Kwartalnik Geologiczny, t. 35, nr 1, 1991 r., str. 119–130

Sylwester SKOMPSKI

Trace fossils in the deposits of ice-dammed lakes

Trace fossils recorded within ice-dammed lake deposits in western Poland (Urad near Słubice) belong to rarely found marks of life in cold waters in front of Pleistocene ice-sheet. Four ichnospecies have been described and interpreted as traces of walking (stepping) of arthropods on the bottom of an ice-dammed basin during the South-Polish Glaciation. As the knowledge on trace fossils advances they may become useful for biostratigraphic, palaeoecologic and glacial limnologic investigations or even for tectonic (glaciotectonic) interpretations.

Contrary to the lacustrine deposits which comprise remnants of different animals (S. Skompski, 1977, 1986, 1987*a,b*;K. Szeroczyńska, 1986 and many others)[1], ice-dammed lake deposits consisting mainly of clays and silts (often of varve type) usually do not contain any fauna. However trace fossils of invertebrates, although rare, are known from this type of sediments.They have been described in Sowie Mountains (M. Schwarzbach, 1938, 1940) at Lębork (A. Ludwig, 1963) and recently in Mazowsze Region (T. Merta, 1980). They are also known from the remote localities e.g. Middle Pleistocene of England (P. L. Gibbard, A. J. Stuart, 1974). The above authors identified the discovered traces and refered them to some contemporary traces e.g. *Asellus*. Traces in ice-dammed deposits have been described not only in

[1] There are already tens of studies avilable. Many of them have been listed in the *Catalogue of Quaternary Fossils* (I. Brodniewicz, S. Skompski, 1977), in the *Atlas of Quaternary Fossils* (S. Skompski, A. Makowska, 1989; T, Sywula, E. Pietrzeniuk, 1989) and in other comprehensive or through treatises on different groups of invertebrates.

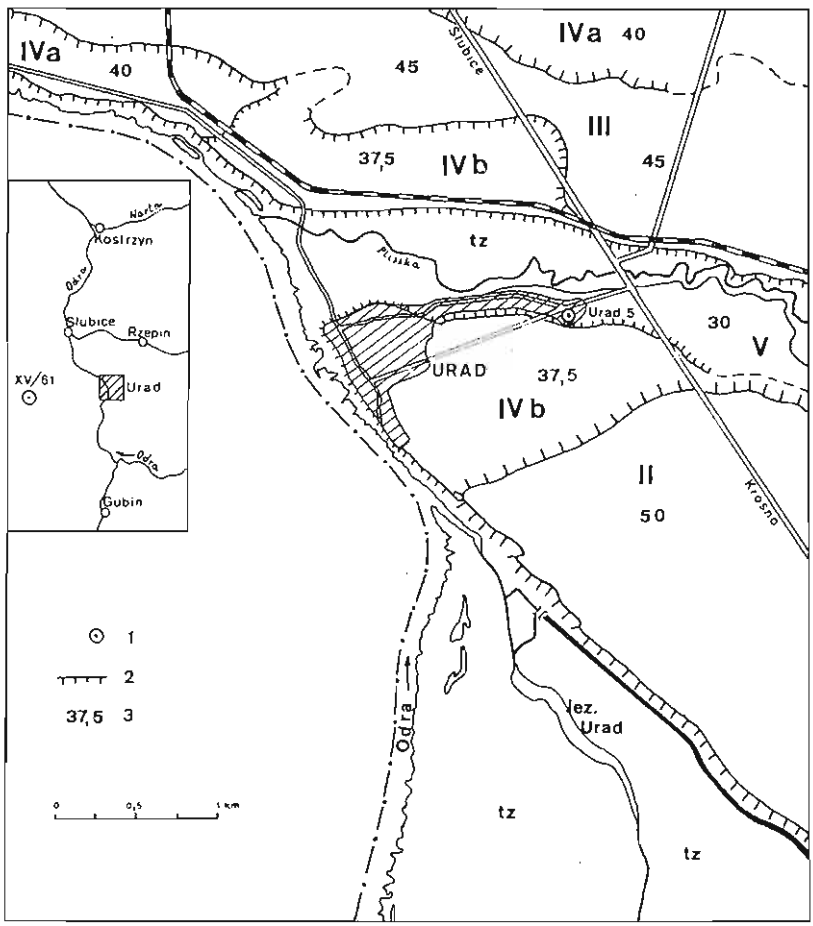


Fig. 1. Geomorphological situation of the borehole Urad 5

1 — borehole; 2 — terrace edge; 3 — altitude of a terrace (in meters above sea level); II — sandr terrace (50 m a.s.l.) — North-Polish Glaciation, Poznań Phase; III, IV — Urstrom valley terrace, Pommeranian Phase: III — 45 m a.s.l.; IVa — 40 m a.s.l.; IVb — 37.5 m a.s.l.; V — overflood river terrace (30 m a.s.l.), Older Dryas Phase; tz — flood-plain, Holocene

