Geological Quarterly, Vol. 40, No. 3, 1996, p. 353–366

Stanisław ORŁOWSKI, Włodzimierz MIZERSKI

The Cambrian rocks and their tectonic evolution in the Dyminy Anticline of the Holy Cross Mts.

The Dyminy Anticline is the Variscan tectonic unit with its core consisting of the Lower Cambrian rocks. The Cambrian core is covered by the Ordovician, Silurian and Devonian deposits on the slopes. The Lower Cambrian structure is a monocline inside which there are longitudinal tectonic grabens filled in with the Ordovician and Silurian deposits.

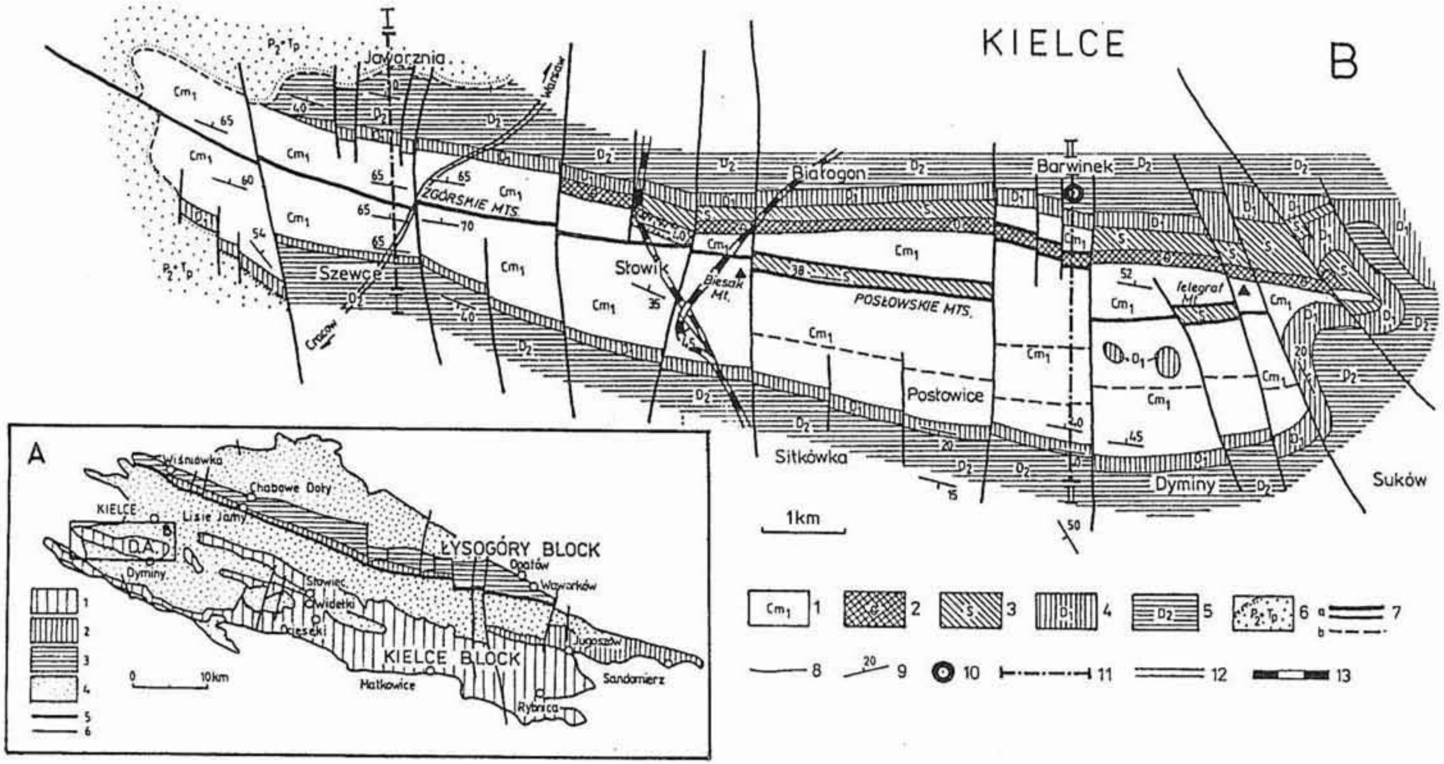
INTRODUCTION

About 10 km south of Kielce a chain of hills built mainly of Cambrian rocks is well visible (Fig. 1). The hills show very differentiated relief and are covered by forest. Thick cover of weathered rocks, fluvioglacial deposits and loess makes a study of the Cambrian rocks difficult. Only a few natural outcrops exist there but, fortunately, a new highway cutting offers large exposure. Other opportunities are the railway cutting to the Trzuskawica lime kiln and the Barwinek borehole located on the northern slope of the anticline (Fig. 1).

Both authors investigated the geology of this area in last few years and they found new trilobites and trace fossils in Cambrian rocks as well as made tectonic observations too. It is the base for revision of the stratigraphy of rocks, for making the new stratigraphic subdivision of the Cambrian rocks and their new tectonic interpretation.

HISTORY OF RESEARCH

First information about the Cambrian rocks of the Dyminy Anticline were given by J. Czarnocki (1919), who named the "Dyminy fold" — a new tectonic unit in the Holy Cross


KIELCE
B
Jaworznia
Szewce
ZGÓRSKIE MTS.
Słowik
Biesak Mt.
Białogon
POSŁOWSKIE MTS.
Barwinek
Telegraf Mt.
Postowice
Sitkówka
Dyminy
Suków
1km
A
Wiśniówka
Chabowe Doły
KIELCE
Lisie Jamy
ŁYSOGÓRY BLOCK
KIELCE BLOCK
Opatów
Dyminy
Słowiec
Widełki
Sandomierz
Rybnica
0 10km

Mts. It is built mainly of Cambrian rocks and partly of Silurian rocks. J. Czarnocki mentioned the scarcity of the Cambrian outcrops and pointed out the difficulties in its stratigraphy. He also proposed the stratigraphic correlation with similar rocks exposed near the Ociesęki village and in the Orłowiny Range and added that "... fundamental discussion on the correlation will be made in the future". In the northern part of the "Dyminy fold" he differentiated the "Dyminy sandstone". South of this sandstone older rocks are exposed represented by thin-bedded, sandstones with elongated cavities filled with greenish clay.

