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Insects and crustaceans from the latest Early–early Middle Triassic of Poland

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ABSTRACT

Two stratigraphical horizons in the Pałęgi clay-pit, a new Triassic paleontological site within Buntsandstein deposits (latest Olenekian–early Anisian in age) in the Holy Cross Mountains (Poland), have yielded arthropod faunas comprising ca. 400 fossil specimens assigned to two subphyla: Crustacea (class Branchiopoda and Maxillopoda) and Hexapoda (class Insecta). The Pałęgi arthropod assemblage is similar to that described from the Middle Triassic of France and Germany but is dominated by remains of conchostracans and cockroaches. This new fauna expands our knowledge of the latest Early–early Middle Triassic diversity of insects and freshwater arthropods in the Germanic Basin. The newly discovered fauna represents one of the oldest Mesozoic records of insects described from the Buntsandstein facies of Europe, and provides important information to better appreciate the process of ecosystem recovery after the Permian–Triassic extinction.

1. Introduction

Deposits with Early or Middle Triassic fossil insects and other terrestrial (freshwater) arthropods (e.g., limulids, triopsids, cycloids, conchostracans) are known from a selected number of exposures in Germany, France, Spain, European Russia (and Siberia, Urals), Kyrgyzstan, Mongolia and Australia (see Trümpy, 1957; Kozur and Seidel, 1983a,b; Hauschke and Szurlies, 1998, 2006; Lozovsky et al., 2001; Durante and Luvsantseden, 2002; Jell, 2004; Gall and Grauvogel-Stamm, 2005; Shcherbakov, 2008a,b; Béthoux et al., 2009; Bashkuev et al., 2011). Arthropod fossils generally are very rare in the Early–Middle Triassic continental deposits, except for numerous occurrences of conchostracans and ostracods (see Kozur and Weems, 2010). The succession of insect and small freshwater crustacean assemblages in the Early–Middle Triassic is typically well recognized based on material collected from sites in European Russia, the Urals, Siberia, China, Kyrgyzstan and Mongolia, but very rich and exceptionally preserved arthropod fossils were described from the early Middle Triassic of France and Germany (Gall and Grauvogel-Stamm, 2005; Bashkuev et al., 2011). The most interesting fossils are insects, which are good indicators of environmental changes and fluctuations in biodiversity. The most complete entomofaunal successions of the Late Permian and Early Triassic (across the Permian-Triassic boundary) have been found in European Russia (Shcherbakov, 2008a,b).

In this study, we present a preliminary description of arthropod remains (conchostracans, cycloid crustacean and insects) collected from the Pałęgi clay-pit (Fig. 1), a new late Early–early Middle Triassic paleontological locality, which is situated in the easternmost part of the Germanic Basin. Triassic deposits from this site contain also fossils of other invertebrates (gastropods and bivalves), plants (both micro- and macrofossils), numerous invertebrate trace fossils and tetrapod bones and traces (Kuleta et al., 2006; Skawina and Niedźwiedzki, 2012).

Lower–Middle Triassic continental deposits are widely distributed in several basins of western and central Europe (Aigner and Bachmann, 1992), but they are often represented by the classic redbed sequences that are poorly fossiliferous. Arthropod remains (others than conchostracans) are very rare in the Late Permian–Middle Triassic succession of the Buntsandstein facies of Europe. They have been found only in a few sites (France, Germany, and Spain) and are usually not well preserved with the exception of material from the Middle Triassic 'Grès à Voltzia' Formation (Ansorge, 1994; Gall and Grauvogel-Stamm, 2005; Aristov and Zessin, 2009; Bashkuev et al., 2011).

The first conchostracans and other arthropod remains were discovered at Pałęgi in 2003 by one of the authors of this paper (GN) and were mentioned by Kuleta et al. (2006). The occurrence of fossil insects in Pałęgi was first mentioned by Krzemińska et al. (2007), at a meeting of the Section of Fossil Insects Polish Entomological Society in Gdańsk in 2007 (see Krzemińska et al., 2007). Their poor state of preservation did not allow the undisputed classification of the specimens to any insect group. The authors gathered thirty specimens and suggested that the specimens included representatives of Coleoptera,

