

## New finds of vertebrate footprints from the Lower Permian of Wambierzyce, Poland

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New specimens of vertebrate footprints are reported from the Early Permian deposits in Poland. Footprints discovered in a well-known Early Permian Rotliegend tracksite at Wambierzyce (old German name Albendorf) represent ichnites of *Hyloidichnus arnhardti* Haubold, 1973.

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### INTRODUCTION

In autumn of 2001, new vertebrate footprints were discovered in the Rotliegend deposits at Wambierzyce near Kłodzko (formerly Albendorf) tracksite exposure, Intrasudetic Basin (Fig. 1). The new specimens were found and conserved by an amateur geologist, Mr. Artur Gołasa.

Vertebrate footprints from Wambierzyce have been reported for over 140 years. They were originally discovered by H. R. Goepfert in 1861 (and reported to the Schlesische Gesellschaft für Vaterländische Kultur) and reported also by Goepfert in 1864/65 (see Czyżewska, 1955). The vertebrate footprints from Wambierzyce were later described by Pabst (1908) and more recently by Czyżewska (1955).

The vertebrate track assemblage identified from Wambierzyce in these studies includes: *Dromopus lacertoides* (Geinitz, 1861); *Amphisauropus imminutus* Haubold, 1970; *Ichniotherium cottae* (Pohlig, 1885), and *Dimetropus leisnerianus* (Geinitz, 1863). The holotype of *D. leisnerianus* from Wambierzyce is housed in the Staatliches Museum für Mineralogie, Dresden, Germany (Haubold, 1971).

The material came from Ratno quarry, located near the road from Wambierzyce to Ratno (see also Czyżewska, 1955). The exposure reveals laminated claystones, shale and calcareous

sandstone. These deposits represent the upper part of the Słupiec Formation, known also as the “Walchia Shale” (see Nemeč, 1981; Mastalerz *et al.*, 1995). According to Mastalerz *et al.* (1995), this unit formed during prolonged sedimentation in a lacustrine environment. Material described by Pabst (1908), Czyżewska (1955) and the newly discovered tracks were probably formed on the lake shore.

A track assemblage similar to that of Wambierzyce was also identified in the lower part of the Słupiec Formation (“Building Sandstone” member), consisting of sedimentary rocks overlain conformably by a few tens of metres of basaltic rocks exposed at Tłumaczów (Mastalerz *et al.*, 1995). The sedimentary rocks exposed in that quarry consist of reddish-brown fine clastics and sandstones. The deposits at Tłumaczów accumulated on a flat, mud-sand plain to the shore of a shallow lake (Mastalerz *et al.*, 1995). Vertebrate footprints from Tłumaczów are now being studied in detail.

The aim of this short paper is to describe new material of footprints from Wambierzyce, because it contains the first finds of the ichnogenus *Hyloidichnus* from this locality.

The locality needs further investigation, as it may yield more interesting Permian vertebrate footprints, such as the rare, poorly known lacertoid and small amphibian footprints occasionally found at this stratigraphic level.

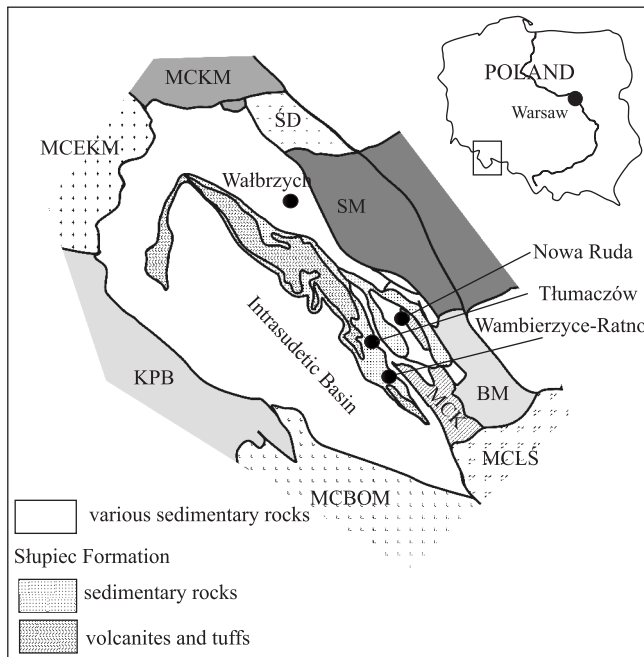


Fig. 1. Early Permian sites (Wambierzyce and Tłumaczów) with vertebrate footprints in the Intrasudetic Basin, SW Poland (modified from Nemeč, 1981)

