A new occurrence of benthic fauna in the Niewachłow Greywackes (Upper Silurian) from Zalesie near Łagów in the Holy Cross Mountains

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INTRODUCTION

In the Bardo Syncline, in the southern part of the Holy Cross Mountains, the Silurian deposits which are developed as shales with graptolites, are well understood. They are known to comprise graptolite zones from Akidograptus acuminatus to Saetograptus leintwardinensis (H. Tomczyk, 1956, 1968). However, the Silurian deposits above the Saetograptus leintwardinensis Zone, known as the Niewachłow Greywackes, are developed mainly in the mudstone-greywacke facies. The deposits lying above a graptolite series in the Kielce region of the Holy Cross Mountains were ascribed to a wide stratigraphic interval (considering the rare occurrence of fauna in them) and no more importance was attached to their detailed stratigraphic position (E. Tomczykowa, 1959). However, the discovery of numerous and well-preserved fauna in the section of Gruchawka in the western part of the Kielce region (J. Malec, 1993), allowed the evaluation of its stratigraphic significance (E. Tomczykowa, 1993).

The discovery (by K. Dembicz, W. Kozłowski, T. Ochmański) of fairly abundant faunal assemblage in Zalesie near Łagów, confirms the synchronous occurrence of greywacke deposits in the entire southern part of the Holy Cross Mountains, from Gruchawka to Jurkowice (Fig. 1). As noted by the authors, and earlier, the occurrence of Bohemograptus bohemicus (Barrande) specimens, and other Upper Ludlow graptolites in these deposits indicates that they correspond to the Lower Siedlce unit in the East European Platform (H. Tomczyk, 1968).

GEOLOGY

The section described is located on the bank of the stream which takes its source at the village of Sadków. This stream flows towards a ravine in a west-east direction being a continuation of the Zalesie ravine (Fig. 2). On the left-hand slope of the ravine there appear the following strata (from bottom to top):

1. Uniform series of mudstones with graptolites and greywacke shales (thickness unknown). The distance from the bottom of the greywacke series appears not to exceed 180 m (Fig. 3). There is a possibility, however, that the actual thickness may be less.

2. Series of coarse-grained, thick-bedded greywackes: — layer of yellow, coarse-grained greywacke, in the lower part with numerous skeletal fauna, mainly cephalopods (thickness 0.13 m);
Fig. 1. Map of occurrence of the Silurian deposits against the background of the Palaeozoic core of the Holy Cross Mountains

- Upper Palaeozoic; b - Silurian deposits in the Łysogóry (northern) region; c - Silurian deposits in the Kielce (southern) region; d - Cambrian and Ordovician deposits; e - main dislocations; f - Holy Cross Fault; g - outcrops of the Niewachłow Greywackes with benthic fauna: 1 - Gruchawka, 2 - Niestachów, 3 - Widelki, 4 - Zalesie (indicated by arrow), 5 - Jurkowice

1. Brown, thick-bedded, coarse-grained greywackes with lithoclasts, feldspar, and quite numerous detritus of fauna (thickness 0.25 m);
2. Light yellow, coarse-grained greywackes with numerous grains of feldspar (thickness 0.06 m).
3. Hard, tabular, laminated, olive-gray greywacke mudstones, interbedded with mudstones and coarse-grained greywackes (unknown thickness).

The orientation of the strata is 128°/37° N.

Within the series 1, directly below series 2 in the greywacke mudstones following graptolites were found: Bohemograptus bohemicus (Barrande), B. bohemicus tenuis (Bouček) and Pristiograptus sp. (determined by H. Tomczyk). Earlier (E. Tomczykowa, 1959), in addition to the above species, the following graptolites were noted from an outcrop in Zalesie: Monograptus tomczyki Wiliefert (earlier determined as Monograptus ultimus Perner) and Linograptus posthumus Richter.

Series 2, lithologically different, contains a significant amount of coarse-grained material (feldspar, quartz, lithoclasts). The general lithological development, together with the observed graded bedding in series 2, and also the overlying, laminated series (3) indicates the turbidite character of the sedimentation.

