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Article

Brachyuran decapods (including five new species and one new genus) from Jurassic (Oxfordian-Kimmeridgian) coral reef limestones from Dobrogea, Romania

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With 17 figures

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Abstract: Analysis of the fossil decapod faunas in coral reefs from localities at Topalu and Piatra in Central Dobrogea, Romania, yielded four new species, *Goniodromites narinosus, Verrucarcinus cutifrontis, Laeviprosopon lazarae, Lecythocaris stoicai*, belonging to Homolodromioidea ALCOCK, 1899, and one new genus and species, *Concavolateris barbulescuae*, assigned to Glaessneropsoidea PATRULIUS, 1959. Comparison of the abundance and diversity of decapod faunas from these Jurassic coral reefs with those from sponge-algal reefs in the same geographic area and of the same age (middle Oxfordian) has led to some interesting paleoecological differences. The coral reef environments yielded 124 specimens of decapods, of which 54 were brachyurans. The brachyuran were represented by six families in seven genera and ten species, including the new taxa. The sponge reef environments yielded 22 specimens that represented only three families with four genera and five species. These two different types of environments share only one genus in common, *Goniodromites*, and no species. The nearly complete taxonomic difference between the environments suggests that the environments selected for different adaptations, leading to niche partitioning within and between habitats. The higher abundance and diversity in the coral environments may reflect a higher number of niches available for decapods, shallower water depth, higher oxygen content and/or difference in energy levels in the two environments, making coral reefs a more suitable environment for decapods.

Key words: Decapoda, Jurassic, Romania, Dobrogea, Coral reefs.

1. Introduction

During the Jurassic, Central Dobrogea, Romania, was covered by a shallow, warm sea along the northern margin of the Tethyan Ocean, and was the site of development of a series of coral and sponge reefs on a vast carbonate platform that sheltered abundant mollusks, corals, echinoderms, and other organisms. Previous work (FELDMANN et al. 2006; SCHWEITZER et al. 2007) on the Jurassic decapods from Central Dobrogea have concentrated on the sponge reefs in the area and has yielded one new genus and one new species.

Following two field work campaigns in the fall of 2006 and summer of 2007, when the sponge and the coral reefs of Central Dobrogea were extensively collected, 146 decapod specimens were collected. The sponge reefs yielded 22 specimens of brachyurans and anomurans whereas 124 decapod specimens, 54 brachyurans and 70 anomurans, squat lobsters, were collected from different coral reefs habitats. Of the

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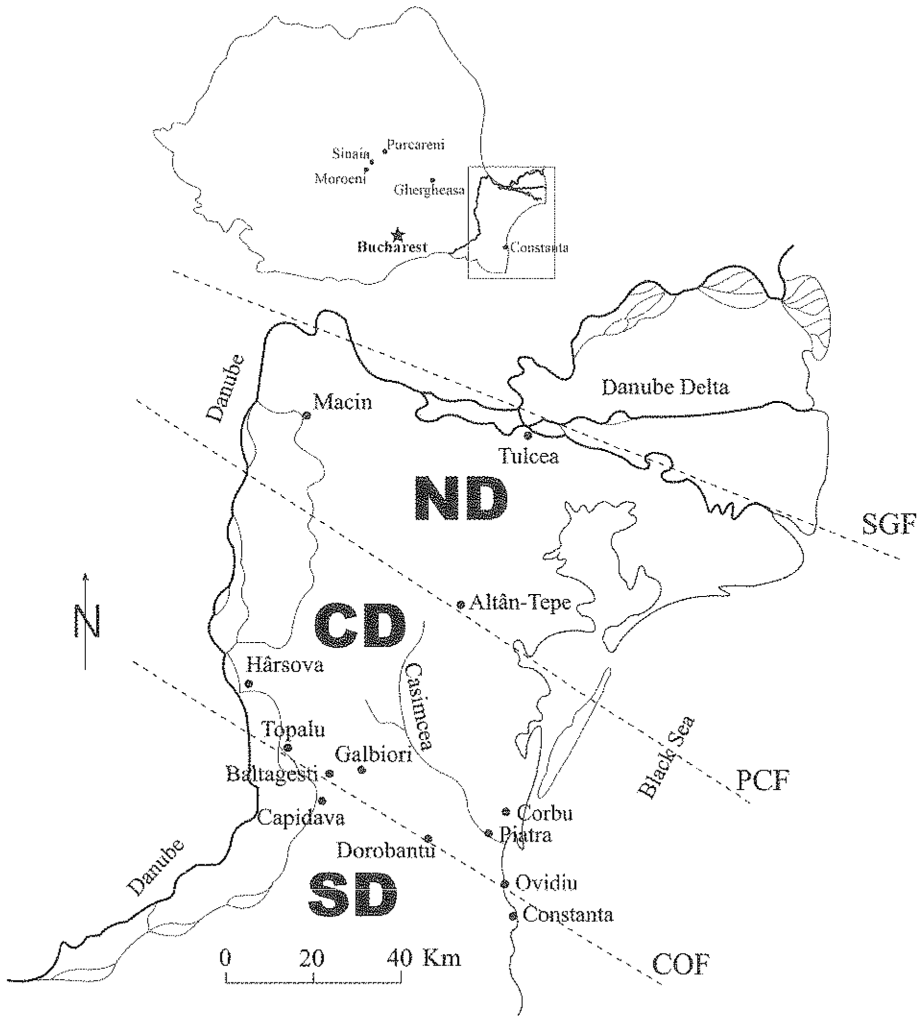


Fig. 1. Main tectonic units from Dobrogea (modified from HERMANN in LEINFELDER et al. 1994). ND – North Dobrogea, CD – Central Dobrogea, SD – South Dobrogea, SGF – St. George Fault, PCF – Peceneaga-Camena Fault, COF – Capidava-Ovidiu Fault.

124 specimens, only the 54 brachyurans represent the subject of this research.

2. Geology and stratigraphical framework

Central Dobrogea lies on the Moesic Platform and is bounded by major faults (Fig. 1). To the north, the Peceneaga-Camena Fault separates central Dobrogea from the North Dobrogean Orogen, and to the south the boundary is marked by the Capidava-Ovidiu Fault (SĂNDULESCU 1984). In central Dobrogea, sedimentary rocks are thin and are comprised of Jurassic, Cretaceous, and Miocene (Sarmatian) deposits (Fig. 2). Middle Jurassic (Bathonian) strata are the oldest sedimentary rocks to overlie the crystalline basement. They are in turn overlain by Callovian-Oxfordian and Kimmeridgian rocks (MUTIHAC et al. 2004). The most important outcrops with Jurassic rocks in central Dobrogea are aligned on a NW-SE line: Hârsova-Topalu-Băltăgeşti-Gălbiori in the western area; the Casimcea area in the central-eastern part; and Dorobanţu-Ovidiu in the south-eastern part (DRAGASTAN et al. 1998).

Jurassic deposits from central Dobrogea are Middle Jurassic (upper Bathonian-Callovian) and Late Jurassic (Oxfordian-Kimmeridgian) in age. These deposits represent the base of the sedimentary suite in central Dobrogea. They lie directly over the strongly folded

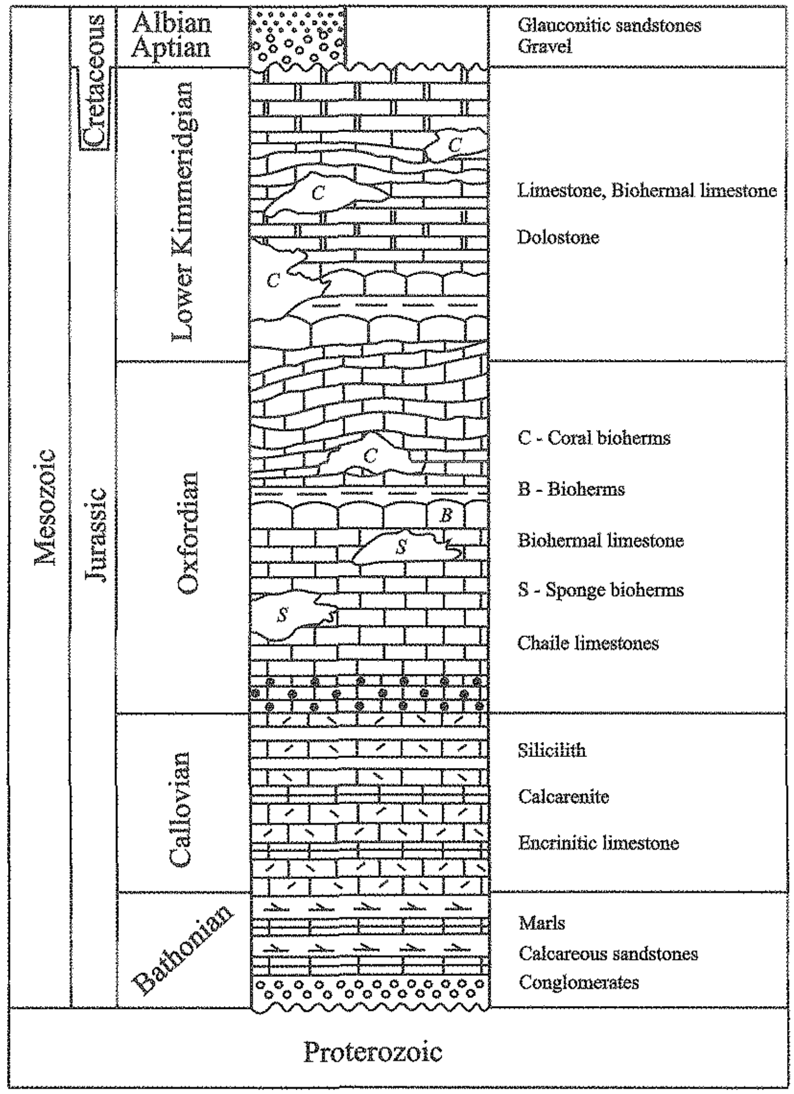


Fig. 2. Stratigraphic chart for central Dobrogea, (redrawn after Mutihac et al. 2004).

Green Schists of the basement. In central Dobrogea, the Jurassic section has been divided into three formations: Tichileşti Formation, Gura Dobrogei Formation, and Casimcea Formation (Dragastan et al. 1998). The following is a brief outline of the stratigraphy of the Tichileşti and Gura Dobrogei formations and a more detailed stratigraphy for the Piatra and Topalu members of the Casimcea Formation. The decapod faunas were collected from these two members.

The Tichileşti Formation was described by Drăgănescu & Beauvais (1985). The Tichileşti Formation corresponds to what previously was called "Basal Detrital Horizon" or "Sandy-Conglomeratic-Calcarenite Series". The thickness varies from 0-35 m, due to sedimentation hiatuses at the base, post-depositional erosion at the top, and condensation. Analyzing the sedimentation rate, Drăgănescu & Beauvais (1985) recognized two different types of sequences: normal and condensed. The Tichileşti Formation represents a distinct sedimentation cycle deposited during a transgression over the green schist basement. The upper part is separated from younger Jurassic deposits by a lithologic discontinuity and a stratigraphic unconformity. This formation consists of sands, conglomerates, calcareous sandstones with pebbles of green schist and quartz, an alternation of marls and calcarenite, sandy limestone, nodular limestone, calcareous sandstone with cross bedding (only in the western part of central Dobrogea), and encrinal limestone with siliceous bands.

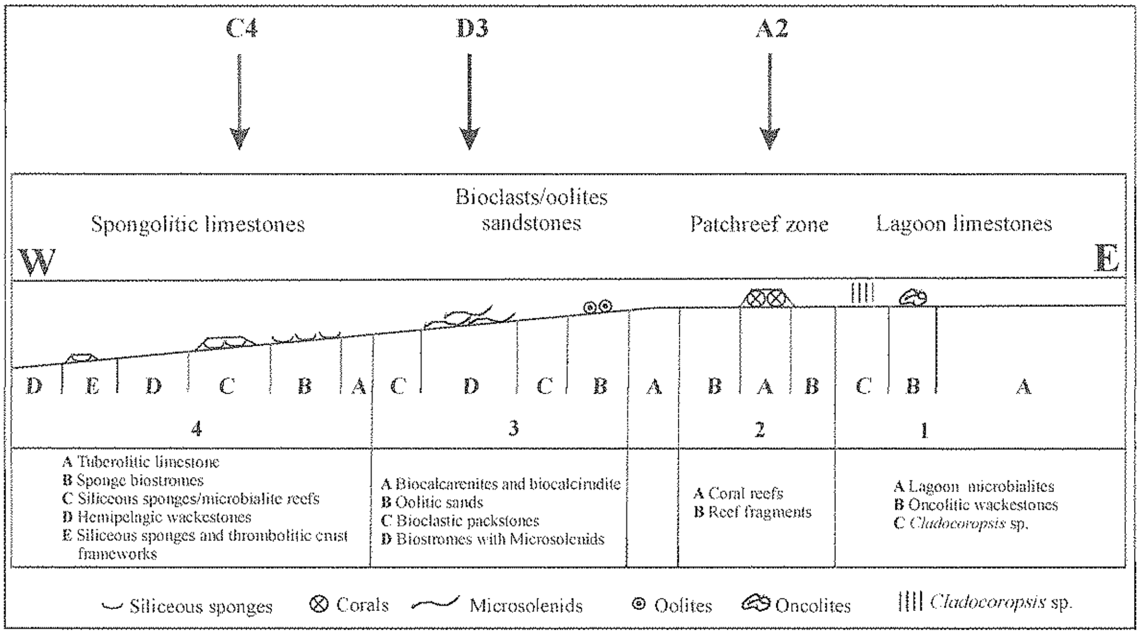


Fig. 3. Facies distribution on the carbonate ramp of central Dobrogea (modified from HERMANN in LEINFELDER et al. 1994). A2 – coral reef zone; D3 – biostromes with microsolenids; C4 – sponge reef zone.

