

Three new species of the genus *Tanidromites* (Decapoda: Brachyura: Tanidromitidae) from the Late Jurassic (Oxfordian) of Poland

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ABSTRACT

Representatives of *Tanidromites* are very common brachyurans in Oxfordian localities of southern Poland. There were four species, known before from the literature, recorded from these localities and one new. Herein three other new species are described: *T. longinosa*, *T. schweitzerae*, and *T. wysokaensis*. These species can be distinguished by repetitive characters of the anterior part of the carapace. Flattened augenrest was a feature characteristic for this genus before *T. alexandrae* Starzyk, 2015 was described. *Tanidromites schweitzerae* n. sp., described herein, is the second species of the genus with an elevated orbital margin. This species differs from others in having only the suborbital margin elevated. These new characters widen the pattern of the genus and make it more various, and might be related with the environmental changes. A key to all 14 species of *Tanidromites* is provided.

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INTRODUCTION

Jurassic family Tanidromitidae Schweitzer and Feldmann, 2008 consists of two genera; *Tanidromites* Schweitzer and Feldmann, 2008 and *Gabriella* Collins et al., 2006. As Schweitzer and Feldmann wrote in 2008, the genus *Tanidromites* differs from other representatives of the Prosopidae sensu lato in having a highly vaulted carapace, distinct groove pattern, and a shallow augenrest. This diagnosis was based on four species: *T. insignis* (von Meyer, 1860) (localities in Germany, Poland, Slovakia), *T.*

etalloni (Collins in Collins and Wierzbowski, 1985) (Poland), *T. sculpta* (Quenstedt, 1857) (Germany, Poland) and *T. richardsoni* (Woodward, 1907) (Great Britain, Germany). Subsequently further species were described: *T. lithuanicus* Schweigert and Koppka, 2011 (Lithuania), *T. maerteni* Fraaije et al., 2013 (France), *T. montreuilense* Crônier and Boursicot, 2009 (France), *T. scheffnerae* Schweigert and Koppka, 2011 (Germany), *T. raboeufi* Robin et al., 2015 (France) and one *T. pustulosa* (von Meyer, 1840) was transferred into this group by Schweitzer and Feldmann (2010). The recently

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palaeo-electronica.org/content/2016/1660-new-species-of-tanidromites

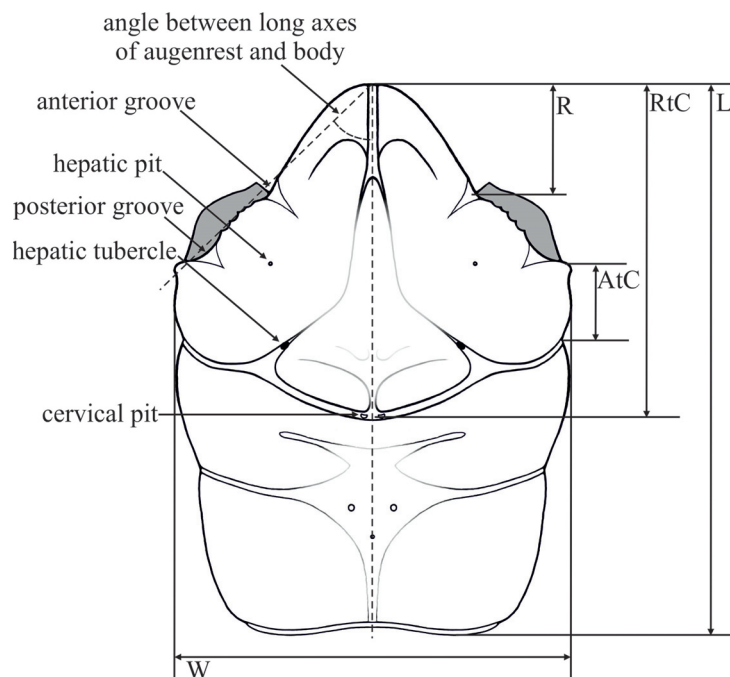


FIGURE 1. Analyzed measurements and a groundplan of the morphological structures in the species of *Tanidromites* on the example of *T. alexandrae* (after Starzyk, 2015a, figure 1). Further explanation in text (ag – anterior groove, hp – hepatic pit, ht – hepatic tubercle, cp – cervical pit). Abbreviations for the measurements are in the Material and Methods.

described *Tanidromites alexandrae* Starzyk (Starzyk, 2015a) diverges from the above diagnosis in having a concave augenrest. This character is present also in one of the three species described herein.

Recently also some additional structures of the carapace were described (anterior grooves, hepatic pits, hepatic tubercles – Starzyk, 2013; pseudorostral spines – Robin et al., 2015; scars on the mesogastric region – Schweitzer and Feldmann, 2009; Schweigert and Koppka, 2011); double scars on the mesogastric region – Starzyk, 2013), which supplement the diagnosis of the genus. Topology of these structures is illustrated in Starzyk (2013, figure 2) and Starzyk (2015b, figure 1).

Descriptions of new species of the genus *Tanidromites* are based on the specimens from the collection of Jurassic decapods housed in the Museum of the Institute of Systematics and Evolution of Animals (ISEA), Polish Academy of Sciences in Kraków, Poland (ISEA PAS, I-F/MP). The collection contains about 7,000 specimens of brachyurans (Starzyk et al., 2011, 2012; Starzyk, 2013, 2015a, 2015b) and anomurans (Fraaije et al., 2012a, 2012b, 2012c; Krzemińska et al., 2015) collected from several Oxfordian localities in the Polish Jura Chain.

There were four species previously recorded from these localities by me (*T. insignis*, *T. etalloni*, *T. sculpta*, and *T. scheffnerae* – Starzyk, 2013) and one new species described (*T. alexandrae* – Starzyk, 2015a).

MATERIAL AND METHODS

Specimens of the three new species studied herein come from the collection of the Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków, Poland (ISEZ PAN, I-F/MP). In total, there are about 75 specimens of the species described herein determined so far. For this study the 25 best-preserved specimens were selected.

Measurements helpful for diagnostic purposes were taken from the dorsal view of the carapace. Analyzed measurements (Figure 1, Table 1) are the same as in Starzyk, 2015a except R – the length from the tip of the rostrum to the anterior groove; RtC – length from the tip of the rostrum to the cervical groove; AtC – length from the end of the outer augenrest angle (outer orbital spine if present) to the cervical groove; L – maximum length of the carapace; W – maximum width of the carapace.