Near the Słowik village, situated in the Bobrza ravine, that cuts the Dyminy Hills, he discovered a specimen of *Obolus* in fragile graywacke. Near this place other sandstones, olive and grey in colour, are exposed. J. Czarnocki (1919, p. 59–63) correlated these rocks with the rocks in the Orłowiny Range and on this basis he stated the Middle Cambrian age of these rocks. He also mentioned that "... grey and olive clay shales with thin sandstone intercalations..." without fossils are similar to "...the Upper Cambrian deposits exposed in the Main Range and partly in the Orłowiny Range (Wola Łagowska, Olszewica villages)".

J. Czarnocki (1938) presented the geology of the Dyminy Anticline on the geological map, Kielce sheet (1:100 000). This tectonic unit shows on this map almost east-west trend. The Cambrian rocks inside were defined as Holmia Beds of the Lower Cambrian and differentiated Lower and Middle Cambrian in general. The rocks of the latter subdivision build the highest parts and the northern slope of the hills. From the point of view of stratigraphy he repeated his earlier opinion but he neglected the Upper Cambrian age of the rocks. The Ordovician and Silurian rocks overlie the Cambrian rocks on the northern slopes of the hills. He stated also that the Cambrian rocks are cut by longitudinal faults, between which the Silurian rocks are wedged.

After the Second World War the 20th Geological Meeting of the Polish Geological Society took place in the Holy Cross Mts. The geological guidebook was prepared by J. Czarnocki (1947). For the area of Dyminy Anticline he mentioned the "greenish graywackes" and sandstones with fossils near the Słowik village. The fossils are: *Strenuella primaeva* Brögger, *Strenuella kiaeri* and *Obolus*. All the rocks with fossils belong to the Lower Cambrian (Holmia Zone).

Fig. 1. A. The area of the research (in rectangle) situated on the simplified map of Palaeozoic in the Holy Cros Mts. 1 — Lower Cambrian, 2 — Middle Cambrian, 3 — Upper Cambrian, 4 — Ordovician to Lower Carboniferous, 5 — main faults, 6 — geological boundaries; D. A. — Dyminy Anticline

B. Tectonic map of the Dyminy Anticline (after J. Czarnocki, 1938; W. Bednarczyk *et al.*, 1970 — partly modified)

1 — Lower Cambrian, 2 — Ordovician, 3 — Silurian, 4 — Lower Devonian, 5 — Middle Devonian, 6 — Permian and Triassic, 7 — faults (a — established, b — supposed), 8 — geological boundaries, 9 — strike and dip of rocks, 10 — Barwinek borehole, 11 — lines of cross-sections (see Fig. 7), 12 — road cutting, 13 — railways

A. Lokalizacja obszaru badań (w prostokącie) na tle schematycznej mapy trzonu paleozoicznego Gór Świętokrzyskich

1 — kambr dolny, 2 — kambr środkowy, 3 — kambr górny, 4 — ordowik-dolny karbon, 5 — główne uskoki, 6 — granice geologiczne; D. A. — antyklina dymińska

B. Mapa tektoniczna antykliny dymińskiej (według J. Czarnockiego, 1938; W. Bednarczyka i in., 1970 — częściowo zmienione)

1 — kambr dolny, 2 — ordowik, 3 — sylur, 4 — dewon dolny, 5 — dewon środkowy, 6 — perm i trias, 7 — uskoki (a — pewne, b — przypuszczalne), 8 — granice geologiczne, 9 — biegi i upady warstw, 10 — otwór wiertniczy Barwinek, 11 — linie przekrojów z fig. 7, 12 — obwodnica Kielc, 13 — linia kolejowa

The Barwinek borehole (situated on the northern slope of the Posłowskie Mts.) was drilled in early sixties. It penetrated Quaternary deposits (0–36.5 m), Devonian deposits (36.5–109.7 m), and the Cambrian sandstones and siltstones down to 800.1 m. The dip of the Cambrian rocks is 40° no data concerning the dip in Devonian rocks were given. The Cambrian rocks — according to the documentation housed in the Polish Geological Survey — were examined superficially only. The lithology was briefly described. But the finding of acritarchs in the rocks gave the occasion to mention not only Lower Cambrian but also Middle and even Upper Cambrian age of the rocks in the borehole (W. Bednarczyk *et al.*, 1970).

The presence of the Upper Cambrian rocks in the area of the Klimontów Anticlinorium is a local geological sensation. The Middle Cambrian rocks in the whole Kielce Block are exposed only in few separated places (S. Orłowski, W. Mizerski, 1995) and in that case they are always well defined by lithology, fossils and trace fossils. The Upper Cambrian deposits were not recognized in this area until now. So the need of reinterpretation of age of the rocks from the Barwinek borehole was another reason for the authors to examine the geology of the Dyminy Anticline.

LITHOLOGY AND STRATIGRAPHY

The profile of Cambrian rocks of this area is based mainly on the outcrops visible in the highway cutting the Dyminy Anticline. The outcrops are almost 500 m long and up to 15 m high. All other outcrops were also examined and the documentation of the Barwinek borehole critically studied.

The oldest rocks are visible in the southern part of this area. They are fine-grained sandstones and mudstones, thin-bedded (2–5 cm), not hard, with rough surfaces. There are few sandstone intercalations, very hard, olive in colour, up to 3 cm thick. Only rare trace fossils were found: *Planolites montanus* Richter and *Bergaueria perata* Prantl.