The Gura Dobrogei Formation, also known as the Middle Jurassic Encrinal Formation (DRĂGĂNESCU 1971), is discordant and transgressive over the green schist basement or over the Middle Jurassic deposits. At the top, and separated by a paraconformity and a lithologic discontinuity, are early/middle Oxfordian deposits. This formation consists of bio-spar calcarenite with crinoid fragments, echinoid plates and spines, and very rare fragments of epibenthic bivalves. The intergranular material is usually sparite or micrite, in variable quantities. Some silt-sized, angular, quartz grains are also present. The thickness of the Gura Dobrogei Formation is estimated to be between 12 and 15 m. The formation shows decimeter scale stratification. The age of the Gura Dobrogei Formation is middle-late Callovian (DRĂGĂNESCU 1971), which was established on the basis of stratigraphic position.

The Casimcea Formation is the third major lithostratigraphic unit in central Dobrogea (DRĂGĂNESCU 1976). This formation is more important to this study than the other two due to its spatial extent, thickness, lithofacies complexity, and variable fossil content. It has been estimated that the Casimcea Formation has a thickness of 150-500 m. This formation is dominated by skeletal limestone (bio-accumulated and bio-constructed). In the upper part, minor lagoonal micritic limestone and rare dolomites are present. Based on ammonite biostratigraphy, the Casimcea Formation has been dated as middle Oxfordian to Kimmeridgian (ANASTASIU 1898; SIMIONESCU 1907, 1910; PATRULIUS & ORGHIDAN 1964; BĂRBULESCU 1969, 1970, 1974, 1979; CHIRIAC et al. 1977).

The Piatra Member crops out in the eastern part of central Dobrogea. The type section is situated between Sârtorman Valley (South of Palazu Mic) and Piatra on the eastern banks of Taşaul Lake. The thickness of this member is 20-30 m. The Piatra succession consists of a complex array of coralline limestone. Two coral/algal biostromal sequences are present separated by 3-4 m of granular biodetrital coralliferous limestone. Coral colonies that comprise these coral-rich sequences are of multiple types: lamellar, parallel, meandering, and branching. Frequently the branching type is associated with small subspherical polyps and robust branching types (DRAGASTAN et al. 1998). HERMANN (in LEINFELDER et al. 1994), studied the types of microbial crusts. She placed these biostromes with microsolenids from the eastern part of central Dobrogea in the oolitic, bioclastic sandstones to the east of the sponge-rich limestone (Fig. 3, D3). The existence of this intermediate facies makes it possible to correlate the coralliferous limestone (Fig. 3, A2)

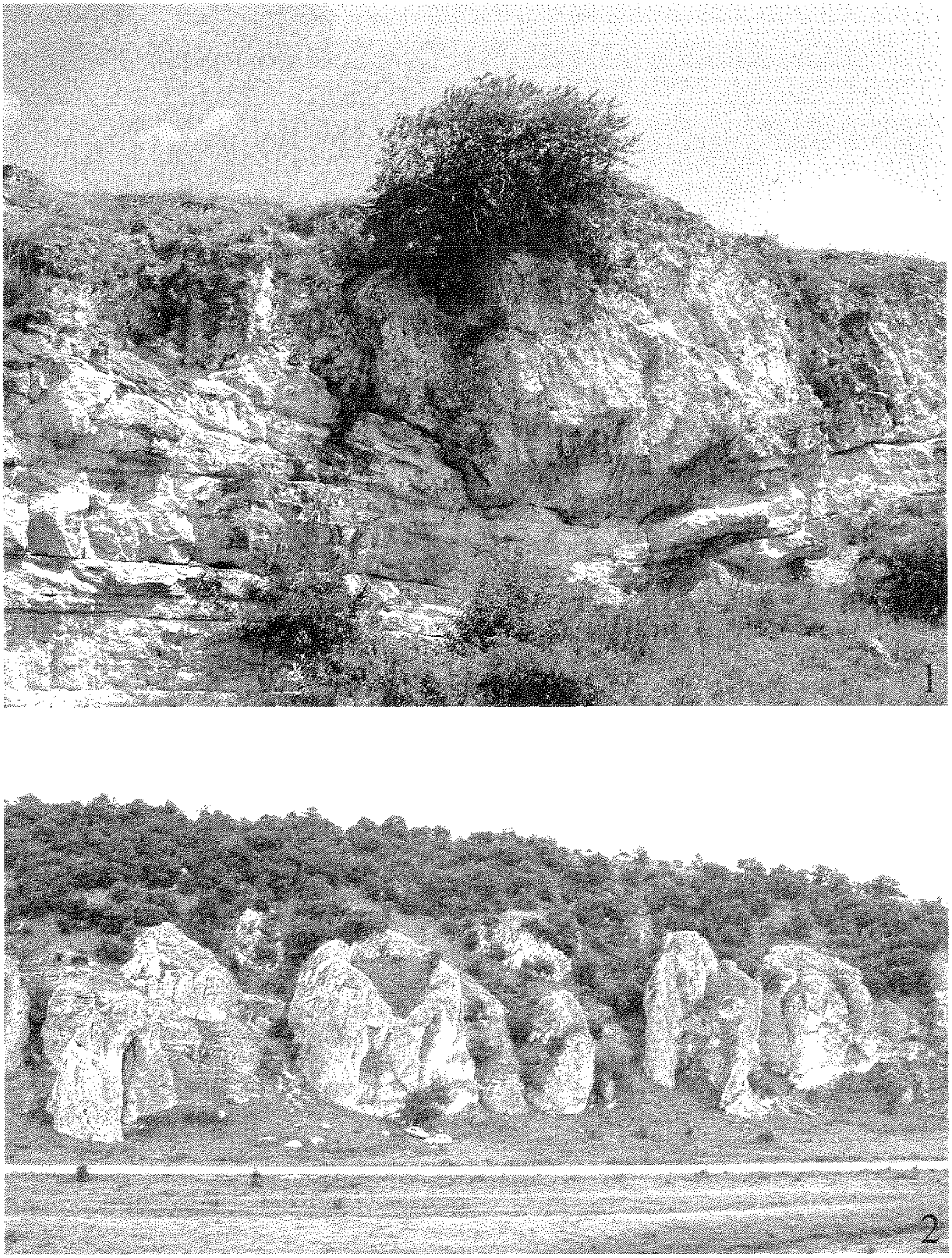


Fig. 4. Outcrop images from Topalu and Cheia; 1. Bioherm and associated biostromes at Topalu (photo by OVIDIU FRANŢESCU); 2. Ring-shaped sponge reefs at Cheia (photograph by R. FELDMANN).

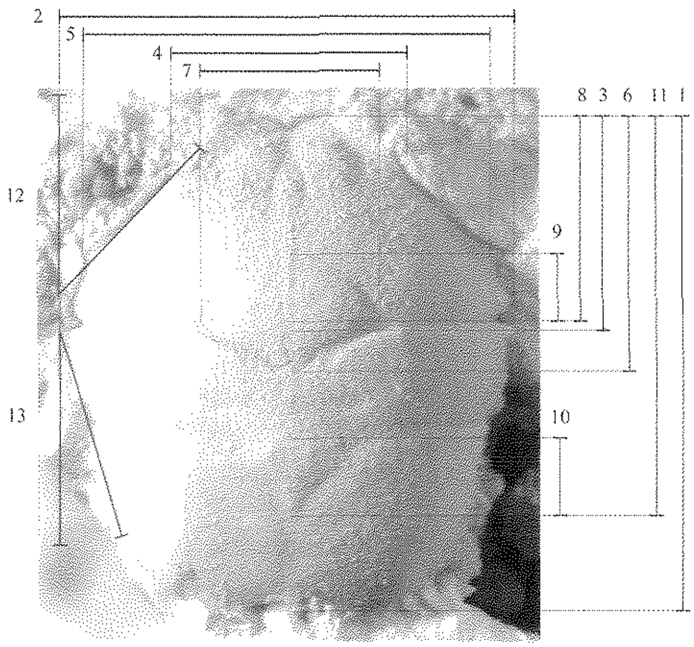


Fig. 5. Principal axes used for measurements. 1. L-Length, 2. W-Width, 3. MWD-Maximum width distance from front, 4. FW-Frontal margin width, 5. FOW-Fronto-orbital width, 6. MGRD-Metagastric region distance from front, 7. MGRW-Metagastric region width, 8. CGD-Cervical groove distance from front, 9. OOSD-Outer orbital spine distance from cervical groove, 10. CRL-Cardiac region length, 11. CRD-Cardiac region distance from front, 12. OA-Orbital angle with longitudinal axis, 13. LA-Lateral margin angle with longitudinal axis.

with the sponge-rich limestone (Fig. 3, C4) to the west. Overall, they indicate a middle to late Oxfordian age.

The Topalu Member is a coral-bearing facies that crops out in the western part of Central Dobrogea, north of Topalu; on the Veriga Channel, south of Topalu village to Capidava; and on the Danube tributary valleys as small outcrops in Alsăneşti Valley, Calachioi, and Coada Zăvălanului south of Topalu. The type section of this member consists of about 12-20 m of reef structures that crop out at Topalu for about a kilometer along the Veriga Channel. North of Topalu, this section is represented by a large number of patch reefs (Fig. 4.1) and coral colonies that are linked by a continuous biostrome. The base of this reef complex is undulatory, just like the other coralliferous strata from the stromatolitic/coralliferous complex. The undulations are due to differential compaction under the weight of the larger coralliferous bioconstructions (Fig. 4.1) (Dragastan et al. 1998). Branching colonies (some of them more than a meter in diameter) are predominant but there are also lamellar/sub-massive colonies, as well as sub-spherical and some conical or cylindrical solitary polyps. The age of the Topalu Biostrome can be determined only by its stratigraphic position. In the highest stromatolitic level, the ammonite fauna is limited but allows dating to the fourth, early Kimmeridgian coralliferous level. This coralliferous biostrome lies on limestone with *Ataxioceras* sp. and *Physodoceras* sp. The pseudostromatolitic complex, situated above these coral/algal limestones, south of Topalu, is not known to contain any paleontological elements that can indicate an age younger than early Kimmeridgian. The Topalu association is one of the richest in Europe (Roniewicz 1976), except for the associations from the Jura and Western Carpathians at Štramberk, Czech Republic. The richness of the fauna from this outcrop is representative of the late Oxfordian and early Kimmeridgian from Dobrogea.

Localities: The specimens have been collected from five localities in Central Dobrogea, two localities in the limestone quarry near the Piatra Village, on the banks of Taşaul Lake, Locality 1 (44°23'44.19"N, 28°33'42.43E) is in the active part of the quarry and Locality 2 (44°23'44.8"N, 28°33'33.6E) is on the side of the quarry in a large pile of stones; the other three localities are on the right bank of Veriga Channel, on the east bank of the Danube river, in a series of old limestone quarries, Locality 3 (44°33'30"N, 28°02'07.6"E) is in an old quarry north of Topalu Village, south of a shepherd's house; Locality 4 (44°34'02.3"N, 28°02'00.3"E) is in a quarry north of the shepherd's house; and Locality 5 (44°34' 22.4"N, 28°02'04.9"E) is in a small bioherm along the Veriga Channel, in a road cut.

