NATURE JOURNAL VOL. 48: 101–113 (2015)
OPOLE SCIENTIFIC SOCIETY

NOTES ON TURONIAN DECAPOD CRUSTACEAN BODY FOSSILS AND ICHNOTAXA FROM ODRA NOWA QUARRY, OPOLE (SOUTHWEST POLAND)

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ABSTRACT: Similar to thoracican cirripedes, malacostracan crustacean body fossils from lower–upper Turonian strata exposed at the Odra Nowa quarry (Opole, southwest Poland) appear to be rare, in spite of the fact that ichnofossil taxa such as *Thalassinoides* (*Thalassinoides* Ichnofabric, *Cruziana* Ichnofacies) are relatively common. Here we record a largely dissociated individual of a lobster, *Enoploclytia leachii* (Mantell, 1822), from the Lower Marls unit (middle–upper Turonian, *Inoceramus lamarcki* and *Inoceramus costellatus* zones) and an example of *Thalassinoides* cf. *suevicus* (Rieth, 1932), in which a piece of carbonised driftwood is preserved, from the Lower Clayey Marls unit (middle Turonian, *Inoceramus apicalis* Zone).

KEY WORDS: Cretaceous, Astacidea, trace fossils, driftwood, central Europe.

Introduction

Although largely outdated, the paper by Leonhard (1898) still is the most accessible overview of Turonian macrofossil taxa from the Opole area (Fig. 1). In recent years, this was complemented by studies of the entire fauna (Tarkowski 1991; Mazurek 2008), as well as of selected groups such as inoceramid bivalves (Walaszczyk 1988, 1992; Tarkowski 1996; Kędzierski 2008), irregular echinoids (Olszewska-Nejbert 2000), shark teeth (Niedźwiedzki and Kalina 2003; Niedźwiedzki and Godlewska 2005), calcareous nannofossils (Kędzierski 2008), brachiopods (Sklenář and Simon 2009), cirripedes (Jagt and Mazurek 2011) and ichnofossil assemblages (Kędzierski and Uchman 2001, 2015; Jurkowska and Uchman 2013; Bieńkowski-Wasiluk et al. 2015; Hunt et al. 2015).

Fieldwork in June 2009 and in April-July 2015 at the Odra Nowa quarry has resulted in new faunules from the Lower Clayey Marls and Lower Marls units (middle Turonian; Fig. 2). From these we here describe carbonised driftwood preserved inside a crustacean burrow (*Thalassinoides* cf. *suevicus*) and a largely dissociated exuvia of the lobster *Enoploclytia leachii*. The occurrence of plant remains within *Thalassinoides* from the Opole area has been noted previously; records of malacostracans appear to be very rare, and except for Leonhard's (1898) mention of *Enoploclytia leachii*, we are not aware of any other.

Previous work

As noted above, we are familiar only with Leonhard's (1898, p. 63, as *Enoploclytia Leachi* Reuss [*sic!*]) record of a near-complete cephalothorax (right side exposed) and a poorly preserved, partial left major cheliped, both from the 'Oppelner Turon (Scaphitenzone)'. In current terminology, this would mean the Marly Limestones unit of middle–late Turonian age (upper *Inoceramus costellatus* and lower *Mytiloides incertus* zones; see Fig. 2). The example of this astacidean lobster described here is slightly older.

Ichnofabric and ichnofacies of the lower–upper Turonian in the Opole area have been treated in much more detail in recent years (Kędzierski and Uchman 2001, 2015).
The rare occurrence of plant debris in *Thalassinoides* (Lower Marls unit) was noted by Kędzierski and Uchman (2001, p. 87, pl. 2, fig. 2). Their illustration suggests this carbonised debris to represent remains of conifer twigs, rather than driftwood.

Systematic descriptions

We follow Feldmann et al. (2015) for higher-order classification.

Family Erymidae Van Straelen, 1924
Genus *Enoploclytia* M'Coy, 1849
Type species – *Astacus leachii* Mantell, 1822, by monotypy.

