremadoc deposits and location of the most important palaeostructural units

Isopachs of the Upper Cambrian–Lower Tremadoc (in metres): 1 — interpolated, 2 — reconstructed; 3 — present extent of the Upper Cambrian–Lower Tremadoc deposits

The Słupsk Bank Depression (Fig. 5) is the westernmost palaeotectonic element in the analysed area. It was very distinct during the preceding stage of palaeotectonic development (Fig. 4) as well. It is located in the marginal part of the Pre-Vendian Platform (East European Craton), which has undergone relatively strong subsidence. Taking into account palaeobathymetry and compaction of predominantly clayey sediments it may be supposed that the subsidence must have been much greater than that calculated directly from the present-day sediment thickness values.

Southwestward of the above elevation there is an area of thicknesses highly reduced down to 9.5 m in the Kościerzyna–Niestępowo "Elevation" (B. Szymański, 1984). Its palaeotectonic character, however, can not be interpreted univocally. A slight elevation can be interpreted in the pre-Arenig basement topography (e.g. the lowermost lower Arenig horizons are missing in the Kościerzyna IG 1 borehole). Nevertheless, clayey sediments predominate there suggesting a rather deeper sedimentary enviroment. Possibly this was an area in which subsidence was not compensated by deposition (Z. Modliński, 1982, 1988).