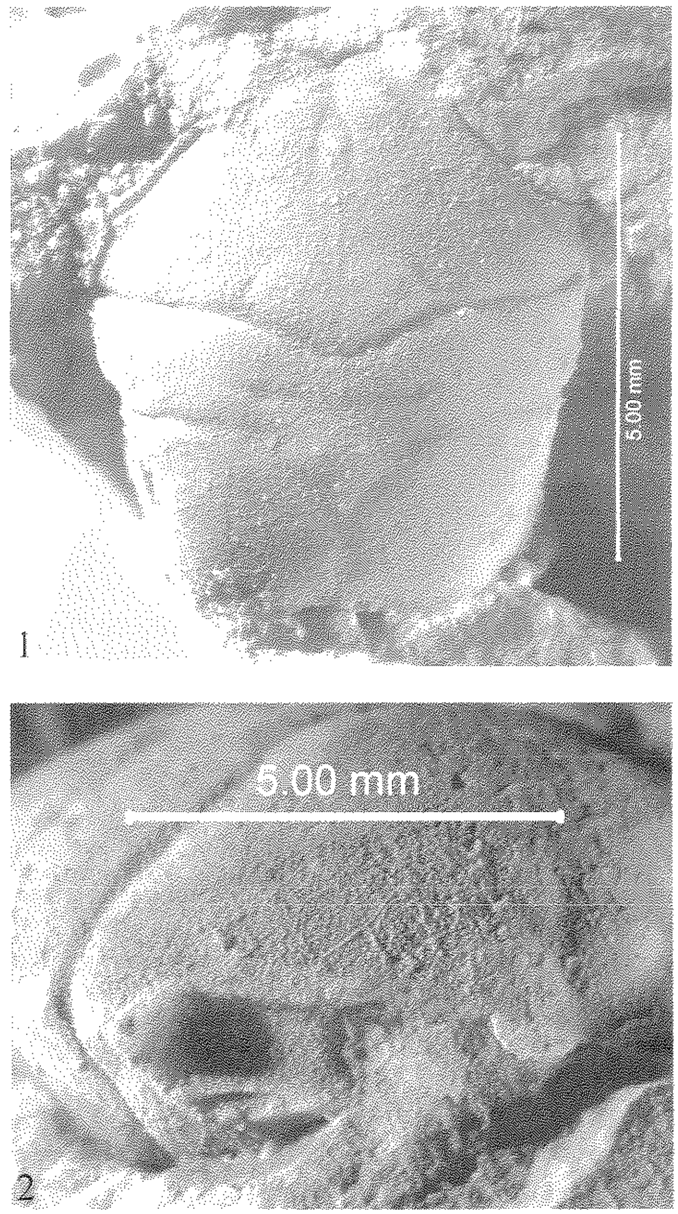


Fig. 6. *Goniodromites polyodon* Reuss, 1858; **1** – Dorsal carapace of specimen LPBIIIart-165-16; **2** – Orbital area detail of specimen LPBIIIart-165-14.

Abbreviations: LPBIIIart – Laboratory of Paleontology, Department of Geology and Paleontology, University of Bucharest, România; NHMW – Naturhistorisches Museum Wien (Natural History Museum of Vienna), Austria. Specimens have been measured along the axis shown in Fig. 5, and are noted as follows: L-Length, W-Width, MWD-Maximum width distance from front, FW-Frontal margin width, FOW-Fronto-orbital width, MGRD-Metagastric region distance from front, MGRW-Metagastric region width, CGD-Cervical groove distance from front, OOSD-Outer orbital spine distance from cervical groove, CRL-Cardiac region length, CRD-Cardiac region distance from front, OA-Orbital angle with longitudinal axis, LA-Lateral margin angle with longitudinal axis.

3. Systematic paleontology

Phylum Arthropoda Latreille, 1802
Class Malacostraca Latreille, 1802
Order Decapoda Latreille, 1802
Infraorder Brachyura Linnaeus, 1758
Superfamily Homolodromioidea Alcock, 1899
Family Goniodromitidae Beurlen, 1932

Genus *Goniodromites* Reuss, 1858 [imprint 1857]

Type species: *Goniodromites bidentatus* Reuss, 1858 [imprint 1857], p. 12.

Other species included: *G. aliquantulus* Schweitzer, Feldmann & Lazar, 2007; *G. cenomanensis* (Wright & Collins, 1972); *G. dentatus* Lőrenthey in Lőrenthey & Beurlen, 1929; *G. laevis* (Van Straelen, 1940); *G. polyodon* Reuss, 1858; *G. serratus* Beurlen, 1929; *G. dacica* (v. Mücke, 1915), *G. hirotai* Karasawa & Kato, 2007, *G. sakawense* Karasawa & Kato, 2007; *G. transsylvanicus* Lőrenthey in Lőrenthey & Beurlen, 1929; *Goniodromites narinosus* herein.

Diagnosis: See Schweitzer & Feldmann 2008 [imprint 2007]:123.

Goniodromites polyodon Reuss, 1858
Fig. 6

1858 *Goniodromites polyodon* Reuss, p.12.
2008 [imprint 2007] *Goniodromites polyodon* Reuss 1858. – Schweitzer & Feldmann, p. 127, pl. 2, fig. C (with further synonymy).

Description of material: Carapace hexagonal, longer than wide, moderately vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region, maximum width of carapace in anterior part of epibranchial regions. Carapace traversed by two moderately incised transverse grooves (Fig. 6.1).

Rostrum wide, spatulate, downturned, with shallow, high angle axial incision; anterior part of rostrum rounded; rostrum and orbital margin intersection at low angle, in a smooth transition. Orbital margins straight, very finely serrated upper orbital rim, orbital angle is between 45° and 55° to longitudinal axis; orbits are rounded, shallow; augenrest shallow, elongate, separated from orbit by a small vertical ridge (Fig. 6.2); lateral margins of cephalic area straight, parallel with each other, with two outer orbital spines also characteristic for *G. bidentatus*. Lateral margins between outer orbital spine and branchiocardiac groove straight, posteriorly converging on longitudinal axis, bearing up to four lateral spines. Posterolateral margins rounded, posteriorly converging on longitudinal axis at an angle between 12° and 21°. Lateral and posterolateral margins merge at high angle, with pronounced offset at branchiocardiac groove.

Cervical groove well defined, laterally straight or undulated; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove weakly defined as two small segments on median third of carapace, perpendicular to axis. Branchiocardiac groove well developed on lateral third, weakly developed on median third which is strongly curved posteriorly, defining lateral sides of cardiac region, median third ends perpendicular to posterior margin. Cervical and branchiocardiac grooves are approximately parallel with each other.

Epigastric regions comprised of weakly elevated ovoid bulbs, converging anteriorly, separated by sulcus. Mesogastric region transversely ovate, well defined posteriorly by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior projection weakly defined, reaching epigastric region by anterior process; anterior part of mesogastric region weakly expressed, axially marked by a faint keel. Metagastric region rectangular, transverse to longitudinal axis; well defined by cervical and postcervical grooves. Urogastric region between postcervical groove and cardiac region, weakly developed, defined as two small depressions, perpendicular to axis; same width as metagastric region. Cardiac region triangular, apex oriented posteriorly, may have three tubercles on triangle tips, lateral margins defined by branchiocardiac groove, well defined on anterior side and weakly defined on posterior side. Intestinal region poorly defined, small triangular depressed area, apex of triangle oriented anteriorly. Protogastric and hepatic regions not differentiated. Epibranchial regions well defined as slanted rectangles by cervical and branchiocardiac grooves. Mesobranchial and metabranchial regions not differentiated.

Abdomen, venter, and appendages not preserved.

Material examined: LPBIIIart-165-1; LPBIIIart-165-2; LPBIIIart-165-3; LPBIIIart-165-5; LPBIIIart-165-6; LPB IIIart-165-7; LPBIIIart-165-8; LPBIIIart-165-9; LPBIIIart-165-19; LPBIIIart-165-20 – collected from Locality 1; LPBIIIart-165-4 – collected from Locality 2; LPBIIIart-165-12; LPBIIIart-165-13; LPBIIIart-165-14; LPBIIIart-165-15; LPBIIIart-165-16; – collected from Locality 3; LPBIIIart-165-10; LPBIIIart-165-11; LPBIIIart-165-17; LPBIIIart-165-18; – collected from Locality 4.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-165-1		9.69	4.53			4.53	4.05	3.69	0.80	2.24	7.83	43	17
LPBIIIart-165-2		11.40	5.34			6.90	4.27	5.36	1.87	1.91	10.34	53	21
LPBIIIart-165-3	13.64	12.17		10.89		6.26	4.89	4.98		4.02	11.33		
LPBIIIart-165-4		4.19					1.66		0.52	0.82			
LPBIIIart-165-5		10.02					4.74		1.27				
LPBIIIart-165-6		3.49			3.29		1.44		0.91	2.13			
LPBIIIart-165-7	15.24	13.42	6.34	6.85	12.02	7.44	5.58	5.46	1.70	2.97	12.48	52	18
LPBIIIart-165-8							5.00		1.35	2.89			
LPBIIIart-165-9							4.65						

Measurements (in mm): (cont.)

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-165-10		12.63	6.80		10.84	6.80	4.61	5.16	1.94	2.30	11.58	51	19
LPBIIIart-165-11		10.84			9.69		4.48		1.48			55	21
LPBIIIart-165-12		9.78	5.42		8.75	5.42	3.67	3.86	1.22	2.00	8.94	48	17
LPBIIIart-165-13	14.49	13.18	7.33	7.40	12.01	7.33	5.22	5.66	1.96	2.86	12.28	54	18
LPBIIIart-165-14	11.09	9.79	5.35	4.82	8.74	5.35	3.84	4.40	1.44	1.70	8.76	45	21
LPBIIIart-165-15		10.48			9.53				1.47			47	12
LPBIIIart-165-16	6.50	5.93	2.82	3.10	5.26	3.35	2.37	2.70	0.89	1.02	5.25	43	16
LPBIIIart-165-17	16.30	15.73	4.87	7.16		7.38	5.90	5.94	2.19	3.09	12.76	54	17
LPBIIIart-165-18		10.18	5.86	5.84		5.86	3.92	4.52	1.40			52	
LPBIIIart-165-19		8.83	3.47	5.05	7.92	5.27	3.67	3.89	0.67			56	
LPBIIIart-165-20		8.70					4.23		1.23	1.63		41	23

Discussion: The specimens examined have been collected from both locations, Piatra and Topalu, and they have an age range from middle Oxfordian to early Kimmeridgian. Based on their general morphology with carapace longer than wide, position and definition of the regions, and groove pattern, these specimens were placed within *Goniodromites*. Based on their specific morphological characters, including presence of four spines on the lateral margin, they were placed within *G. polyodon*. This is a species that has been found in abundance throughout Jurassic carbonate rocks in Europe.

Goniodromites cf. *bidentatus* Reuss, 1858
Fig. 7

cf. 1858 *Goniodromites bidentatus* Reuss, p.12.
cf. 2008 [imprint 2007] *Goniodromites bidentatus* Reuss 1858. – Schweitzer & Feldmann, p. 125, pl. 2, fig. A (with further synonymy).

Description of material: Left anterolateral part of the carapace preserved. Carapace moderately vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region, maximum width of carapace at the posterior anterolateral spine (Fig. 7.1).

Rostrum poorly preserved, appears to be rounded, axially sulcate; rostrum and orbital margin intersection at low angle, in a smooth transition. Orbital margins weakly convex, very finely serrated upper orbital rim, orbital angle is 51° to longitudinal axis; orbits rounded, shallow, augenrest shallow, elongate, separated from orbit by small vertical ridge (Fig. 7.2); lateral margins of cephalic area straight, parallel with each other, with outer orbital spines. Lateral margins partly preserved, posteriorly converging on longitudinal axis. Posterolateral and posterior parts of the carapace not preserved.

Cervical groove well defined, laterally straight; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove and branchiocardiac groove not preserved.

Epigastric regions comprised of weakly elevated, circular bulbs separated by sulcus. Mesogastric region transversely ovate, well defined posteriorly by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior projection weakly defined, reaching epigastric region by anterior process, anterior part of mesogastric region weakly expressed. Epibranchial regions well defined as slanted rectangles by cervical and branchiocardiac grooves. Metagastric, urogastric, cardiac, mesobranchial, metabranchial and intestinal regions not preserved.

Abdomen, venter, and appendages not preserved.

Material examined: LPBIIIart-166 – collected from Locality 4.