The material described herein originates from five localities in the southern Polish Uplands, north-

TABLE 1. Measurements (mm) of 14 specimens of *Tanidromites longinosa* n. sp. and 7 specimens of *Tanidromites wysokaensis* n. sp. L – maximum length of the carapace; W – maximum width of the carapace; RtC – length from the tip of the rostrum to the cervical groove; AtC – length from the end of the outer augenrest angle to the cervical groove; R – length from the tip of the rostrum to the anterior groove.

Specimen	L	W	RtC	AtC	R
<i>Tanidromites longinosa</i> n. sp.					
I-F/MP/474/1497/08	-	-	-	0.94	-
I-F/MP/530/1497/08	3.39	2.11	2.04	0.49	0.83
I-F/MP/642/1502/08	2.36	1.61	1.45	0.32	0.60
I-F/MP/1788/1517/08 paratype	3.57	2.36	2.17	0.46	0.76
I-F/MP/1849/1517/08	2.91	1.86	1.77	0.39	0.73
I-F/MP/1908/1517/08	-	-	-	0.72	-
I-F/MP/2053/1517/08	-	3.28	-	0.63	-
I-F/MP/2054/1517/08	6.02	3.74	3.39	0.71	1.59
I-F/MP/2725/1530/08 paratype	-	-	-	0.52	-
I-F/MP/6235/1588/11	-	8.45	-	1.91	-
I-F/MP/6238/1588/11	-	5.12	-	1.01	-
I-F/MP/6239/1588/11 paratype	8.28	5.58	4.60	1.16	1.51
I-F/MP/6242/1588/11	-	6.42	-	-	-
I-F/MP/6307/1599/12 holotype	4.46	2.94	2.34	0.58	0.88
<i>Tanidromites wysokaensis</i> n. sp.					
I-F/MP/1078/1508/08	-	5.95	5.52	2.03	1.48
I-F/MP/1896/1517/08	-	-	4.13	1.39	1.23
I-F/MP/4507/1534/08	-	-	-	2.25	-
I-F/MP/4962/1543/09	-	7.18	6.18	2.15	1.82
I-F/MP/6240/1588/11 holotype	20.34	12.95	10.88	4.43	3.08
I-F/MP/6260/1588/11 paratype	-	7.37	-	2.74	-
I-F/MP/6263/1588/11 paratype	-	14.01	-	4.64	-
<i>Tanidromites schweitzerae</i> n. sp.					
I-F/MP/4515/1534/08 holotype	-	13.92	12.79	4.26	3.49
I-F/MP/4562/1534/08	5.73	4.36	3.10	1.37	0.66
I-F/MP/6249/1588/11 paratype	-	-	14.38	4.65	4.06

west of Kraków (Poland), namely Bzów and Ogródzieniec (50°27'52"N 19°30'43"E), Kroczyce (50°33'59"N 19°34'11"E), Niegowonice (50°24'10"N 19°24'35"E), and Wysoka (50°25'51"N 19°21'35"E).

The localities and their stratigraphy were characterized in Fraaije et al. (2012a), where a map is

provided (Fraaije et al., 2012a, figure 1). Specimens of the species studied herein and other material described before were collected by a family of amateur collectors: Iwona, Robert, and Karolina Borek.

SYSTEMATIC PALAEONTOLOGY

Order DECAPODA Latreille, 1802
 Infraorder BRACHYURA Linnaeus, 1758
 Section DROMIACEA de Haan, 1833
 Superfamily HOMOLODROMIOIDEA Alcock, 1900
 Family TANIDROMITIDAE Schweitzer and
 Feldmann, 2008
 Genus *TANIDROMITES* Schweitzer and
 Feldmann, 2008

1835 *Prosopon* von Meyer, p. 329 (pars).

1824 *Pithonoton* von Meyer, p. 71 (pars).

1861 *Coelopus* Étallon, p. 148 (pars).

Diagnosis (from Schweitzer and Feldmann, 2008, emended). Carapace longer than wide; width of hepatic region is 0.60-0.75 of length, moderately to strongly vaulted transversely and longitudinally. Lateral margins parallel or converging slightly posteriorly; lateral flanks very strongly developed. Regions are distinct, usually smooth; epigastric region inflated. Protogastric and hepatic regions not differentiated. Rostrum is downturned, triangle shaped, with blunt end or *with pseudorostral spines*, with raised borders, divided by an axial groove. *Augenrest is various, from flat to concave with differentiated shape of margins.* Weak, short lateral ridge extending posteriorly from the augenrest. *Angle between long axes of the augenrest and the body is 35-65°.* Cervical and branchio-cardiac grooves are deep (emendations in italics).

Type species. *Prosopon insigne* von Meyer, 1860, by original designation.

Other species included. *T. alexandrae* Starzyk, 2015; *T. etalloni* (Collins in Collins and Wierzbowski, 1985), as *Coelopus*; *T. lithuanicus* Schweigert and Koppka, 2011; *T. maerteni* Fraaije et al., 2013; *T. montreuilense* Crônier and Boursicot, 2009; *T. pustulosa* (von Meyer, 1840), as *Pithonoton*; *T. raboeufi* Robin et al., 2015; *T. richardsoni* (Woodward, 1907), as *Prosopon*; *T. scheffnerae* Schweigert and Koppka, 2011; *T. sculpta* (Quenstedt, 1857), as *Prosopon*; *T. longinosa* n. sp., *T. wysokaensis* n. sp., *T. schweitzerae* n. sp.

Age. The genus is known from the lower upper Bajocian to Tithonian (Fraaije et al., 2013).

Key to species of the genus *Tanidromites*. All the species known before and those described herein are included in the key. The nine species redescribed or described by me (*T. alexandrae*, *T. etalloni*, *T. insignis*, *T. lithuanicus*, *T. sculpta*, *T. scheffnerae*, *T. longinosa* n. sp., *T. schweitzerae* n. sp., *T. wysokaensis* n. sp.) are presented in Figure 2. Other species characters are known from the lit-

erature (*T. maerteni* – Fraaije et al., 2013, *T. montreuilense* – Crônier and Boursicot, 2009, *T. pustulosa* – Schweitzer and Feldmann, 2010, *T. raboeufi* - Robin et al., 2015, *T. richardsoni* – Schweitzer and Feldmann, 2008; Schweigert and Koppka, 2011).