These rocks pass gradually upwards into alternation of fine-grained and thin-bedded sandstones, silty shales and occasionally grey clay shales. The sandy intercalations increase in number toward the top of the succession and the thickness of the beds also increase up to 20 cm. Trace fossils are much more common with: *Planolites beverleyensis* (Billings) and *Phycodes palmatum* (Hall).

The youngest member of this profile consists of hard, fine-grained grey sandstones, with many reddish spots. Thickness of beds changes from 10–15 to 30–40 cm and sporadically even to 1 m. Trace fossils are very common, inside the beds and on the surfaces. The most common is *Planolites*, some beds are full of it. The list of trace fossils is: *Planolites montanus* Richter, *P. beverleyensis* (Billings), *Monocraterion tentaculatum* Torell, *Multilamella spatiosa* Orłowski, *Teichichnus rectus* Seilacher, *Paleophycus tubularis* Hall, *Syringomorpha nilssoni* Torell, *Rhisocorallium jenense* Zenker, *Phycodes palmatum* (Hall) and *Cruziana magna* Orłowski.

In the same rocks, but in the railway cutting to the lime kiln Trzuskawica a trilobite was found: *Ellipsocephalus sanctacrucensis* (Samsonowicz). In the same rocks in outcrop Słowik, west of the bridge, two cranidia of *Strenuaeva orlovinensis* Samsonowicz were found and other fragments of trilobites. The last place is the same one mentioned by J.

Czarnocki (1919) where he had found a fossil *Obolus* and designed the age of the rocks as Middle Cambrian. Later on J. Czarnocki (1947) mentioned from the same place trilobites belonging to *Strenuella* and decided that the rocks belong to Holmia Zone of the Lower Cambrian.

Discussion concerning the Lower Cambrian trilobites of the Holy Cross Mts. with new descriptions, redescriptions and stratigraphic positions was given by S. Orłowski (1985*a*). The two trilobite species mentioned above are typical of the Protolenus-Strenuaeva Zone of the Lower Cambrian in this area (S. Orłowski, 1975, 1985*a*, 1992*a*, *b*).

The Cambrian sequence of the Barwinek borehole fits well to the lithostratigraphic subdivision established for Klimontów Anticlinorium. The Cambrian rocks were stated in the interval from 109.7 to 800.1 m, their dips being 40°. In the interval 109.7–436.6 m these are mainly fine-grained grey sandstones with silty cement, and trace fossils not described or even identified. In the interval 436.6–800.1 m there are fine-grained sandstones and silty shales dark grey with rough surfaces, and four sandstone intercalations each 4–8 m thick.

Only acritarchs were mentioned from the described rocks. These are: *Lophorytidodiacrodium atavum* Timofeev, *L. inane* Timofeev, *L. intorosum* Timofeev, *Archaeohystrichosphaeridium denticulatum* Timofeev, and *Acanthorytidodiacrodium decipiens* Timofeev, recognized by L. Jagielska (1962). In her opinion these acritarchs are not precise stratigraphically to determine the age of the investigated rocks. This opinion is correct if one remembers that at those times the acritarch correlation was made with the Cambrian deposits on the East-European Platform, where the Cambrian sections are not of great stratigraphic value.

Using the mentioned acritarchs the age of rocks in the Barwinek borehole was defined as Middle and Upper Cambrian (W. Bednarczyk *et al.*, 1970). These authors did not give neither descriptions nor photographs of the acritarchs, so we know only the names of fossils. Additionally L. Jagielska quoted latter (1967) the genus *Archaeohystrichosphaeridium* among others from the Holmia Zone of the Lower Cambrian in some borings situated in the area of Klimontów Anticlinorium as for example in the borehole Dyminy 1, situated in the investigated area.

The acritarchs mentioned above are cited neither from the Middle and Upper Cambrian of the Moscow Syneclise (N. A. Volkova, 1980), nor from the Middle Cambrian of the NE Poland (M. Moczydłowska, 1981), and from the Middle Cambrian of the Baltic Syneclise (S. E. Hagenfeldt, 1989; T. Jankauskas, K. Lendzion, 1992).

These acritarch genera were critically discussed, some of the names do not exist any more or were treated as synonyms (A. Eisenack, 1973, 1976; R. A. Fensmere *et al.*, 1990). *Archaeohystrichosphaeridium denticulatum* Timofeev has a Late Proterozoic age. The diagnosis of species and their time intervals were repeated after first publications by Timofeev (*fide* L. Jagielska, 1962) and are not mentioned from other places than in these publications (see also R. A. Fensmere *et al.*, 1990).

It seems that in this case acritarchs are not good time indicators and the age of rocks is doubtful (L. Jagielska, 1962). More suitable in this situation are trilobites and lithostratigraphic correlation.

The Cambrian sequence described above both in highway cutting and Barwinek borehole is typical for the Cambrian of the whole Klimontów Anticlinorium. It means that the Cambrian rocks in the Dyminy Anticline can be easily included in the lithostratigraphic and