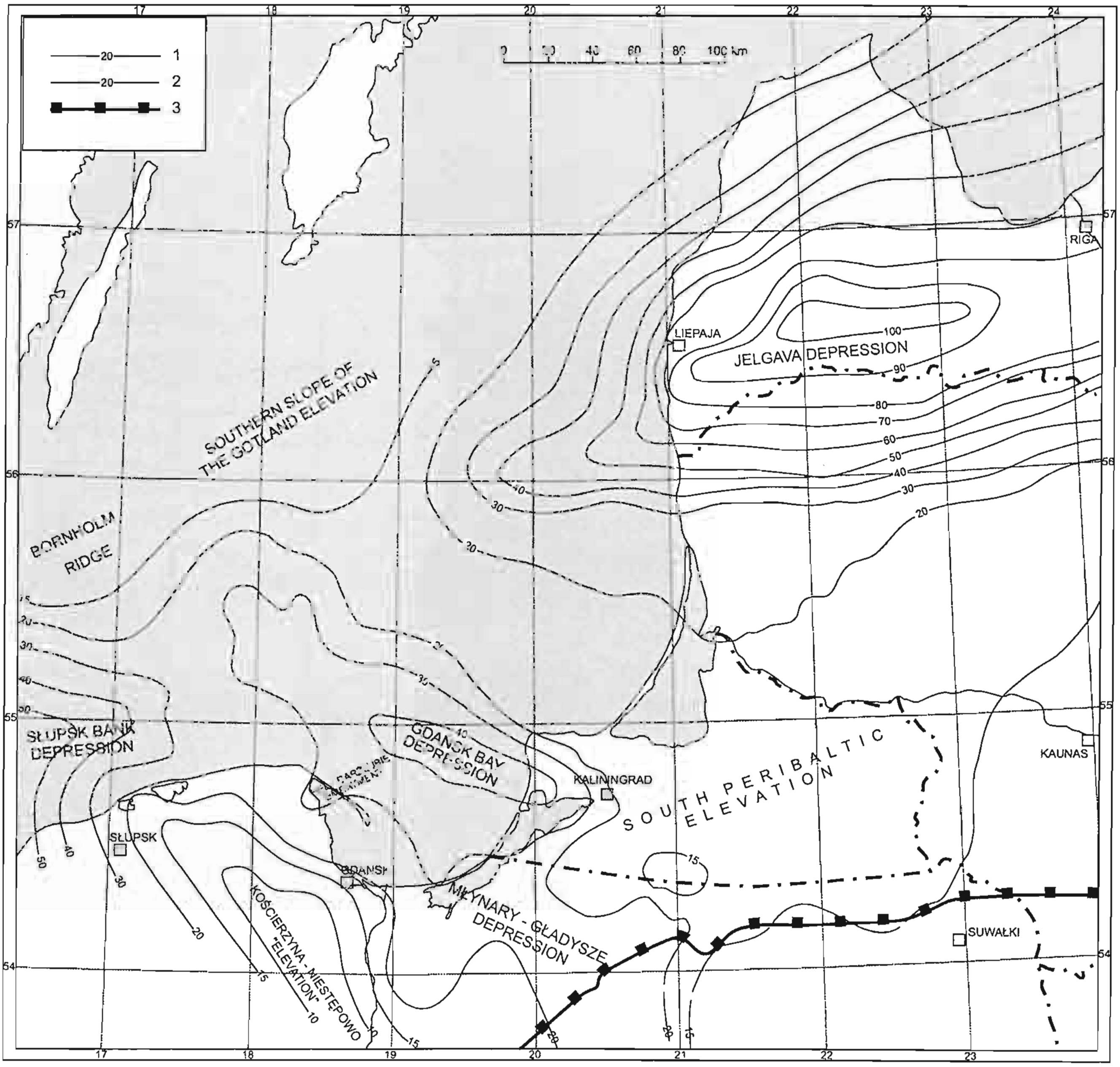

Fig. 5. Palaeothickness map of the Lower Ordovician (Ceratopyge–Kunda) deposits and location of the most important palaeostructural units

Isopachs of the Lower Ordovician (in metres): 1 — interpolated, 2 — reconstructed; 3 — present extent of the Lower Ordovician deposits

Farther east, the Gdańsk Bay Depression forms a distinct palaeotectonic element. At its periphery there are other minor negative elements such as the Hel–Darżlubie Embayment and Młynary–Gładysze Depression (B. Szymański, 1984).

The Gdańsk Bay Depression is bordered in the east by a vast South Peribaltic Elevation (E. M. Laskov, S. O. Mjagi, 1978). Analysis of the Lower Ordovician thickness pattern shows that this elevation formed a single weakly differentiated tectonic block. Local insignificant thickness changes are caused by palaeorelief of the pre-Arenig substratum.

The Jelgava Depression embraces the entire northeastern part of the analysed area (R. M. Männil, 1966) being there the most prominent Ordovician palaeotectonic unit. It is characterized by a relatively strong subsidence compensated by deposition and the highest thickness gradients. The axis of this unit trends almost west-east in the eastern part, whereas it deviates toward WSW in the western part. The boundary between the Jelgava Depression and the South Peribaltic Elevation has been arbitrarily drawn at 30 m isopach coinciding onshore with the Tielsza dislocation zone.