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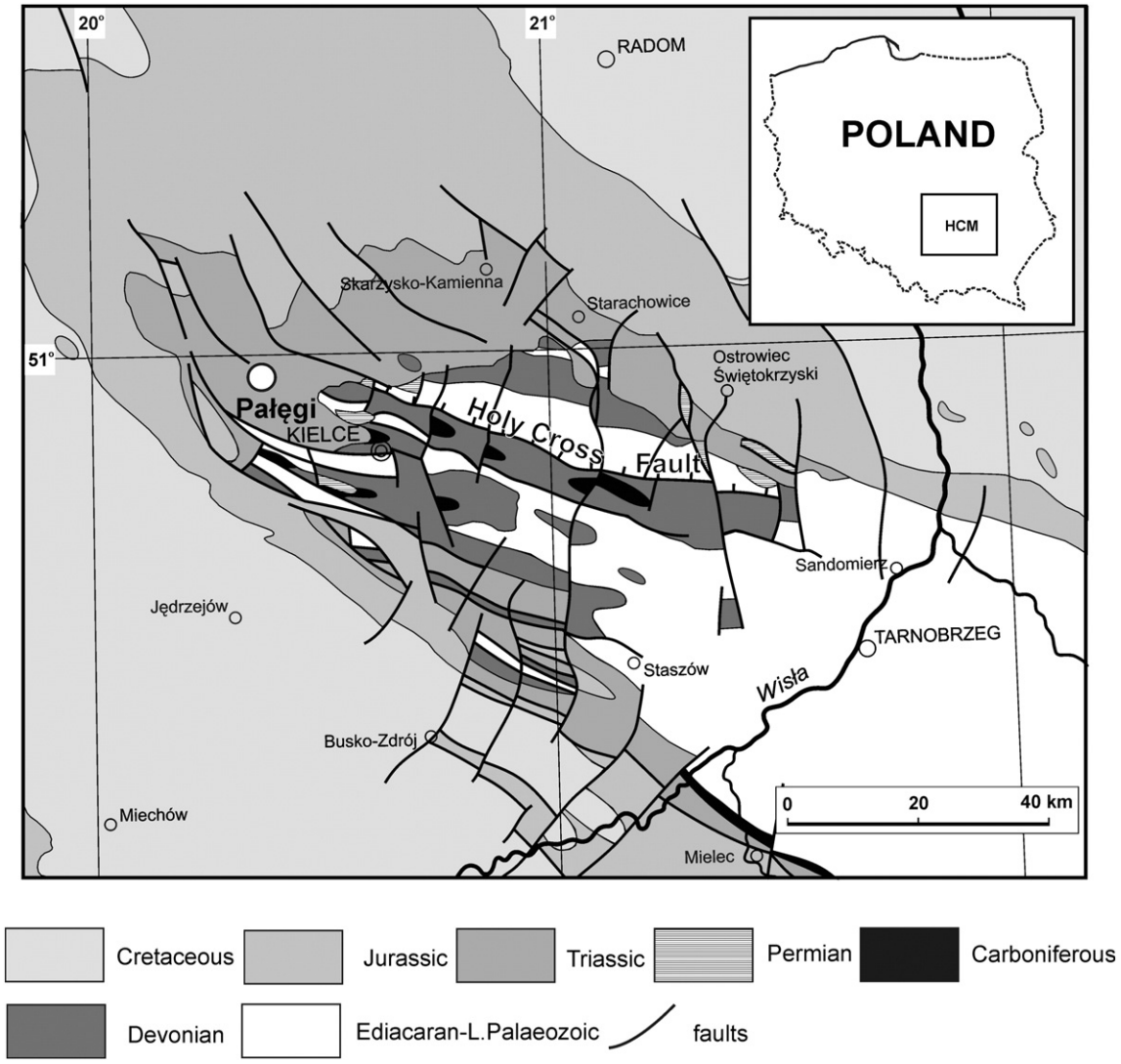

Fig. 1. Location of Pałęgi clay-pit in the Triassic deposits of the northern slope of the Holy Cross Mountains (HCM), Poland (modified from Klein and Niedźwiedzki, 2012).

homopterous and heteropterous Hemiptera. Our exploration of insects in Pałęgi in 2010–2012 led to an assembly of many important new specimens, several of which are well preserved. In total, 20 specimens were found, including 19 preserved in the form of isolated wings and one as a body (without wings). Initially they were classified into three groups: Blattodea, Grylloblattida and Mecoptera. The most abundant specimens are Blattodea.

2. Geological, stratigraphical and palynological setting

The Pałęgi site is located within a pit of vitrified clay situated near Grzymałków about 7 km to the west from the town of Mniów (see Kuleta et al., 2006; Ptaszyński and Niedźwiedzki, 2006). The exposed sedimentary section in Pałęgi is comprised of the upper part of the Samsonów Formation, which is described as late Olenekian in age (Kuleta and Nawrocki, 2000; Kuleta et al., 2006). In the upper part of the Pałęgi exposure younger Middle Triassic deposits are also exposed, which was recently recognized on the basis of palynomorphs and conchostracans (see below).

The exposed section of the claystone, siltstone, mudstone and sandstone deposits (about 20 m in thickness) exhibits a lithofacies succession characteristic for meandering rivers (Fig. 2A,B) (Kuleta et al., 2006). Numerous arthropod remains were collected principally from two horizons in the middle part of the exposed profile (Fig. 2B). The lower part of the stratigraphic section is represented by floodplain deposits and is developed as siltstone and mudstone (with rare plant roots casts and paleosoil horizons), and contain local intercalations (up to 20 cm) of fine- to medium-grained red and pink sandstone and breccia-like deposits (Fig. 3A,C,D). These sand deposits represent crevasse-splays, levees and in part small delta fans.

In the middle part of the profile channel-like and crevasse-splay deposits occur with a few bodies of massive pink, yellow or grey sandstone (Figs. 3B, 4A). These sandstone deposits contain horizons with mudclasts (Fig. 4B) and include numerous, poorly preserved plant remains (Fig. 4D; mainly casts of stalks or trunks), casts of bones and numerous invertebrate and vertebrate ichnofossils (tracks and swimming traces of tetrapods and fishes), which are preserved on the lower surfaces of sandstone layers (Fig. 4C). Invertebrate trace fossils are very diverse and represented by the ichnogenera *Cruziana*, *Rusophycus*, *Kouphichnium*, *Lockeia*, *Planolites* and *Palaeophycus* (Kuleta et al., 2006).

The upper part of the profile is represented by red or reddish-brown siltstone and mudstone deposits with intercalations (up to 20 cm) of fine- to medium-grained red sandstone and layers of greenish to yellowish mudstone with small carbonate nodules and rare bone fragments (Fig. 3E, F). In the upper part of the exposure, on the eastern wall of the clay-pit, there may exist a contact of the Samsonów Formation with reddish-brown, dark and porous sandstone and dark reddish-brown siltstone and mudstone representing what is most likely the