Measurements (in mm):

Specimen	L	W	MW	FW	FO	MGR	MGR	CG	OOS	CR	CR	O	L
LPBIIIart-166		8.68			8.02		3.50		1.00			51	

Discussion: This specimen was collected at Topalu from rocks with an age range of late Oxfordian to early Kimmeridgian. Even though it is only a fragment, the part that is preserved allowed identification of this specimen as belonging to *Goniodromites*. The manner in which the rostrum connects with the orbital margins, in a smooth transition, indicates that this specimen does not belong to *Goniodromites narinosus* n. sp. and the size of the two

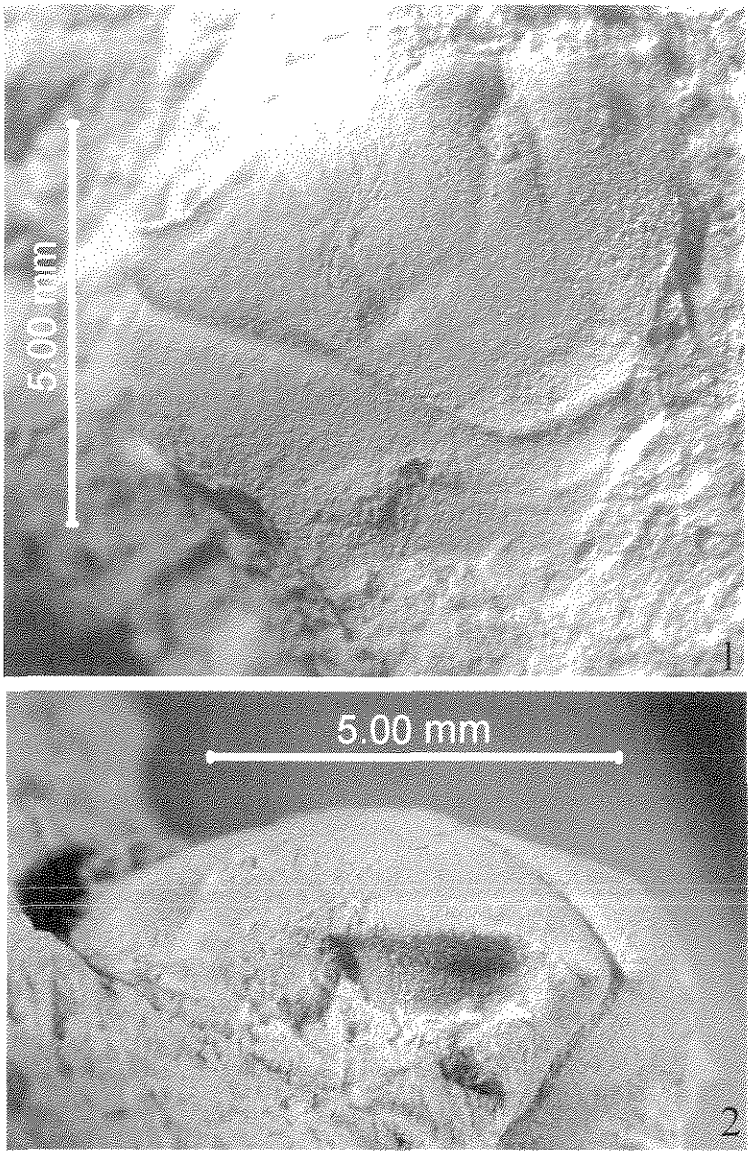


Fig. 7. Left antero-lateral fragment of *Goniodromites* cf. *bidentatus* Reuss, 1858. Specimen LPBIIIart-166; **1** – dorsal view; **2** – detail of orbital area.

outer orbital spines makes it different from *G. dentatus* Lőrenthey, 1929, that has larger outer orbital spines. Because the specimen does not preserve all the necessary characters to allow a precise species determination, it has been, with reservation, assigned to *G. bidentatus*. Because this specimen does not preserve the lateral margins it cannot be compared with *G. polyodon*.

Goniodromites narinosus n. sp.
Fig. 8

Etymology: The name of this species comes from the Latin word "narinosus" which means broad-nosed in order to reflect the shape and size of the rostrum of this species.

Types: LPBIIIart-164-1 – Holotype, collected from Locality 1; LPBIIIart-164-2 – Paratype, collected from Locality 3; LPBIIIart-164-3 – Paratype, collected from Locality 4.

Type locality and horizon: Specimens have been collected at Locality 1 (44°23'44.19"N, 28°33'42.43"E) in a limestone quarry near Piatra Village, on the banks of Taşaul Lake, from Piatra Member of Casimcea Formation, middle to late Oxfordian. Locality 3 (44°33'30"N, 28°02'07.6"E), and Locality 4, (44°34'02.3"N, 28°02'00.3"E) are on the right bank of Veriga Channel, on the east bank of the Danube river, in a series of old limestone quarries, from Topalu Member of Casimcea Formation, late Oxfordian to early Kimmeridgian.

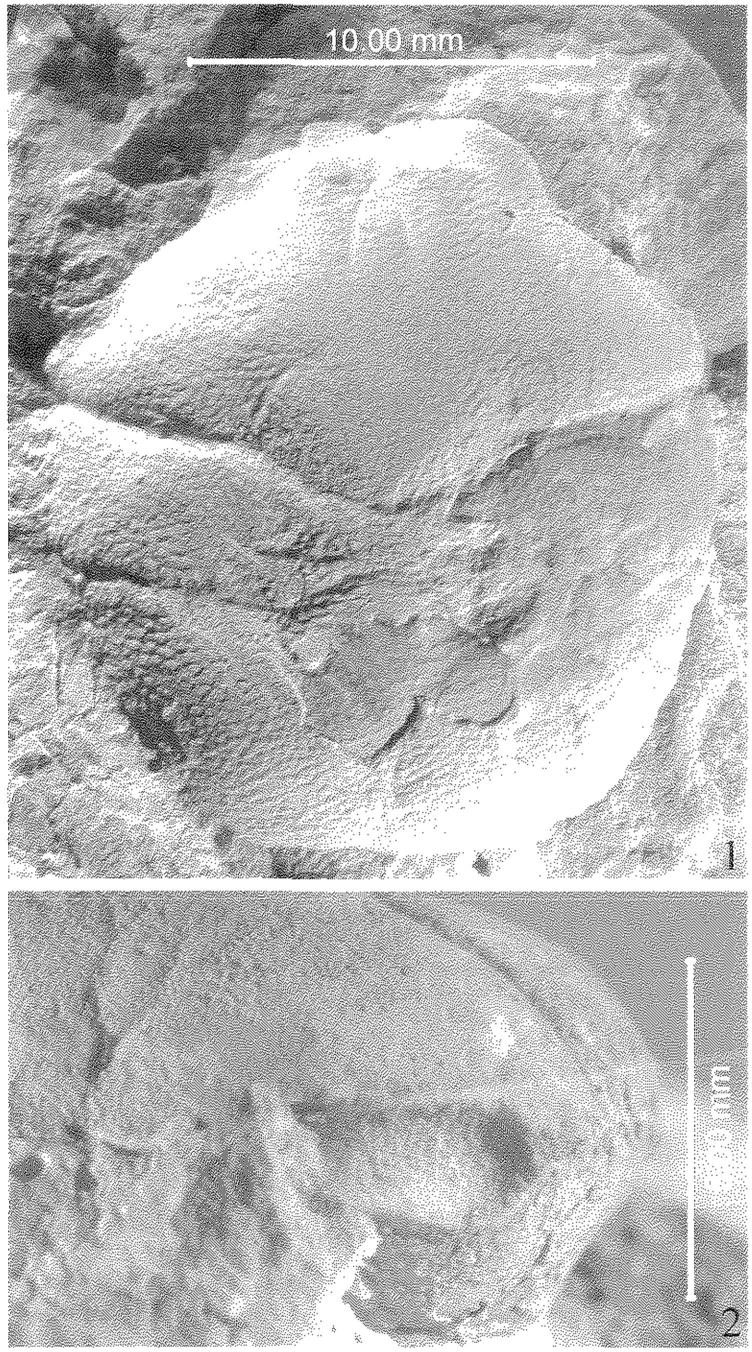


Fig. 8. *Goniodromites narinosus* n. sp.; **1** – Dorsal carapace of specimen LPBIIIart-164-1, holotype; **2** – Orbital area detail of specimen LPBIIIart-164-3, paratype.

Diagnosis: Carapace longitudinally ovoid, rostrum broad, spatulate, straight anterior margin perpendicular to axis, with small, shallow indent; rostrum meets orbital margins at high angle.

Description of material: Carapace longitudinally ovoid, moderately vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region, maximum width of carapace in anterior part of epibranchial regions. Carapace traversed by two transverse grooves, cervical groove well incised, branchiocardiac groove weakly incised (Fig. 8.1).

Rostrum wide, spatulate, downturned, most strongly downturned in mid third, with shallow axial incision; anterior margin of rostrum straight, perpendicular to longitudinal axis; rostrum and orbital margins merge at high angle. Orbital area with augenrest, elongate, moderately deep (Fig. 8.2), with straight margins, very finely serrated

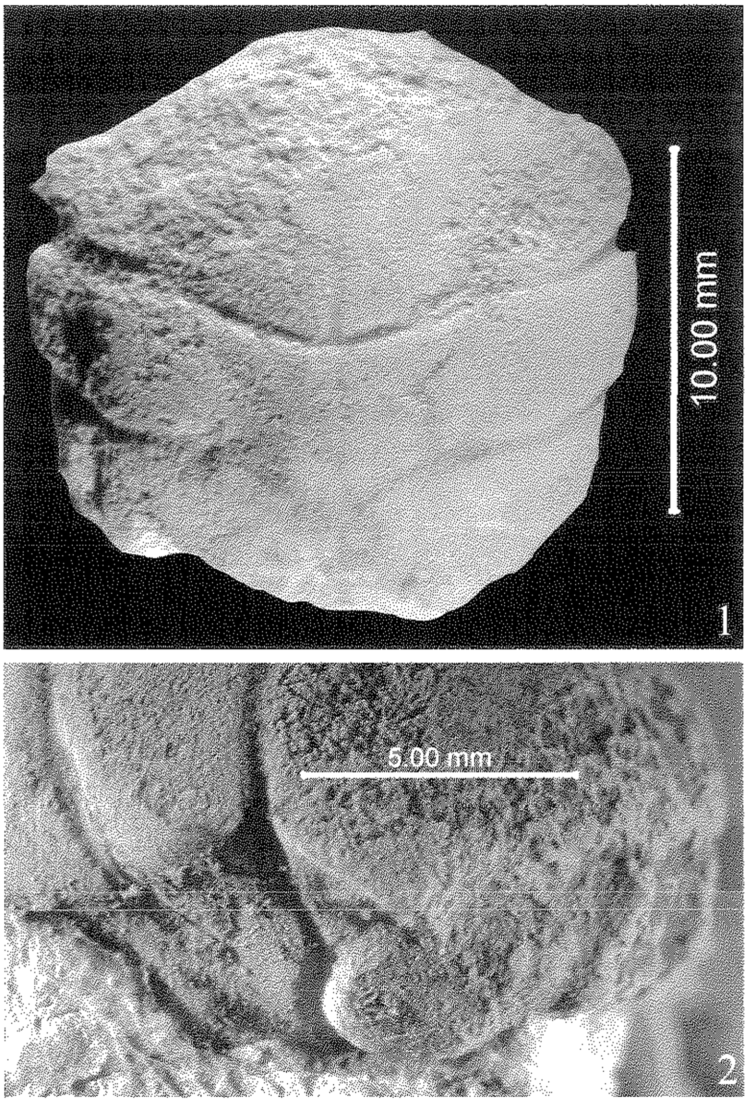


Fig. 9. *Eodromites grandis* (v. MEYER, 1857), specimen LPBIIIart-167; **1** – dorsal view; **2** – anterolateral view showing subhepatic region.

upper orbital rim, orbital angle between 41° and 56° to longitudinal axis; lateral margins of cephalic area anteriorly converging, with outer orbital spines. Lateral margins between cervical groove and branchiocardiac groove poorly preserved, straight, parallel with longitudinal axis. Posterolateral margins rounded, posteriorly converging on longitudinal axis at an angle between 15° and 27°.

Cervical groove well defined, laterally straight; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove weakly defined as two small segments on median third of carapace, perpendicular to longitudinal axis. Branchiocardiac groove moderately developed on lateral third, weakly developed on median third, strongly curved posteriorly, defining lateral margins of cardiac region, median third perpendicular to posterior margin. Lateral thirds of cervical and branchiocardiac grooves are approximately parallel with each other.

Epigastric region comprised of two slightly prominent ovoid bulbs, oriented and converging anteriorly, separated by sulcus. Mesogastric region transversely ovate, posteriorly well defined by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior side weakly defined, connecting to epigastric region by anterior process. Metagastric region rectangular, short, perpendicular to axis; well defined anteriorly by cervical groove and posteriorly by postcervical groove. Urogastric region weakly developed, defined as small depression between postcervical groove and cardiac region; same width as metagastric region. Cardiac region triangular, apex oriented posteriorly, lateral margins defined by branchiocardiac groove, well defined on anterior side with traces of two nodes, and weakly defined on posterior side. Intestinal region poorly defined, small triangular depressed area, apex of triangle oriented anteriorly. Protogastric and hepatic regions not differentiated, subhepatic region well defined by antennar groove, not inflated. Epibranchial regions well defined as slanted rectangles by cervical and branchiocardiac grooves. Mesobranchial and metabranchial regions not differentiated. Scabrous ornamentation on cuticule.

Abdomen, venter, and appendages not preserved.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-164-1	19.05	17.36	9.85	9.16	15.26	9.85	6.71	7.02	2.49			53	27
LPBIIIart-164-5		6.31	2.14	3.71	5.84	3.78	2.48	2.95	0.79	0.93	5.41	50	
LPBIIIart-164-6		13.38	5.06	6.95	12.52	7.95	4.76	5.82	2.17	3.06	13.00	48	15

Discussion: The specimens have been collected from both locations, Piatra and Topalu, with an age range of middle Oxfordian to early Kimmeridgian. Based on the general morphological characters, these specimens have been assigned to *Goniodromites* but they represent a new species because the overall outline of the carapace is more rounded than for *G. polyodon* and *G. bidentatus*, giving it an inflated appearance. The rostrum of *Goniodromites narinosus* n. sp. is broad and has a straight anterior margin which is perpendicular to the longitudinal axis, compared with *G. dentatus* which has a rostrum with a rounded anterior margin. The lateral margins of the rostrum of *Goniodromites narinosus* n. sp. are almost parallel with the longitudinal axis, connecting with the orbital margin at a high angle, giving the rostrum a rectangular shape with rounded anterior corners which differs than the outline of the rostrum of *G. laevis* and *G. polyodon*. The cephalic region is more inflated than in *G. polyodon*, and the augenrest is deeper than in *G. polyodon*.