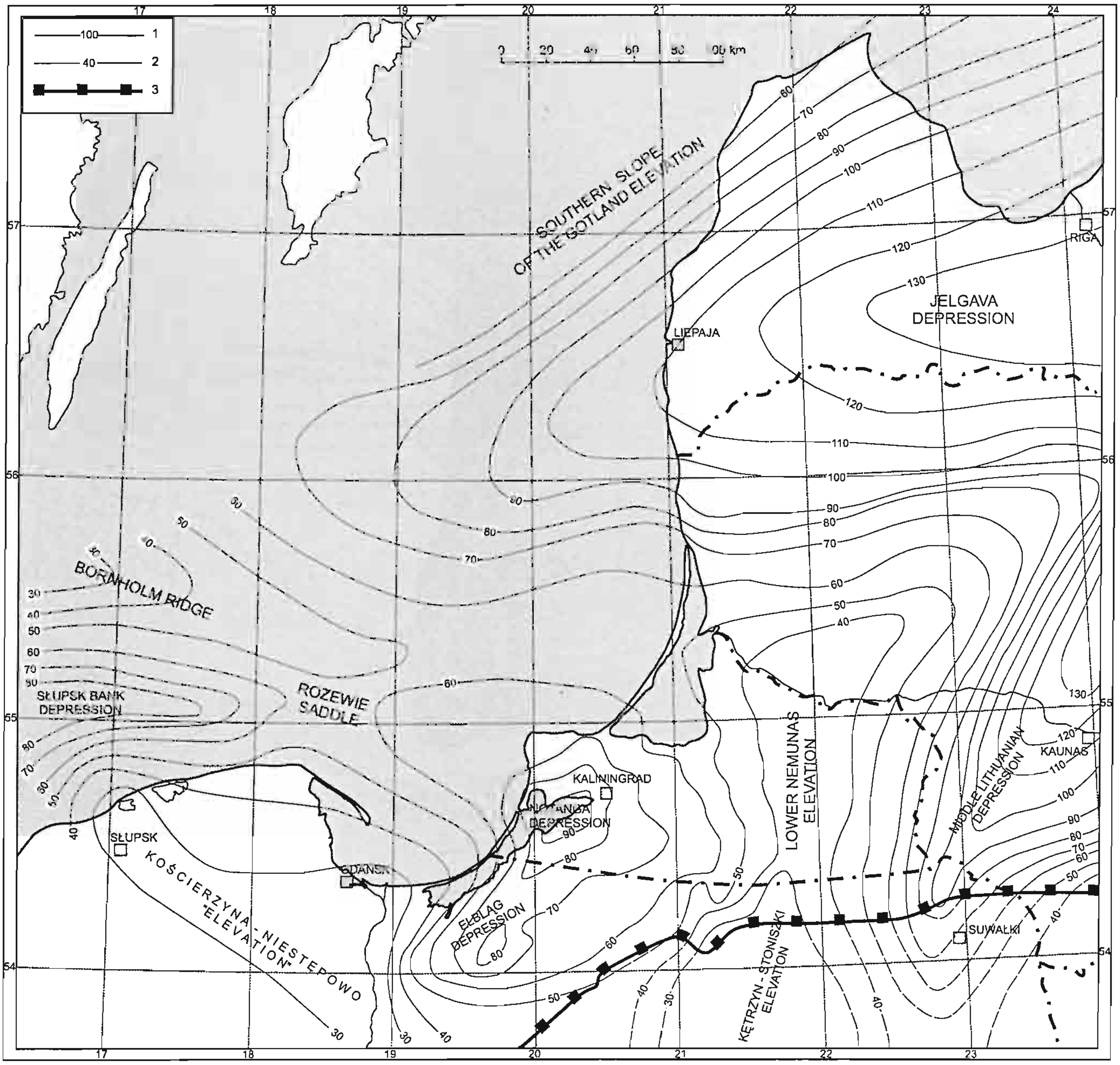

Fig. 6. Palaeothickness map of the Middle–Upper Ordovician deposits and location of the most important palaeostructural units

Isopachs of the Middle–Upper Ordovician deposits (in metres): 1 — interpolated, 2 — reconstructed; 3 — present extent of the Middle Ordovician deposits

MIDDLE–LATE ORDOVICIAN

The Middle–Late Ordovician stage of the palaeotectonic development embraces a period from the Late Llanvirn up to the latest Ashgill, i.e. the stages from Aseri up to Porkuni according to the Baltic subdivision. In the northern part of the area the structural pattern includes many elements known already from the Early Ordovician (Fig. 5). Nevertheless, the amplitude of the observed palaeostructures as a rule increases (Fig. 6).

In the west a narrow Słupsk Bank Depression is very distinct. In its axial part, trending W–E, the clayey sediments are up to 88 m thick in the A8-1 borehole section. It is bordered in the north by the Bornholm Ridge (A. Witkowski, 1989), whereas in the south there is an area of a considerably reduced thickness attaining minimum value of 21.5 m in the Kościerzyna IG 1 borehole section. This is the so-called Kościerzyna–Niestępowo "Elevation" (B. Szymański, 1984). In this unit, as it was probably the case also with the Bornholm Ridge the subsidence was not compensated by deposition.