Sytuacja geomorfologiczna otworu wiertniczego Urad 5

1 — otwór wiertniczy; 2 — krawędź tarasu; 3 — wysokość tarasu w m n.p.m.; II — taras sandrowy (50 m n.p.m.) — zlodowacenie północnopolskie, faza poznańska; III, IV — taras pradolinny, faza pomorska: III — 45 m n.p.m.; IVa — 40 m n.p.m.; IVb — 37,5 m n.p.m.; V — taras nadzalewowy (30 m n.p.m.), faza starszego dryasu; tz — taras zalewowy, holocen

Pleistocene basins but in Palaeozoic ones as well (Late Carboniferous or Early Permian in South Africa – N.M. Savage, 1971).

The matter of trace fossils has been considered by geologists and palaeontologists since long time. The problem has a broad genetic and stratigraphic background.

Trace fossils have been recorded in deposits of different origin and age – from Carboniferous to Quaternary. [2] Nowadays this extensive subject is reflected in the Polish literature (M. Książkiewicz, 1970; S. Orłowski et al., 1970; A. Radwański, P. Roniewicz, 1973; A. Radwański, 1977; P. Roniewicz, G. Pieńkowski, 1977 and others).

As the species of an animal which is responsible for the mark recorded in the deposit is extremely difficult to define, an attempt has been made to classify the trace fossils entirely according to the shape of a structure or to the kind of animal's activity (moving, feeding etc.). Thereforein the ice-dammed lake deposits the traces have been classifield with reference to the shape of structures (T. Merta, 1980). The author has distinguished 9 morphospecies which differ each from other in size and appearence.

The trace fossils described below are found in deposits of different age. The oldest are Lauenburg clays near Hamburg (D. Dahm, W. Otto, 1953) and ice-dammed lake deposits from the vicinities of Müllrose (M. Hannemann, 1965) which are refered to Elstera Glaciation (equivalent to South-Polish Glaciation), the younger are derived from Mazowsze region (T. Merta, 1980) and assigned to Middle-Polish Glaciation while the youngest are Lębork clays. Finally after changing the stratigraphic position in the course of research, Lębork clays have been assigned to the decline phase of North-Polish Glaciation due to the results of geological mapping in the area of Lębork section[3] (W. Morawski, 1986).

Recently in the ice-dammed lake deposits the trace fossils of invertebrates have been recorded at the Urad village (near Słubice, Western Poland) in the course of geological mapping for the Rybocice map section (S. Skompski, 1987*c*). The deposits described are connected with ice-dammed lake of Eastern Germany (vicinities of Müllrose, Fig. 1) as far as locality and age are considered. The deposits of both localities (Müllrose and Urad) are of similar geological situation hence correlable.

