

The ammonoids from the Argiles de Teguentour of Oued Temertasset (early Late Tournaisian; Mouydir, Algeria)

Dieter Korn^{*, 1}, Jürgen Bockwinkel² and Volker Ebbighausen³

¹ Museum für Naturkunde Berlin, Invalidenstraße 43, 10115 Berlin, Germany. E-mail: dieter.korn@mfn-berlin.de

² Dechant-Feinstraße 22, 51375 Leverkusen, Germany. E-mail: jbockwinkel@t-online.de

³ Engstenberger Höhe 12, 51519 Odenthal, Germany. E-mail: volker@vvr.de

Abstract

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The ammonoids from the Teguentour Shales (Tournaisian, Early Carboniferous) of Oued Temertasset (Mouydir, Algeria) are described monographically. The following new ammonoid taxa are introduced: *Imitoceras dimidium* n. sp., *Imitoceras strictum* n. sp., *Triimitoceras tantulum* n. sp., *Acrocanites disparilis* n. sp., *Jdaidites cultellus* n. sp., *Pericyclus tortuosus* n. sp., *Pericyclus circulus* n. sp., *Pericyclus trochus* n. sp., *Pericyclus intercisis* n. sp., *Nodopericyclus* n. gen., *Nodopericyclus circumnodosus* n. sp., *Nodopericyclus deficerus* n. sp., *Ammonellipsites serus* n. sp., *Helicocyclus formosus* n. sp., *Helicocyclus inornatus* n. sp., *Helicocyclus laxaris* n. sp., *Ouaoufilalites creber* n. sp., family Temertassetiidae n. fam., *Temertassetia* n. gen., *Temertassetia temertassetensis* n. sp., *Temertassetia secunda* n. sp., *Temertassetia decorata* n. sp., *Temertassetia coarta* n. sp., *Jerania* n. gen., *Jerania jeranensis* n. sp., *Jerania sicilicula* n. sp., *Jerania pusillens* n. sp., *Jerania subvexa* n. sp., *Jerania persimilis* n. sp., *Kusinia* n. gen., *Kusinia falcifera* n. sp., *Bouhamedites insalahensis* n. sp., *Muensteroceras subparallelum* n. sp., *Muensteroceras multitudum* n. sp., *Follotites* n. gen., *Follotites folloti* n. sp., *Follotites stelus* n. sp., *Follotites flexus* n. sp., family Rotopericyclidae n. fam., *Eurites permutus* n. sp., *Eurites doliaris* n. sp., *Mouydiria* n. gen., *Mouydiria mouydirensis* n. sp., *Mouydiria scutula* n. sp., *Rotopericyclus kaufmanni* n. sp., *Rotopericyclus rathi* n. sp., *Rotopericyclus wendti* n. sp., *Rotopericyclus lubesederi* n. sp., subfamily Dzhaprakoceratinae n. subfam., *Dzhaprakoceras punctum* n. sp., *Dzhaprakoceras amplum* n. sp., *Dzhaprakoceras vergum* n. sp., *Dzhaprakoceras biconvexum* n. sp., Progoniatitinae n. subfam., *Progoniatites uncus* n. sp., *Progoniatites pilus* n. sp., *Progoniatites paenacutus* n. sp., *Progoniatites globulus* n. sp., Habadraitinae n. subfam., *Habadraitites* n. gen., *Habadraitites weyeri* n. sp., *Habadraitites supralatus* n. sp., *Primogoniatites* n. gen., *Primogoniatites fundator* n. sp., Antegoniatitinae n. subfam., *Antegoniatites* n. gen., and *Antegoniatites anticiparis* n. sp.. The ammonoids occur in three successive assemblages and are the richest ammonoid faunas of the time interval worldwide.

Key Words

Ammonoidea
Mississippian
Carboniferous
North Africa
taxonomy

Introduction

The Middle and early Late Tournaisian was regarded for a long time as an example of a period of low-diversity in the evolutionary history of the Ammonoidea (Konovalova 2005). At the beginning of the 21st century, for instance, only about 25 species were known from the

early Late Tournaisian, and most of the assemblages were rather poor in species numbers. The discovery of an ammonoid fauna of this age with eleven new species in the Anti-Atlas of Morocco, however, showed that there is a potential for a much more detailed overview of the ammonoid evolution of that time interval (Korn et al. 2003a).

* Corresponding author

Middle and Late Tournaisian ammonoids are known from many places in the world, but occur often in low-diversity assemblages. An exception is the terminal Tournaisian Erdbach Limestone of Germany (Holzapfel 1889; Schindewolf 1951), from which comparatively species-rich occurrences have been described. Time-equivalents of this fauna are also very diverse, as seen in the occurrences of Kyrgyzstan (Librovitch 1927; Popov 1965, 1968) and North Russia (Kusina 1980), for instance.

Early Late Tournaisian assemblages are much smaller, and are limited in their geographic distribution. They are known from the classic occurrences in the Calcaire de Calonne of Belgium (de Koninck 1844, 1880; Delépine 1940), the 'Carboniferous Limestone' of Ireland (Crick 1899; Foord 1901, 1903), and the Rockford Limestone as well as the Marshall Sandstone of the North American Midcontinent (Hall 1860; Miller & Collinson 1951; Miller & Garner 1955). An outstanding site is the Borden Formation of Kentucky, which yielded well-preserved ammonoids from three successive faunal complexes (Work & Mason 2003, 2004, 2005).