MCKM — metasedimentary complex of the Kaczawa Mts.; MCEKM — metamorphic complex of the Eastern Karkonosze Mts.; KPB — Karkonosze Piedmont Basin; MCBOM — metamorphic complex of Bystrzyca/Orlica Mts.; MCLŚ — metamorphic complex of Łądek/Śnieżnik; BM — Bardo Mts.; MCK — metamorphic complex of Kłodzko; SM — Sowie Góry Mts.; ŚD — Świebodzice Depression

The slab containing the specimens is housed in the collection of the Holy Cross Branch of the Polish Geological Institute in Kielce (Muz. PIG OS).

## ICHNOSYSTEMATIC DESCRIPTION

Ichnogenus: *Hyloidichnus* Gilmore 1927

*Hyloidichnus arnhardti* Haubold 1973

(Fig. 2A–E)

**Material.** — Muz. PIG OS-220/141, slab with track-bearing surface, natural moulds (see Fig. 2); AG 7B (natural cast of the same surface, specimen housed in the private collection of A. Gołasa) with at least two well preserved trackways.

**Description.** — Trackway. Manual imprints are situated anteriorly to the pedal prints. Pedal axes are close to the

midline, being slightly inclined at about  $+13^\circ$ . The average inclination of manual axes to the midline is more distinct, attaining  $+21^\circ$  up to  $+28^\circ$ . The length of stride varies from 72 mm to 82 mm. In the best preserved trackway (Fig. 2), pedal and manual pace angulation equal  $86\text{--}91^\circ$  and  $97\text{--}100^\circ$ , respectively. The pedal width of paces is 40–44 mm. That value for manual imprints attains only 33 mm. Oblique pace length ranges in all measurements from 86 mm up to 100 mm. Marks of the tail dragging are not clearly visible.

The length and width of pedal digit group I–IV is 12 and 16 mm. In the another, more fragmentary pedal imprint similar in size, the entire length and width of pedal imprints are 19 and 17 mm, while the digit group is 17 by 16 mm, respectively. The length of pedal digits I–IV increases from I to IV attaining 6, 8, 9 and 12 mm respectively. Digit V is not very long, attaining possibly 8–10 mm. Divarications of digits II–IV, I–IV and I–V are  $43^\circ$ ,  $54^\circ$  and  $95^\circ$  on average.

In shallow imprints only digits I–IV are usually visible, or even only their blunt tips. Some deeper imprints show also the sole, not distinctly divided from the heel area of the foot. On some specimens small, sharp and distinct claws are present.

Manual imprints are relatively wide, smaller than pedal ones. Manual digits I–IV are less differentiated, 6, 8, 9, 10 mm long, from I to IV respectively, straight or slightly bent inward. The whole manus imprint is 15 mm long and 17 mm wide. The digit group I–IV is 14 mm long by 14 mm wide, indistinctly separated from the palm. Digit V, 8 mm long, is relatively short, rarely visible, diverging from the I at about  $93^\circ$ . Divarications of digits I–IV and II–IV attain about  $65^\circ$  and  $43^\circ$ , respectively. Both pes and manus imprints show the greatest, although not a remarkable, load on the medial margin of the foot.

## DISCUSSION

Specimens from Wambierzyce show no differences from specimens described as *Hyloidichnus arnhardti* by Haubold (1973) and Fichter (1983), being also similar (somewhat smaller) in size. Small differences in the inclination of pedal imprints to the midline may result from track irregularity.

*Hyloidichnus arnhardti* was found, in great number, but with no other accompanying ichnospecies. There are also extramorphologic features present, interpreted as the results of claw or digit tips dragging on the sediment surface (Fig. 2C, D, E). They are up to 25 mm long, narrow and often bent. Similar structures have been found in another representative of this ichnogenus, *Hyloidichnus major* described by Gand (1987, figs. 41, 42). *Hyloidichnus arnhardti* is known from the Lower and Upper Autunian of Europe (Haubold, 1973; Haubold, 1984; Gand and Haubold, 1988).