Enoploclytia leachii (Mantell, 1822)
(Fig. 3A-C)

Material – A single, disarticulated individual (exuvia) from the Lower Marls unit (middle–upper Turonian, *Inoceramus lamarcki* and *Inoceramus costellatus* zones), consisting of two ?carapace fragments, right and left chelipeds, two pleonal somites and the right uropod (endopod, exopod), contained in various slabs of flaky marls (NHMM 2015 017, leg. R. Kijok).
Description – ?Carapace remains are fragmentary, and do not show any grooves, although ornament is comparable to that of appendages. Right and left chelipeds are broadly comparable, slender, much longer than wide (although both incompletely preserved)

and rounded in cross section with wide, rounded margins; typical is the marked elongation of moveable and fixed fingers which is preserved in the left cheliped. Cutting edges have rather stout teeth, but are smooth otherwise; the outer surface has comparatively large thorns, occasionally arranged in rows, with smaller granules in between. Pleonal somites are of different length, but of comparable width; one of them preserves a pleuron. The telson is not preserved, but right and (partial) left uropods are, the former consisting of endopod and slightly larger exopod; diaeresis well developed.

Discussion – Comparison with previous records of *E. leachii* (see Figs 4, 6), inclusive of the junior synonyms *E. heterodon* Schlüter, 1862 and *E. granulicauda* Schlüter, 1879 (Fig. 5), shows beyond doubt that the present specimen is conspecific. Another species, *E. dixoni* (Bell, *in* Dixon 1850) (see Figs 7A,B), from the Albian–Cenomanian of southern England, has coarser ornament of carapace and appendages, and chelipeds are less slender (Woods 1928, 1929).

The stratigraphic range of *E. leachii* is lower Turonian to upper Campanian, with records across northwest and central Europe (Reuss 1854; Fritsch and Kafka 1887; Mertin 1941; Förster 1966; Jagt and Fraaije 2002).

Ichnogenus *Thalassinoides* Ehrenberg, 1944
Type ichnospecies – *Thalassinoides callianassae* Ehrenberg, 1944, by original designation.

Thalassinoides cf. *suevicus* (Rieth, 1932)
(Fig. 8A-B)

Material – A slab (greatest width 320 mm) from the prominent marl bed in the upper part of the Lower Clayey Marls unit (middle Turonian, *Inoceramus apicalis* Zone; see Fig. 2), the bedding plane of which preserves the burrow.

Description – From a large, unwalled 'central' area, horizontal tunnels continue to all sides, only one of which is branched in a Y-shaped pattern; tunnel width is between 18 and 24 mm; burrow fill is of a darker grey than the surrounding matrix. The piece of wood is carbonised, 40 mm in greatest length, and surrounded on all sides by a reddish brown 'crust', possibly representing limonite staining after pyrite disintegration.

Discussion – Kędzierski and Uchman (2001, p. 87, pl. 2, fig. 2) were the first to record the rare occurrence of plant detritus inside *Thalassinoides*-type burrows from the Lower Marls unit at Odra Nowa quarry. They recorded comparable tunnel widths and the Y-shaped bifurcation in the horizontal plane, typical of *Th. suevicus*. From their illustration it appears that this carbonised debris might well represent the remains of conifer twigs, rather than driftwood. Comparable finds, albeit not part of burrow fills, have been made from the Lower Clayey Marls unit at Odra Nowa quarry during our own recent fieldwork.

Thalassinoides is typical of the *Thalassinoides* ichnofabric, which is produced by various taxa of decapod crustaceans, and of the *Cruziana* ichnofacies (Pemberton et al. 2004; MacEachern et al. 2007; Buatois and Mangano 2011; Knaust et al. 2012). Kędzierski and Uchman (2001) recorded the *Thalassinoides* ichnofabric mainly from the middle part of the section exposed at the Odra Nowa quarry, while the *Chondrites* ichnofabric is typical of the lower part (Lower Clayey Marls), although cross-cutting *Thalassinoides* has also been recorded from the latter part of the section (Kędzierski and Uchman 2001, pl. 4, fig. 3).

Both extinct and extant 'thalassinideans', now assigned to the infraorders Axiidea and Gebiidea (see Dworschak et al. 2012), are known to produce burrows of the *Thalassinoides* type. Recent

studies have shown most members of these infraorders to be obligate burrowers, with most of them suspension feeding, while some feed on floating seagrass and brown algae which they catch and drag into their burrows. Burrows also serve as traps for organic matter.

In view of the size of the piece of carbonised wood described here, it is highly unlikely that the crustacean that constructed the burrow and tunnels (Fig. 8A), actively manipulated it. Rather it would seem to be a chance occurrence where the wood was washed into the (?vacated) burrow system via the shaft at the sediment/water interface. The example recorded by Kędzierski and Uchman (2001, pl. 2, fig. 2) is more difficult to interpret. The mass of plant debris, consisting of bits and pieces of varying sizes, might either constitute food items manipulated by the crustacean, or illustrate conifer foliage that was swept into the burrow and disintegrated there.