While Early Tournaisian (Ebbighausen et al. 2004; Bockwinkel & Ebbighausen 2006; Ebbighausen & Bockwinkel 2007) and Late Viséan (Korn et al. 1999, 2007; Klug et al. 2006; Korn & Ebbighausen 2008) ammonoid Faunas from North Africa have been outlined in several monographs, the state of knowledge of middle or early Late Tournaisian ammonoids from that region is still limited. A rich early Late Tournaisian fauna was recently described by Korn et al. (2003a, 2005, 2007) from Bouhamed and Jdaïd in the Anti-Atlas of Morocco, being with twelve species the most diverse assemblage known so far from this time unit with the genera *Irinoceras*, *Triimitoceras*, *Pericyclus*, *Orthocyclus*, *Helicocyclus*, *Jerania*, *Muensteroceras*, *Mouydiria*, *Progoniatites*, *Becanites*, and *Mero-canites*. In contrast to most of the other places, where the specimens occur in calcareous sedimentary rocks, the assemblage from Bouhamed is composed of shales, in which the specimens are preserved as limonitic steinkerns.

Ammonoids of early Late Tournaisian age have been known from the Mouydir in Algeria for decades. Termier & Termier (1950) figured '*Pericyclus rotuliformis*' (= *Rotopericyclus kaufmanni* n. sp.) and '*Pericyclus dilatatus*' (= *Pericyclus trochus* n. sp.), collected in the course of oil exploration near Hassi Habadra in the Mouydir. Follet (1951, 1952, 1953) published a fossil list of an occurrence at Oued Temertasset in the Mouydir, in which he enumerated several goniatite taxa, among them the nomen nudum *Pericycloides* (which was renamed by Korn et al. 2003a into *Progoniatites*). A description of Follet's specimens, however, has unfortunately never been published, and Follet's (1952, pl. 3) schematic drawings of some specimens are not clear enough to allow detailed examination. Short reports on the ammonoid faunas were later provided by Conrad (1966, 1967). Pareyn & Conrad (1968) figured and de-

scribed some individuals of *Progoniatites*, which probably came from the same locality, under the name *Goniatites* cf. *crenistris*. Later, Conrad (1984) presented a number of well-preserved specimens from the Oued Temertasset and other localities. These belong to various genera such as *Imitoceras*, *Rotopericyclus*, *Pericyclus*, *Jerania*, and *Progoniatites*.

Considerably rich early Late Tournaisian ammonoid faunas were reported from the following geographic areas:

Indiana – The fauna of the Rockford Limestone (Hall 1860; Miller 1891; Gutschick & Treckman 1957) shows some resemblance with the newly described assemblages. The Rockford fauna is composed of the genera *Imitoceras*, *Gattendorfia*, *Prodromites*, *Muensteroceras*, and *Protocanites*.

Kentucky – Of the three Osagean ammonoid assemblages (Work & Mason 2003, 2004, 2005), it is particularly the Nada Member of the Borden Formation that is similar to the occurrences at Oued Temertasset. The fauna contains *Polaricyclus* and *Winchello-ceras* (Work & Mason 2003).

Ireland – Of the rich ammonoid fauna described by Crick (1899) and Foord (1901, 1903), particularly the material from St. Doulagh's (Co. Dublin) which shows a close resemblance with a distinct horizon within the Argiles de Teguentour. The species (names given by Foord and revised names) known from this locality are the following:

<i>Pericyclus Foordi</i>	= <i>Rotopericyclus foordi</i>
<i>Pericyclus subplicatilis</i>	= <i>Rotopericyclus subplicatilis</i>
<i>Pericyclus Bailly</i>	= <i>Rotopericyclus baillyi</i>
<i>Pericyclus rotuliformis</i>	= <i>Rotopericyclus rotuliformis</i>
<i>Glyphioceras (Beyrichoceras) corpulentum</i>	= <i>Eurites corpulentus</i>
<i>Glyphioceras (Beyrichoceras) truncatum</i>	= <i>Dzhaprakoceras hibernicum</i>

Belgium – Two rock formations yielded ammonoids of early Late Tournaisian age, the Calcaire de Vaulx and the Calcaire de Calonne (de Koninck 1844, 1880; Delépine 1940).

The Calcaire de Vaulx yielded the following species (determinations by Delépine and revised names):

<i>Acrocanites tornacensis</i>	= <i>Acrocanites tornacensis</i>
<i>Muensteroceras rotella</i>	= <i>Xinjiangites rotella</i>
<i>Muensteroceras perspectivum</i>	= <i>Xinjiangites perspectivus</i>
" <i>Goniatites</i> " (<i>Pericyclus</i> ?) <i>crenulatus</i>	= indet.
<i>Protocanites lyoni</i>	= <i>Becanites tornacensis</i>

The Calcaire de Calonne yielded the following species (determinations by Delépine and revised names):

<i>Imitoceras rotatorium</i>	= <i>Imitoceras rotatorium</i>
<i>Pericyclus princeps</i>	= <i>Pericyclus princeps</i>
<i>Pericyclus ryckholti</i>	= <i>Bouhamedites ryckholti</i>
<i>Muensteroceras rotella</i>	= <i>Xinjiangites rotella</i>

Pericyclus princeps var. *multiplicatus*
 = *Temertassetia multiplicata*
Muensteroceras complanatum = *Jerania complanata*
Pericyclus divisus = *Progoniatites divisus*

The faunal lists show that the Calcaire de Vaulx has some resemblance with the lower assemblage described by Korn et al. (2010a) from the Grès de Kahla supérieur of Timimoun. The Calcaire de Calonne is, with its composition of genera, very similar to the assemblages from the Argiles de Teguentour at Oued Temertasset described herein.