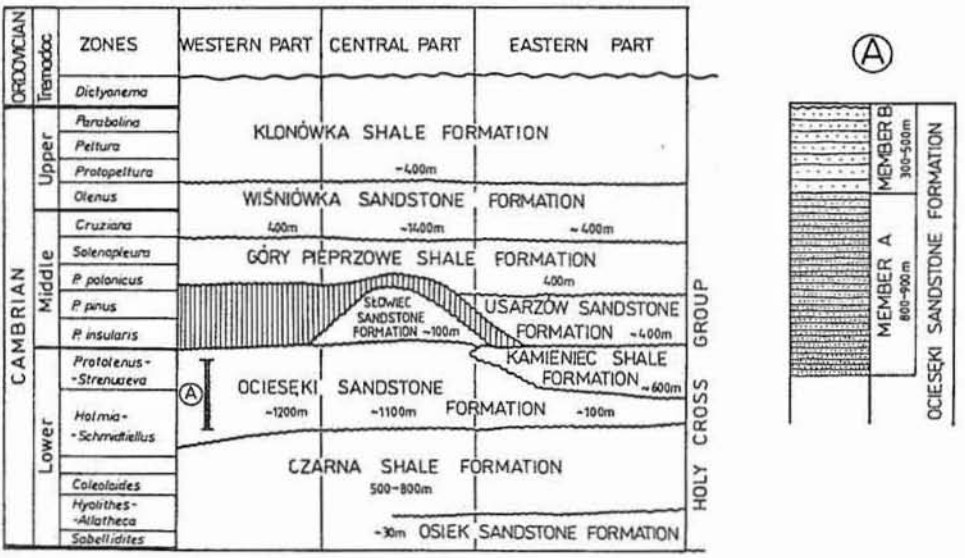


Fig. 2. Cambrian subdivision and the stratigraphic position of the Cambrian deposits in the Dyminy Anticline (A); minimum thicknesses are presented for Cambrian rocks

Podziału litostratygraficzny kambru świętokrzyskiego i miejsce utworów kambryjskich antykliny dymińskiej (A); w profilu utworów kambryjskich antykliny dymińskiej podano miąższości minimalne

biostratigraphic subdivisions of the Holy Cross Mts. (Fig. 2). According to lithology, trilobites and trace fossils they belong to the Ociesęki Sandstone Formation (S. Orłowski, 1975, 1992*a*, *b*). It is suitable to recognize two informal members within this formation:

— member A is represented by fine-grained sandstones and mudstones, thin-bedded (2–5 cm), fragile, olive or grey; the member is about 800–900 m thick;

— member B is represented by fine-grained sandstones, with thickness of beds from 10 up to 100 cm; sandstones are hard and they build the highest hills in this area; trace fossils are common, trilobites are rare; trilobites are good indicators of the Protolenus-Strenuaeva Zone, the youngest one of the Lower Cambrian; from the collection of trace fossils the most important is *Cruziana magna* Orłowski, which is a good indicator for the top part of the Lower Cambrian (S. Orłowski, 1992*a*, *b*); the member is about 300–500 m thick.

The thickness of both members were stated in places with complete lithological sequence and without tectonic repetitions. Possibly the member B may be thicker in other places. Presence of other longitudinal faults (compare J. Znosko, 1994) not visible on the surface is possible. If they do exist they may increase the original thickness of the rock sequence in this area.

The collection of trace fossils gathered from the Cambrian rocks of the Dyminy Anticline is identical to that one from the stratotypical area for the Ociesęki Sandstone Formation (Ociesęki and Orłowiny Ranges — S. Orłowski, 1989).

The Ociesęki Sandstone Formation in the investigated area differs from the stratotypical area only in thickness of the both members (Fig. 2). In the western part of Klimontów

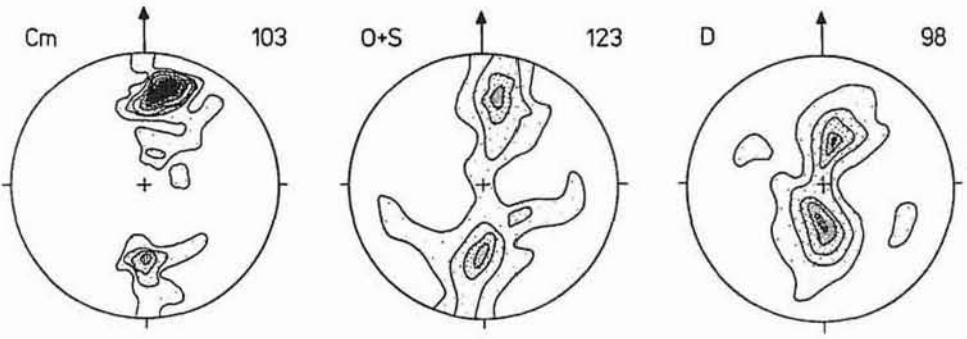


Fig. 3. Attitude of the strata in the Palaeozoic rocks of the Dyminy Anticline

On the upper right-hand side of each diagram — number of measurements (projection of normals onto the upper hemisphere);on the upper left-hand side of each diagram — age of the strata: Cm — Cambrian, O+S — Ordovician and Silurian, D — Devonian; percentage isarhythms: 2, 4, 6, 8, 10, and 12

Diagramy położenia warstw utworów budujących antyklinę dymińską

Po prawej stronie u góry każdego diagramu — liczba pomiarów (projekcja normalnych na górną półkulę); po lewej stronie u góry każdego diagramu — wiek warstw: Cm — kambr, O+S — ordowik i sylur, D — dewoni; zarytmy procentowe: 2, 4, 6, 8, 10 i 12

Anticlinorium the transition between shales of the Czarna Formation into the sandstones of Ociesęki Formation is from clay and silty shales through mudstones and fine-grained sandstones (= member A) and this member is here much thicker than in the stratotypical area.

The rocks from the Barwinek borehole are recognized as part of the Ociesęki Sandstone Formation. Hence they are Lower Cambrian in age.

TECTONIC EVOLUTION

The Dyminy Anticline is a large tectonic unit situated in the western part of the Klimontów Anticlinorium. Its main axis is trends almost latitudinally (Fig. 1). The core of the anticline is built of Cambrian rocks with a narrow belt of Silurian and probably Ordovician rocks occurring in a tectonic graben. Elsewhere the Ordovician and Silurian rocks are exposed on the northern slope of the anticline only. Devonian rocks cover the Cambrian on the southern slope and on the northern slope they rest on Silurian deposits. The structural plans of the Cambrian, Ordovician and Silurian from one side and the Devonian from the other are strongly differentiated (H. Tomczyk, 1956; W. Bednarczyk *et al.*, 1970)

ATTITUDE OF THE STRATA

The strike of the Cambrian rocks is 90–110° (Fig. 3). Only near some transversal faults the strike varies greatly (Fig. 1). The dip is as a rule directed toward the north. This is well visible on the diagram (Fig. 3) with the main interval 95–110/55–70°N. The second interval

is 90/50°S but it is of much smaller frequency. It is recorded in about 10% of the measurements and is connected with transversal and longitudinal faults. The diagram confirms the north dip of the Cambrian rocks except for the peri-fault situations only. The hieroglyphs suggest that the rocks are in normal tectonic position.