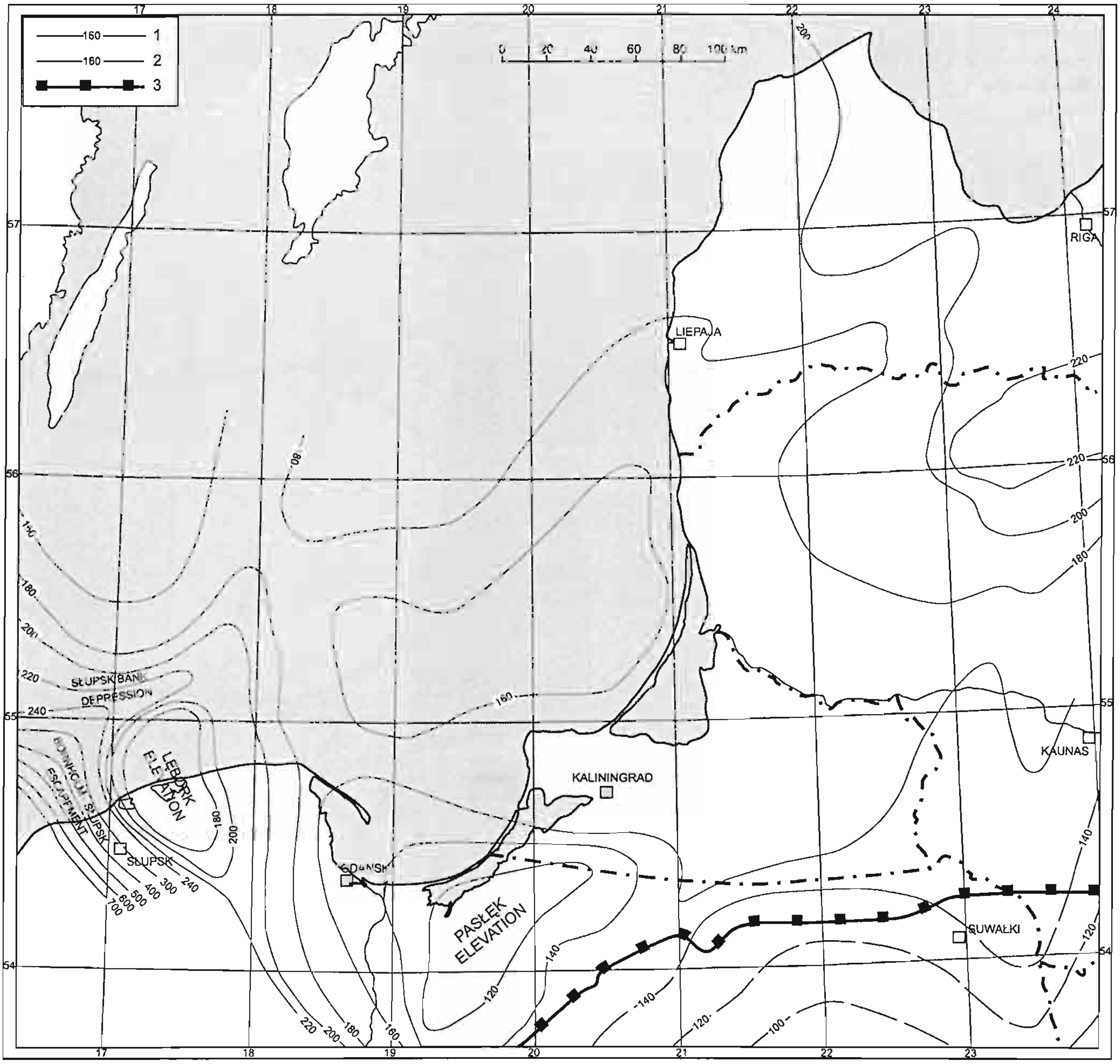

Fig. 7. Palaeothickness map of the Lower Silurian deposits and the location of the most important palaeostructural units

Isopachs of the Lower Silurian deposits (in metres): 1 — interpolated, 2 — reconstructed; 3 — present extent of the Lower Silurian deposits

Some structural rearrangement had taken place, however, in an area situated farther east. The Gdańsk Bay Depression disappeared (Fig. 5) as well as some smaller elements associated with it, like the Hel–Darżlubie Embayment and the Młynary–Gładysze Depression. Such a rapid disappearance of those Early Ordovician elements may be explained by the fact that it was the palaeotopography of the substratum which controlled the sediment thickness pattern and not the subsidence variability. A well pronounced depressed unit of SW–NE direction was formed that time, with the southern depocenter named the Elbląg Depression (Z. Modliński, 1973) and the northern one — the Notanga Depression (E. M. Laskovas, 1968).

East of these two depressions there is a chain of elevations named Kętrzyn–Stoniszki Elevation which continues southward in the Podlasie Depression near Sokołów Podlaski (Z. Modliński, 1982). Its northern part is known as the Lower Nemunas Elevation (E. M. Laskovas, 1968). The latter is a distinct element with predominantly carbonate sediments of small thickness (30–50 m) and stratigraphic gaps within the Middle–Upper Ordovician interval. East of this elevation, in the north-easternmost Poland and central Lithuania, the