Thuringia – Phosphatic nodules in the Rußschiefer near Zadelsdorf yielded ammonoids (Schindewolf 1922, 1926, 1939), which at least partly can be regarded as time equivalents of the fauna of the Argiles de Teguentour. Schindewolf listed the following species:

Imitoceras wurmi = *Imitoceras* (?) *wurmi*
Imitoceras apertum = *Gattendorfia aperta*
Acrocanites multilobatus = *Acrocanites multilobatus*
Münsteroceras euryomphalum
 = *Muensteroceras* (?) *euryomphalum*
Pericyclus (*Pericyclus*) *dilatatus* = *Pericyclus dilatatus*
Pericyclus (*Pericyclus*) *carinatus* = *Stenocyclus carinatus*
Glyphioceras angustilobatum = *Progoniatites angustilobatus*
Protocanites quadratus = *Becanites* (?) *quadratus*

Pay-Khoy and Vaigach Isles – Kusina (2000) described four species from four genera, *Paraqiannanites*, *Pericyclus*, *Orthocyclus*, and ‘*Zhifangoceras*’ (the species described here belongs in fact to *Progoniatites*). *Pericyclus* and *Progoniatites* suggest a correlation with the Argiles de Teguentour.

South Urals – The small fauna consisting of *Polaricyclus* and *Orthocyclus* (Kusina 2000) may be a time equivalent of the Argiles de Teguentour.

Geographic and geological setting

The Mouydir is a desert region in the Central Sahara, located south-east of the town In Salah in South Algeria (Fig. 1). It is characterised by gently folded Palaeozoic rocks, which are strongly weathered and partly covered by a Cainozoic cover and sand dunes. The Mouydir belongs to a sedimentary basin on the northern part of the Sahara Craton, which means that it has a North Gondwana palaeogeographic position (Conrad 1984; Wendt et al. 2009).

The Carboniferous rock succession begins with a sandstone complex (Grès du Khenig), which shows an alteration of fine to medium-grained, often cross-bedded sandstones and silty shales. Its total thickness ranges between 85 and 310 metres (Conrad 1984; Wendt et al. 2009), unfortunately its stratigraphy is not well known. Most likely the Devonian-Carboniferous boundary lies within this formation.

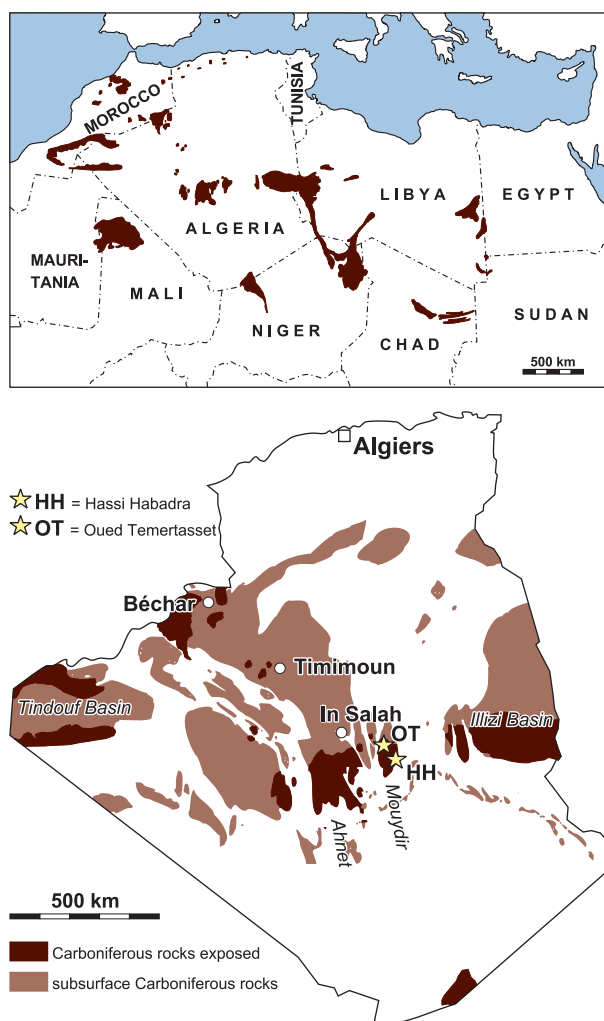


Figure 1. The outcrop of Palaeozoic rocks in northern Africa and the geographic position (marked by an asterisk) of the localities of the Argiles de Teguentour of Oued Temertasset.

The overlying Argiles de Teguentour are not very well exposed due to strong weathering; this formation yielded the ammonoid fauna described in this monograph. Its thickness is difficult to estimate, but may attain 200 metres at Oued Temertasset, of which only the basal 70 metres are fossiliferous (Wendt et al. 2009). The claystones are strongly weathered, and only a few places allow a spot-like insight into the lithological succession. Therefore, all the faunas were collected on the surface. Thin limestone intercalations occur at the base of the formation, but these are almost always small lenticular bodies of limestone or only sporadically and irregularly occurring sideritic nodules. Almost always, they are micritic in their internal composition.

Above the Argiles de Teguentour follows another sandstone unit of about 200 metres in thickness, the Grès de Tibaradine, whose upper part constitutes a prominent sandstone ridge. This is overlain by the Dalle des Iridet, a limestone rather rich in fossils, particularly in brachiopods, rugose corals, ammonoids (Korn et al. 2010b), and nautiloids.