Acknowledgements

For granting access to their quarry grounds, we thank Rafał Adamarczuk; for producing photographs of specimens we are grateful to Tomasz Ciesielczuk (Opole, Poland) and John W. Stroucken (Heerlen, the Netherlands), and to Dr René H.B. Fraaije (Oertijdmuseum De Groene Poort, Boxtel, the Netherlands) and Barry W.M. van Bakel (Naturalis Biodiversity Center, Leiden, the Netherlands, and Oertijdmuseum De Groene Poort, Boxtel, the Netherlands) for insightful reviews of an earlier typescript. This is Contribution no. 6 of the working group ‘Cretaceous stratigraphy and faunas’ of Opole and Sosnowiec universities.

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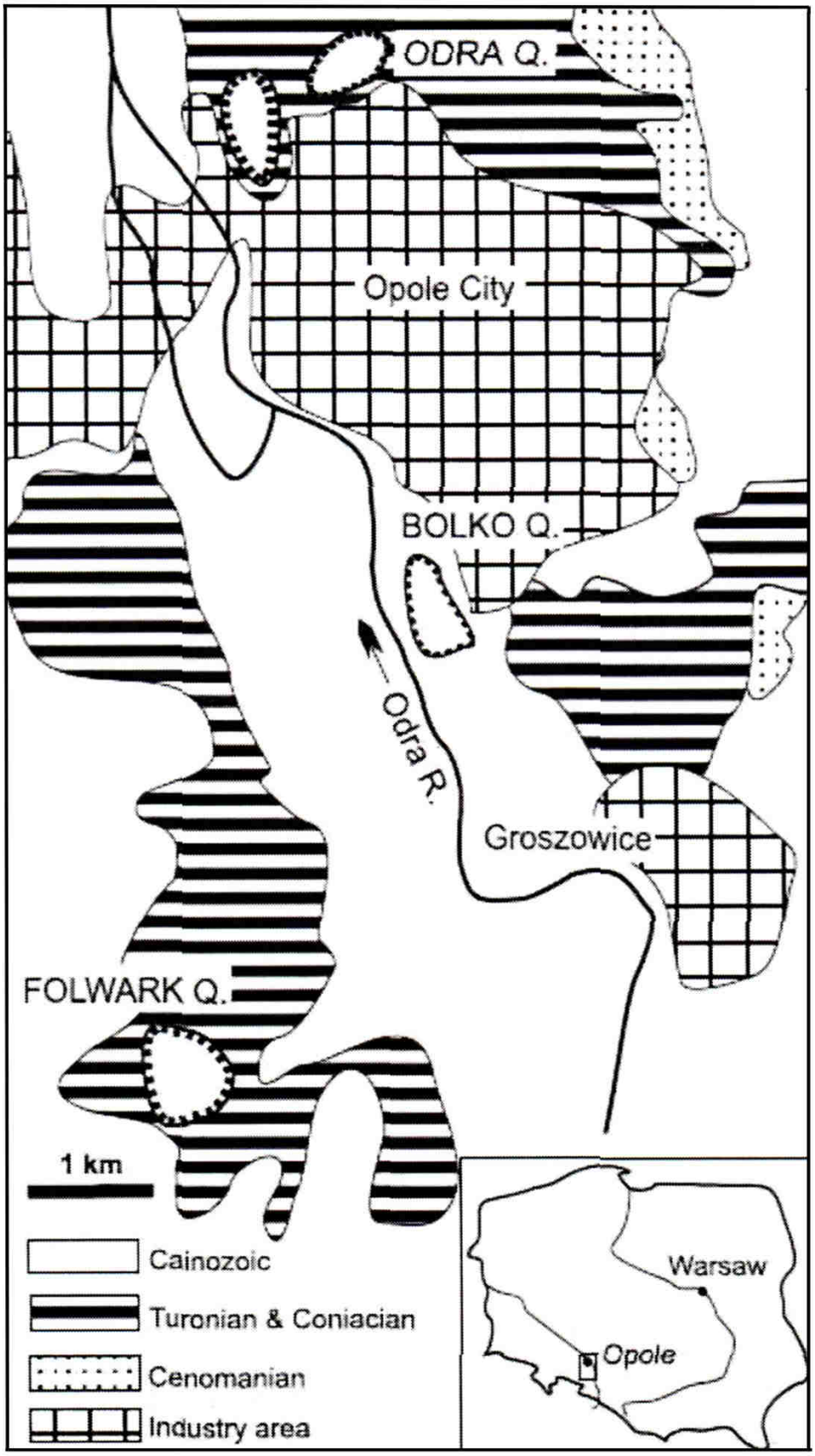


Fig. 1. Map of the Opole area (southwest Poland; after Jagt-Yazykova and Jagt 2015, fig. 1), showing the Odra (both disused and currently exploited [Odra Nowa]), Bolko (disused/flooded) and Folwark quarries (from Mazurek 2008).