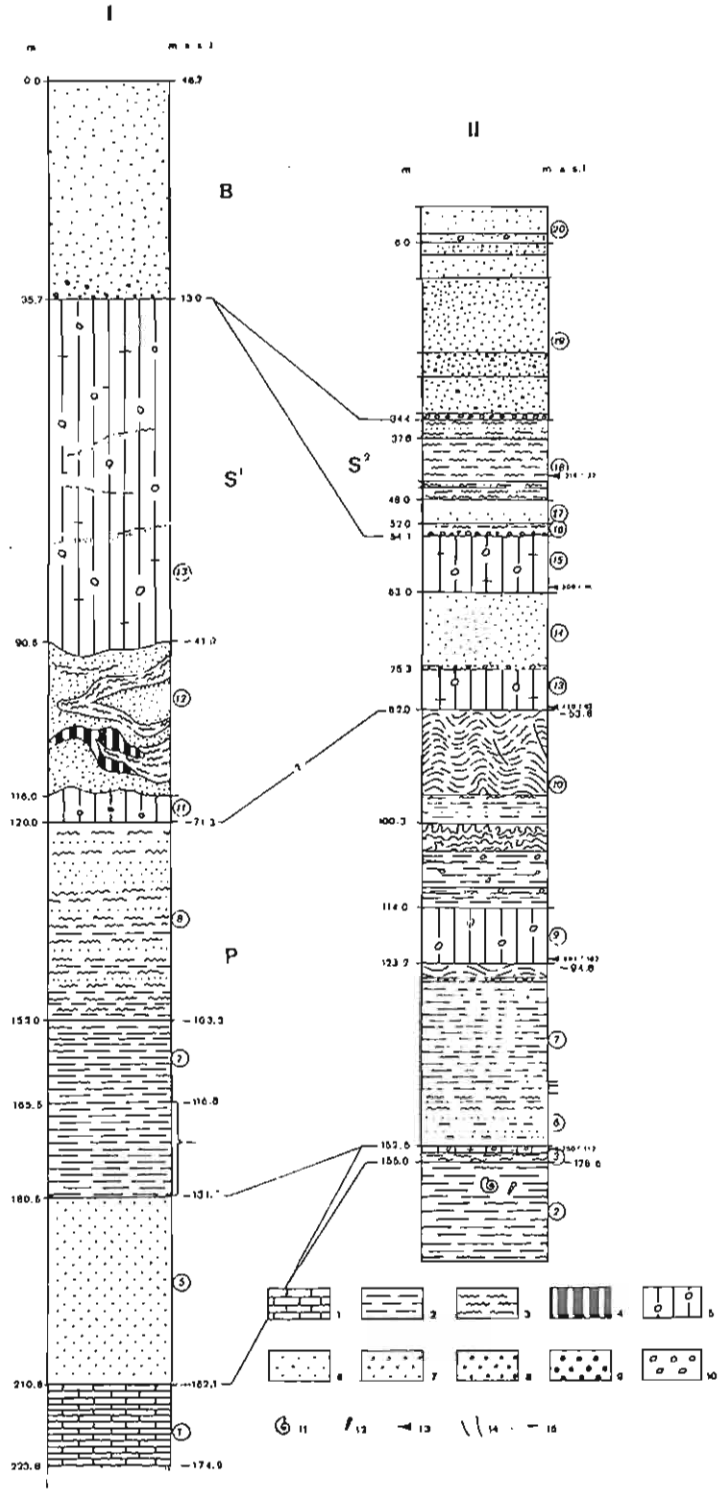
In Germany these traces are described as resulted from arthropods, stepping on the bottom of a Pleistocene ice-dammed basin. They are recorded in a borehole XV/61 (Fig. 1) at the depth of 165.5–180.5 m within silts intercalated with sands. In places the silts become fat, grey, laminated and calcareous clays (M. Hannemann, 1965). According to the results of stratigraphic research in this area the deposits belong to Elstera Glaciation (M. Hannemann, H. Radtke, 1961; M. Hannemann, 1964) thus they are equivalent to ice-dammed lake deposits assigned to South-Polish Glaciation in Western Poland (S. Skompski, 1981, 1982).

In this paper M. Hannemann attached photographs of 8 different marks which probably belong to eight different species (?) of arthropods.

---

[2] Comprehensive papers on the literature concerning the subject have been published by O. Abel (1935), R. Richter (1941), A. Seilacher (1954, 1985), W. Häntzschel (1975), B.C. Ratcliffe, J.A. Fagerstrom (1980), T.M. Bown (1982), D. W. Boyd (1975)

[3] According to the subdivision of the territory of Poland into sections for the purposes of geological mapping in the scale of 1:50 000


I
II
B
S¹
S²
P
m
m a s l
0.0
46.7
35.7
13.0
90.6
41.0
116.0
120.0
71.3
153.0
103.3
165.5
116.8
180.6
131.7
210.8
182.1
223.8
174.9
0.0
44.4
37.6
48.0
52.0
54.1
63.0
75.3
83.0
53.8
100.3
114.0
123.2
94.8
153.0
156.0
178.6
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

In Western Poland trace fossils were found within the area of Rybocice section (borehole Urad 5) at the depth of 124.2; 139.2 and 142.0 m (Fig. 2 and Tab. 1). They are preserved on the surfaces of mud laminae of microscopic thickness (0,01–0,1 mm) which are present among thicker layers of clay and denote their divisional planes.

Table 1

Results of TL datings (J. Butrym, 1984)

Depth in m	Age in thousand of years	Laboratory number
43.2	216±32	Lub.470
62.1	300±45	Lub.471
81.7	420±63	Lub.472
122.6	681±102	Lub.473
152,.7	750±112	Lub.474

Moreover the comparison of trace fossils of Müllrose and Urad to the Mazovian ichnofossils revealed the occurence not only of arthropods but also other animals within Pleistocene ice-dammed lake deposits e.g. molluscs (T. Merta, 1980).