Material

The material described in this monograph was collected in an area extending for about 40 kilometres, 140 to 180 kilometres east-south-east of the town In Salah (South Algeria, Central Sahara). The localities are located in the vicinity of Oued Temertasset, a dry valley eight kilometres east of the conspicuous mountain chain of the El Jerane. The Argiles de Teguentour, from which the material was collected, is poorly exposed due to intensive weathering. Some outcrops of this formation were investigated, but these proved difficult to sample for macrofossils because of the rarity of organic remains. Therefore all the material was collected on the surface. It was assembled during four field sessions, 1997, 1999, and 2001 by Jobst Wendt and colleagues (Tübingen), and in 2002 by the authors in co-operation with Dieter Weyer (Berlin). More than 7,200 specimens were examined.

The material collected by the authors of this publication was, at those places where no significant reworking by transport could be expected, collected from small sample areas. In some places, a sampling of various succeeding horizons was possible because of their separation

by small ridges in the topography of the desert. This enabled the construction of a stratigraphic scheme for these faunas and by this method, three faunal units could be separated. Nearly all of the less rigorously collected samples can be placed rather precisely in this scheme and appear to support it.

Nearly all of the material from the Argiles de Teguentour is preserved as limonitic internal moulds. There are only two exceptions, (1) rare carbonate nodules, which occasionally contain a rather diverse ammonoid fauna, and (2) a particularly striking horizon with large specimens (up to 10 centimetres across) of *Rotopericyclus*.

Simultaneously with the ammonoid collections, conodont samples were taken from carbonate horizons. Unfortunately, most of them were not productive, but one sample (MOU-C3) yielded a fauna of the base of the *anchoralis* Zone (determinations by Z. Belka, Poznan). All the accompanying fauna from the Argiles de Teguentour were also sampled; further elements are brachiopods, bivalves, gastropods, nautiloids, and trilobites (Hahn et al. 2004).

The material comes from the following localities (material of samples with the prefix A was collected by Jobst Wendt and colleagues, Tübingen); material of samples with the prefix MOU was collected by the authors and D. Weyer in 2002):

Locality and sample A-232, Hassi Habadra, 177 km east-southeast of In Salah (26.5116° N; 4.1110° E):

<i>Helicocyclus inornatus</i> n. sp.	37 specimens (MB.C.18715.1–37)
<i>Muensteroceras multitudum</i> n. sp.	42 specimens (MB.C.18716.1–42)
<i>Eurites permutus</i> n. sp.	28 specimens (MB.C.18717.1–28)
<i>Eurites doliaris</i> n. sp.	2 specimens (MB.C.18718.1–2)
<i>Kusinia falcifera</i> n. sp.	24 specimens (MB.C.18719.1–24)

Locality and sample A-264, north-west of Oued Temertasset, 140 km east-southeast of In Salah (26.6890° N; 3.8031° E):

<i>Imitoceras strictum</i> n. sp.	7 specimens (MB.C.18720.1–7)
<i>Triimitoceras tantulum</i> n. sp.	1 specimen (MB.C.18721)
<i>Pericyclus circulus</i> n. sp.	14 specimens (MB.C.18722.1–14)
<i>Pericyclus trochus</i> n. sp.	4 specimens (MB.C.18723.1–4)
<i>Pericyclus intercisus</i> n. sp.	8 specimens (MB.C.18724.1–8)
<i>Temertassetia decorata</i> n. sp.	1 specimen (MB.C.18725)
<i>Jerania jeranensis</i> n. sp.	8 specimens (MB.C.18726.1–8)
<i>Jerania sicilicula</i> n. sp.	2 specimens (MB.C.18727.1–2)
<i>Jerania persimilis</i> n. sp.	1 specimen (MB.C.18728)
<i>Jerania subvexa</i> n. sp.	1 specimen (MB.C.18729)
<i>Dzhaprakoceras vergum</i> n. sp.	85 specimens (MB.C.18730.1–85)
<i>Progoniatites uncus</i> n. sp.	1 specimen (MB.C.18731)
<i>Progoniatites pilus</i> n. sp.	8 specimens (MB.C.18732.1–8)

Locality and sample A-320/5, south of Oued Temertasset (26.6116° N; 3.8362° E); see Wendt et al. (2009, fig. 8):

<i>Ouaoufilalites creber</i> n. sp.	32 specimens (MB.C.18733.1–32)
<i>Follotites folloti</i> n. sp.	5 specimens (MB.C.18734.1–5)
<i>Follotites flexus</i> n. sp.	7 specimens (MB.C.18735.1–7)
<i>Mouydiria mouydirensis</i> n. sp.	21 specimens (MB.C.18736.1–21)
<i>Dzhaprakoceras biconvexum</i> n. sp.	85 specimens (MB.C.18737.1–85)

Locality and sample A-320/7; horizon above sample A-320/5:

<i>Rotopericyclus kaufmanni</i> n. sp.	4 specimens (MB.C.18738.1–4)
<i>Rotopericyclus rathi</i> n. sp.	6 specimens (MB.C.18739.1–6)
<i>Rotopericyclus wendti</i> n. sp.	47 specimens (MB.C.18740.1–47)
<i>Rotopericyclus lubesederi</i> n. sp.	12 specimens (MB.C.18741.1–12)
<i>Rotopericyclus?</i> sp.	4 specimens (MB.C.18741.1–4)

Locality and sample A-321, as sample A-264:

<i>Imitoceras dimidium</i> n. sp.	13 specimens (MB.C.18742.1–13)
<i>Pericyclus circulus</i> n. sp.	12 specimens (MB.C.18743.1–12)
<i>Pericyclus trochus</i> n. sp.	27 specimens (MB.C.18744.1–27)
<i>Pericyclus intercisus</i> n. sp.	20 specimens (MB.C.18745.1–20)
<i>Helicocyclus formosus</i> n. sp.	1 specimen (MB.C.18746)
<i>Temertassetia coarta</i> n. sp.	2 specimens (MB.C.18747.1–2)
<i>Jerania sicilicula</i> n. sp.	4 specimens (MB.C.18748.1–4)
<i>Jerania persimilis</i> n. sp.	25 specimens (MB.C.18749.1–25)
<i>Progoniatites pilus</i> n. sp.	2 specimens (MB.C.18750.1–2)