- 1a. Outer orbital spine and anterior groove present2
- 1b. Outer orbital spine and anterior groove absent8
- 2a. Hepatic tubercles absent [hepatic pits distinct; augenrest short, rounded; regions of carapace strongly vaulted] *T. lithuanicus*
- 2b. Hepatic tubercles present3
- 3a. Hepatic pits absent [carapace slightly narrowing posteriorly; broad rostrum] *T. richardsoni*
- 3b. Hepatic pits present4
- 4a. Augenrest flat, without elevated upper and suborbital margins5
- 4b. Augenrest protected by upper and suborbital margins [hepatic pits and tubercles weakly developed] *T. alexandrae*
- 5a. Lateral borders of carapace parallel or narrowing posteriorly6
- 5b. Lateral borders of carapace narrowing anteriorly *T. montreuilense*
- 6a. Spine on the lateral border, in front of branchio-cardiac groove present [cervical groove arched backward on both sides of cervical pits] *T. maerteni*
- 6b. Spine on the lateral border in front of branchio-cardiac groove absent7
- 7a. Distance from rostrum to end of augenrest is the smallest among all species of the genus, outer orbital spines small, blunt; carapace slightly narrowing posteriorly] *T. sculpta*
- 7b. Distance from rostrum to end of augenrest is long; augenrest short, sharply ended *T. insignis*
- 8a. Hepatic tubercles absent9
- 8b. Hepatic tubercles present [outer orbital spines and hepatic pits absent; augenrest very short, rounded; rostrum sharply ended] *T. scheffnerae*
- 9a. Augenrest longer than wide, protected by suborbital margin [hepatic pits absent, rostrum short, rounded] *T. schweitzerae* n. sp.
- 9b. Augenrest as long as wide or wider than long, flattened10
- 10a. Rostrum short ($R/RtC \leq 0.3$)11
- 10b. Rostrum long ($R/RtC > 0.3$) [regions of carapace flattened; posterior part of augenrest weakly distinguished; four short spines on upper orbital margin; hepatic pits absent] *T. longinosa* n. sp.
- 11a. Rostrum rounded12

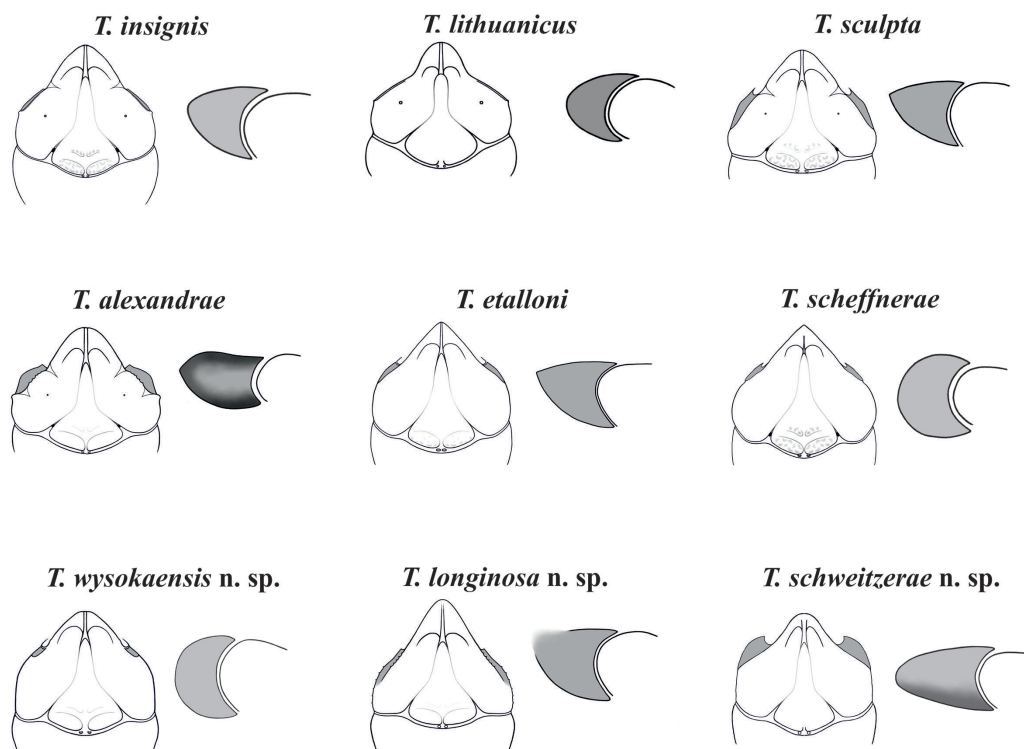


FIGURE 2. Anterior part of the carapace and the augenrest in *Tanidromites* spp. The area of augenrest is shaded.

- 11b. Rostrum sharply ended [augenrest narrowing posteriorly, sharply ended; triangular mesogastric region; anterior groove, outer orbital spine, hepatic pits absent]. *T. etalloni*
- 11c. Rostrum with pseudorostral nodes [carapace convex; hepatic pits absent; augenrest rounded]. *T. raboeufi*
- 12a. Carapace long and strongly vaulted [hepatic pits absent]. *T. wysokaensis* n. sp.
- 12b. Carapace short [hepatic pits absent]. *T. pustulosa*

It is noteworthy that the abundance of a various newly described structures on the carapace allows determining the specimens even if they are only fragmentarily preserved.

Tanidromites longinosa n. sp.

Figures 2, 3

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Diagnosis. Small sized species (max. carapace length 8.28 mm). Carapace is widest across hepatic region. Outer orbital spine is absent. There are small spines on lateral border between augenrest and cervical groove. AtC distance (as defined in Figure 1) is short (0.21-0.25 of RtC). Rostrum is very long ($R/RtC > 0.3$) with a blunt tip. Augenrest is as long as wide, with short spines on

the upper and suborbital margin. Posterior section of orbital margin smoothly changes into lateral border of the carapace. Cervical pits are absent. Hepatic pits and hepatic tubercles are absent.

Comparison. The species is most similar to *Tanidromites sculpta*. It is also a small sized species; as *T. sculpta*, *T. etalloni*, and *T. alexandrae*. The length of the biggest specimen of *T. longinosa* n.sp. is 8.28 mm. The augenrest is flattened and as long as wide, as in *T. etalloni* and *T. sculpta*. The difference is visible in the posterior section of the orbital margin, which is distinct in *T. sculpta* and *T. etalloni* and smoothly changes into the lateral border of the carapace in *T. longinosa* n. sp. The rostrum of *T. longinosa* n. sp. is longer than in other species of the genus, the ratio of length from the tip of the rostrum to the anterior groove, and of the length from the tip of the rostrum to the cervical groove is larger than 0.3. Another difference is visible in the convexity of the carapace, which in *T. longinosa* n. sp. is slightly convex, while in *T. sculpta* and *T. alexandrae* it is flat and in other species is highly convex.