Fig. 2. Geological profiles of Müllrose XV/61 (I) and Urad 5 (II) boreholes

1 — marine marls; 2 — clays; 3 — silts; 4 — brown coals; 5 — tills; 6 — fine-grained sand; 7 — medium-grained sand; 8 — coarse-grained sand; 9 — fine gravel; 10 — pebbles; 11 — molluscs; 12 — foraminifers; 13 — sampling sites for the thermolumineseence (TL) datings (see — Tab. 1); 14 — microfaults (slickensides); 15 — sites of arthropods traces; n u m b e r i n c i r e l e s : Createceous (Upper Turonian): 1 — marls; Oligocene (Rupelian): 2 — marine clays with mollusks and foraminifers; South-Polish Glaciation (P): 3 — silts and clays with brown coals — floes, 4 — till of lower stadial, 5 — fine- and medium-grained sands, 6 — varved silt with mica, 7 — varved clays, 8 — varved clays, silts and fine sands, 9 — clayey till of upper stadial, 10 — varved clays, deformed in places; Middle-Polish Glaciation?: 11 — till, 12 — fine sands, brown coal and carbonaceous silts — Miocene floes; Middle-Polish Glaciation, Odra Stadial (S1): 13, 15 — till, 14 — fine and medium grained sands; Warta Stadial (S2): 16 — varved clays and silts, 17 — fluvioglacial medium and fine grained sands, 18 — varved silts and fine sands; North-Polish Glaciation (B): 19 — fluvioglacial medium and coarse grained sands in places with admixture of gravels, transgressive phase, 20 — fluvial vari-grained sands, decline phase

Profile geologiczne otworów wiertniczych Müllrose XV/61 (I) i Urad 5 (II) 1 – margle morskie; 2 — iły; 3 — mułki; 4 — węgle brunatne; 5 — gliny zwałowe; 6 — piaski drobnoziarniste; 7 — piaski średnioziarniste; 8 — piaski gruboziarniste; 9 — żwirki; 10 — głaziki; 11 — mięczaki; 12 — otwornice; 13 — miejsca pobrania próbek do badań wieku metodą termoluminescencyjną (TL) — tab. 1; 14 — mikrouskoki (zlustrowania); 15 — miejsca wystąpień śladów stawonogów; c y f r y w k ó ł k a c h : kreda (górny turon): 1 — margle; oligocen (rupel): 2 — iły morskie z fauną mięczaków i otwornic; zlodowacenie południowopolskie (P): 3 — mułki i iły z węglem brunatnym (porwak), 4 — glina zwałowa dolnego stadiału, 5 — piaski drobno- i średnioziarniste, 6 — pyły z miką, zastoiskowe, 7 — iły zastoiskowe, 8 — iły, mułki i piaski drobnoziarniste, zastoiskowe, 9 — glina zwałowa ilasta górnego stadiału, 10 — iły zastoiskowe miejscami zaburzone; zlodowacenie środkowopolskie?: 11 — glina zwałowa, 12 — piaski drobnoziarniste, węgiel brunatny i mułki węgliste, kra mioceńska; zlodowacenie środkowopolskie, stadiał odry (S1): 13, 15 — glina zwałowa, 14 — piaski średnio- i drobnoziarniste; stadiał warty (S2): 16 — iły i mułki zastoiskowe, 17 — piaski średnio- i drobnoziarniste, wodnolodowcowe, 18 — mułki i piaski drobnoziarniste, zastoiskowe; zlodowacenie północnopolskie (B): 19 — piaski średnio- i gruboziarniste, miejscami ze żwirkiem, wodnolodowcowe z transgresji, 20 — piaski różnoziarniste rzeczne, ze schyłku zlodowacenia

At Urad four ichnospecies? (morphologic ichnospecies) have been distinguished and described below. They all belong to genus *Irichnus* ichnogen. nov. It is a new discovered biogenic trace of walking (stepping) found in deposits.

Irichnus saltatorius ichnosp. nov.
(Pl. I, Fig. 4)

Holotype. MUZ PIG 1596.II.1 — a fragment of drilling core with traces of arthropod's walking. Retained in the Museum of the Geological Institute of Poland in Warsaw.
Locus typicus. Urad near Słubice. Western Poland, borehole Urad 5, depth 124.2 m.
Stratum typicum. Radzików Formation, South-Polish Glaciation (S. Skompski, 1981).

Description. On the surface of a layer of ice-dammed lake silts there are oval marks of about 2 mm diameter arranged in pairs. The marks are situated 2.5 mm each from other and the distance between pairs ranges 16–17 mm. They resemble twin marks made by jumping sparrow that is reflected by the name of a species. Among distinct pairs of oval traces there are slightly visible intermediate pairs of linear marks illustrated in Fig. 3. Totally three pairs of limbs (?) are marked but only one pair (supposed to be expressed by oval marks) is distinct.

Interpretation. Traces of an arthropod walking on the bottom of an ice-dammed basin.

Irichnus substrictus ichnosp. nov.
(Fig. 3, Pl. I, Fig. 5a)

Locus typicus, stratum typicum and the interpretation – see the above ichnospecies – *Irichnus saltatorius*.

Description. Single narrow traces (comma-shaped) arranged in pairs, situated 4–5 mm each from other and 3–6 mm between pairs (the length of a pace). In the upper part the traces described meet the marks of other type (Fig. 3) which probably reflect the activity of another genus — *Irichnus streketus* ichnosp. nov.

Irichnus streketus ichnosp. nov.
(Fig. 3; Pl. I, Fig. 5b)

Holotype. MUZ PIG 1596.II.2
Locus typicus and stratum typicum — see *Irichnus saltatorius*.