In series 2 there occurs a rich assemblages of benthic fauna, partly as a skeletal detritus. However, a significant part of fauna contains the complete moulds, indicating a short transport of the skeletal material. It should be stressed that the state of preservation of the trilobite fauna allows precise and unequivocal determination (Pl. 1).

From the above described series 2, in the summer 1995-1997 K. Dembićz, W. Kozłowski and T. Ochmański collected the following fauna, as determined here by E. Tomczykowa:

- Atrypa sp., Stropheodonta sp., Camarotoechia nacula (Dalman), Icortis sp., Delthyris sp., Baliozoma erraticum (Schrank), Dalmanites nexilis (Salter), Richterarges kielcensis Tomczykowa, Helokybe sp, Harpiderella sp., Sphaerochus sp., and Calymene sp.

Furthermore, numerous trochites, cephalopod remains (Kionoceras sp.), fragments of Tabulata, solitary corals, gastropods, bivalves, and ostracods have been found.

In the uppermost series (3) (Fig. 3) no fauna was found.

CORRELATION

Of the trilobites occurring in series 2, those with the most stratigraphic and correlative significance are as follows: Baliozoma erraticum (Schrank), Dalmanites nexilis (Salter), Richterarges kielcensis Tomczykowa, Helokybe sp., and Harpiderella sp. (Pl. 1). These trilobites were described by E. Tomczykowa (1993) from the Gruchawka sequence (J. Malec, 1993), where they are somewhat better preserved. They occur there in so-called Kielce Beds, described as an informal lithostratigraphical unit (J. Malec, 1993). The fauna under discussion occurs in the upper part of the section i.e. approximately 224 and 104 m below the Miedziana Góra Conglomerates (J. Malec, 1993, p. 514, Pl. V). From the strata lying approximately 65 m below the Miedziana Góra Conglomerates, J. Malec (1993) claims the occurrence of graptolites Monograptus transgressivi Perner (determined by L. Teller). Unfortunately the author did not include a photograph of the specimen.

Fragments of Baliozoma erraticum (Schrank), and Dalmanites nexilis (Salter) were also noted in the greywackes of
Fig. 2. Geological map of the Zalesie area, Bardo Syncline (according to H. Tomczyk, 1958)

1 — Lower Cambrian (Cm1); 2 — Ordovician (Or); 3 — Lower Silurian (S1), graptolite shales; 4 — Upper Silurian (S2), Niewachl6w Greywackes; 5 — Pleistocene (Q); 6 — Holocene (h); 7 — diabase (d) and its range; 8 — borehole Zalesie IG 1; the arrow indicates the layer with trilobites

Jurkowice (A. Romanek, M. Rup, 1989) in the eastern part of the southern region of the Holy Cross Mountains.

Identical trilobite fauna as in the Niewachl6w Greywackes is also known from Widelki in Bardo Syncline (E. Tomczy­kowa, 1959). The following species of trilobites appear: Ota­rion sp. (= Harpidella sp.), Proetus sp. (probably Helokybe sp.), "Trochurus sp." (= Richterarges sp.) and Calymene sp., recorded also from Niestachów (E. Tomczykowa, 1959). From a Widelki section of a shale series lying above a grey­wacke series, E. Porębska noted the following graptolites: Bohemograptus bohemicus (Barrande), B. bohemicus tenuis (Bouček), Pristograptus dubius s.l., P. sp., and Neocucullograptus sp. (E. Stupnicka et al., 1991). These graptolites are explicitly indicative of the Lower Siedlce unit.

The terrigenous sediments under discussion, long known (J. Czarnocki, 1919, 1936) as the Niewachłow Greywackes occur in the entire southern region of the Holy Cross Mountains. The shaly sedimentation with graptolites developed here in the zones scanicus to leintwardinensis, which have been well studied in Niestachów and Bardo–Pragowiec sec­tions, and it marks the bottom of the greywacke series discus­sed here (H. Tomczyk, 1956, 1958).

Considering the poverty of fossils, the overlying sedi­ments so far were ascribed rather generalized age. Therefore the benthic fauna discovered here, together with graptolites in Zalesie near Łagów in the entire central region of the Holy Cross Mountains, has a great stratigraphical significance.