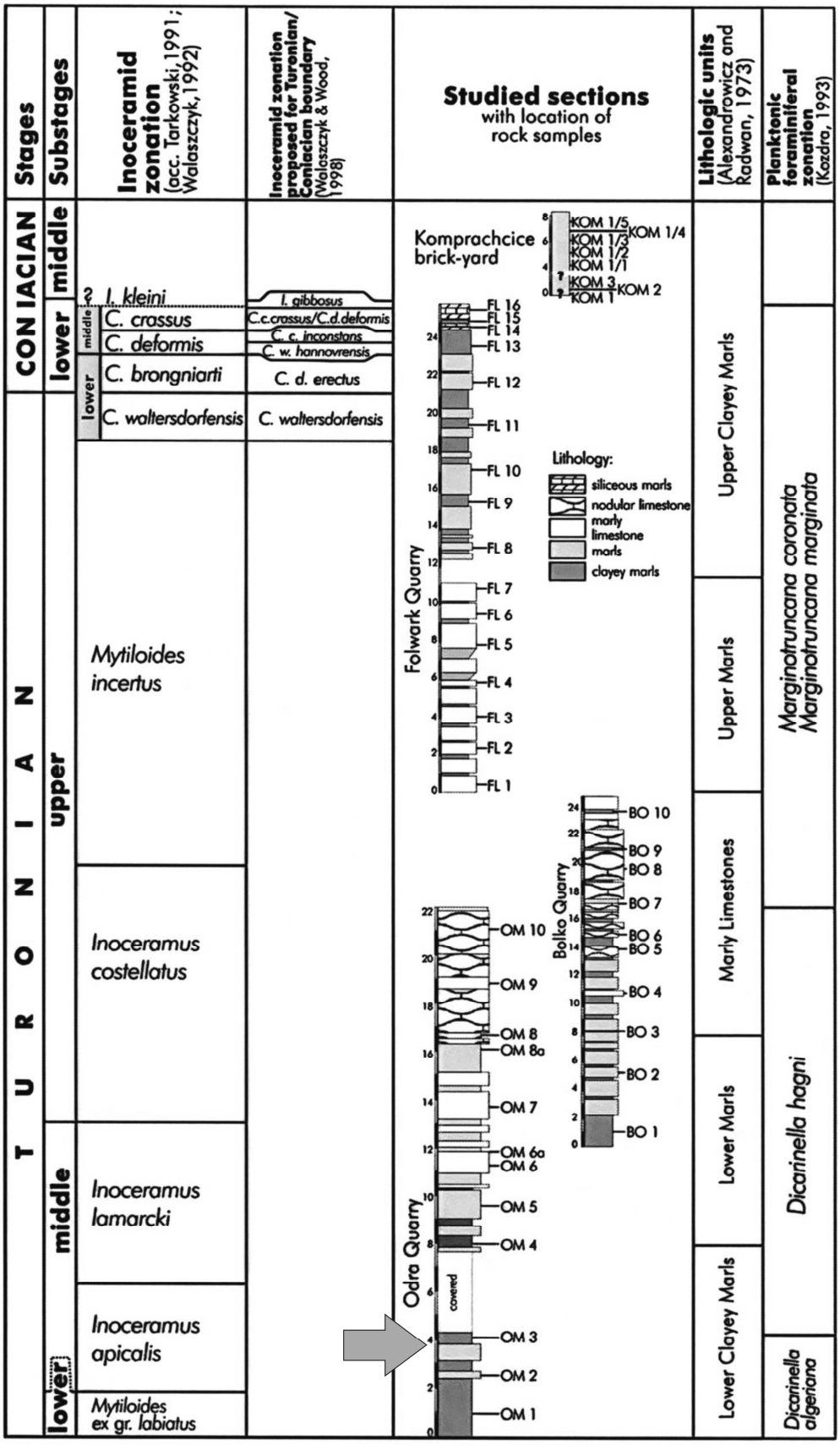


Fig. 2. Inoceramid biozones, lithostratigraphy and planktonic foraminiferal biostratigraphy of Turonian–Coniacian strata in the Opole area (from Kędzierski 2008), with indication (arrow) of provenance of *Thalassinoides* as here described (see Fig. 8A-B).