Locality and sample A-330/17, north of Ain Tiouendjiguine (26.9315° N; 3.5826° E):

<i>Pericyclus circulus</i> n. sp.	3 specimens (MB.C.18751.1–3)
<i>Progoniatites pilus</i> n. sp.	3 specimens (MB.C.18752.1–3)

Locality and sample MOU-A, north-west of Oued Temertasset (26.6909° N; 3.8038° E); bulk sample of various horizons:

<i>Imitoceras dimidium</i> n. sp.	6 specimens (MB.C.18753.1–6)
<i>Imitoceras strictum</i> n. sp.	7 specimens (MB.C.18754.1–7)
<i>Acrocanites disparilis</i> n. sp.	1 specimen (MB.C.18755)
<i>Pericyclus circulus</i> n. sp.	28 specimens (MB.C.18756.1–28)
<i>Pericyclus trochus</i> n. sp.	59 specimens (MB.C.18757.1–59)
<i>Pericyclus intercisus</i> n. sp.	11 specimens (MB.C.18758.1–11)
<i>Ouaoufilalites creber</i> n. sp.	1 specimen (MB.C.18759)
<i>Temertassetia temertassetensis</i> n. sp.	3 specimens (MB.C.18760.1–3)
<i>Temertassetia coarta</i> n. sp.	5 specimens (MB.C.18761.1–5)
<i>Jerania jeranensis</i> n. sp.	3 specimens (MB.C.18762.1–3)
<i>Jerania sicilicula</i> n. sp.	31 specimens (MB.C.18763.1–31)
<i>Jerania pusillens</i> n. sp.	2 specimens (MB.C.18764.1–2)
<i>Jerania subvexa</i> n. sp.	2 specimens (MB.C.18765.1–2)
<i>Bouhamedites insalahensis</i> n. sp.	1 specimen (MB.C.18766)
<i>Muensteroceras subparallelum</i> n. sp.	15 specimens (MB.C.18767.1–15)
<i>Follotites folloti</i> n. sp.	2 specimens (MB.C.18768.1–2)
<i>Follotites stelus</i> n. sp.	5 specimens (MB.C.18769.1–5)
<i>Follotites flexus</i> n. sp.	4 specimens (MB.C.18770.1–4)
<i>Dzhaprakoceras vergum</i> n. sp.	23 specimens (MB.C.18771.1–23)
<i>Dzhaprakoceras amplum</i> n. sp.	1 specimen (MB.C.18772)
<i>Dzhaprakoceras biconvexum</i> n. sp.	7 specimens (MB.C.18773.1–7)
<i>Progoniatites uncus</i> n. sp.	11 specimens (MB.C.18774.1–11)
<i>Progoniatites globulus</i> n. sp.	4 specimens (MB.C.18775.1–4)
<i>Habadrates weyeri</i> n. sp.	3 specimens (MB.C.18776.1–3)
<i>Primogoniatites fundator</i> n. sp.	10 specimens (MB.C.18777.1–10)
<i>Becanites inflateralis</i> Korn et al., 2010	3 specimens (MB.C.18778.1–3)

Locality and sample MOU-B, north-west of Oued Temertasset (26.7007° N; 3.7978° E); bulk sample of various horizons (B0–B9 as mentioned in the text are subsamples):

<i>Imitoceras dimidium</i> n. sp.	14 specimens (MB.C.18779.1–14)
<i>Pericyclus circulus</i> n. sp.	27 specimens (MB.C.18780.1–27)
<i>Pericyclus trochus</i> n. sp.	51 specimens (MB.C.18781.1–51)
<i>Pericyclus intercisus</i> n. sp.	21 specimens (MB.C.18782.1–21)
<i>Nodopericyclus circumnodosus</i> n. sp.	3 specimens (MB.C.18783.1–3)
<i>Temertassetia temertassetensis</i> n. sp.	14 specimens (MB.C.18784.1–14)
<i>Temertassetia secunda</i> n. sp.	4 specimens (MB.C.18785.1–4)
<i>Temertassetia decorata</i> n. sp.	12 specimens (MB.C.18786.1–12)
<i>Temertassetia coarta</i> n. sp.	21 specimens (MB.C.18787.1–21)
<i>Jerania jeranensis</i> n. sp.	4 specimens (MB.C.18788.1–4)
<i>Jerania sicilicula</i> n. sp.	19 specimens (MB.C.18789.1–19)
<i>Jerania persimilis</i> n. sp.	3 specimens (MB.C.18790.1–3)
<i>Muensteroceras subparallelum</i> n. sp.	13 specimens (MB.C.18791.1–13)
<i>Follotites folloti</i> n. sp.	5 specimens (MB.C.18792.1–5)
<i>Follotites stelus</i> n. sp.	12 specimens (MB.C.18793.1–12)
<i>Follotites flexus</i> n. sp.	2 specimens (MB.C.18794.1–2)
<i>Eurites permutus</i> n. sp.	1 specimen (MB.C.18795)
<i>Mouydiria scutula</i> n. sp.	1 specimen (MB.C.18796)
<i>Dzhaprakoceras vergum</i> n. sp.	11 specimens (MB.C.18797.1–11)
<i>Dzhaprakoceras amplum</i> n. sp.	4 specimens (MB.C.18798.1–4)
<i>Progoniatites uncus</i> n. sp.	10 specimens (MB.C.18799.1–10)
<i>Progoniatites pilus</i> n. sp.	7 specimens (MB.C.18800.1–7)
<i>Progoniatites paenacutus</i> n. sp.	3 specimens (MB.C.18801.1–3)
<i>Progoniatites globulus</i> n. sp.	2 specimens (MB.C.18802.1–2)
<i>Habadrates supralatus</i> n. sp.	1 specimen (MB.C.18803)
<i>Primogoniatites fundator</i> n. sp.	23 specimens (MB.C.18804.1–23)
<i>Becanites inflateralis</i> Korn et al., 2010	1 specimen (MB.C.18805)