Goniodromites sp.

Material examined: LPBIIIart-168-1; LPBIIIart-168-2; LPBIIIart-168-3; LPBIIIart-168-4; LPBIIIart-168-5; LPB IIIart-168-6; LPBIIIart-168-7; LPBIIIart-168-8; LPBIIIart-168-9; LPBIIIart-168-10; LPBIIIart-168-11; LPBIIIart-168-12; LPBIIIart-168-18 – collected at Locality 1; LPB IIIart-168-17 – collected at Locality 3; LPBIIIart-168-13; LPBIIIart-168-14; LPBIIIart-168-15; LPBIIIart-168-16 – collected at Locality 4.

Discussion: Twenty fragments of poorly preserved specimens have been examined but cannot be identified to species level. The few morphological characters that they preserve allowed assignment to *Goniodromites* sp. The specimens were collected from both locations, Piatra and Topalu, and they have an age range from middle Oxfordian to early Kimmeridgian. *Goniodromites* sp. is an omnipresent genus within Jurassic rocks throughout Europe.

Genus *Eodromites* Patrulius, 1959

Type species: *Prosopon grande* v. Meyer, 1857, by original designation.

Other species included: *Eodromites depressus* (v. Meyer, 1860); *E. nitidus* (A. Milne Edwards, 1865); *E. polyphemi* (Gemmellaro, 1869); *E. rostratus* (v. Meyer, 1840); *E. dobrogea* (Feldmann, Lazăr & Schweitzer, 2006).

Diagnosis: See Schweitzer & Feldmann, 2008 [imprint 2007]: 133.

Eodromites grandis v. Meyer, 1857
Fig. 9

1857 *Prosopon grande* v. Meyer, p. 556.
2008 [imprint 2007] *Eodromites grandis* (von Meyer). – Schweitzer & Feldmann, p. 134, pl. 4, figs. A-G (with further synonymy).

Description of material: One poorly preserved specimen. Carapace subrounded, weakly vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region, maximum width of carapace at the outer orbital nodes. Carapace traversed by two weakly incised transverse grooves (Fig. 9.1).

Fronto-orbital margin not preserved. Orbits at angle of 56° to longitudinal axis, elongated, shallow, with outer orbital nodes. Lateral margins between outer orbital node and branchiocardiac groove straight, posteriorly converging on longitudinal axis at angle of 16°, deeply incised by cervical groove. Posterolateral margins appear to be rounded.

Cervical groove well defined, laterally slightly concave; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third, it appears that two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove weakly defined as two small segments on median third of carapace, converging posteriorly. Branchiocardiac groove poorly developed, median third is strongly curved posteriorly, defining lateral sides of cardiac region. Cervical and branchiocardiac grooves lateral thirds are approximately parallel with each other.

Mesogastric region appearing transversely ovate, posteriorly defined by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior side poorly preserved, it has a slight tendency to subdivide.

Metagastric region rectangular, short and narrow; defined anteriorly by cervical groove and posteriorly by postcervical groove, transverse to longitudinal axis. Urogastric region not developed. Cardiac region weakly defined, pentagonal, apex oriented posteriorly, lateral margins defined by branchiocardiac groove. Intestinal region not preserved. Subhepatic region well inflated, well defined by antennar groove (Fig. 9.2). Epibranchial regions well defined by cervical and branchiocardiac grooves as slanted rectangles, slightly inflated ventro-lateral. Mesobranchial and metabranchial regions not preserved.

Abdomen, venter, and appendages not preserved.

Material examined: LPBIIIart-167 – collected at Locality 4.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-167		17.05								3.32		56	16

Discussion: The single specimen was collected from Topalu and has an age within the late Oxfordian to early Kimmeridgian. Even though the specimen is poorly preserved, morphological characters such as the pattern of the grooves, especially the cervical groove; the shape of the lateral margin; the overall shape of the carapace; and the strong inflation of the subhepatic region allowed placement of this specimen in *Eodromites*. It is assigned to *E. grandis* because the specimen has a more rounded outline than *E. depressus* which has the posterolateral margins strongly converging posteriorly. The shape of the cervical groove and the morphology of the lateral margins distinguish this specimen from *E. rostratus* because in *E. rostratus* the cervical groove is perpendicular on the axis where as in *E. grandis* is not; the shape and the size of the cardiac region separates this specimen from *E. polyphemi* because in *E. grandis* the cardiac region is pentagonal and in *E. polyphemi* the cardiac region is subcircular with a long and narrow anterior process.

Family Tanidromitidae Schweitzer & Feldmann, 2008 [imprint 2007]

Genus *Tanidromites* Schweitzer & Feldmann, 2008 [imprint 2007]

Type species: *Prosopon insigne* v. Meyer, 1857, by original designation.

Other species included: *Tanidromites etalloni* (Collins in Collins & Wierzbowski, 1985); *T. lingulata* (v. Meyer, 1858); *T. richardsoni* (Woodward, 1907).

Diagnosis: See Schweitzer & Feldmann, 2008 [imprint 2007]: 137.

Tanidromites cf. *richardsoni* Woodward, 1907

Fig. 10

cf. 1907 *Prosopon richardsoni* Woodward, p. 80, figs. 1-2.

cf. 2007 *Tanidromites richardsoni* (Woodward). – Schweitzer & Feldmann, p. 141, pl. 6, fig. K (with further synonymy)

Description of material: Carapace ovate, longer than wide, moderately vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region, maximum width of carapace in central part of epibranchial regions. Preserved part of carapace traversed by one moderately incised transverse groove. Cephalic area relatively flat. Posterior portion of dorsal carapace, from branchiocardiac groove, not preserved (Fig. 10.1).

Rostrum wide, triangular, axially depressed, downturned, with broken tip. Orbits shallow, elongate, with augenrest consisting of a elongated, depressed area, deeper than orbit, separated from orbit by small ridge (Fig. 10.2); upper orbital margin straight, divided by augenrest ridge, suborbital margins extend anteriorly more than upper orbital margin, orbital angle is 51° to longitudinal axis, orbits end with blunt outer orbital spine; fronto-orbital width, including augenrest, is 88 % of maximum width. Lateral margins from outer orbital node to branchiocardiac groove straight, parallel to longitudinal axis.

Cervical groove well defined, lateral third deeply incised; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove not defined. Branchiocardiac groove not preserved.

Epigastric region comprised of two moderately prominent ovoid bulbs, posteriorly converging, separated by deep sulcus. Mesogastric region transversely ovate, width about 53 % of maximum width, well defined posteriorly by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior side weakly defined, reaching epigastric region by anterior process. Metagastric and urogastric region poorly preserved. Protogastric and hepatic regions not differentiated. Epibranchial regions well defined by cervical groove, slightly convex. Cuticle covered with small pits.

Abdomen, venter, and appendages not preserved.

Material examined: LPBIIIart-159 collected at Locality 4.

Measurements (in mm):

Specimen	L	W	MW	F	FO	MGR	MGR	CG	OOS	CR	CR	O	L
LPBIIIart-159		18.00	14.15		15.8	15.78	9.51					51	

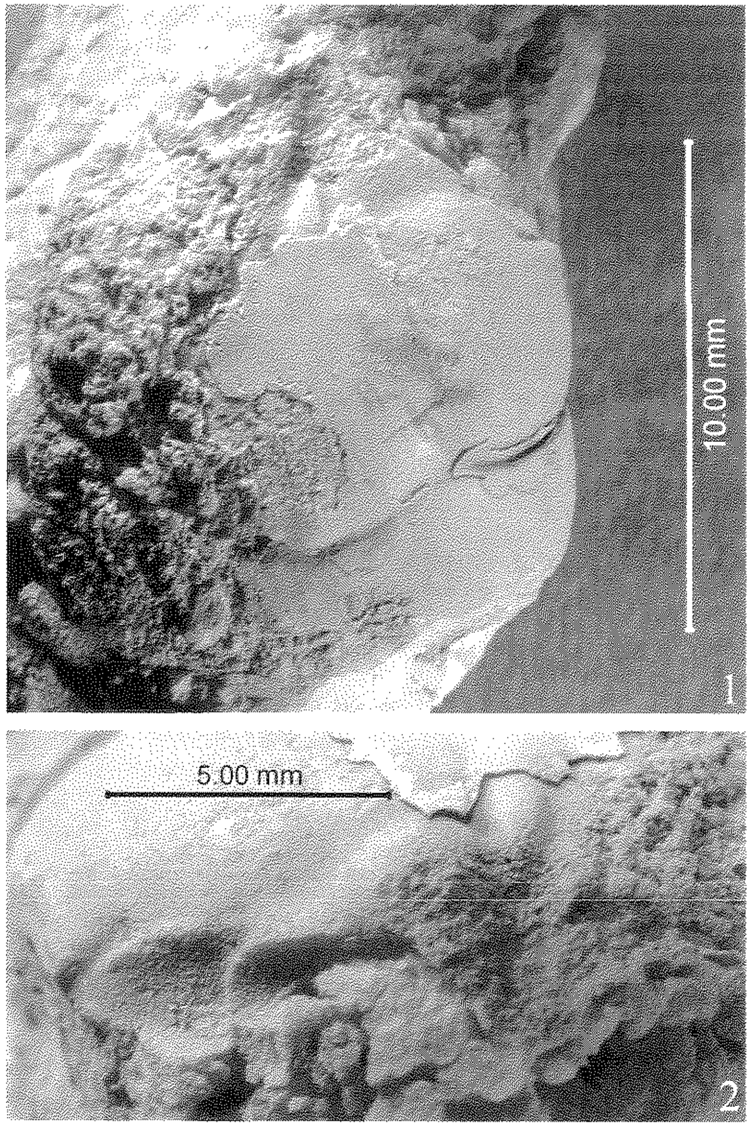


Fig. 10. *Tanidromites* cf. *richardsoni* (WOODWARD, 1907), specimen LPBIIIart-159; **1** – dorsal view; **2** – anterolateral view showing deeply sulcate, downturned rostrum and orbital area.

Discussion: The single specimen was collected from Topalu and has an age within late Oxfordian to early Kimmeridgian. Even though the specimen is poorly preserved, morphological characters such as the pattern of the cervical groove, the shape of the lateral margin, the flatness of the carapace, the way the suborbital margin extends anteriorly more than upper orbital margin, and the type of augenrest allowed placement in *Tanidromites*. This specimen was assigned to *Tanidromites* cf. *richardsoni* because the oval outline of the mesogastric region differs from the subtriangular outline of the mesogastric region of *T. insignis*. The depth of the grooves in *Tanidromites* cf. *richardsoni* differs from those of *T. lingulata* because the grooves in *T. lingulata* are more deeply incised; the parallel lateral margins separate this specimen from *T. lingulata* and *T. etalloni*; and the cephalic area of the carapace of *Tanidromites* cf. *richardsoni* is less inflated than the cephalic area of *T. etalloni*.

Superfamily Glaessneropsoidea PATRULIUS, 1959
Family Konidromitidae SCHWEITZER and FELDMANN, in press.

Genus *Concavolateris* nov.

Etymology: The name of this genus derives from the Latin words "concavus" and "lateris" which means "arched inward" and "side/flank". The name reflects the morphology of the lateral margins which have a deep reentrant on them.

Type species: *Concavolateris barbulescuae* n. gen. n. sp., monotypic.

Diagnosis: As for the type species.

Discussion: This genus has been placed in this family because it has forward-directed orbits, well developed flanks which are very high, and a subhepatic region which is similar to those of other genera within Konidromitidae. However this specimen has a series of characters which make it stand apart as a new genus. The outline of the carapace is more oval than for other species within Konidromitidae because of the antero-lateral margins; the branchiocardiac groove is poorly developed, only on the lateral thirds; all of the regions are poorly defined or not developed; the lateral margins have a deep reentrant from the anterior part of epibranchial region to the mid section of metabranchial region; and the posterior margin is deeply concave.

Concavolateris barbulescuae n. sp.
Fig. 11

Etymology: This species was named after Dr. Aurelia Bărbulescu, for her contribution to the paleontology of Dobrogea, Romania.

Type: LPBIIIart-158 – Holotype.

Type locality and horizon: The specimen was collected from Locality 4, (44°34'02.3"N, 28°02'00.3"E) on the right bank of Veriga Channel, on the east bank of the Danube river, in an old limestone quarry, from Topalu Member of Casimcea Formation, late Oxfordian to early Kimmeridgian.

Diagnosis: Carapace longitudinally ovate, tall, with steep lateral flanks; lateral margins with deep reentrant; regions poorly defined or not developed; subhepatic regions with flat surface; metabranchial regions with four spines.