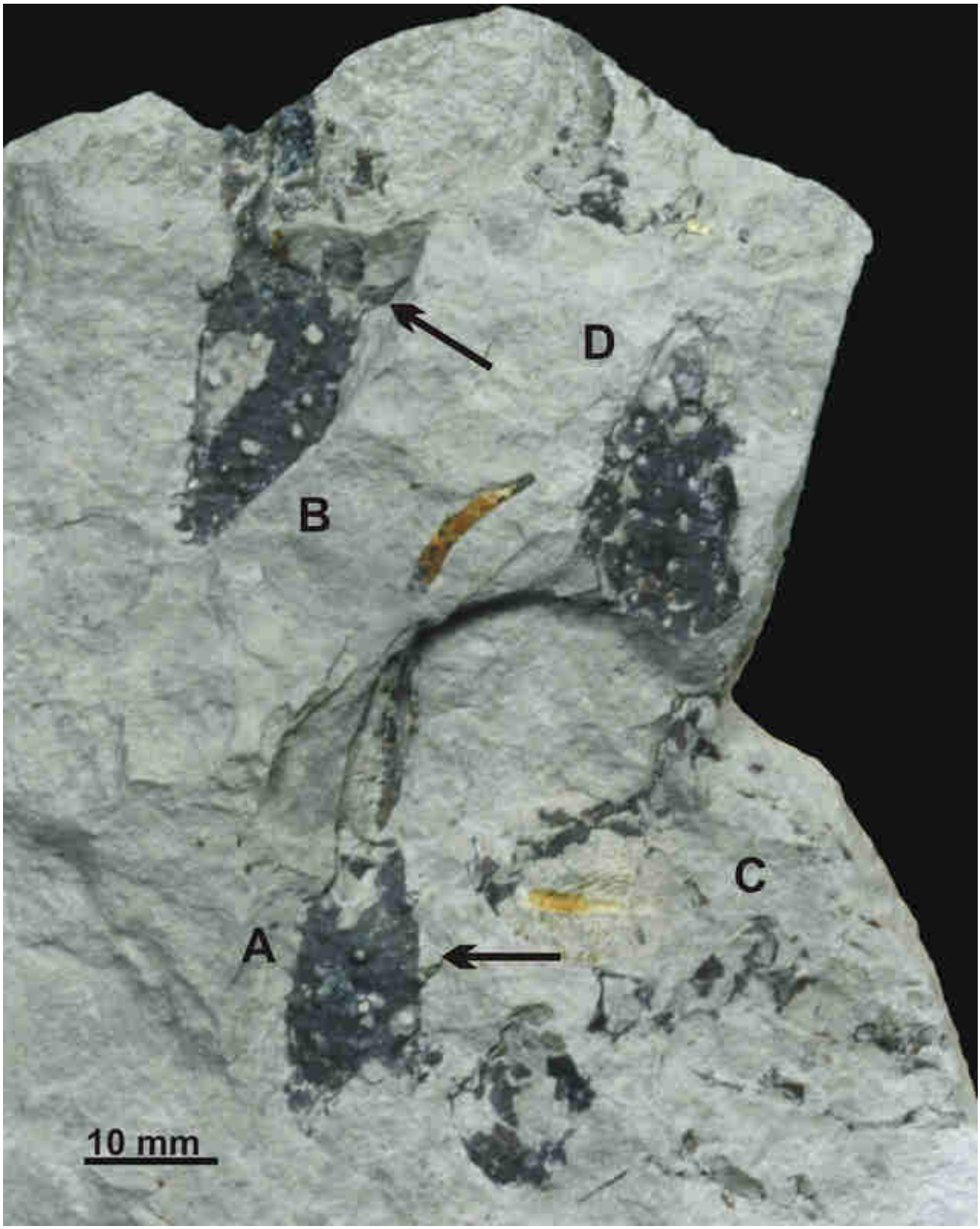


Fig. 3A. *Enoploclytia leachii* (Mantell, 1822), Odra Nowa quarry (collected June 2009; Natuurhistorisch Museum Maastricht, NHMM 2015 017, leg. R. Kijok), Lower Marls unit (middle-upper Turonian, *Inoceramus lamarcki* and *Inoceramus costellatus* zones); A–B – left and right chelipeds, respectively; note the large marginal spines (arrows); C – uropod (exopod); D – fragment of ?carapace (photograph: J.W. Stroucken).