The Ordovician and Silurian rocks are visible only on the northern slope of the Dyminy Anticline. The strike is almost the same as in the Cambrian with maximum 90–110° (Fig. 3). The dips are both to the north and south almost in the same proportions (Fig. 3). It means that the rocks are folded. Longitudinal faults along the Ordovician-Silurian boundary were observed in the eastern part of the anticline (H. Tomczyk, 1956). The Ordovician and Silurian rocks are known also from a narrow tectonic graben, situated within the Cambrian; they dip towards the north.

The contact between the Cambrian and Ordovician is visible in the Biesak quarry only. The Ordovician rocks lay penacordantly on the Cambrian rocks and perhaps this type of contact is typical of the whole investigated area.

The Sandomierz tectonic phase was characterized very probably only by block-fault style in this area, contrary to other areas of Klimontów Anticlinorium where this phase has a folding style. Afterwards the Cambrian was folded together with the Ordovician and Silurian. The data collected from Silurian which lie in a local tectonic graben on the Cambrian confirm this opinion.

The measurements of Devonian rocks are shown on diagram in Figure 3. The strike is the same as in the Early Palaeozoic rocks but dips are directed symmetrically to the north and south on both sides of the Dyminy Anticline. Some anomalies in strikes and dips are connected with transversal faults only.

FOLDS

Folds in the Cambrian rocks are strictly connected with lithology and they are small. The rocks of member A are locally shaped in small folds, mainly in southern part of area. Their axes are parallel to the anticline axis. But in the member B, built of thick-bedded sandstones, and their deformations are limited to get bending near some faults (Fig. 4).

Tectonic analysis of the Cambrian rocks suggests that they are arranged monoclinally with dips directed exclusively northwards.

The monoclinal structure of the rock sequence with the presence of folds in shales, thin-bedded siltstones and sandstones only suggests the disharmonic style of folding. The same concerns the rocks in the Barwinek borehole (W. Bednarczyk *et al.*, 1970).

FAULTS

Both longitudinal and transversal faults were observed. They cut the Early and Late Palaeozoic rocks. Some faults cut even the Permo-Mesozoic cover (Fig. 1).

A major longitudinal fault zone runs parallel to the strike of the Cambrian strata. It consists of two parallel faults that bound the Silurian and possibly also Ordovician strata between them (Fig. 1). A detailed study of these faults in the highway cutting suggests their steep dipping. These are partly normal faults and partly reverse faults.

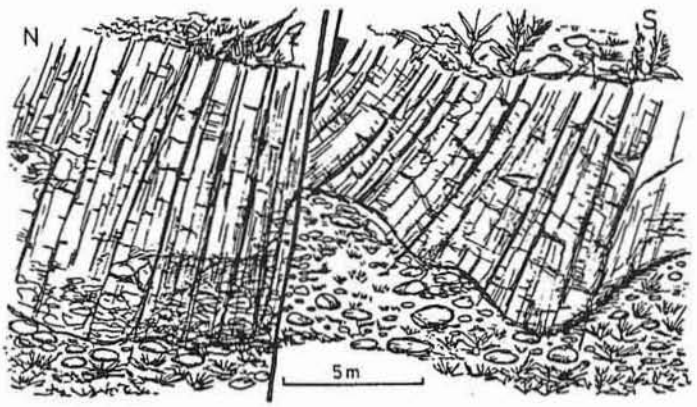


Fig. 4. The bend of beds near the main longitudinal dislocation in the Cambrian deposits; outcrop in the road cutting through Zgórskie Mts.

Podgięcie warstw w sąsiedztwie głównego uskoku podłużnego w obrębie utworów kambryjskich antykliny dymińskiej, obserwowane w skarpie obwodnicy Kielc biegnącej przez Góry Zgórskie

As it was suggested earlier a possibility exists of the presence of some other longitudinal faults cutting the Cambrian rocks. The argument for such a situation is an extremely large thickness of the Cambrian deposits along cross-sections through the anticline. The thickness here exceeds much the stratotypical sequence of the Ociesęki Sandstone Formation.

A major group of transversal faults is characterized by N–S orientation (Fig. 5). These are dip-slip faults and oblique-slip faults, of rather small amplitude. The biggest are two faults situated east and west of the Barwinek borehole with an amplitude of about 200 m (Fig. 1). Transversal faults with NW–SE orientation are of secondary importance and these are mainly strike-slip faults (Fig. 5).

It is difficult to determine the age of the longitudinal and transversal faults. They are mainly post-Devonian in age (NW–SE orientation) — but some may have Late Caledonian origin and these show N–S orientation. The post-Devonian faults are very probably connected with the main phases of the Variscan orogeny. The faults of N–S direction represent a period of elevation of the folded area.

The age of the longitudinal faults is very probably Late Caledonian or Variscan but some other geological data suggest the first possibility. Very probably these faults were rejuvenated after the Mesozoic (Fig. 1).