Description: Carapace ovate, longer than wide, width 85% of maximum length, anterior third about 43% of maximum length, slightly vaulted transversely and moderately vaulted longitudinally, point of maximum convexity in middle of metagastric region, maximum width of carapace in anterior part of epibranchial regions at about 37 % of total length. Carapace traversed by two grooves, cervical groove well incised, branchiocardiac groove poorly developed only on the lateral thirds. Flanks tall, slightly convex, converging ventrally (Fig. 11.1).

Rostrum not preserved; orbits short, at angle of 67° to the longitudinal axis, sub-orbital margin appears to extend anteriorly more than upper orbital margin. Fronto-orbital width 68% of maximum width. Anterolateral margins rounded anteriorly, converging on longitudinal axis. Lateral margins deeply indented posterior to epibranchial region, with remains of a large spine on the anterior side of epibranchial region and remains of up to five small spines on

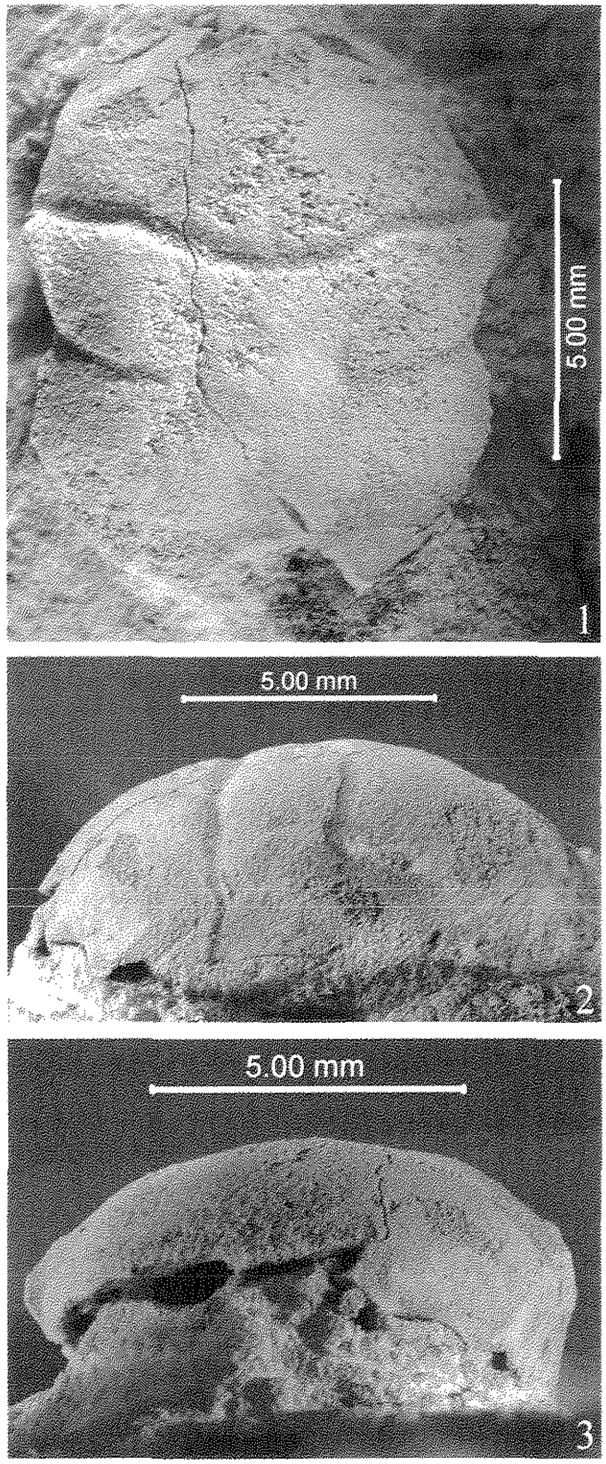


Fig. 11. *Concavolateris barbulescuae* n. sp., specimen LPBIIIart-158, holotype; **1** – dorsal view; **2** – lateral view; **3** – frontal view.

branchial region. Posterolateral margins rounded, posteriorly converging on longitudinal axis. Posterior margin poorly preserved.

Cervical groove well defined; median third weakly curved posteriorly defining posterior side of mesogastric region; it appears that at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove not defined. Branchiocardiac groove well developed on lateral third, not developed on median third. Cervical and branchiocardiac grooves approximately parallel with each other.

Epigastric region not differentiated. Mesogastric region transversely ovate, width about 78 % of maximum width, well defined posteriorly by cervical groove, lateral sides defined by two shallow grooves connected to cervical groove; anterior side not differentiated from epigastric region; small notch on posterior side represents separation point of insertion of masticator muscle. Metagastric and urogastric regions poorly developed and not differentiated, rectangular, short, transverse to longitudinal axis. Cardiac region poorly developed, pentagonal, apex oriented posteriorly, moderately prominent; wider than long, length 68 % of width. Intestinal region poorly defined, large triangular depressed area, length 17 % of total length of carapace, apex of triangle oriented anteriorly. Protogastric and hepatic regions not differentiated. Subhepatic region poorly defined by ventral extensions of the cervical groove, slightly depressed (Fig. 11.2). Epibranchial regions well defined by cervical and branchiocardiac grooves. Mesobranchial and metabranchial regions not differentiated.

Abdomen, venter, and appendages not preserved.

Other species included: *Laeviprosopon fraasi* (Moericke, 1889); *L. grandicentrum* Schweitzer & Feldmann, 2008; *L. laculatum* Schweitzer & Feldmann, 2008; *L. punctatum* (v. Meyer, 1857); *L. sublaeve* (v. Meyer, 1857), *Laeviprosopon lazarae* n. sp. herein.

Diagnosis: See Schweitzer & Feldmann, 2008: 276

Laeviprosopon lazarae n. sp.
Fig. 12

Etymology: This species was named after Dr. Iuliana Lazăr, as appreciation for her guidance and advising during my undergraduate studies.

Types: LPBIIIart-161-1 – Holotype; LPBIIIart-161-2 – Paratype.

Type locality and horizon: The specimens were collected from Locality 4, (44°34'02.3"N, 28°02'00.3"E) on the right bank of Veriga Channel, on the east bank of the Danube river, in an old limestone quarry, from Topalu Member of Casimcea Formation, late Oxfordian to early Kimmeridgian.

Diagnosis: Carapace rhombohedral, anterolateral margins strongly converging anteriorly; rostrum broad, triangular, depressed; mesogastric region highly inflated; hepatic and subhepatic regions inflated and with two large spines; protogastric and hepatic regions well differentiated; cardiac region narrow, long, with three notes.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-158	10.93	9.25	4.03		6.29	4.75	7.20	3.69				67	

Discussion: The single specimen was collected from Topalu, and has an age within the late Oxfordian to early Kimmeridgian. The roundness of the anterolateral and posterolateral margins gives the carapace of this species a distinctive ovate shape, and combined with the steepness of the lateral flanks (Fig. 11.3), this carapace is dome-shaped. Also, the two reentrants on the lateral margins make it stand apart as a distinct new genus and species. The anterior part of the specimen is not well enough preserved so the orbital areas cannot be fully described.

Family *Prosopidae* v. Meyer, 1860

Genus *Laeviprosopon* Glaessner, 1933

Type species: *Prosopon laeve* v. Meyer, 1857.

Description: Carapace rhombohedral, longer than wide, width 67 % of maximum length, maximum width at middle of epibranchial region, strongly vaulted transversely and longitudinally, point of maximum convexity in middle of mesogastric region. Carapace traversed by two well incised transverse grooves, metabranchial regions not preserved (Fig. 12.1).

Rostrum short, broad, triangular, spatulate, with broken tip; orbits pointing forward, upper orbital rim with reentrant. Fronto-orbital width 63 % of maximum width. Posterolateral margins not preserved. Posterior margin partially preserved.

Cervical groove well defined, composed of three arched segments; median third curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two distinct grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove weakly defined as two short depressed segments, posteriorly converging. Branchio-

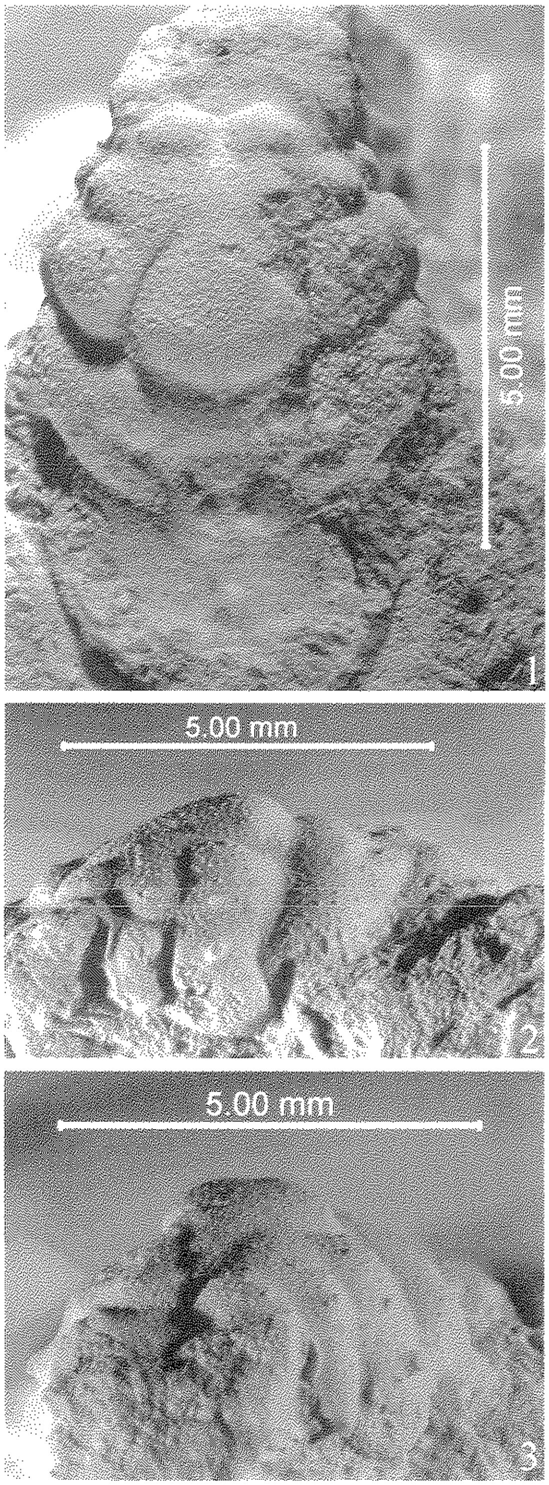


Fig. 12. *Laeviprosopon lazarae* n. sp., specimen LPBIIIart-161-1, holotype;
1 – dorsal view; **2** – lateral view; **3** – antero-lateral view.

cardiac groove well developed median third curved posteriorly defining lateral and posterior side of cardiac region, median third not reaching onto posterior margin. Cervical and branchiocardiac grooves are approximately parallel with each other.

Epigastric region, weakly developed, comprised of two moderately prominent ovoid swellings, perpendicular to longitudinal axis, separated by sulcus, anterior part slightly depressed. Mesogastric region ovate, transverse to longitudinal axis, highly inflated, bulbous (Fig. 11.2); width about 44 % of maximum width, well defined posteriorly by cervical groove, faint keel separates attaching points for masticator muscles; lateral sides defined by two distinct grooves connected to cervical groove; anterior side weakly defined, reaching epigastric region by anterior process. Metagastric region well developed, rectangular shape, short, wider than mesogastric region, transverse to longitudinal axis. Urogastric region weakly developed, slightly depressed. Cardiac region well developed, long, triangular, posteriorly oriented apex, two inflated nodes on anterior side. Intestinal region poorly developed as small depressed area between metabranchial regions. Hepatic regions well developed, divided in two subregions, with one small spine at the lower part on each subregion. Subhepatic regions well developed, well differentiated, highly inflated (Fig. 12.3), divided into subregions, anterior subregion acts as protective cover for augenrest, posterior subregion with large spine on superior margin. Epibranchial regions well defined, moderately inflated, ovate in shape, posteriorly converging, anterolateral ends poorly preserved. Metabranchial regions not preserved.

Abdomen, venter, and appendages not preserved.

Measurements see below

Discussion: The specimens were collected from Topalu and have an age within the late Oxfordian to early Kimmeridgian. The rhombohedral outline of the carapace is due to lack of preservation of the posterolateral sides of the carapace, most likely because of their weak calcification; a defining character of the superfamily. Careful examination of the specimens showed some important differences between this new species and *Laeviprosopon laeve*; the rostrum is short and triangular on the new species compared with the trifid rostrum of *L. leave*, the subdivision of hepatic and subhepatic regions of the new species is not

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-161-1	7.51	5.04	4.19		3.20	4.19	2.23	3.09		1.06	7.11		25
LPBIIIart-161-2							2.66						

present on *L. leave*, and the new species exhibits large spines on the hepatic and subhepatic region and also on the rim of the augenrest, spines that are not present on *L. laeve*. The mesogastric region of the new species is subrounded compared with *L. laeve*, which has a subtriangular mesogastric region. Also the anterior process of the new species is not as developed as in *L. laeve*; and the cardiac region is narrow and less inflated on the new species compared with *L. laeve*. This new species differs from *L. fraasi* because the anterior process of the mesogastric region of *L. fraasi* it is well developed, longer and wider, completely separating the epigastric regions; cervical groove of *L. lazarae* n. sp. is more arcuate than the cervical groove in *L. fraasi* which also has a much wider cardiac region than *L. lazarae* n. sp.