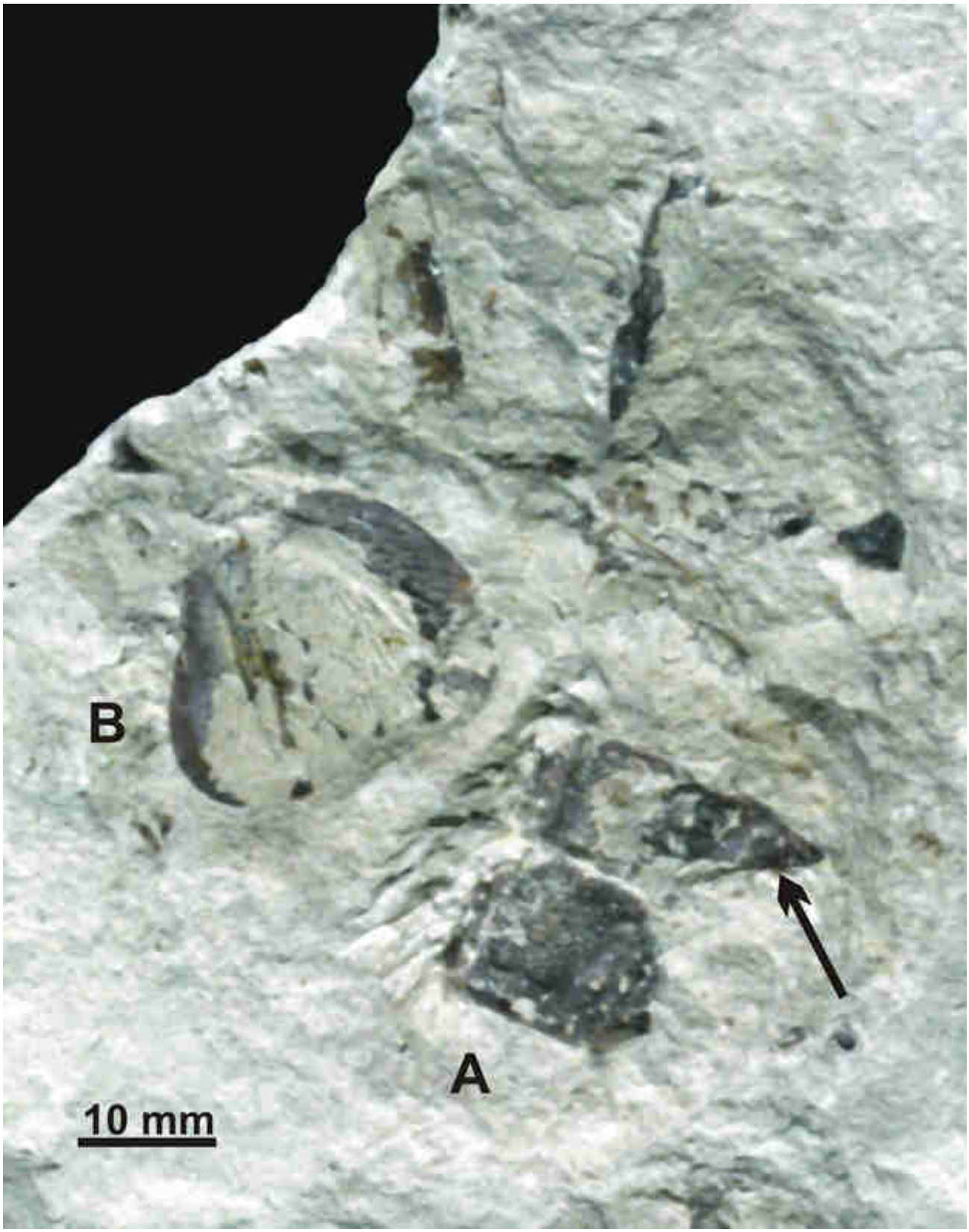
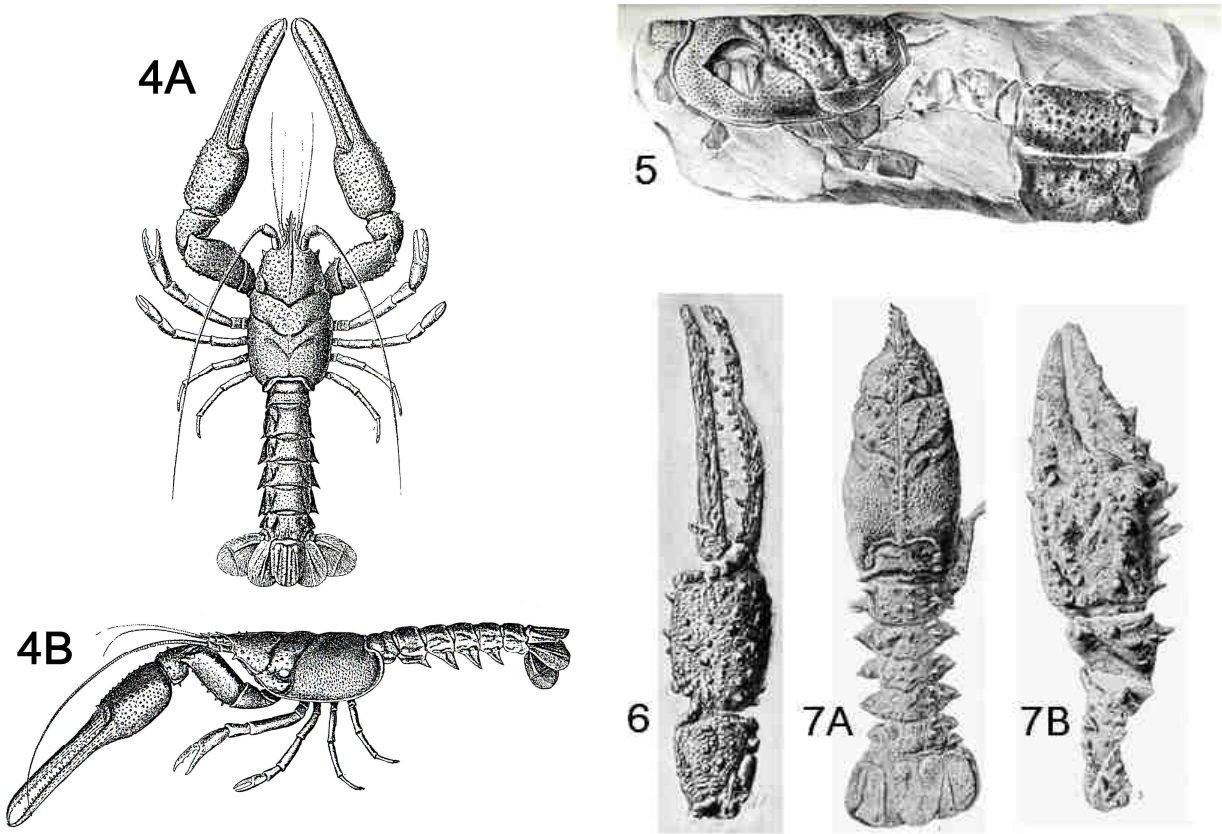