Etymology. The trivial name refers to the long rostrum of this species. It comes from the Latin words *longus* – long, *nasus* – nose.

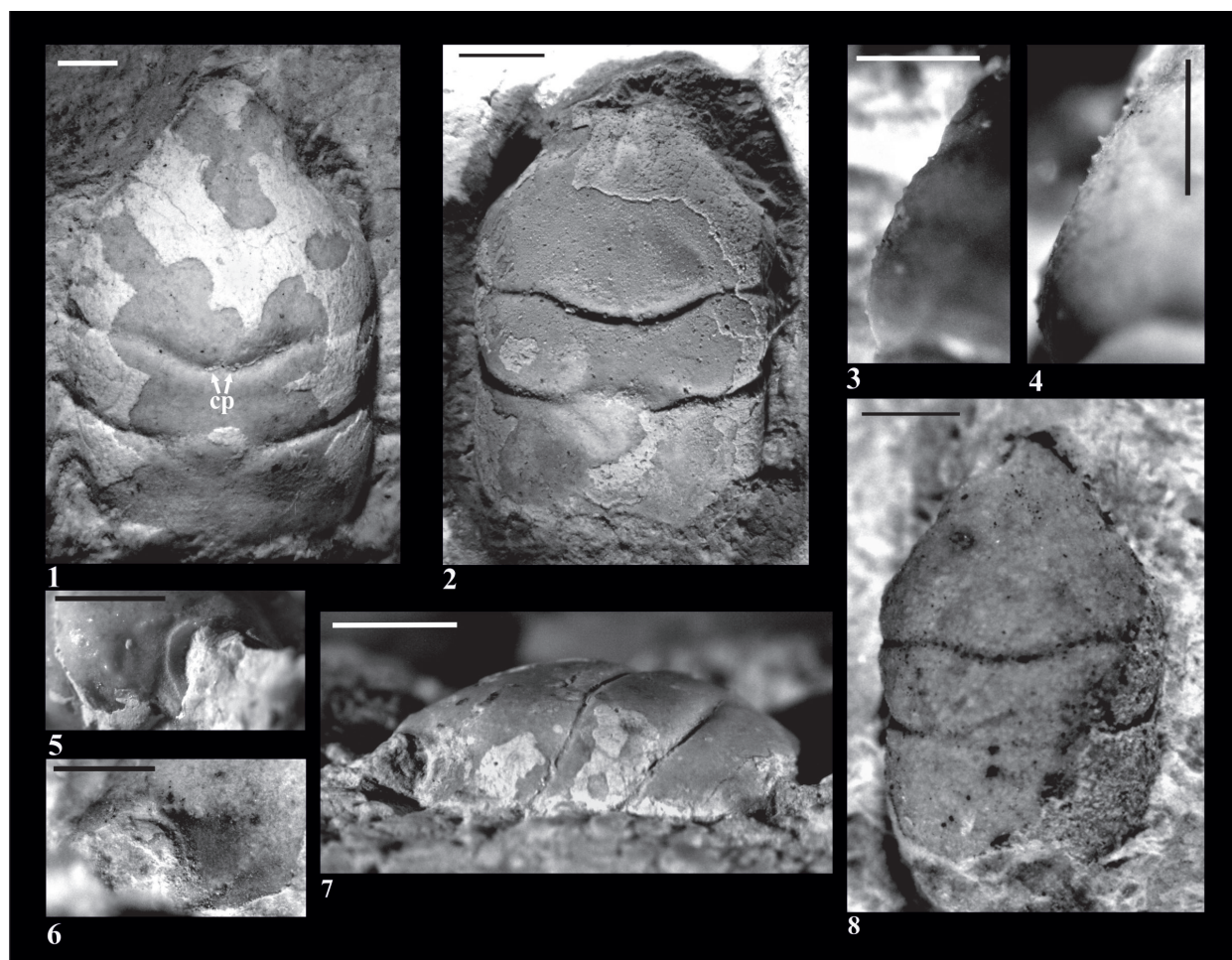


FIGURE 3. *Tanidromites longinosa* n. sp. **1**, paratype (#6239, Ogradzieniec) (cp – cervical pit); **2**, specimen (#6242, Ogradzieniec); **3, 4**, upper orbital margin (3 – #2725 Bzów; 4 – #1908, Bzów); **5, 6**, augenrest, anterior view (5 – #6302, Kroczyce; 6 – #1908, Bzów); **7**, lateral view (#6238, Kroczyce); **8**, holotype (#6307, Ogradzieniec). Scale bars equal 1 mm.

Material

Type material. Holotype: I-F/MP/6307/1599/12; type locality: Ogradzieniec; age: Early-Middle Oxfordian.

Paratypes. I-F/MP/6239/1588/11; locality: Ogradzieniec; I-F/MP/1788/1517/08; I-F/MP/2725/1530/08; locality: Bzów; age: Middle Oxfordian. Coll.: I.K.R. Borek.

Additional material. Specimens from Bzów: I-F/MP/1849/1517/08; I-F/MP/1908/1517/08; I-F/MP/2053/1517/08; I-F/MP/2054/1517/08. Specimens from Kroczyce: I-F/MP/6238/1588/11, I-F/MP/6302/1599/12. Specimens from Ogradzieniec: I-F/MP/474/1497/08; I-F/MP/530/1497/08; I-F/MP/642/1502/08; I-F/MP/6235/1588/11; I-F/MP/6242/1588/11. Coll.: I.K.R. Borek.

Total number of specimens.34.

Full list of the specimens and localities is presented in the Appendix.

Dimensions (Table 1). The length of the biggest specimen is 8.28 mm and the maximum width across the epibranchial region is 6.42 mm.

Description. The carapace is slightly convex (Figure 3.7), widest across the hepatic region. Lateral borders are parallel or narrowing posteriorly, smooth without the outer orbital spine, except the border between the end of the augenrest and the cervical groove (AtC) – there are several small spines there (Figure 3.4). The AtC distance is short (0.21-0.25 of the RtC distance) (Figures 2, 3.1, 3.2, 3.8).

The rostrum is long ($R/RtC > 0.3$), downturned; the axial groove does not reach the blunt tip (Figure 3.1, 3.8).

The augenrest is as long as wide. There are short spines on the upper and suborbital margin (Figures 2, 3.3, 3.4). The suborbital margin slightly projects beyond the upper orbital margin. The posterior part of the orbital margin smoothly changes into the lateral border of the carapace (Figure 3.5, 3.6). This character is visible on every specimen with an augenrest preserved, which means it is not caused by preservation but it is a repetitive character.