Superfamily Glaessneropsoidea Patrulius, 1959
Family Glaessneropsidae Patrulius, 1959

Genus *Verrucarcinus* Schweitzer & Feldmann, 2009

Type species: *Prosopon torosum* v. Meyer, 1857.

Other species included: *Verrucarcinus ordinatus* (Collins in Collins & Wierzbowski, 1985); *Verrucarcinus cutifrontis* n. sp. herein.

Diagnosis: See Schweitzer & Feldmann 2009: 89.

Verrucarcinus cutifrontis n. sp.
Fig. 13

Etymology: The name of this species comes from the Latin words “cutio” and “frontis” which means “small insect” and “face”. This name was chosen in order to reflect how protogastric and mesogastric regions connect with each other and resemble an insect face, a praying mantis.

Type: LPBIIIart-160 – Holotype.

Type locality and horizon: The specimen was collected from Locality 5 (44°34’22.4”N, 28°02’04.9”E) on the east bank of the Danube river, in a small bioherm along the Veriga Channel, in a road cut, from Topalu Member of Casimcea Formation, late Oxfordian to early Kimmeridgian.

Diagnosis: Carapace ovate; cervical groove moderately incised, comprised of three arches; posterior side of mesogastric region well rounded; protogastric regions defined only on posterolateral sides; metagastric region not subdivided; ornamentation comprised of low nodes, large spines only on the posterolateral margins.

Description: Carapace ovate, longer than wide, width 79% maximum length, maximum width at middle of metabranchial regions, strongly vaulted transversely and longitudinally, point of maximum convexity in middle of

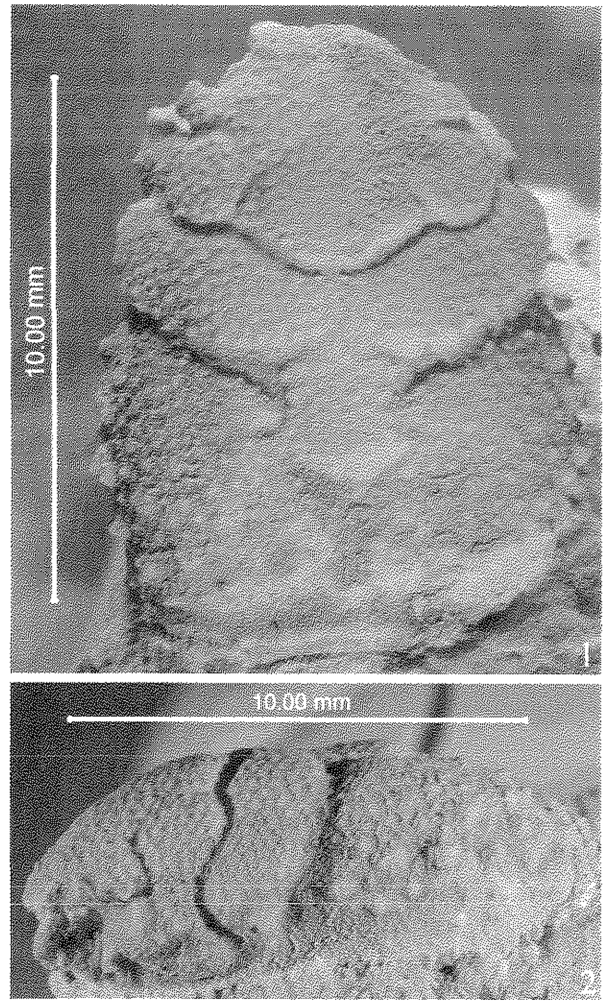


Fig. 13. *Verrucarcinus cutifrontis* n. sp., specimen LPBIIIart-160, holotype; 1. Dorsal view; 2. Lateral view.

cardiac region. Carapace traversed by two well incised transverse grooves (Fig. 13.1).

Rostrum not preserved; orbital rim at angle of 67° to longitudinal axis; sub-orbital spine triangular, upper orbital spine with rectangular shape, both anterolaterally oriented; outer orbital spine triangular, anteriorly oriented. Fronto-orbital width 67 % of maximum width. Anterolateral margins straight, converging anteriorly on longitudinal axis. Lateral margins behind branchiocardiac groove with 5-7 large nodes with small spines on them. Posterolateral margins and posterior margin arcuate; posterior margin has spines and depressed rim.

Cervical groove well defined as three concave forward arches; median arch weakly curved posteriorly defining posterior side of mesogastric region; at connection point of middle third with lateral third two weakly shallow grooves arise and curve anteriorly, defining lateral margins of mesogastric region. Postcervical groove weakly defined as two segments, anteriorly converging, connected to branchiocardiac groove, defining anterior side of cardiac region. Branchiocardiac groove well developed, median third curved posteriorly defining lateral and posterior side of cardiac region, terminate perpendicular to posterior rim, completely separates metabranchial regions. Cervical and branchiocardiac grooves are approximately parallel with each other.

Epigastric region poorly preserved, weakly developed, comprised of two moderately prominent subrounded swellings separated by sulcus. Mesogastric region triangular with apex oriented anteriorly, width about 40 % of maximum carapace width, well defined posteriorly by cervical groove, lateral margins defined by two shallow grooves connected to cervical groove; anterior side weakly defined, reaching epigastric region by anterior process, with very poorly developed longitudinal groove. Metagastric region very well developed, bilobate, transversely oriented, defined by cervical groove on the anterior side and posterior side defined by branchiocardiac and postcervical grooves, axially divided by a longitudinal groove. Urogastric region not developed. Cardiac region, short, well developed, pentagonal with concave sides parallel to longitudinal axis, posterior side more inflated than anterior side. Intestinal region poorly developed as a small depression between metabranchial regions. Hepatic regions well developed, circular, anterior side weakly differentiated from epigastric regions. Subhepatic regions well developed, well differentiated, moderately inflated, with spines on anterolateral margin (Fig. 13.2). Epibranchial regions well defined, weakly differentiated from metagastric region, ovate in shape, posteriorly converging, anterior sides moderately inflated. Mesobranchial and metabranchial regions not differentiated, well developed, inflated.

Carapace covered by small tubercles, large nodes present only on posterolateral margin.

Abdomen, venter, and appendages not preserved.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-160	12.08	9.54	8.18		6.44	5.19	3.78	3.18		2.88	9.13	67	19

Discussion: The specimen was collected from Topalu and has an age within the late Oxfordian to early Kimmeridgian. This new species has been placed within this genus because the outline of the carapace, the morphology of the orbital areas, and the size and the shape of the cardiac region are similar to those of other species of *Verrucarcinus*. Compared with *Verrucarcinus torosus* (v. MEYER), the carapace of *Verrucarcinus cutifrontis* n. sp. is shorter, wider, and flatter than of *V. torosus* which is longer and narrower giving him the form of an arrow head; cardiac region of *V. cutifrontis* n. sp. is longer and poorly defined on the anterior part whereas *V. torosus* has a well defined cardiac region; intestinal region is longer in *V. cutifrontis* n. sp.; posterior margin is wider; posterior part of mesogastric region is more rounded; lateral parts of the metagastric regions are weakly differentiated from the epibranchial regions; the third segment of the carapace, from the branchiocardiac groove to posterior margin, is longer than or equal to the anterior two segments, where in *V. torosus* the third segment is shorter than the anterior two segments; third segment ornamentation consists of large nodes and small spines only on the lateral sides, anterior segments are ornamented with small nodes. When compared with *V. ordinatus*, *V. cutifrontis* n. sp. has grooves surrounding the mesogastric region and the postcervical groove less incised; the metagastric region is not as divided as in *V. ordinatus*, being almost one single area, and the ornamentation of the metabranchial regions differs because *V. cutifrontis* n. sp. has small nodes on the branchial regions, and has large spines only on the outline of metabranchial regions, whereas *V. ordinatus* has large nodes covering the entire branchial area and has no spines.

Family Lecythocaridae SCHWEITZER & FELDMANN, 2009

Genus *Lecythocaris* v. MEYER, 1860

Type species: *Prosopon paradoxum* v. MEYER, 1858.

Other species included: *Lecythocaris obesa* SCHWEITZER & FELDMANN, 2009; *Lecythocaris stoicai* n. sp. herein.

Diagnosis: See SCHWEITZER & FELDMANN 2009: 94.

Lecythocaris stoicai n. sp.
Fig. 14

Etymology: This species was named after Dr. MARIUS STOICA as appreciation for his guidance and advising during my undergraduate studies.

Type: LPBIIIart-162 – Holotype.

Type locality and horizon: The specimen was collected from Locality 4, (44° 34' 02.3"N, 28° 02' 00.3"E) on the right bank of Veriga Channel, on the east bank of the Danube river, in an old limestone quarry, from Topalu Member of Casimcea Formation, late Oxfordian to early Kimmeridgian.

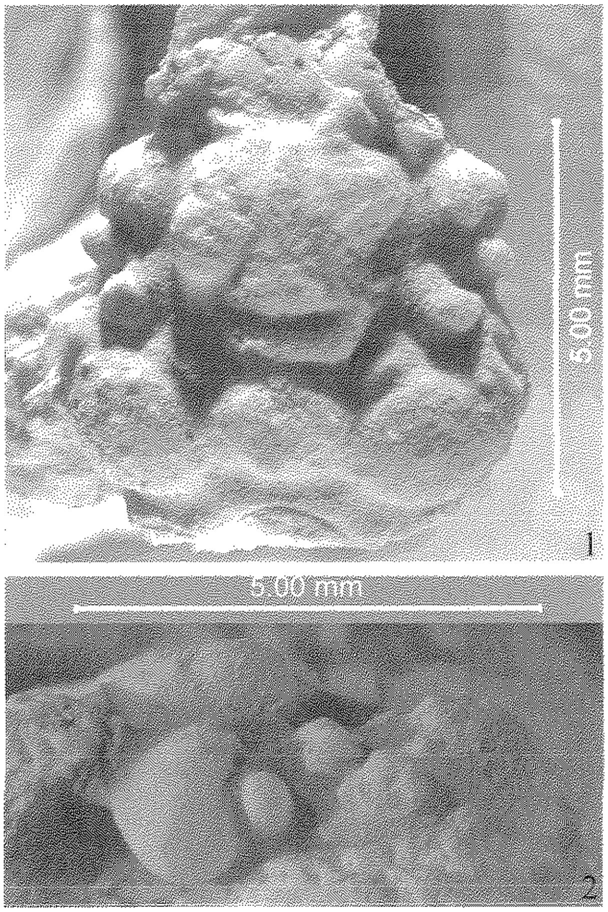


Fig. 14. *Lecythocaris stoicai* n. sp., specimen LPBIIIart-162, holotype; **1** – dorsal view; **2** – lateral view.

Diagnosis: Carapace triangular, wider than longer; deep well incised grooves; highly inflated regions; mesogastric region poorly differentiated; large, inflated hepatic regions; small cardiac region; epibranchial region developed as two prominent nodes.

Description: Carapace triangular, wider than longer, width 105 % maximum length, maximum width metabranchial regions, strongly vaulted transversely and longitudinally, point of maximum convexity at protogastric regions. Carapace traversed by deep, incised grooves. All regions inflated, bulbous, well defined (Fig. 14.1).

Rostrum poorly preserved, appears to be broad, spatulate, with rounded downturned tip, axially depressed. Orbits pointing forward, upper orbital rim with ovoid reentrant; Suborbital rim appears to extend forward more than upper rim, same type of reentrant, and one suborbital spine. Fronto-orbital width 54 % of maximum width. Posterior margin deeply concave.

Cervical groove weakly developed, poorly defined, arched. Postcervical groove weakly defined only in axial region as short straight segment perpendicular to mid axis. Branchiocardiac groove poorly defined as two arcuate segments delimiting metabranchial regions, two arcs connect with posterior rim, never with each other. Posterior rim well defined along entire length.

Epigastric region not differentiated from protogastric region, weakly developed as subcircular, flat areas, separated by anterior process of mesogastric region. Mesogastric region triangular, apex anteriorly oriented, poorly defined, slightly inflated, small, 23 % of maximum width; lateral sides defined by two shallow grooves connected to cervical groove; anterior side weakly defined, reaching epigastric region by anterior process, which is well developed. Metagastric region well developed, rectangular, transversely oriented. Urogastric region not differentiated. Cardiac region well developed, highly inflated, almost circular. Intestinal region not differentiated. Protogastric regions well developed, ovate, longitudinally oriented, highly bulbous on posterior side. Hepatic regions small, weakly developed, remains of up to two laterally oriented spines. Subhepatic regions very well developed, well differentiated, highly inflated on the ventral side (Fig. 14.2), remains of two spines. Epibranchial regions weakly defined as two inflated nodes, ovate in shape, converging posteriorly, anterolateral margins poorly preserved. Metabranchial regions very well developed, ovate, converging posteriorly, highly inflated, covered with low nodes.