Description. Twin scratches transverse to the direction of movement. Particular scratches are close each to other (1–1.5 mm) and the distance between

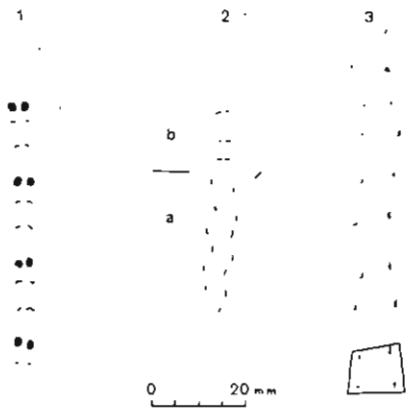


Fig. 3. Biogenic traces on the bedding plane, borehole Urad 5 (see Pl. I)
Ślady biogeniczne na powierzchni oddzielności rdzenia z otworu wiertniczego Urad 5 (por. tabl. I)
1 — *Irichnus saltatorius*; 2a — *I. substrictus*; 2b — *I. streketus*; 3 — *I. uradicus*

pairs (the length of a pace) is 4–6 mm. They are situated in the line of *Irichnus substrictus* marks.

Interpretation. The trace is caused by an arthropod walking on the bottom of an ice-dammed basin. Disappearance of the traces of the *I. streketus* on the spot of the meeting with traces described above as *I. substrictus* (Fig. 3) probably means that the former fell a prey of the latter.

Irichnus uradicus ichnosp. nov.
(Fig. 3; Pl. II, Fig. 6)

Holotype. MUZ PIG 1596.II.3.
Locus typicus and stratum typicum — see *Irichnus saltatorius*.

Description. On the divisional surface there are two rows off eyelet marks. The distance between particular eyelets is 6–10 mm within a row. Each eyelet has an equivalent in a second row and make a pair with it; respective eyelets are situated further or closer each to other alternately.

The longer distance within one pair is 8–9 mm, and the shorter one is 6–7 mm. Each two pairs (4 eyelets) are arranged in a trapeziform pattern (Fig. 3). As regards regularity the marks described are similar to trace fossils recorded in Lauenburg clays at Jeddeloh near Oldenburg (D. Dahm, W. Otto, 1953), in ice-dammed lake clays of Erlenbusch in Sowie Mountains (M. Schwarzbach, 1940) and at Müllrose (M. Hannemann, 1965 — p. 111, Fig. 3). At Urad by some traces there are two V-shaped setae visible.

Interpretation. The marks are probably caused by insects (*Insecta*) but the number of limbs (4) is astonishing. D. Dahm and W. Otto (1953) explained that the missing (the third) pair of limbs had to perform other functions as it happened with some aquatic insect species.

CONCLUSIONS

1. If each of hitherto described trace fossil from the ice-dammed lake deposits is classified as a species, it will become clear that the number of species which inhabited, Pleistocene ice-dammed basin exceeds at least more that ten.

2. Focusing attention and through research of trace fossils in ice-dammed lake deposits may enrich the knowledge of a habitat in Pleistocene ice-dammed basins.

3. Animals' traces which are found in deposits of diversified origin (not only ice-dammed ones) may be useful in Quaternary research for palaeoecologic, palaeoclimatic, and stratigraphic interpretations especially to determine a regular or reversed position of layers (hieroglyphs).

Zakład Kartografii Geologicznej
Państwowego Instytutu Geologicznego
Warszawa, ul. Rakowiecka 4
Reeeived: 27.02.1991

REFERENCES

ABEL O. (1935) — Vorzeitliche Lebensspuren. Fischer-Verlag. Jena.

BOWN T.M. (1982) — Ichnofossils and rhizoliths of the nearshore fluvial Jebel Qatrani Formation (Oligocene), Fayum Province, Egypt.

BOYD D.W. (1975) — False or misleading traces. The study of trace fossils. A synthesis of principles, problems and procedures in ichnology. Ed. R. Frey. Springer Verlag.

BRODNIEWICZ I., SKOMPSKI S. (1977) — Fauna bezkręgowców czwartorzędu. In: Budowa geologiczna Polski. T. 2. Katalog skamieniałości. Cz. 3b. Kenozoik. Czwarorzęd. Inst. Geol. Warszawa.

BUTRYM J. (1984) — Termoluminescencyjne datowaie osadów czwartorzędowych z profili geologiczych: Grzmiąca 4 (ark. Rąpice), Drzeńsk Wlk. 2 i Żytowań 3 (ark. Chlebowo), Urad 5 i Czarne Zdroje 6 (ark. Rybocice). Arch. Państw. Inst. Geol. Warszawa.