Mesogastric region is distinctly bordered by grooves in the anterior and posterior part, weaker in the middle. Anterior (narrow) part of the region is a little shorter than the posterior (wide) part. Cervical pits are rounded (Figures 2, 3.1). There is an incision in the posterior margin of the mesogastric region. Mesogastric scars (corresponding to attachments of the gastric muscles) are elongated, weakly developed, positioned on both sides of this incision, and extend across the entire posterior border of the mesogastric region. Proximally they are accompanied by a parallel pair of smaller scars which are very faint.

Protogastric and hepatic regions are not differentiated. Hepatic pits and tubercles are absent.

Epigastric regions are elongated. There is a small tubercle on the urogastric region. Cardiac region is weakly divided; there are two tubercles in the anterior part and one in the posterior. Branchial region is much longer and almost as convex as the epibranchial one.

The cervical groove is deep. The branchio-cardiac groove is deep in lateral parts (parallel to the cervical groove); middle part of this groove disappears (Figure 3.1, 3.2).

There is no ornamentation on the carapace. Internal mold and the cuticle are smooth (Figure 3.1, 3.2, 3.8). There is no well-preserved cuticle on the augenrest and no spines on the upper and suborbital margin covered with the cuticle.

Tanidromites wysokaensis n. sp.
Figures 2, 4

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Diagnosis. Species reaching relatively large size – maximum carapace length 20.34 mm. Carapace is widest across epibranchial region. AtC distance is very long (0.33-0.42 of RtC distance). Rostrum is short ($R/RtC \leq 0.3$), downturned, with a blunt tip. Augenrest is flat, rounded and bordered; its length is half of width. Outer orbital spine is absent. Cervical pits are crescent-shaped. Hepatic pits and hepatic tubercles are absent.

Comparison. The species is most similar to *Tanidromites scheffnerae* and *T. insignis*; which are

also large sized species. Maximum carapace length of *T. wysokaensis* n. sp. is 20.34 mm, while the length of the biggest specimen of *T. scheffnerae* is 27.34 mm and of *T. insignis* – 22.5 mm. The rostrum of *T. wysokaensis* n. sp. is not sharply ended as in *T. scheffnerae* and *T. etalloni* but more similar to *T. insignis*. *Tanidromites scheffnerae* and *T. insignis* have hepatic tubercles and hepatic pits (only *T. insignis*) which are absent in *T. wysokaensis* n. sp., as in *T. etalloni*. The shape of the augenrest is similar only to *T. scheffnerae*.

Etymology. The trivial name refers to one of the localities where this species was found – Wysoka (gender feminine, in Genitivum).

Material

Type material. Holotype: I-F/MP/6240/1588/11; type locality: Ogradzieniec; age: Early-Middle Oxfordian. Coll.: I.K.R. Borek.

Paratypes. I-F/MP/6260/1588/11; locality: Ogradzieniec; I-F/MP/6263/1588/11; locality: Niegowonice; age: Middle-Late Oxfordian. Coll.: I.K.R. Borek.

Additional material. Specimens from Bzów: I-F/MP/1896/1517/08. From Niegowonice: I-F/MP/1078/1508/08; I-F/MP/4507/1534/08; I-F/MP/4962/1543/09. Coll.: I.K.R. Borek.

Total number of specimens. 18.

Full list of the specimens and localities is presented in the Appendix.

Dimensions. The width across the epibranchial region ranges between 5.95 and 12.95 mm. The maximum carapace length 20.34 mm.

Description. The carapace is about 1.7x as long as wide, slightly convex (Figure 4.1-3, 4.5), with parallel borders. Lateral borders are smooth without the outer orbital spine. The AtC distance is very long (0.33-0.42 of the RtC) (Figures 2, 4.1-3).

The rostrum is short ($R/RtC \leq 0.3$), downturned, with blunt tip. The axial groove reaches the anterior end of the rostrum (Figure 4.2, 4.8).

The augenrest is flat, rounded, and very short; its length is 0.5x the width (Figure 2), bordered. The outer orbital spine is absent. Upper and suborbital margins are smooth (Figure 4.6, 4.7).

The mesogastric region is distinctly bordered by grooves in the anterior and posterior part, weaker in the middle. Anterior (narrow) and posterior (wide) part of the mesogastric region are more or less the same length; there is an incision in the posterior margin. Cervical pits are crescent-shaped (Figure 2). Mesogastric scars are elongated, strongly developed, positioned on both sides of the posterior incision, and extend across the entire posterior border of the mesogastric region. Proxi-