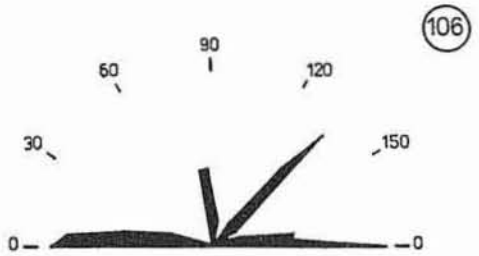


Fig. 5. Diagram of the faults in the Dyminy Anticline

On the upper right-hand side of diagram — number of measurements

Diagram kierunkowy uskoków antykliny dymińskiej

Po prawej stronie u góry — liczba pomiarów

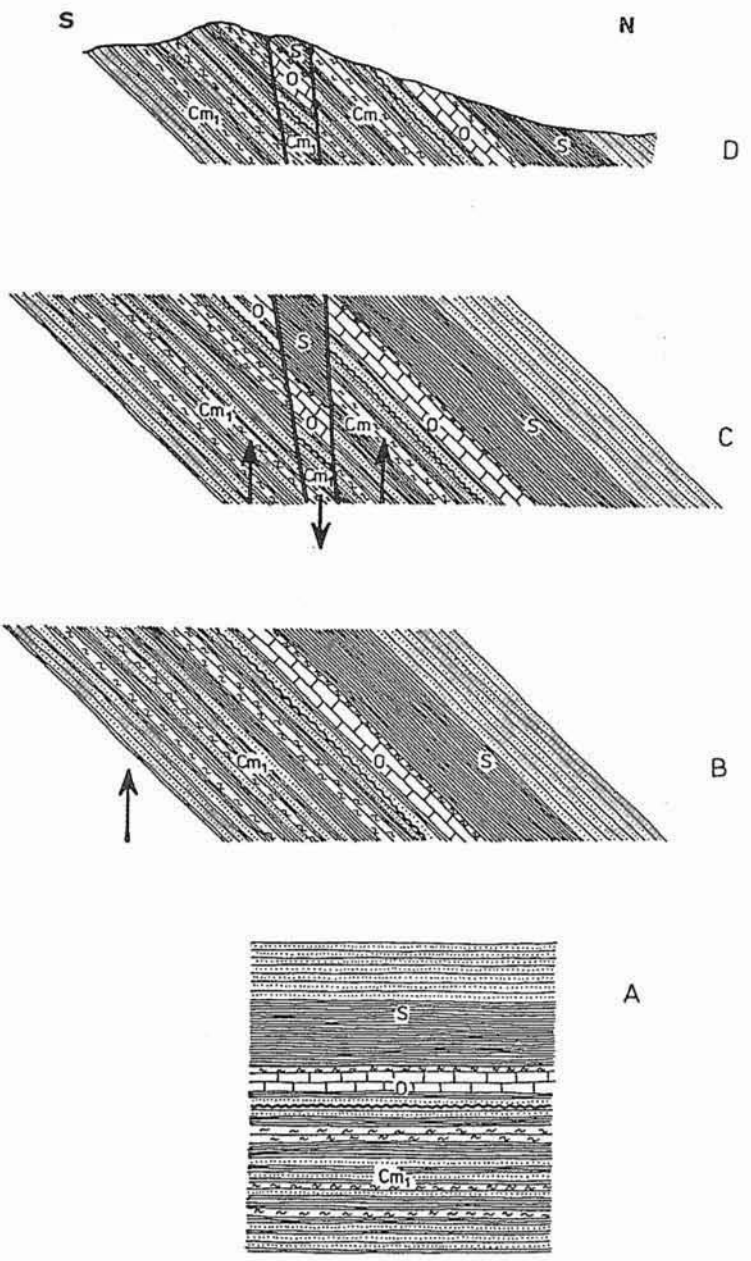


Fig. 6. The development stages (A–D) of the tectonic grabens within the Cambrian deposits of the Dyminy Anticline
Cm_1 — Lower Cambrian, O — Ordovician, S — Silurian
Etapy (A–D) powstania rowów tektonicznych w obrębie utworów kambryjskich antykliny dymińskiej
Cm_1 — kambr dolny, O — ordowik, S — sylur

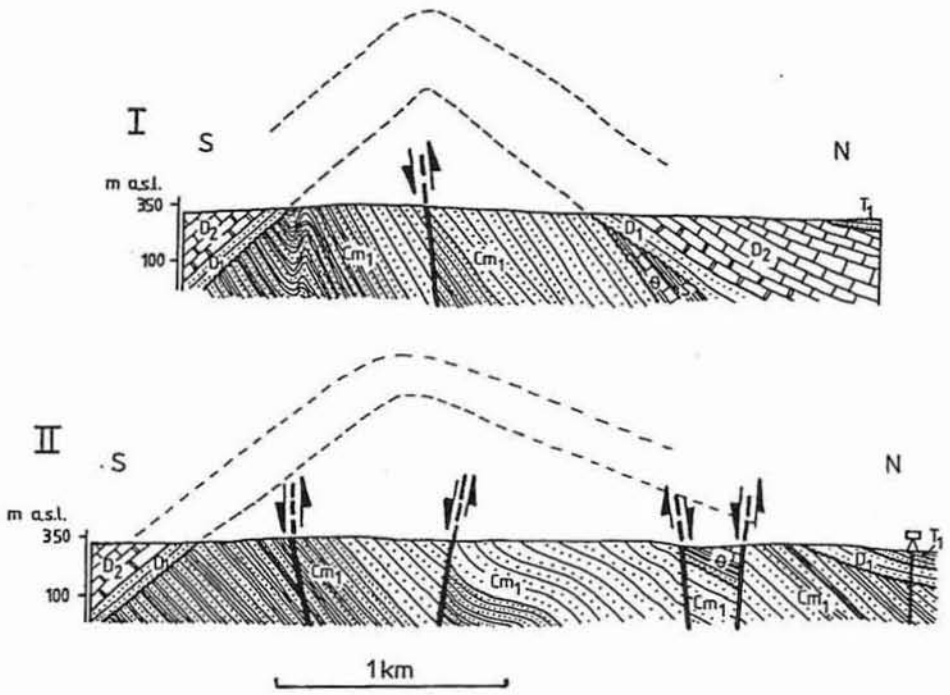


Fig. 7. Geological cross-sections through the Dyminy Anticline (for localization see Fig. 1)
T_1 — Lower Triassic; other explanations as in Fig. 1
Przekroje geologiczne przez antyklinę dymińską (lokalizacja przekrojów na fig. 1)
T_1 — trias dolny; pozostałe objaśnienia jak na fig.1

TECTONIC GRABENS

The earlier papers (J. Czarnocki, 1919, 1938; H. Tomczyk, 1956; W. Bednarczyk *et al.*, 1970) suggest the existence of two narrow belts of Silurian wedged into the Cambrian rocks. These belts were claimed to be thrust slices within the folded Cambrian. A similar narrow belt but with Ordovician rocks only is situated near Barwinek borehole (Fig. 1). The longitudinal faults are the tectonic boundaries of the belts which disappear on the transversal faults.