The faunal zone under discussion is defined by graptolites, of which the most stratigraphically important are: Bohemo­graptus bohemicus (Barrande), B. bohemicus tenuis (Bouček) as well as by numerous trilobites. The most stratigraphically important are the trilobites represented here by: Baliozoma erraticum (Schrank), Dalmantites nexilis (Salter), Richter­ges kielcensis Tomczykowa, Helokybe cf. spio Thomas, Har­pidella sp., Sphaerozoocus sp., and Calymene sp.

The majority of the afore-mentioned species have been described earlier (E. Tomczykowa, 1993). Only Sphaerozoocus sp. — a small pygidium of which was found by T. Ochmański in Zalesie, in series 2 — does not occur in remain­ing outcrops. It is an interesting fact that, until now, this
Fig. 3. Lower Palaeozoic sequence in Zalesie near Łagów, based on the outcrops and borehole Zalesie IG 1 (interpreted by H. Tomczyk 1958; H. Tomczyk, E. Tomczykowa, 1976)

1—claystones with graptolites; 2—black graptolite shales with siliceous shales and limestones; 3—graptolitic shales and claystones with limestone intercalations and lenses; 4—greywackes and mudstones; 5—coarse-grained greywackes with feldspars and rich fragments of fauna; 6—diabase; 7—tectonic discordance; 8— hiatus; 9—statigraphic position of described trilobites; T, Ar, Lr, L, C, A—Ordovician stages

The genus has not been recorded in deposits younger than Wenlock, with the exception of Sphaeroxochus paramirus Snajdr, from the lower part of the Kopańska Formation in Barrandien (M. Snajdr, 1980). A distinctive feature is that the assemblage of trilobites similar to those from Zalesie, occurs there in mixed pyroclastic-carbonate deposits (I. Chlupáč, 1987, p. 176). However, the pygidium Sphaeroxochus sp. from Zalesie (Pl. I, Fig. 4) is very similar to that illustrated from the Arctic Canada as Sphaeroxochus dimorphus Perry et Chatterton (D. G. Perry, B. D. E. Chatterton, 1977, pl. 2, figs. 17–20; D. J. Holloway, 1980; D. L. Strusz, 1980). The entire assemblage of trilobites occurring in the Niewachów Greywackes in the southern part of the Holy Cross Mountains is almost identical to the species occurring also in the Bohé-
mograpthus bohemicus Zone in the Red Bay Formation in Arctic Canada (A. T. Thomas, G. M. Narbonne, 1979). Some of the trilobite species mentioned above occur in the upper Ludlow in Welsh Borderland (D. G. Mikulic, R. Watkins, 1981) in erratic boulders (E. Schrank, 1972) and in Gotland. This was noted earlier by E. Tomczykowa (1993).

CONCLUSIONS

1. The assemblage of trilobites occurring in the entire southern region of the Holy Cross Mountains, from Jurkowice in the east to Gruchawka in the west includes the same taxa (at least 7 species) documenting the same stratigraphical level.

2. Trilobites: Baliozona erraticum (Schrank), Dalmanites nexitis (Saltzer), Richterarges kielcensis Tomczykowa, Helocybe cf. spio Thomas, occurring in the Niewachlow Greywackes and in Kielce Beds indicate unequivocally the middle part of the Ludlow (E. Tomczykowa, 1993).

3. The co-occurring graptolites confirm the stratigraphic position of the whole assemblage, indicating the Bohemograpthus bohemicus Zone.

4. The assemblage should be treated as a stratigraphic zone within the Niewachlow Greywackes and probably in the informal Kielce Beds.

5. At least the most part of the Kielce Beds (as defined by J. Malec, 1993) corresponds to the Bohemograpthus bohemicus Zone. This age is documented in the Gruchawka sequence by the key trilobite assemblage 104 and 224 m below the Miedziana Gdra Conglomerate (J. Malec, 1993).

6. The question of the age of the upper Silurian deposits in the Gruchawka section remains open (at least until an objective verification of the determination of graptolites is made).