Locality and sample MOU-C1, immediately south of Oued Temertasset (26.6178° N; 3.8392° E); sample from one nodule horizon, *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Rotopericyclus kaufmanni</i> n. sp.	13 specimens (MB.C.18806.1–13)
<i>Rotopericyclus rathi</i> n. sp.	7 specimens (MB.C.18807.1–7)
<i>Rotopericyclus wendti</i> n. sp.	81 specimens (MB.C.18808.1–81)
<i>Rotopericyclus lubesederi</i> n. sp.	34 specimens (MB.C.18809.1–34)
<i>Rotopericyclus?</i> sp.	5 specimens (MB.C.18741.1–5)

Locality and sample MOU-C2, shales around the nodular horizon; *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Triimitoceras tantulum</i> n. sp.	1 specimen (MB.C.18811)
<i>Kusinia falcifera</i> n. sp.	303 specimens (MB.C.18812.1–303)
<i>Muensteroceras multitudum</i> n. sp.	500 specimens (MB.C.18813.1–500)
<i>Eurites permutus</i> n. sp.	137 specimens (MB.C.18814.1–137)
<i>Eurites doliaris</i> n. sp.	18 specimens (MB.C.18815.1–18)
<i>Rotopericyclus lubesederi</i> n. sp.	1 specimen (MB.C.18816)

Locality and sample MOU-C3, carbonate nodules approximately 8 m below sample MOU-C1; *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Ammonellipsites serus</i> n. sp.	4 specimens (MB.C.18817.1–4)
<i>Muensteroceras multitudum</i> n. sp.	5 specimens (MB.C.18818.1–5)
<i>Eurites permutus</i> n. sp.	5 specimens (MB.C.18819.1–5)
<i>Eurites doliaris</i> n. sp.	2 specimens (MB.C.18820.1–2)

Locality and sample MOU-C4, approximately 20 m below sample MOU-C1; Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	29 specimens (MB.C.18821.1–29)
<i>Acrocanites disparilis</i> n. sp.	1 specimen (MB.C.18822)
<i>Jdaidites cultellus</i> n. sp.	1 specimen (MB.C.18823)
<i>Pericyclus tortuosus</i> n. sp.	1 specimen (MB.C.18824)
<i>Pericyclus circulus</i> n. sp.	1 specimen (MB.C.18825)
<i>Temertassetia secunda</i> n. sp.	1 specimen (MB.C.18826)
<i>Muensteroceras subparallelum</i> n. sp.	95 specimens (MB.C.18827.1–95)
<i>Eurites permutus</i> n. sp.	1 specimen (MB.C.18828)
<i>Dzhaprakoceras biconvexum</i> n. sp.	1 specimen (MB.C.18829)
<i>Habadrates weyeri</i> n. sp.	1 specimen (MB.C.18830)

Locality and sample MOU-C5, horizon near sample MOU-C1; *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Helicocyclus inornatus</i> n. sp.	5 specimens (MB.C.18831.1–5)
<i>Ouaoufilalites creber</i> n. sp.	1 specimen (MB.C.18832)
<i>Kusinia falcifera</i> n. sp.	17 specimens (MB.C.18833.1–17)
<i>Muensteroceras multitudum</i> n. sp.	50 specimens (MB.C.18834.1–50)
<i>Eurites permutus</i> n. sp.	20 specimens (MB.C.18835.1–20)
<i>Dzhaprakoceras biconvexum</i> n. sp.	1 specimen (MB.C.18836)
<i>Progoniatites paenacutus</i> n. sp.	1 specimen (MB.C.18837)

Locality and sample MOU-C undifferentiated; contains elements of the Lower *Pericyclus-Progoniatites* Assemblage and the *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	10 specimens (MB.C.18838.1–10)
<i>Imitoceras strictum</i> n. sp.	3 specimens (MB.C.18839.1–3)
<i>Triimitoceras tantulum</i> n. sp.	1 specimen (MB.C.18840)
<i>Acrocanites disparilis</i> n. sp.	1 specimen (MB.C.18841)
<i>Nodopericyclus deficerus</i> n. sp.	1 specimen (MB.C.18842)
<i>Helicocyclus inornatus</i> n. sp.	5 specimens (MB.C.18843.1–5)
<i>Helicocyclus laxaris</i> n. sp.	1 specimen (MB.C.18844)
<i>Ouaoufilalites creber</i> n. sp.	1 specimen (MB.C.18845)
<i>Jerania subvexa</i> n. sp.	58 specimens (MB.C.18846.1–58)
<i>Kusinia falcifera</i> n. sp.	10 specimens (MB.C.18847.1–10)
<i>Muensteroceras multitudum</i> n. sp.	98 specimens (MB.C.18848.1–98)
<i>Eurites permutus</i> n. sp.	25 specimens (MB.C.18849.1–25)
<i>Eurites doliaris</i> n. sp.	6 specimens (MB.C.18850.1–6)
<i>Dzhaprakoceras vergum</i> n. sp.	54 specimens (MB.C.18851.1–54)
<i>Dzhaprakoceras biconvexum</i> n. sp.	7 specimens (MB.C.18852.1–7)