Fig. 3B. *Enoploclytia leachii* (Mantell, 1822), Odra Nowa quarry (collected June 2009; Natuurhistorisch Museum Maastricht, NHMM 2015 017, leg. R. Kijok), Lower Marls unit (middle-upper Turonian, *Inoceramus lamarcki* and *Inoceramus costellatus* zones); A – pleonal somites; B – uropod (endopod, exopod) (photograph: J.W. Stroucken).

Fig. 3C. *Enoploclytia leachii* (Mantell, 1822), Odra Nowa quarry (collected June 2009; Natuurhistorisch Museum Maastricht, NHMM 2015 017, leg. R. Kijok), Lower Marls unit (middle-upper Turonian, *Inoceramus lamarcki* and *Inoceramus costellatus* zones); counterpart of Fig. 3B; uropod (endopod, exopod – white arrow) (photograph: J.W. Stroucken).



Figs. 4–7. 4 – *Enoploclytia leachii* (Mantell, 1822), reconstruction of entire animal, in dorsal (A) and lateral (B) views, respectively (scan of Fritsch and Kafka 1887, figs 48 and 49, respectively); 5 – *Enoploclytia granulicauda* Schlüter, 1879, the holotype in lateral view (scan of Schlüter 1879, pl. 14, fig. 1). Most subsequent authors (e.g., Mertin 1941; Förster 1966) treated *E. granulicauda* as a junior synonym of *E. leachii;* 6 – *Enoploclytia leachii* (Mantell, 1822), right cheliped (scan of Woods 1929, pl. 25, fig. 1, for comparison with Fig. 3A); 7– *Enoploclytia dixoni* (Bell, *in* Dixon, 1850); A – the holotype in dorsal view (scan of Woods 1928, pl. 24, fig. 1); B – left cheliped (scan of Woods 1928, pl. 24, fig. 3).