DAHM D., OTTO W. (1953) — Über Lebensspuren in Bändertonen Nordwestdeutschlands. Freiberger Forsch.-H., C5, p. 34-40.

HANNEMANN M. (1964) — Quartärbasis und älteres Quartär in Ostbrandenburg. Ihre Bedeutung für die angewandte Geologie. Z. Angew. Geol., 10, p. 370–376, H. 7.

HANNEMANN M. (1965) — Schreitspuren in elsterkaltzeitlichen Bändertonen der Bohrung XV/61 bei Müllrose (Ostbrandenburg). Geologie, 14, p. 110–113, H. 1.

HANNEMANN M., RADTKE H. (1961) — Früglaziale Ausräumungszonen in Südostbrandenburg. Z. Angew. Geol., 7 , p. 69–74, H. 2.

HÄNTZSCHEL W. (1975) — Trace fossils and problematica. In: C. Teichert (ed.). Treatise on Invertebrate Paleontology. Part W. Miscellanea, suppl. 1, p. 177–245.

GIBBARD P.L., STUART A.J. (1974) — Trace fossils from proglacial lake sediments. Boreas 3, p. 67–74, nr 2.

KSIĄŻKIEWICZ M. (1970) — Observations on the ichnofauna of the Polish Carpathians. Trace Fossils (Geol. Jour. Spec. Iss. 3).

LUDWIG A. (1963) —Ein neuer Fährtenfund aus dem Bänderton. Geologie, 12, p. 493–496, H. 4.

MERTA T. (1980) — Arthropod and Mollusk traces in the varved clays in Central Poland. Acta Geol. Pol., 30, p. 165–173, nr 2.

MORAWSKI W. (1986) — Szczegółowa mapa geologiczna Polski w skali 1:50 000, ark. Lębork. Państw. Inst. Geol. Warszawa.

ORŁOWSKI S., RADWAŃSKI A., RONIEWICZ P. (1970) — The trilobite ichnocoenosis in the Cambrian sequence of the Holy Cross Mountains. Trace Fossils (Geol. Jour. Spec. Iss., 3).

RADWAŃSKI A. (1977) — Present-day types of trace in the Neogene sequence; their problems of nomenclature and preservation. Trace Fossils, 2, Geol. Jour. Spec. Iss., ed. T.P. Crimes and J.C. Harper. Liverpool.

RADWAŃSKI A., RONIEWICZ P. (1973) — Rola śladów działalności organizmów w badaniach geologicznych. Postępy Nauk Geol., 5, p. 113–119.

RATCLIFFE B.C., FAGERSTROM J.A. (1980) — Invertebrate lebensspuren of Holocene floodplains; their morphology, origin and paleoecological significance. Jour. Paleont., 54, p. 614–630, nr 3.

RICHTER R. (1941) — Fährten als Zeugnisse des Lebens auf dem Meeresgrunde. Senckenbergiana, 23, p. 218–260, H. 4/6.

RONIEWICZ P., PIEŃKOWSKI G. (1977) — Trace fossils of the Podhale Flysh Basin. Trace Fossils, 2. Geol. Jour. Spec. Iss., ed. T.P. Crimes and J.C. Harper. Liverpool.

SAVAGE N.M. (1971) — A varvite ichnocoenosis from the Dwyke Series of Natal. Lethela, 4, p. 217–233, nr 2.

SCHWARZBACH M. (1938) — Tierfährten aus Eiszeitlichen Bändertonen. Z. Geschiebeforsch., 14, p. 14–152.

SCHWARZBACH M. (1940) — Das diluviale Klima während des Höchststandes einer Vereisung. Z. Deutsch. Geol. Ges., 92, p. 565–582.

SEILACHER A. (1954) — Die geologische Bedeutung fossiler Lebensspuren. Z. Deutsch. Geol. Ges., 105, p. 214–228, H. 2.

SEILACHER A. (1985) — Trilobite palaeobiology and substrate relationships. Transactions of the Royal Soc. of Edinburgh, 76.

SKOMPSKI S. (1977) — Fauna plejstoceńskich osadów jeziornych w Polsce. Kwart. Geol., 21, p. 311–323, nr 2.

SKOMPSKI S. (1981) — Stratygrafia osadów czwartorzędowych Ziemi Lubuskiej. Biul. Inst. Geol., 321, p. 151–163.

SKOMPSKI S. (1982) — Correlation of the Mazovian Interglacial of the Western Poland with the Holstein Interglacial of the Eastern Part of German Democratic Republic. Biul. Inst. Geol., 343, p. 51–58.

SKOMPSKI S. (1986) — Spätglaziale und Holozäne Süsswassermollusken in Pomorze. Acta Univ. Nicol. Copern. , Geografia, 21, p. 23–28.