Locality and sample MOU-D0, 1 km south of locality MOU-C (26.6066° N; 3.8389° E):

<i>Imitoceras dimidium</i> n. sp.	3 specimens (MB.C.18853.1–3)
<i>Imitoceras strictum</i> n. sp.	1 specimen (MB.C.18854)
<i>Acrocanites disparilis</i> n. sp.	1 specimen (MB.C.18855)

<i>Pericyclus circulus</i> n. sp.	1 specimen (MB.C.18856)
<i>Jerania subvexa</i> n. sp.	13 specimens (MB.C.18857.1–13)
<i>Dzhaprakoceras vergum</i> n. sp.	83 specimens (MB.C.18858.1–83)

Locality and sample MOU-D1; horizon above sample MOU-D0; Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	48 specimens (MB.C.18859.1–48)
<i>Imitoceras strictum</i> n. sp.	9 specimens (MB.C.18860.1–9)
<i>Acrocanites disparilis</i> n. sp.	4 specimens (MB.C.18861.1–4)
<i>Pericyclus circulus</i> n. sp.	118 specimens (MB.C.18862.1–118)
<i>Pericyclus trochus</i> n. sp.	195 specimens (MB.C.18863.1–195)
<i>Pericyclus interciscus</i> n. sp.	180 specimens (MB.C.18864.1–180)
<i>Temertassetia temertassetensis</i> n. sp.	19 specimens (MB.C.18865.1–19)
<i>Temertassetia secunda</i> n. sp.	3 specimens (MB.C.18866.1–3)
<i>Temertassetia decorata</i> n. sp.	18 specimens (MB.C.18867.1–18)
<i>Temertassetia coarta</i> n. sp.	90 specimens (MB.C.18868.1–90)
<i>Jerania jeranensis</i> n. sp.	8 specimens (MB.C.18869.1–8)
<i>Jerania sicilicula</i> n. sp.	10 specimens (MB.C.18870.1–10)
<i>Jerania pusillens</i> n. sp.	22 specimens (MB.C.18871.1–22)
<i>Jerania persimilis</i> n. sp.	6 specimens (MB.C.18872.1–6)
<i>Bouhamedites insalahensis</i> n. sp.	1 specimen (MB.C.18873)
<i>Muensteroceras subparallelum</i> n. sp.	89 specimens (MB.C.18874.1–89)
<i>Dzhaprakoceras vergum</i> n. sp.	82 specimens (MB.C.18875.1–82)
<i>Progoniatites uncus</i> n. sp.	29 specimens (MB.C.18876.1–29)
<i>Progoniatites pilus</i> n. sp.	1 specimen (MB.C.18877)
<i>Progoniatites paenacutus</i> n. sp.	3 specimens (MB.C.18878.1–3)
<i>Progoniatites globulus</i> n. sp.	2 specimens (MB.C.18879.1–2)
<i>Habadrates weyeri</i> n. sp.	1 specimen (MB.C.18880)
<i>Habadrates supralatus</i> n. sp.	7 specimens (MB.C.18881.1–7)
<i>Primogoniatites fundator</i> n. sp.	3 specimens (MB.C.18882.1–3)
<i>Becanites inflateralis</i> Korn et al., 2010	1 specimen (MB.C.18883)

Locality and sample MOU-D2; horizon above sample MOU-D1; Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	35 specimens (MB.C.18884.1–35)
<i>Imitoceras strictum</i> n. sp.	30 specimens (MB.C.18885.1–30)
<i>Pericyclus circulus</i> n. sp.	80 specimens (MB.C.18886.1–80)
<i>Pericyclus trochus</i> n. sp.	10 specimens (MB.C.18887.1–10)
<i>Pericyclus interciscus</i> n. sp.	6 specimens (MB.C.18888.1–6)
<i>Temertassetia temertassetensis</i> n. sp.	74 specimens (MB.C.18889.1–74)
<i>Temertassetia secunda</i> n. sp.	27 specimens (MB.C.18890.1–27)
<i>Temertassetia decorata</i> n. sp.	24 specimens (MB.C.18891.1–24)
<i>Temertassetia coarta</i> n. sp.	10 specimens (MB.C.18892.1–10)
<i>Jerania jeranensis</i> n. sp.	1 specimen (MB.C.18893)
<i>Jerania sicilicula</i> n. sp.	45 specimens (MB.C.18894.1–45)
<i>Jerania pusillens</i> n. sp.	1 specimen (MB.C.18895)
<i>Jerania persimilis</i> n. sp.	1 specimen (MB.C.18896)
<i>Muensteroceras subparallelum</i> n. sp.	1 specimen (MB.C.18897)
<i>Mouydiria mouydirensis</i> n. sp.	1 specimen (MB.C.18898)
<i>Mouydiria scutula</i> n. sp.	1 specimen (MB.C.18899)
<i>Dzhaprakoceras amplum</i> n. sp.	2 specimens (MB.C.18900.1–2)
<i>Dzhaprakoceras biconvexum</i> n. sp.	7 specimens (MB.C.18901.1–7)
<i>Progoniatites uncus</i> n. sp.	15 specimens (MB.C.18902.1–15)
<i>Progoniatites pilus</i> n. sp.	12 specimens (MB.C.18903.1–12)
<i>Progoniatites paenacutus</i> n. sp.	3 specimens (MB.C.18904.1–3)
<i>Habadrates supralatus</i> n. sp.	2 specimens (MB.C.18905.1–2)
<i>Primogoniatites fundator</i> n. sp.	1 specimen (MB.C.18906)