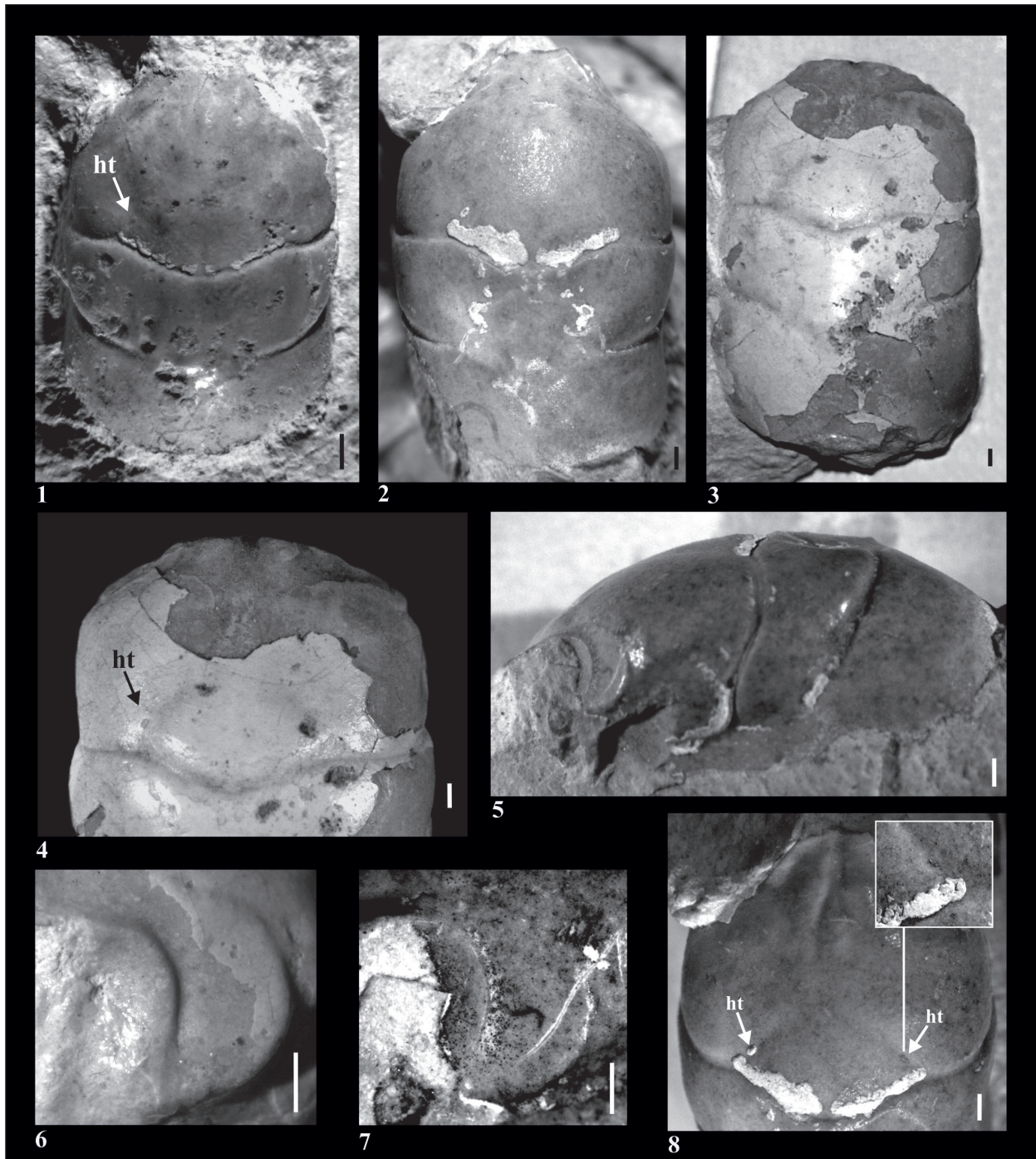


FIGURE 4. *Tanidromites wysokaensis* n. sp. **1**, paratype (#6260, Ogródzieniec); **2**, holotype (#6240, Ogródzieniec); **3**, paratype (#6263, Niegowonice); **4**, anterior part of the carapace (paratype, #6263, Niegowonice); **5**, lateral view (#6240, Ogródzieniec); **6**, **7**, augenrest, anterior view (6 – #6263, Niegowonice; 7 – #6240, Ogródzieniec); **8**, anterior part of the carapace (holotype, #6240, Ogródzieniec). ht – hepatic tubercle. Scale bars equal 1 mm.

mally they are accompanied by a parallel pair of smaller scars. Protogastric and hepatic regions are not differentiated. Hepatic pits and hepatic tubercles are absent.

Epigastric regions are elongated. There is a small tubercle on the urogastric region.

There are two tubercles lying on the anterior part of the cardiac region. The posterior tubercle is absent.

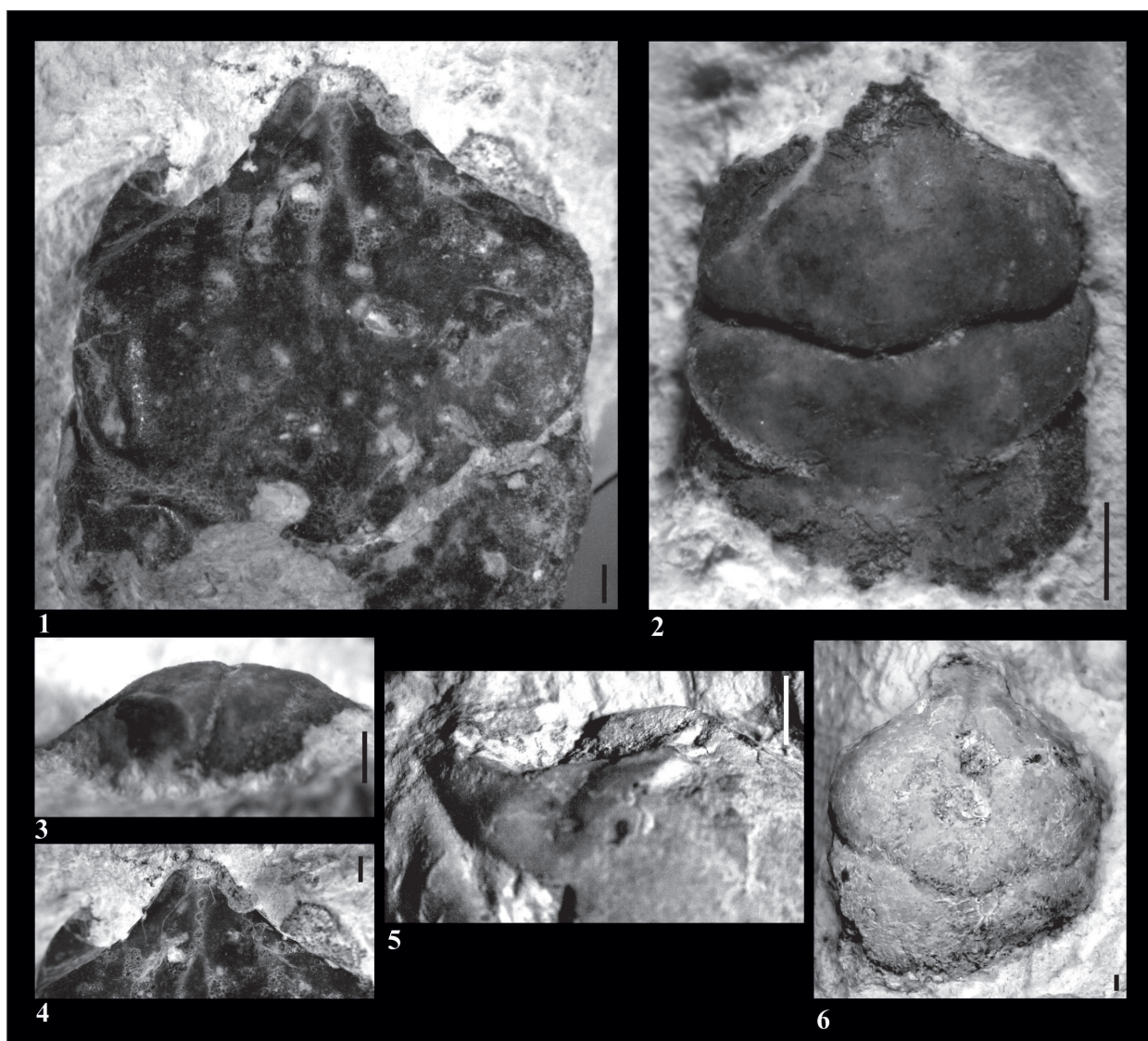


FIGURE 5. *Tanidromites schweitzerae* n. sp. **1**, holotype (#4515, Niegowonice); **2**, specimen (#4562, Niegowonice); **3**, lateral view (#4562, Niegowonice); **4**, rostrum (holotype #4515, Niegowonice); **5**, augenrest, view from above (holotype #4515, Niegowonice); **6**, specimen (#6249, Niegowonice). Scale bars equal 1 mm.