SKOMPSKI S. (1987*a*) — Eine kartographische Darstellung von biostratigraphischen Problemen des Quartärs. Wiss. Z. Ernst-Moritz-Arndt-Univ. Greifswald, Math.-Nat. Wiss. Reihe, 36, p. 134–140, H. 2–3.

SKOMPSKI S. (1987*b*) — Ostrakodoj en la kvaternaraj sedimentoj de Pollando. Geologio Internacia, 7, p. 71–76.

SKOMPSKI S. (1987*c*) — Szczegółowa mapa geologiczna Polski w skali 1:50 000, ark. Rybocice. Państw. Inst. Geol. Warszawa.

SKOMPSKI S., MAKOWSKA A. (1989) — Mollusca. In: Budowa geologiczna Polski, t. 3. Atlas skamieniałości przewodnich i charakterystycznych, cz. 3b. Kenozoik. Czwartorzęd. Wyd. Geol. Warszawa.

SYWULA T., PIETRZENIUK E. (1989) — Ostracoda. In: Budowa geologiczna Polski, t. 3. Atlas skamieniałości przewodnich i charakterystycznych, cz. 3b. Kenozoik. Czwartorzęd. Wyd. Geol. Warszawa.

SZEROCZYŃSKA K. (1986) — Cladocera jako wskaźnik ekologiczny w późnoczwartorzędowych osadach jeziornych Polski Północnej. Acta Palaeont. Pol., **30**, p. 3–69, nr 1–2.

Sylwester SKOMPSKI

ŚLADY ZWIERZĄT W OSADACH ZASTOISKOWYCH

Streszczenie

Rzadko spotykane w osadach zastoiskowych ślady działalności zwierząt odkryto ostatnio w iłach i mułkach zastoiskowych zlodowacenia południowopolskiego koło Słubic nad Odrą (otwór wiertniczy Urad 5).

Opisano 4 gatunki ichnologiczne (fig.3). Holotypy zabezpieczono w Muzeum Państwowego Instytutu Geologicznego w Warszawie.

1. *Irichnus saltatorius* ichnosp. nov. (tabl. I, fig. 1). Parzyste, owalne ślady około 2,5 mm średnicy występują na powierzchni laminy mułkowej w odległości 16–17 mm od siebie. Między parami owalnych śladów znajdują się dwie pary śladów linijnych bardzo słabo zaznaczonych. Gatunek ten pochodzi z Uradu koło Słubic nad Odrą (*locus typicus*) z formacji radzikowskiej (*stratum typicum* — S. Skompski, 1981). Głębokość występowania w otworze wiertniczym Urad 5 – 124,2 m. Ślady te interpretuje się jako odciski odnóży stawonoga chodzącego po dnie zastoiska

2. *Irichnus substrictus* ichnosp. nov. (tabl. I, fig. 2a). Wąskie, przecinkowate parzyste ślady w odległości 3–6 mm para za parą. Głębokość występowania — 139,2 m. *Locus typicus, striatum typicum* oraz interpretacja jak wyżej.

3. *Irichnus strekeus* ichnosp. nov. (tabl. I, fig. 2b). Ślady chodzenia stawonoga w formie parzystych kreseczek ustawionych obok siebie poprzecznie do kierunku ruchu, w odległości 1–1,5 mm, przy odstępie między parami 4–6 mm. Głębokość występowania — 139,2 mm. *Locus typicus* i *striatus typicum* jak wyżej

4. *Irichnus uradicus* ichnosp. nov. (tabl. II, fig. 1). Dwa rzędy punktowych śladów oddalonych od siebie 6–11 mm. U niektórych punktów widoczne dwie szczecinki ustawione w kształcie litery V. Każde dwie pary punktów tworzą formę zbliżoną do trapezu. Głębokość występowania 142,0 m. *Locus typicus* i *stratum typicum* oraz interpretacja jak przy *Irichnus saltatorius*.

Jak wynika z dotychczasowych badań w osadach zastoiskowych zachowały się ślady działalności wielu gatunków zwierząt, przede wszystkim bezkręgowców. Ślady zwierząt w osadach (nie tylko zastoiskowych) mogą być w przyszłości przydatne do różnych celów geologicznych i paleontologicznych, np. w biostratygrafii a także służyć przy interpretacji tektonicznej (glacitektonicznej) warstw.