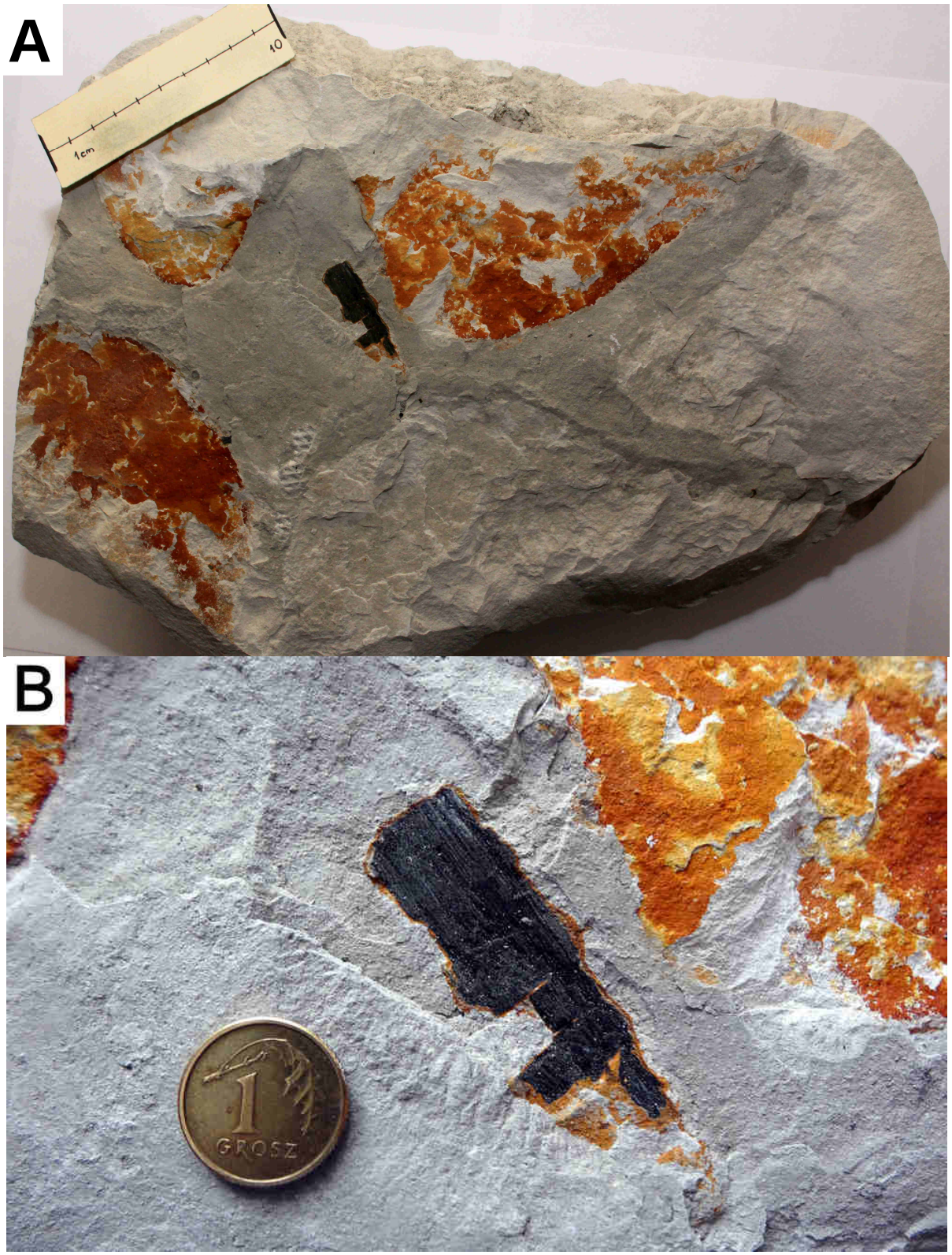


Fig. 8A-B. *Thalassinoides* cf. *suevicus* (Rieth, 1932) (photograph: Tomasz Ciesielczuk) preserving carbonised driftwood; Odra Nowa quarry (southwest corner; collected 10 July 2015), Lower Clayey Marls unit (middle Turonian; *Inoceramus apicalis* Zone). A – Overall view of the slab; B – detail of driftwood. Collections of Opole University, Department of Biosystematics; the original slab is 320 mm in greatest width.