However, the examination of outcrops, and of the geological map (J. Czarnocki, 1938) suggests that the Cambrian rocks form a monocline dipping to the north. The strike and dip of the Silurian are the same as that of the Cambrian (Fig. 6). It is quite possible that Ordovician rocks, which are exposed on the northern slope of the anticline, occur also below the Silurian in grabens. The same geological history have the Ordovician deposits in the local graben, situated far to the north near Barwinek borehole. Its northern position is a result of the activity of faults with combination of erosion of this area (Fig. 1).

The main longitudinal dislocations and local tectonic grabens are presumably of Late Caledonian age.

STRUCTURE OF DYMINY ANTICLINE

Two structural stages are easily recognized in the Dyminy Anticline. The first one consists of Cambrian, Ordovician and Silurian rocks in form of a monocline. Younger structural stage is an anticline (Fig. 7). So the term Dyminy Anticline means the Variscan structure with large Late Caledonian monocline inside it.

CONCLUSIONS

The stratigraphic position of the Cambrian rocks in the Dyminy Anticline is now more precisely defined than before.

The large outcrops along the highway cutting are of great value for the knowledge of the rock sequence and for the thicknesses of lithostratigraphic units. The Cambrian rocks, about 1200 m thick, belong to the Ociesęki Sandstone Formation. Two informal members were distinguished in the formation. Trilobites were found in two places and they are typical for the Strenuaeva-Protolenus Zone of the Lower Cambrian. Trace fossils were found in many outcrops and they are the same as described from the stratotype area of the Ociesęki Sandstone Formation (Ociesęki and Orłowiny Ranges).

The Cambrian, Ordovician and Silurian rocks build the older structural stage. The rocks form a monocline with some secondary deformations connected with transversal and longitudinal faults. The Devonian rocks build the younger structural stage. They make a symmetric anticline. Local tectonic grabens of latitudinal orientation are filled with Ordovician and Silurian rocks. These grabens are situated along a large-scale longitudinal dislocation.

Strikes of the rocks in both structural stages are very similar or almost identical. It means that deformations in both stages have originated in similar fields of stress. The Dyminy Anticline is Variscan in age with large, inner structure of Late Caledonian age. It is subdivided into tectonic blocks by numerous faults, mainly dip-slip faults and oblique-slip faults. The same tectonic style is characteristic for the whole Kielce Block being originated during Variscan orogeny.

Instytut Geologii Podstawowej
Uniwersytetu Warszawskiego
Warszawa, al. Żwirki i Wigury 93
Muzeum Geologiczne
Państwowego Instytutu Geologicznego
Warszawa, ul. Rakowiecka 4
Received: 16.04.1996

REFERENCES

BEDNARCZYK W., CHLEBOWSKI R., KOWALCZEWSKI Z. (1970) — The geological structure of the northern wing of the Dyminy Anticline in Świętokrzyskie Mountains (in Polish with English summary). Biul. Geol. Wydz. Geol. UW, **12**, p. 197–225.

CZARNOCKI J. (1919) — Stratygrafia i tektonika Gór Świętokrzyskich. Pr. Tow. Nauk. Warsz., **28**.

CZARNOCKI J. (1938) — Carte géologique générale de la Pologne 1:100 000, Feuille 4: Kielce (in Polish and French). Państw. Inst. Geol. Warszawa.

CZARNOCKI J. (1947) — Przewodnik XX Zjazdu Polskiego Towarzystwa Geologicznego w Górach Świętokrzyskich w r. 1947. Rocz. Pol. Tow. Geol., **17**, p. 237–295.

EISENACK A. (1973) — Katalog der fossilien Dinoflagellaten, Hystrichosphären und verwandten Mikrofossilien. **3**, Acritarcha, Teil 1, E. Schweizerbart'sche Verlagsbuchhandlung.

EISENACK A. (1976) — Katalog der fossilien Dinoflagellaten, Hystrichosphären und verwandten Mikrofossilien. **4**, Acritarcha, Teil 2, E. Schweizerbart'sche Verlagsbuchhandlung.

FENSMERE R. A., WILLIAMS G. L., SEDELEY BARSS M., FREEMAN J. M., HILL J. M. (1990) — Acritarchs and fossil Prasinophytes: An index to genera, species and intraspecific taxa. AASP, Contribution Series, **25**.

HAGENFELDT S. E. (1989) — Middle Cambrian acritarchs from the Baltic Depression and South-central Sweden, taxonomy and biostratigraphy. Stockholm Cont. Geol., **41**, p. 177–250, no. 2.

JAGIELSKA L. (1962) — Mikrospory w utworach starszego paleozoiku w Górach Świętokrzyskich. Arch. Państw. Inst. Geol. Warszawa.

JAGIELSKA L. (1967) — Mikroflora utworów kambru antyklinorium dymińsko-klimontowskiego. Kwart. Geol., **11**, p. 464, no. 2.

JANKAUSKAS T., LENDZION K. (1992) — Lower and Middle Cambrian acritarch — based biozonation of the Baltic Syneclise and adjacent areas (East European Platform). Prz. Geol., **40**, p. 519–525, no. 9.

MIZERSKI W. (1992) — Tectonics of the Cambrian sequence in the Holy Cross Mountains (in Polish with English summary). Prz. Geol., **40**, p. 142–146, no. 3.