7. The age of the Niewachlow Greywackes does not exceed Late Ludlow. They correspond most closely to the Wydryszows Formation in northern part of the Holy Cross Mountains, and to Lower and Middle Siedlce unit in the East European Platform (H. Tomczyk, 1968)

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NOWE STANOWISKO FAUNY BENTONICZNEJ W SZAROGŁAZACH NIEWACHŁOWSKICH
(GÓRNY SYLUR) W ZALESIU POD ŁAGOWEM (GÓRY ŚWIĘTOKRZYSKIE)

Streszczenie

W synklinie bardziankiej, w Zalesiu pod Łagowem (fig. 1–3), w szaro­
głazach niewachłowskich znaleziono liczny zespół fauny bentonicznej,
odpowiadający faunie znanym z Gruchawki (E. Tomczykowa, 1993; J. Malec, 1993) i Jurkowic (A. Romanek, M. Rup, 1989), a prawdopodobnie też z
Widelek i Niestachowa. Z oznaczonych tu trylobitów największe znaczenie
stratygraficzne i korelacyjne mają: Baliozoma erraticum (Schrank), Dalma­
nites nexilis (Salter), Richterarges kielcensis Tomczykowa, Helokybe sp.,
Harpedila sp., Sphaeroxochus sp. (tabl. 1). Wskazują one na wiek warstw
odpowiadający środkowej części ludlowu (E. Tomczykowa, 1993). Bezpo­
srednio ponizej serii z fauną bentoniczną, która prawdopodobnie chara­
kter turbidytowy, znaleziono graptolity: Bohemograptus bohemicus
(Barrande), B. bohemicus tenuis (Bouček) i Pristiograptus sp. Z serii tej,
opóźcz wymienionych powyżej, wcześniej podawane były (E. Tomczykowa,
1959): Monograptus tomczyki Willefert (wcześniej określony jako Monocli­
nacis ultimus Perner) oraz Linograptus posthumus Richter. Graptolity te
potwierdzają pozycję stratygraficzną poziomu z Baliozoma erraticum
(Schrank), wskazując na poziom Bohemograptus bohemicus. Szaroglazy
niewachłowskie oraz większa część warstw kieleckich (sensu J. Malec,
1993), która zawiera przewodnie trylobity poziomu z Baliozoma, 104 i 224
m ponizej zlepienca miedzianogórskiego (według J. Malec, 1993), należy
zdaniam autorów do poziomu B. bohemicus, czyli do dolnych siedlec. Proble­
mem wieku stropowej części profilu Gruchawki pozostaje otwarty, przynaj­
mniej do czasu paleontologicznego udokumentowania występujących tam
graptolitów.

EXPLANATIONS OF PLATE

PLATE I

Fig. 1–3. Baliozoma erraticum (Schrank, 1972)
Fig. 1 — cranidium, x 6, MUZ PIG 1640.II.1; Fig 2 — hypostom, x 6, MUZ
PIG 1640.II.2; Fig. 3 — pygidium, x 8, MUZ PIG 1640.II.3
Fig. 4. Sphaeroxochus sp.
Pygidium, x 5, private collection of T. Ochmański
Fig. 5. Harpedila sp.
Incomplete pygidium, x 7, MUZ PIG 1641.II.3

Fig. 6. Richterarges kielcensis Tomczykowa, 1993
Cranidium, x 7, MUZ PIG 1641.II.1
Fig. 7. Helokybe sp.
Pygidium, x 4,5, MUZ PIG 1640.II.5
Fig. 8. Dalmanites nexilis (Salter, 1864)
Incomplete pygidium, x 7, MUZ PIG 1640.II.4

All samples are internal moulds; Zalesie near Łagów, Lower Siedlce
(upper Ludlow), photo Barbara Rüstakiewicz and Marek Krzyzanowski
Wojciech KOZŁOWSKI, Ewa TOMCZYKOWA — A new occurrence of benthic fauna in the Niewachłów Greywackes (Upper Silurian) from Zalesie near Łagów in the Holy Cross Mountains