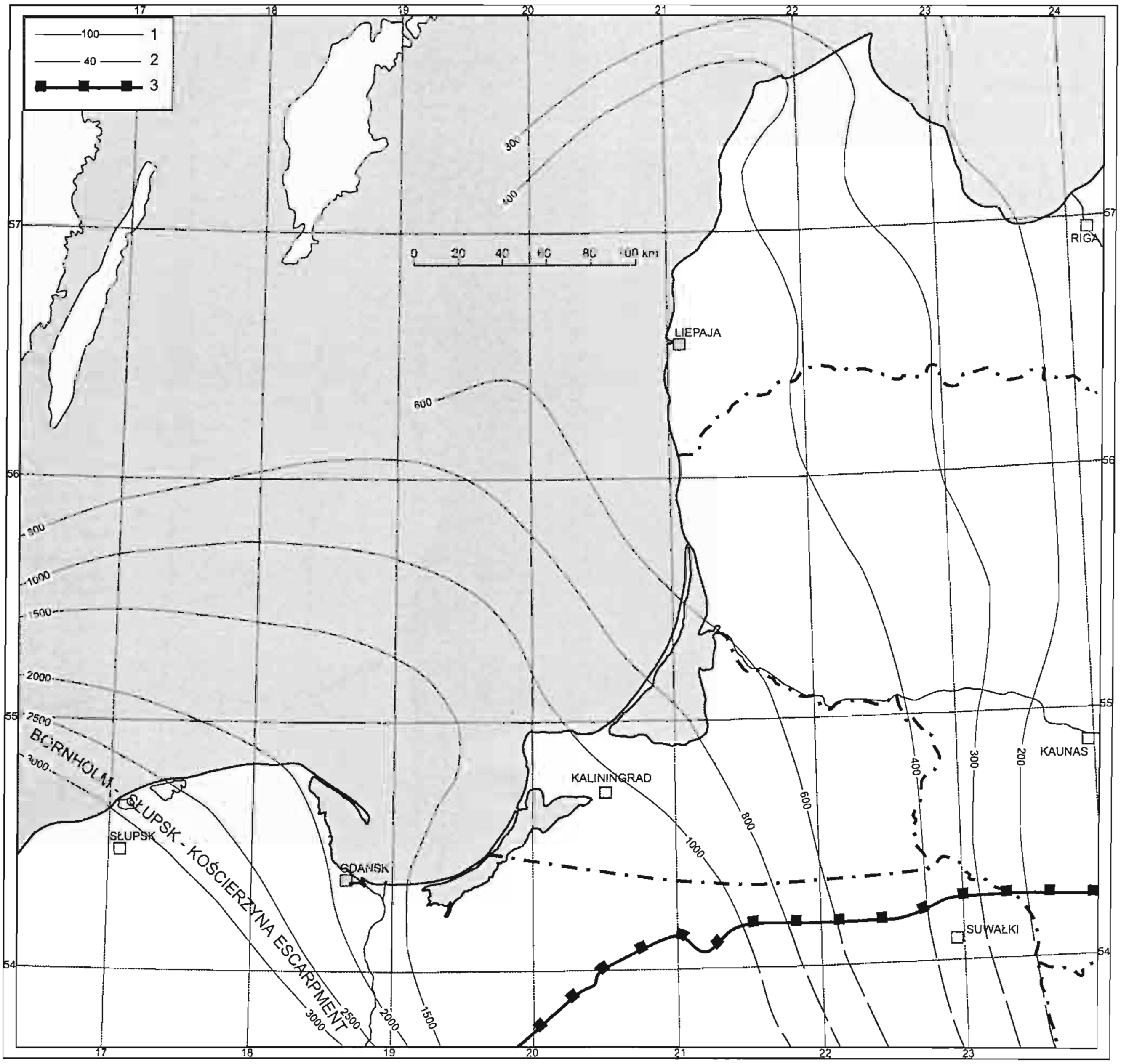

Fig. 8. Palaeothickness map of the Upper Silurian deposits and location of the most important palaeostructural units

Isopachs of the Upper Silurian deposits (in metres): 1 — reconstructed, 2 — reconstructed beyond their present extent; 3 — present extent of the Upper Silurian deposits

Middle Lithuanian Depression runs in SW–NE direction. The entire northeastern part of the analysed area, as it was the case during the Early Ordovician, is occupied by the Jelgava Depression bordered from NW by the southern slope of the Gotland Elevation.

EARLY SILURIAN

The Early Silurian developmental stage embraces Llandovery and Wenlock. The structural pattern differs much from that of the Middle–Late Ordovician (Figs. 6, 7). Majority of previously existing local elements disappeared or underwent considerable modification.