PLATE I

Fig. 4. *Irichnus saltatorius* ichnosp. nov. MUZ PIG 1596.II.1.
Borehole (otwór) Urad 5, 124,2 m
Fig. 5. *Irichnus substrictus* ichnosp. nov. (a) *Irichnus strekeus* ichnosp. nov. (b) MUZ PIG 1596.II.2.
Borehole (otwór) Urad 5, 139,2 m

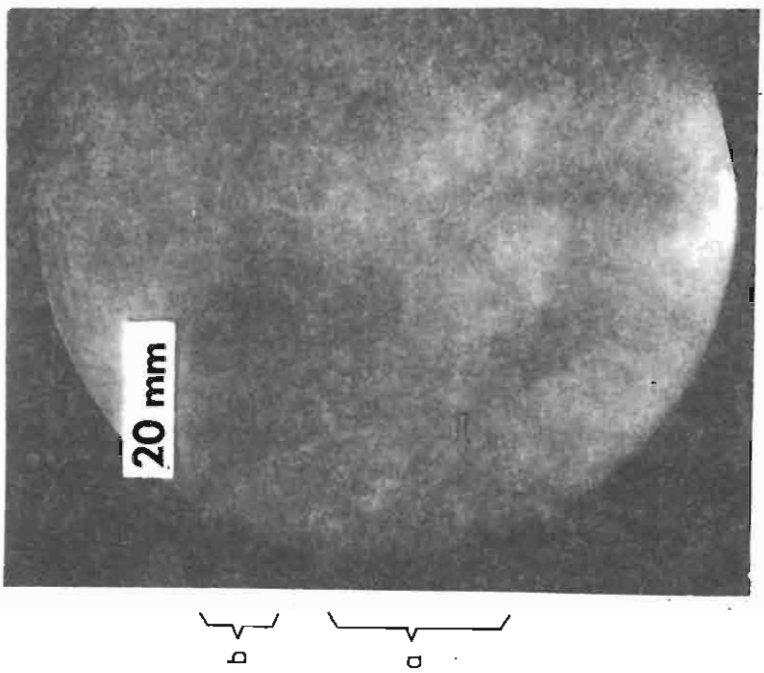


Fig. 5

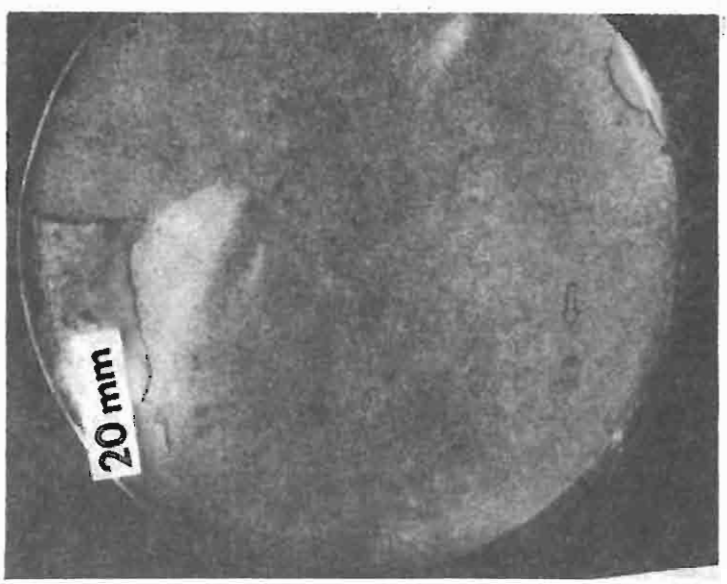


Fig. 4

PLATE II

Fig. 6. *Irichnus uradicus* ichnosp. nov. MUZ PIG 1596.II.3.
Borehole (otwór) Urad 5, 142,0 m

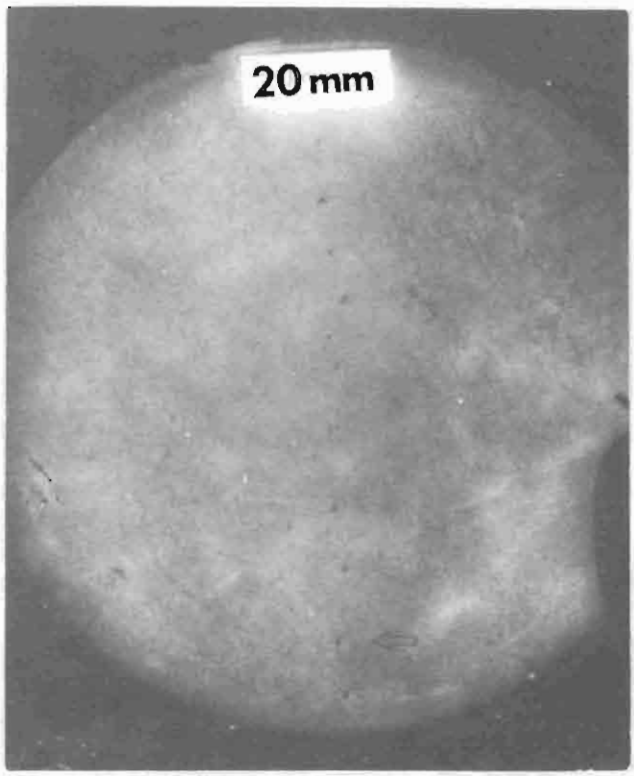


Fig. 6