The epibranchial region is strongly convex, branchial region more flattened. The epibranchial region is much shorter than branchial and hepatic regions.

The cervical groove is deep. The branchio-cardiac groove is deep on the lateral sides (parallel to the cervical groove), the middle part is very weakly visible. The posterior border of the carapace is broad and strongly concave in the middle part. It is rimmed.

There is no ornamentation on the carapace. Internal mold and the cuticle are smooth. A cuticle is preserved on the hepatic tubercles of the paratype (#6263, Figure 4.4) and on one hepatic tuber-

cle of the holotype (#6240, Figure 4.8). They are distinct in both cases, with and without the cuticle.

Tanidromites schweitzerae n. sp.

Figures 2, 5

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Diagnosis. Species reaching relatively large size – maximum carapace width is 14.75 mm. Carapace is flattened, with parallel lateral borders. AtC distance is very long (0.33-0.44 of RtC distance). Rostrum is short ($R/RtC \leq 0.3$) with a blunt tip. Augenrest is long (length is 0.75x width), protected only by suborbital margin, which extends beyond upper orbital margin and is strongest among all

TABLE 2. All species of the genus *Tanidromites* with their respective habitats (information from Crônier and Boursicot, 2009; Fraaije et al., 2013; Hyžný et al., 2011; Müller et al., 2000; Robin et al., 2015; Schweigert and Koppka, 2011; Schweitzer and Feldmann, 2010; Starzyk, 2015a).

Species	Age	Habitat
<i>T. sculpta</i>	Early Oxfordian to Late Kimmeridgian	shallow sponge- microbial mounds
<i>T. scheffnerae</i>	Early Oxfordian to Late Kimmeridgian	shallow sponge- microbial mounds (Poland, Germany)
<i>T. etalloni</i>	Middle to Late Oxfordian	shallow sponge- microbial mounds (Poland)
<i>T. alexandrae</i>	Early to Late Oxfordian	shallow sponge- microbial mounds (Poland)
<i>T. insignis</i>	Early Oxfordian to Early Kimmeridgian	non reefal habitat associated fauna sparse; brachiopods, bivalves and crinoids (Slovakia) shallow sponge- microbial mounds (Poland, Germany)
<i>T. lithuanicus</i>	Middle Callovian	shallow non reefal habitats associated with benthic macrofauna (Lithuania)
<i>T. montreuilense</i>	Early Callovian	lower offshore environment, close to or below storm wave base, with water depth 50-80 m, associated with benthic fauna (France)
<i>T. raboeufi</i>	Late Bathonian	carbonate muddy bottoms (France)
<i>T. richardsoni</i>	Bajocian	shallow non reefal habitats associated with benthic macrofauna (Great Britain, Germany)
<i>T. maerteni</i>	Early Bajocian	shallow non reefal habitats associated (France)

species of the genus. Cervical pits are rounded. Hepatic pores and hepatic tubercles are absent.

Comparison. *Tanidromites schweitzerae* differs from other species of *Tanidromites* significantly. It has a unique shape of the augenrest, long with an extended suborbital margin. The rostrum is also different, short ($R/RtC \leq 0.3$) with a blunt tip. Epibranchial regions are strongly elongated, not round as in other species of the genus.

Etymology. The trivial name is dedicated to Carrie E. Schweitzer, an outstanding specialist of fossil decapods.

Material

Type material. Holotype: I-F/MP/4515/1534/08; type locality: Niegowonice; age: Middle-Late Oxfordian. Coll.: I.K.R. Borek.

Paratype. I-F/MP/6249/1588/11; locality: Niegowonice. Coll.: I.K.R. Borek.

Additional material. Specimen from Niegowonice: I-F/MP/4562/1534/08. Coll.: I.K.R. Borek.

Total number of specimens. 3.

Dimensions. Maximal width across the epibranchial region is 14.75 mm.

Description. The carapace is flattened (Figure 5.5). Lateral borders are smooth and parallel. The AtC distance is very long (0.33-0.44 of the RtC) (Figures 2, 5.1, 5.6, 5.7).

The rostrum is short ($R/RtC \leq 0.3$) with a blunt tip. The axial groove is shallow; it does not reach

the anterior border of the rostrum. The rostrum is best visible on the specimen 4515 (Figure 5.1, 5.2). The augenrest is long (length is about 0.75 of the width) (Figures 2, 5.2-4). Upper and suborbital margins are smooth without any spines or incisions. The suborbital margin is extending beyond the upper orbital margin, strongest of all the species of the genus. The anterior groove is not visible.

The mesogastric region is distinctly bordered by grooves in the anterior and posterior part, weaker in the middle. The anterior (narrow) and posterior (wide) part of the region are more or less the same length. There is an incision in the posterior margin of this region. Cervical pits are rounded. Mesogastric scars are elongated, strongly developed, positioned on both sides of this incision, and extend across the entire posterior border of the mesogastric region. Proximally they are accompanied by a parallel pair of smaller scars which are very weakly visible.

Protogastric and hepatic regions are not differentiated. Hepatic pits and hepatic tubercles are absent. Epigastric regions are strongly elongated. The tubercle on the urogastric region is absent.

The cardiac region is weakly preserved only on specimen 4562. There are two tubercles in the anterior part and one in the posterior part.

The epibranchial region is more convex, and branchial region more flattened. The epibranchial

region is much shorter than branchial and hepatic regions.

The cervical groove is deep. The branchio-cardiac groove is deep on the lateral sides (parallel to the cervical groove), the middle part is more shallow but also distinct.

There is no ornamentation on the carapace. The cuticle is not preserved on any of the specimens.

DISCUSSION

Recently *Tanidromites insignis* was discovered in non-reefal/biohermal deposits aged as Middle Oxfordian (Hyžný et al., 2011). This finding confirms a wide spectrum of adaptations of the genus *Tanidromites* representatives to different types of environments (Table 2). This diversity is reflected in morphologic features and also in size differences.