In the western part of the area a distinct structural escarpment started to form along the edge of the Pre-Vendian Platform (A. Witkowski, 1989). It runs from Bornholm toward Słupsk and Kościerzyna (Fig. 7). The gradient of thickness changes is here several times greater than in the remaining area. A zone of small thicknesses which during the Ordovician has been known as the so-called Kościerzyna–Niestępowo "Elevation" (Fig. 6) (B. Szymański, 1984) is preserved only in the northern part near Lębork (the so-called Lębork Elevation of A. Witkowski, 1989). The Słupsk Bank Depression still may be traced offshore in the north-west.

In the area east of Vistula River a structural inversion took place. In the area of the Ordovician Elbląg Depression there appears the flat Pasłęk Elevation. Farther east, in the area of the Polish part of the Baltic Syneclise a small structural bay appears near Sępopol marked by an increase of sediment thickness. A gradual decrease of thickness toward S and SE is to be noted marking proximity of the Belarus Land area.

In the areas of the Kaliningrad District, Lithuania and Latvia the variability of the Lower Silurian thickness is relatively insignificant. The most prominent negative element is the depression embracing northern part of Lithuania and southern part of Latvia (south of Riga) in which the Lower Silurian sediments are up to 220 m thick.

LATE SILURIAN

The Late Silurian stage of palaeotectonic development embraces Ludlow and Přidoli. During that time, particularly in the Ludlow, a considerable increase of a subsidence rate compensated by deposition had taken place. The subsidence rate was at its maximum in the whole history of development of sedimentary cover in the Baltic Syneclise (A. Witkowski, 1989). The presented map of the Upper Silurian palaeothickness (Fig. 8) is highly hypothetical, as primary thicknesses are not preserved in most of the area. In addition, the magnitude of a post-Silurian erosion is difficult to estimate. Analysis of subcrops of ostracod horizons (Z. Modliński *et al.,* 1994) on the top Silurian surface shows that the most complete Upper Silurian sections are preserved near the Hel Peninsula and in the adjoining northeastern offshore. Off this area we face strong epigenetic erosion of the Upper Silurian deposits. The reconstructed isopach pattern does not allow to identify local structural elements, nevertheless, it shows general regional trends.

The strongest subsidence may be noted in the marginal part of the Pre-Vendian Platform in the Bornholm–Słupsk–Kościerzyna area where a distinct structural escarpment existed during the Early Silurian times (Fig. 6). The primary thickness in this area may be estimated as about 2500–3000 m. The preserved thickness of the Upper Silurian exceeds 2000 m in some sections (e.g. Słupsk IG 1 and Kościerzyna IG 1 boreholes).

Farther east and north in the area of the Baltic Syneclise a gradual decrease of the Upper Silurian palaeothicknesses is noted forming a broad structural bay trending SW–NE and with axis running more or less along the line Rozewie — northern Latvia. During the Přidoli time a decrease of subsidence rate can be observed. This does not refer to the Gdańsk Embayment in which large thicknesses are noted (e.g. the Hel IG 1 borehole). It is supposed that near the end of the Silurian period a structural rearrangement had taken place in the Polish part of the Baltic offshore. As a result, the subsidence centre has shifted from the extremely marginal part of the craton somewhat eastward into the area of the Gdańsk Embayment (R. Dadlez, 1994).

CONCLUSIONS

1. The variable thickness of the clastic sediments of the first transgressive-regressive cycle represented by the latest Vendian–Lower Cambrian (Fig. 2) and Middle Cambrian developmental stages was controlled not only by differentiated subsidence but also by the buried palaeotopography of the crystalline basement.
2. During the Late Cambrian–Early Tremadoc phase of the palaeotectonic development only the western part of the Baltic Syneclise underwent distinct depressive movements (Fig. 4). Uplifting movements prevailed in the remaining areas.
3. During the Early (Fig. 5) and Middle–Late Ordovician times (Fig. 6) the vast Jelgava Depression was the main palaeotectonic element which embraced majority of the Latvian territory, northern Lithuania and the adjacent offshore area. In the marginal part of the Pre-Vendian Platform (East European Craton) the subsidence rate was greater than the rate of deposition thus the Kościerzyna–Niestępowo area of small sediment thickness cannot be interpreted as a relatively uplifted palaeotectonic element.
4. Since the Early Silurian distinct increase of subsidence rate is noted. During the Early Silurian fast subsidence was compensated by deposition only in the marginal zone of the Pre-Vendian Platform within the Bornholm–Słupsk structural escarpment (Fig. 7). During the Late Silurian the sedimentation kept pace with a subsidence over the whole area (Fig. 8).
5. During the latest Vendian and Cambrian several separate depocentres existed in the area of the Baltic Syneclise. In the Ordovician, the predominant palaeotectonic element was the Jelgava Depression trending more or less east-west. The formation of the Baltic Syneclise with its present-day geometry and distinct SW–NE trend was caused by the flexural bending of the marginal zone of the East European Craton due to the Late Silurian orogenic compression (P. Poprawa *et al.*, 1997, in print)