MIZERSKI W. (1995) — Geotectonic evolution of the Holy Cross Mts in Central Europe. Biul. Państ. Inst. Geol., **372**.

MOCZYDŁOWSKA M. (1981) — Lower and Middle Cambrian acritarchs from northeastern Poland. Precambrian Res., **15**, p. 63–74, no. 1.

ORŁOWSKI S. (1975) — Cambrian and Upper Precambrian lithostratigraphic units in the Holy Cross Mts (in Polish with English summary). Acta Geol. Pol., **25**, p. 431–448, no. 3.

ORŁOWSKI S. (1985*a*) — Lower Cambrian and its trilobites in the Holy Cross Mts. Acta Geol. Pol., **35**, p. 231–250, no. 3–4.

ORŁOWSKI S. (1985*b*) — New data on the Middle Cambrian trilobites and stratigraphy in the Holy Cross Mts. Acta Geol. Pol., **35**, p. 251–263, no. 3–4.

ORŁOWSKI S. (1989) — Trace fossils in the Lower Cambrian sequence in the Świętokrzyskie Mountains, Central Poland. Acta Palaeont. Pol., **34**, p. 211–231, no. 3.

ORŁOWSKI S. (1992*a*) — Cambrian stratigraphy and stage subdivision in the Holy Cross Mountains, Poland. Geol. Mag., **129**, p. 471–474, no. 4.

ORŁOWSKI S. (1992*b*) — The Cambrian period in the Holy Cross Mountains (Centenary of stagement) (in Polish with English summary). Prz. Geol., **40**, p. 137–143, no. 3.

ORŁOWSKI S. (1992*c*) — Trilobite trace fossils and their stratigraphical significance in the Cambrian sequence of the Holy Cross Mountains, Poland. Jour. Geol., **27**, p. 15–34, no. 1.

ORŁOWSKI S., MIZERSKI W. (1995) — New data on geology of the Middle Cambrian rocks in the Klimontów Anticlinorium (Holy Cross Mts.). Geol. Quart., **39**, p. 293–306, no. 3.

TOMCZYK H. (1956) — Wenlock and Ludlow in the Kielce syncline of the Święty Krzyż Mts. (in Polish with English summary). Pr. Inst. Geol., **16**.

VOLKOVA N. A. (1980) — Acritarchs of the Middle and Upper Cambrian in Moscov syneclise (in Russian with English summary). Proc. USSR Acad. Sc., **12**, p. 49–57.

VOLKOVA N. A., KIRJANOV V. V., PISKUN L. V., PASKEVICIENE L. T., JANKAUSKAS T. V. (1983) — Plant microfossils. In: Upper Precambrian and Cambrian palaeontology of the East-European Platform (eds. A. Urbanek, A. Y. Rozanov), p. 7–45. Wyd. Geol. Warszawa.

ZNOSKO J. (1994) — Tectonic style of the Early Palaeozoic sequences in the Holy Cross Mountains. Geol. Quart., **40**, p. 1–21, no. 1.

Stanisław ORŁOWSKI, Włodzimierz MIZERSKI

KAMBR ANTYKLINY DYMIŃSKIEJ GÓR ŚWIĘTOKRZYSKICH

Streszczenie

Antyklina dymińska jest jednostką waryscyjską zbudowaną z utworów starszego paleozoiku i dewonu (fig. 1). Pozycja stratygraficzna skał kambru antykliny dymińskiej, dotychczas nie całkiem jasna, w nawiązaniu do antyklinorium klimontowskiego mogła zostać — dzięki badaniom autorów — dość precyzyjnie ustalona. Odsłonięcia kambru w zboczach przekopu przez Góry Zgórskie pozwoliły na: ustalenie w miarę pełnego następstwa warstw, podział na jednostki litostratygraficzne oraz określenie minimalnej miąższości poszczególnych jednostek. Jądro antykliny dymińskiej budują skały kambru dolnego, należące do formacji piaskowców z Ociesęk, o miąższości minimalnej około 1200 m. W skałach tych wyróżniono dwa nieformalne ogniwa (fig. 2).

W dwóch miejscach znaleziono trylobity, a w wielu innych liczne ślady organiczne. Trylobity świadczą o późnodolnokambryjskim wieku skał. Zespół śladów organicznych jest identyczny z opisanym z obszaru stratotypowego dla formacji piaskowców z Ociesęk (Pasmo Ociesęckie–Pasmo Orłowińskie). Przypuszczenia niektórych autorów, iż na terenie antykliny dymińskiej występują skały środkowego i górnego kambru, nie znalazły potwierdzenia.

Skały kambryjskie jądra antykliny dymińskiej należą, wraz z utworami ordowiku i syluru, do dolnego piętra strukturalnego, które ma budowę monoklinalną, zaburzoną przez uskoki podłużne i poprzeczne (fig. 3, 4). W obrębie utworów kambryjskich występują równoleżnikowe rowy tektoniczne, w których znajdują się utwory ordowickie i sylurskie. Rowy te leżą wzdłuż głównej dyslokacji podłużnej w obrębie antykliny dymińskiej (fig. 6). Biegi warstw utworów dolnego i górnego piętra strukturalnego wykazują daleko idące analogie, jeśli nie identyczność (fig. 1, 3). Oznacza to, że deformacje w obu piętrach strukturalnych musiały zachodzić w podobnym polu naprężeń.

Antyklinalna budowa omawianego obszaru widoczna jest dopiero w utworach dewońskich (fig. 7). Oznacza to, że antyklina dymińska jest jednostką waryscyjską z reliktowymi strukturami młodokaledońskimi. Podzielona jest na bloki przez liczne uskoki poprzeczne o głównej składowej zrzutowej, jak również przez uskoki przesuwcze o kierunki NW–SE (fig. 5), które związane są z waryscyjską aktywizacją bloku kieleckiego.