As Klompmaker and others (2013a) wrote, reef expansion could be the cause of decapods diversification. The stratigraphically oldest species of *Tanidromites* are known from the Middle Jurassic (*T. maerteni*, *T. richardsoni*, *T. raboeufi* - Upper Bajocian). In this period reefal environments were rare (Müller et al., 2000, Krobicki and Zatoń, 2008, Kiessling, 2009). Scarcity of reefs might be the reason of a small number of crab species discovered from this period (Klompmaker et al., 2013a, 2013b). Middle Jurassic species lived in shallow or moderately deep waters near the coast (Crônier and Boursicot, 2009). Deep augenrest was not a common character. The eyestalks of the Middle Jurassic species were not protected; their augenrest was a flat surface. It could be plausibly related to lack of need to protect the eye from injuries.

More favorable conditions appeared in connection with a transgression in the Callovian, when sponge reefs started to spread more frequently. A large number of tanidromitids and other crabs described from the Late Jurassic demonstrates how beneficial reefal environments for crabs were. These animals could use reefs as shelters, they were also rich in nutrition, and could also be kind of nutrition themselves (Klompmaker et al., 2013a; Krobicki and Zatoń, 2008). Appearing of deep augenrest might be caused by need to protect the eye from the damage from reef skeletons. In the Late Jurassic most of the tanidromitid species still had flattened augenrests: *T. insignis*, *T. sculpta*, *T. etalloni*, *T. scheffnerae*, *T. pustulosa*, and *T. wysokaensis* n. sp. However, some of the species apparently developed a protection for the eyestalks

in the form of an extension of the suborbital margin, and in some of them also of the upper orbital margin. In *T. longinosa* n. sp. the suborbital margin is a little curved, and the upper and suborbital margins are covered with small spines. The posterior part of the orbital margin smoothly changes into the lateral border of the carapace; it is not distinct as in other species of *Tanidromites*. This character is visible on every specimen with an augenrest preserved. This means it is not caused by preservation but it is a repetitive character. Changes of the augenrest shape in *T. schweitzerae* n. sp. and *T. alexandrae* are much more conspicuous. In *T. schweitzerae* n. sp. the eyestalk was protected from below by very strongly projected suborbital margin. The upper orbital margin was not modified in any way. In *T. alexandrae* the eyestalk was retracted between the enlarged upper and suborbital margins (Starzyk, 2015a). Both these species had a long augenrest while other species had it short and flattened. Probably the enhanced protection enabled to develop a longer eyestalk. The more exposed eye could be advantageous in more open habitats. Similar observation was previously made on the species of *Goniodromites* (Starzyk et al., 2012). Many other Late Jurassic crabs had deep augenrest, ex. representatives of all Jurassic goniodromitid genera (Schweitzer and Feldmann, 2008; Starzyk et al., 2012; Starzyk, 2015a). Species of the genus *Bucculentum* developed different adaptation; their augenrest is situated on the dorsal surface of the carapace (Schweitzer and Feldmann, 2009; Starzyk et al., 2011).

Also a size (Table 1) and shape of the crab's body seem to be related with the type of the environment. Small size of the carapace of Jurassic crabs and their reduced abdomen were great adaptations to expanding reefs. Crabs could colonize many niches in sponge reefs and hide from predators. These niches were not available for larger animals (Förster, 1985; Klompmaker et al., 2015).

The diversity of forms suggests a complex ecology with many modes of life. Sponge and coral reefs opened many opportunities for them.

Despite these substantial differences, a close relationship of all the species of *Tanidromites* is evident. Species with deep augenrest share other features of the genus with those with shallow augenrest. Except characters mentioned above these are features distinguishing species of the genus described previously (Starzyk, 2013): presence of anterior grooves, presence and size of

hepatic pits, presence and appearance of hepatic tubercles, shape of cervical pits.

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APPENDIX

Specimens of *Tanidromites longinosa* n. sp. and *Tanidromites wysokaensis* n. sp. in the Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków.

Specimens of *Tanidromites longinosa* n. sp. in the Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków:

Specimens from Bzów: I-F/MP/**1282**/1508/08; I-F/MP/**1788**/1517/08; I-F/MP/**1849**/1517/08; I-F/MP/**1908**/1517/08; I-F/MP/**2053**/1517/08; I-F/MP/**2054**/1517/08; I-F/MP/**2134**/1517/08; I-F/MP/**2158**/1517/08; I-F/MP/**2376**/1528/08; I-F/MP/**2535**/1528/08; I-F/MP/**2613**/1528/08; I-F/MP/**2725**/1530/08.

Specimens from Kostkowice: I-F/MP/**5848**/1555/09.

Specimens from Kroczyce: I-F/MP/**6238**/1588/11; I-F/MP/**6302**/1599/12.

Specimens from Niegowonice: I-F/MP/**819**/1507/08; I-F/MP/**5643**/1543/09; I-F/MP/**6053**/1555/09.

Specimens from Ogrodzieniec: I-F/MP/**36**/1489/08; I-F/MP/**67**/1489/08; I-F/MP/**474**/1497/08; I-F/MP/

500/1489/08; I-F/MP/**503**/1497/08; I-F/MP/**530**/1497/08; I-F/MP/**603**/1502/08; I-F/MP/**642**/1502/08; I-F/MP/**4178**/1534/08; I-F/MP/**4203**/1534/08; I-F/MP/**4404**/1534/08; I-F/MP/**5990**/1543/09; I-F/MP/**6235**/1588/11; I-F/MP/**6239**/1588/11; I-F/MP/**6242**/1588/11; I-F/MP/**6307**/1599/12.

Specimens of *Tanidromites wysokaensis* n. sp. in the Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków:

Specimens from Bzów: I-F/MP/**1896**/1517/08; I-F/MP/**3889**/1532/08.

Specimens from Niegowonice: I-F/MP/**318**/1497/08; I-F/MP/**1078**/1508/08; I-F/MP/**1118**/1508/08; I-F/MP/**1156**/1508/08; I-F/MP/**3290**/1532/08; I-F/MP/**4507**/1534/08; I-F/MP/**4621**/1534/08; I-F/MP/**4962**/1543/09; I-F/MP/**5326**/1543/09; I-F/MP/**6043**/1555/09; I-F/MP/**6263**/1588/11.

Specimens from Ogrodzieniec: I-F/MP/**6240**/1588/11; I-F/MP/**6260**/1588/11.

Specimens from Wysoka: I-F/MP/**2748**/1530/08; I-F/MP/**6377**/1619/14.