Abdomen, venter, and appendages not preserved.

Measurements see below

Discussion: The specimen has been collected from Topalu and has an age within the late Oxfordian to early Kimmeridgian. Compared with *Lecythocaris obesa* Schweitzer & Feldmann, 2009 (NHMW 1990/004/4126 – holotype), the mesogastric region of *Lecythocaris stoicai* is slightly longer than the mesogastric region in *L. obesa*, the surrounding grooves of the mesogastric region of *L. obesa* are not as deeply developed as in *L. stoicai* n. sp.; the protogastric regions of *L. stoicai* n. sp. have smaller swellings on the posterior side than the protogastric regions of *L. obesa*. Metagastric region of *L. stoicai* n. sp. is much shorter than metagastric region of *L. obesa*; the cardiac region of *L. stoicai* n. sp. is less swollen; nodose swellings on the posterior part of the metabranchial region are absent, and the rostrum and epigastric regions are not that strongly downturned as for *L. obesa*.

Comparison with *L. paradoxa* (v. Meyer, 1858) (NHMW 1990/0041/3983), the anterior half of *L. stoicai* n. sp. is less

Measurements (in mm):

Specimen	L	W	MW	FW	FO	MGR	MGR	CG	OOS	CR	CR	O	L
LPBIIIart-162	6.6	6.9	3.92		3.76	3.92	1.60			1.17	5.88		35

inflated; the upper orbital rim reentrant is shorter and the base is circular; the mesobranchial swellings are larger; there is a length difference between the two large spines on the metabranchial region; and the carapace of *L. stoicai* n. sp. is overall more flattened.

Family Longodromitidae Schweitzer & Feldmann, 2009

Genus *Longodromites* Patrulius, 1959

Type species: *Prosopon angustum* Reuss, 1858, by original designation.

Other species included: *Longodromites bicornutus* Muțiu & Bădăluță, 1971; *L. excisus* (v. Meyer, 1857); *L. ovalis* (Moericke, 1889).

Diagnosis: See Schweitzer & Feldmann 2009: 101.

Longodromites angustus (Reuss, 1858)
Fig. 15

1858 *Pithonoton angustum* Reuss, 1858, p. 11.
2009 *Longodromites angustus* (Reuss 1858). – Schweitzer & Feldmann, p. 101, figs. 1.6, 7.4-7.7 (with further synonymy).

Description of material: Carapace ovate, longer than wider, width 72 % maximum length, maximum width in the anterior part of epibranchial region, weakly vaulted transversely and longitudinally, point of maximum convexity in the mesogastric region. Carapace traversed by well incised grooves; strongly dorso-ventrally compressed (Fig. 15).

Rostrum poorly preserved, appears to be spatulate, with rounded, sulcate, downturned tip. Orbits rounded, facing forward, shallow, pointing anterolaterally at an angle of 47° to longitudinal axis. Fronto-orbital width is 84 % of maximum width. Lateral margins straight, parallel to longitudinal axis; posterolateral margins curved, converging posteriorly; posterior margin straight.

Cervical groove well developed, straight, perpendicular to the axis, slightly concave axial to define posterior margin of mesogastric region. Postcervical groove weakly defined, only in axial region, as short, shallow, straight segment perpendicular to mid axis. Branchiocardiac groove well defined laterally, poorly defined axially, mid section strongly curved posteriorly to define lateral margins of ardiac region. Posterior rim poorly preserved, weakly defined.

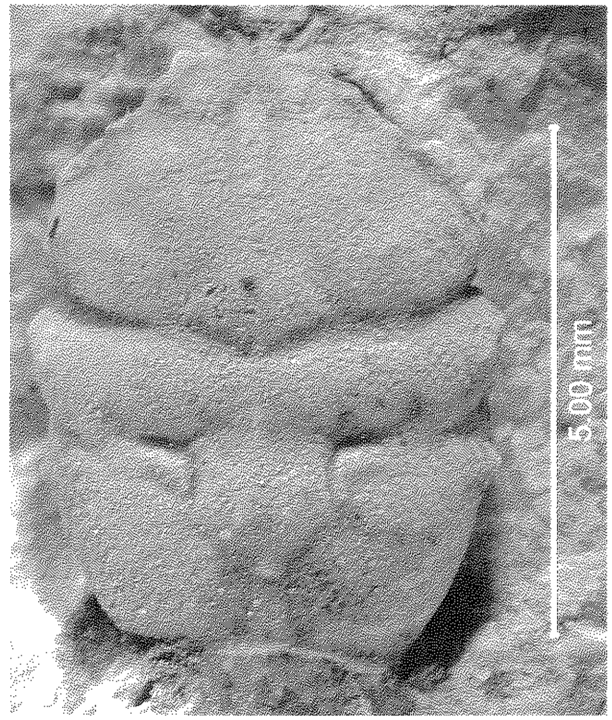


Fig. 15. *Longodromites angustus* (Reuss, 1858), specimen LPBIIIart-163-2; dorsal view.

Epigastric region comprised of two slightly prominent circular swellings separated by sulcus. Mesogastric region poorly defined, transversely ovate, width about 37% of maximum width, connecting to epigastric region by very long anterior process. Metagastric region well developed, long, rectangular shape, transversely oriented. Cardiac region well developed, pentagonal, slightly prominent, with three low nodes. Intestinal region poorly developed. Urogastric region not differentiated. Protogastric region not differentiated. Hepatic regions poorly differentiated, not inflated, with remains of two nodes. Epibranchial regions well defined by cervical and branchiocardiac grooves, slightly inflated, with anterolateral spine, with finger like extension directed at cardiac region. Metabranchial regions well developed, ovate, converging posteriorly.

Abdomen, venter, and appendages not preserved.

Material examined: LPBIIIart-163-1, LPBIIIart-162-5 collected at Locality 4; LPBIIIart-163-2, LPBIIIart-163-3, LPBIIIart-163-4 collected at Locality 3.

Measurements (in mm):

Specimen	L	W	MWD	FW	FOW	MGRD	MGRW	CGD	OOSD	CRL	CRD	OA	LA
LPBIIIart-163-1	6.48	4.71	3.11		4.26	3.11	1.74	2.75		1.49	5.49		16
LPBIIIart-163-2	12.26	9.35	5.46		8.36	5.96	3.68	4.96		2.23	10.19	55	19
LPBIIIart-163-3	6.02	4.34	2.98	1.60	3.64	3.27	1.60	2.67		1.27	5.30	47	24
LPBIIIart-163-4		4.63								1.05			

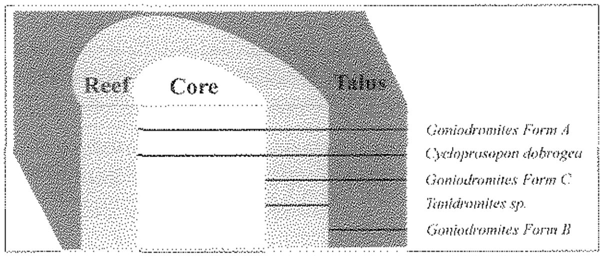
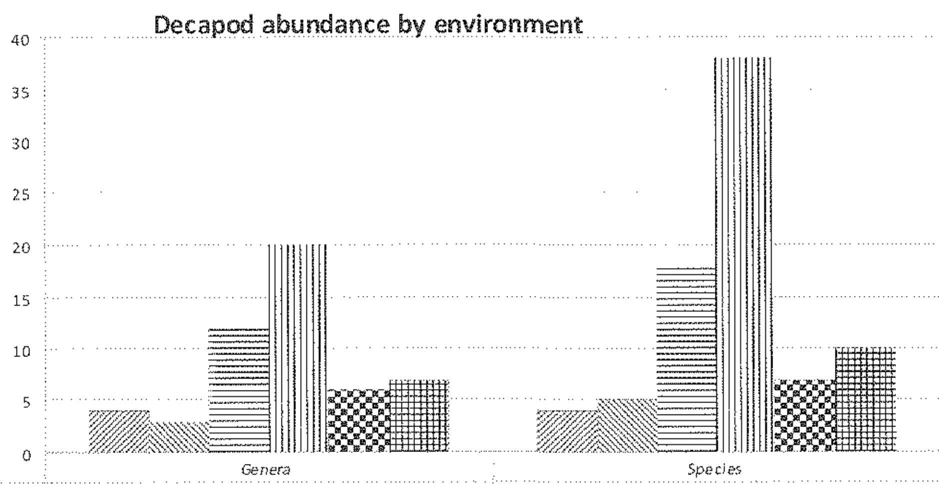


Fig. 16. Schematic diagram representing the distribution of genera within ring-shaped sponge reefs from central Dobrogea (data collected from FELDMANN et al. 2006).

Discussion: The specimens were collected from Topalu and have an age estimated at late Oxfordian to early Kimmeridgian. After studying all the morphological characters presented by these specimens, such as: a bifid, downturned rostrum, parallel lateral margins, a flat carapace; and poorly developed regions, the material can be assigned to *Longodromites angustus*. Because these specimens have parallel lateral margins they are different from *L. ovalis*; and they differ from *L. excisus* because the cervical groove is straight and the branchiocardiac groove is deeply incised.

4. Paleoecology

During the latest Middle Jurassic, central Dobrogea was covered by a warm shallow sea on the northern margin of the Tethys Ocean. A carbonate platform depositional environment (Fig. 3) was established resulting in growth of a multitude of coral patch reefs and sponge reefs (Fig. 4.1, 4.2). These reefs were composed of multiple types of coral colonies and solitary polyps that were loosely intermixed to form complex frameworks that offered a lot of open spaces. Because of this open framework (DRAGASTAN et al. 1998), the reefs were inhabited by a diverse array of organisms, including bivalves, brachiopods, gastropods, echinoids, crinoids, and decapods. This increased variety of organisms inhabiting the reefs along with the coral polyps provided a great food base for decapods, which are scavengers/predators, resulting in an abundance of decapod taxa within these coral reefs. By comparison with sponge reefs from central Dobrogea (Cheia and Gura Dobrogei) (FELDMANN et al. 2006; SCHWEITZER et al. 2007), decapods are almost twice as abundant in the coral reefs. The actual value of this abundance is even higher than the values presented in this paper because specimens assigned to Galatheoidea SAMOUELLE, 1819 (squat lobsters), have



	Genera	Species
Gura Dobrogei - Sponge	4	4
Cheia - Sponge	3	5
Purcareni - Coral	12	18
Sinaia/Moroeni - Coral	20	38
Gherghesa - Coral	6	7
Topalu/Piatra - Coral	7	10

Fig. 17. Decapod abundance by environment and locality from Romania.

been collected but are not included within this research. The only decapod genera that are common between coral reefs and sponge reefs are the ubiquitous *Goniodromites* spp. and the more localized *Tanidromites* sp. (Fig. 16). Even though not all the specimens collected were included, the decapod abundance of coral reefs from central Dobrogea is greater than that from coral reefs of Ghergheasa (Muţiu & Bădăluţa 1971), just east of the Carpathian Mountains (for locations see Fig. 1). However, it is lower than the decapod abundance from coral reefs within the Carpathian Mountains at Purcăreni (Shirk 2006), Sinaia, and Moroeni (Patrulius 1966) (Fig. 17).

It appears that these differences in abundance between coral and sponge reefs from central Dobrogea are due to significant differences in environmental conditions between them such as water depth, energy level, nutrient abundance, sedimentation rate, living space/open framework reef structure, and light conditions.

5. Conclusions

During the Middle Jurassic, central Dobrogea was a vast carbonate platform on which coral and sponge reefs developed. Even though geographic distances are not that great, the environmental settings play a major role in decapod abundance and diversity. Even though galatheoid decapods have not been included in this research project, the brachyuran diversity in the coral reef environments is higher than diversity of brachyurans and anomurans in sponge reefs, and if the anomurans from coral reefs were to be taken in to account then the coral reef decapod diversity would be even higher and much closer to the reality.

In central Dobrogea there are only two shared genera and no shared species between these two environments. *Goniodromites* is omnipresent during the Middle Jurassic in Eastern and Central Europe, and *Tanidromites* sp., is a more environmentally restricted genus because it was found only in the reef rocks, and not in the reef talus or inter reef rocks, compared with *Goniodromites* sp., which has been found in all different reef environments. As mentioned above, galatheoid decapods have not been included in this research project; further investigations are required in order to understand what factors play a major role in their distribution and abundance throughout carbonate environments. Galatheoid decapods have never been described in sponge reefs from central Dobrogea, but they have been collected in substantial numbers from coral reefs. In future work, looking more in-depth at the local ecological and depositional setting of these fossiliferous localities at Piatra and Topalu, and comparing the results with the available data from sponge reefs localities, such as at Gura Dobrogei and Cheia, may prove to be of great value in understanding the delicate balance and relationships between coral and sponge reefs environments.

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