Acknowledgements. The authors wish to express their cordial thanks to Prof. Ryszard Dadlez for his critical remarks to the first version of the manuscript and to Tadeusz Grudzień (PGI, Warszawa) for drawing the computer graphics of the illustrations enclosed in the paper.

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ZARYS EWOLUCJI PALEOTEKTONICZNEJ SYNEKLIZY BAŁTYCKIEJ W STARSZYM PALEOZOIKU NA PODSTAWIE MAP PALEOMIĄŻSZOŚCIOWYCH

Streszczenie

W ramach współpracy międzynarodowej geologów polskich, litewskich, łotewskich i rosyjskich opracowano serię map paleomiąższościowych najmłodszego wendu–starszego paleozoiku syneklizy bałtyckiej. Analiza tych map pozwala na prześledzenie ewolucji paleotektonicznej obszaru w badanym okresie.

Paleomiąższości najwyższego wendu–kambru dolnego ilustruje fig. 2. Dolnokambryjski zalew morski wkroczył na dość zróżnicowane morfologicznie podłoże. Na obszarze Polski najwybitniejszą paleostrukturą jest tzw. wyniesienie Zarębu w części centralnej całkowicie pozbawione osadów kambru dolnego. Na obszarze Obwodu Kaliningradzkiego i Litwy rejestrowane są wąskie grzędy rozdzielone obniżeniami, których pochodzenie związane jest ze zróżnicowaną morfologią fundamentu krystalicznego. W kambrze środkowym zmienność miąższościowa jest silniejsza niż w kambrze dolnym (fig. 3). Na obszarze Polski najbardziej zróżnicowane miąższości obserwuje się na wschód od Wisły. W Obwodzie Kaliningradzkim i na Litwie podstawowe trendy zmian miąższościowych w kambrze środkowym są podobne jak w kambrze dolnym.

Kolejny etap rozwoju paleotektonicznego reprezentowany jest przez kambr górny–tremadok dolny. Ciągła pokrywa osadów tego wieku zachowana jest jedynie w zachodniej części badanego obszaru (fig. 4), gdzie wyraźnie zarysowane jest paleotektoniczne obniżenie Ławicy Słupskiej o kierunku W–E. Na pozostałym obszarze osady tego wieku zachowane są jedynie lokalnie w postaci płatów erozyjnych i brak jest tam wystarczających podstaw przeprowadzenia rejonizacji paleotektonicznej.

Kolejne etapy rozwoju paleotektonicznego to ordowik dolny i ordowik środkowy–górny. Analiza map paleomiąższościowych (fig. 5 i 6) wykazuje, iż najwybitniejszym elementem paleostrukturalnym było wtedy rozległe obniżenie jełgawskie obejmujące większość obszaru Łotwy i część Litwy oraz przyległy akwen Bałtyku. Natomiast strefa wyraźnie zredukowanych miąższości w brzeżnej części platformy prewendyjskiej w rejonie Kościerzyny nie stanowiła prawdopodobnie wyniesienia, lecz obszar, w którym subsydencja nie była kompensowana przez sedymentację.

W etapie dolnosylurskim (fig. 7) większość istniejących wcześniej lokalnych elementów paleostrukturalnych uległa rozformowaniu lub znacznej modyfikacji. W zachodniej części obszaru wzdłuż krawędzi platformy prewendyjskiej formuje się wyraźna skarpa strukturalna Bornholmu–Słupska o wysokim gradiencie zmian miąższościowych. W tym też rejonie w sylurze górnym (fig. 8) została zarejestrowana najsilniejsza subsydencja, a zrekonstruowane paleomiąższości osadów osiągają 2500–3000 m. Jak się przypuszcza (R. Dadlez, 1994) u schyłku syluru, w přidoli, nastąpiła pewna przebudowa planu strukturalnego polegająca na przesunięciu centrum subsydencji ze skrajnej części platformy wgłąb kratonu w kierunku wschodnim w rejon Zatoki Gdańskiej.