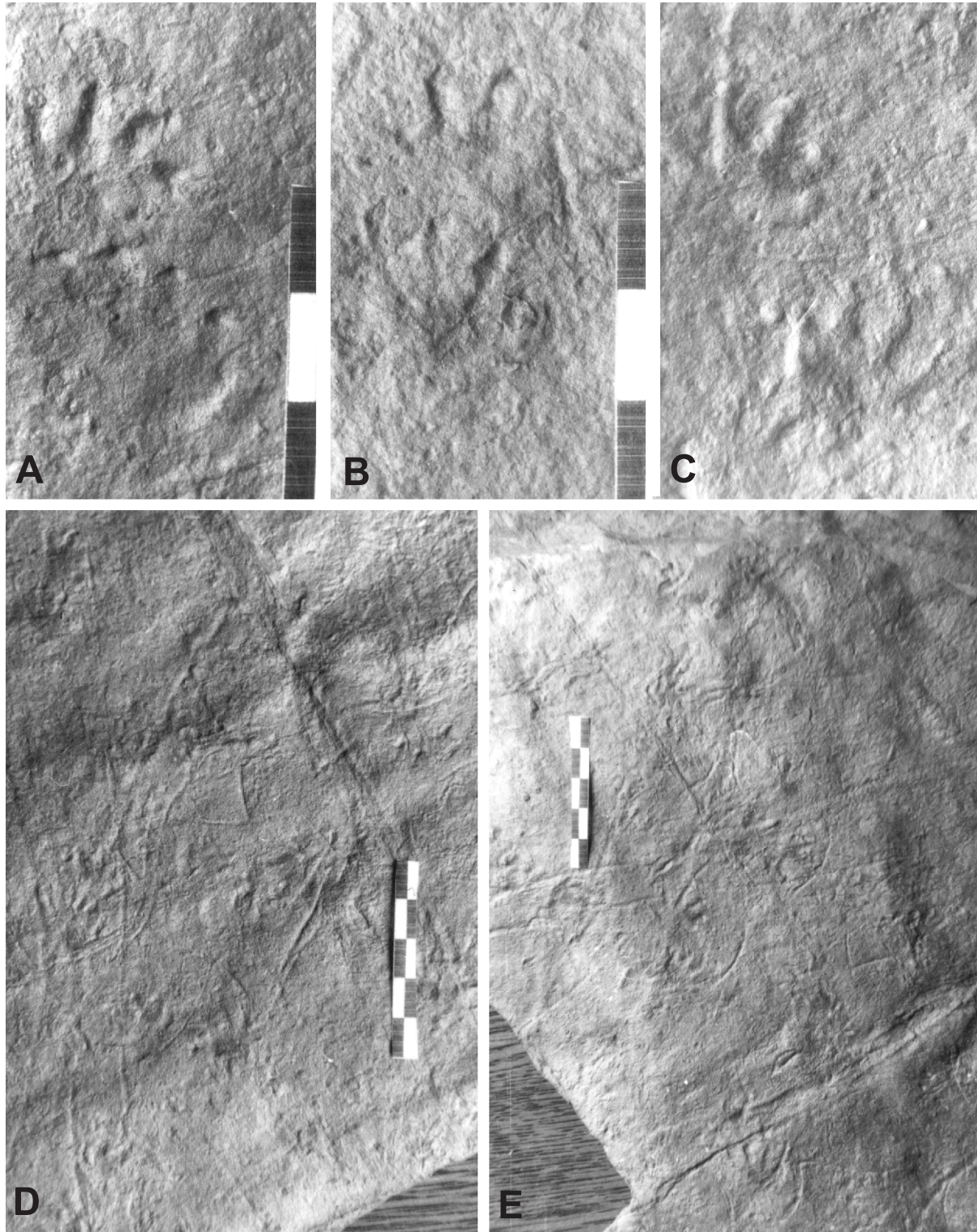


Fig. 2. Muz. PIG OS-220/141, *Hyloidichnus arnhardi* Haubold 1973 from Wambierzyce, Rotliegend, Słupiec Formation, "Walchia Shale" member

A, B and C— pes-manus sets (enlarged from Fig. 1D and E); D and E — surface with numerous footprints (pes-manus sets and tail marks) and invertebrate trails; scale in centimetres



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