Locality and sample MOU-D3; horizon above sample MOU-D2; Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	3 specimens (MB.C.18907.1–3)
<i>Temertassetia temertassetensis</i> n. sp.	4 specimens (MB.C.18908.1–4)
<i>Temertassetia decorata</i> n. sp.	8 specimens (MB.C.18909.1–8)
<i>Jerania jeranensis</i> n. sp.	4 specimens (MB.C.18910.1–4)
<i>Jerania sicilicula</i> n. sp.	4 specimens (MB.C.18911.1–4)
<i>Dzhaprakoceras amplum</i> n. sp.	13 specimens (MB.C.18912.1–13)
<i>Progoniatites uncus</i> n. sp.	7 specimens (MB.C.18913.1–7)
<i>Primogoniatites fundator</i> n. sp.	2 specimens (MB.C.18914.1–2)

Locality and sample MOU-E01, 500 m south of locality MOU-D (26.6013° N; 3.8393° E); strictly recorded (the next following samples with the prefix MOU-E have been obtained in ascending order in the section; their stratigraphy will be outlined below):

Dzhaprakoceras vergum n. sp. 9 specimens (MB.C.18915.1–9)

Locality and sample MOU-E02:

Dzhaprakoceras vergum n. sp. 10 specimens (MB.C.18916.1–10)

Acrocanites disparilis n. sp. 1 specimen (MB.C.18917)

Locality and sample MOU-E03:

Imitoceras dimidium n. sp. 9 specimens (MB.C.18918.1–9)

Imitoceras strictum n. sp. 7 specimens (MB.C.18919.1–7)

Acrocanites disparilis n. sp. 1 specimen (MB.C.18920)

Jerania subvexa n. sp. 16 specimens (MB.C.18921.1–16)

Dzhaprakoceras vergum n. sp. 56 specimens (MB.C.18922.1–56)

Habadraites weyeri n. sp. 11 specimens (MB.C.18923.1–11)

Habadraites supralatus n. sp. 1 specimen (MB.C.18924)

Locality and sample MOU-E04:

Imitoceras dimidium n. sp. 6 specimens (MB.C.18925.1–6)

Pericyclus circulus n. sp. 6 specimens (MB.C.18926.1–6)

Jerania sicilicula n. sp. 1 specimen (MB.C.18927)

Dzhaprakoceras vergum n. sp. 12 specimens (MB.C.18928.1–12)

Locality and sample MOU-E05:

Pericyclus circulus n. sp. 1 specimen (MB.C.18929)

Pericyclus intercisus n. sp. 8 specimens (MB.C.18930.1–8)

Dzhaprakoceras vergum n. sp. 1 specimen (MB.C.18931)

Becanites inflateralis Korn et al., 2010 1 specimen (MB.C.18932)

Locality and sample MOU-E06:

Imitoceras dimidium n. sp. 5 specimens (MB.C.18933.1–5)

Acrocanites disparilis n. sp. 1 specimen (MB.C.18934)

Pericyclus trochus n. sp. 10 specimens (MB.C.18935.1–10)

Temertassetia temertassetensis n. sp. 1 specimen (MB.C.18936)

Temertassetia coarta n. sp. 7 specimens (MB.C.18937.1–7)

Jerania jeranensis n. sp. 5 specimens (MB.C.18938.1–5)

Jerania sicilicula n. sp. 7 specimens (MB.C.18939.1–7)

Jerania persimilis n. sp. 2 specimens (MB.C.18940.1–2)

Dzhaprakoceras vergum n. sp. 7 specimens (MB.C.18941.1–7)

Progoniatites uncus n. sp. 3 specimens (MB.C.18942.1–3)

Locality and sample MOU-E07:

Imitoceras dimidium n. sp. 76 specimens (MB.C.18943.1–76)

Pericyclus circulus n. sp. 2 specimens (MB.C.18944.1–2)

Pericyclus trochus n. sp. 4 specimens (MB.C.18945.1–4)

Pericyclus intercisus n. sp. 2 specimens (MB.C.18946.1–2)

Temertassetia temertassetensis n. sp. 41 specimens (MB.C.18947.1–41)

Temertassetia secunda n. sp. 70 specimens (MB.C.18948.1–70)

Temertassetia decorata n. sp. 58 specimens (MB.C.18949.1–58)

Jerania jeranensis n. sp. 124 specimens (MB.C.18950.1–124)

Jerania sicilicula n. sp. 62 specimens (MB.C.18951.1–62)

Jerania persimilis n. sp. 1 specimen (MB.C.18952)

Progoniatites uncus n. sp. 32 specimens (MB.C.18953.1–32)

Progoniatites pilus n. sp. 12 specimens (MB.C.18954.1–12)

Progoniatites paenacutus n. sp. 1 specimen (MB.C.18955)

Habadraites supralatus n. sp. 1 specimen (MB.C.18956)

Locality and sample MOU-E08:

Imitoceras dimidium n. sp. 5 specimens (MB.C.18957.1–5)

Pericyclus intercisus n. sp. 15 specimens (MB.C.18958.1–15)

Temertassetia decorata n. sp. 9 specimens (MB.C.18959.1–9)

Jerania jeranensis n. sp. 14 specimens (MB.C.18960.1–14)

Jerania sicilicula n. sp. 12 specimens (MB.C.18961.1–12)

Dzhaprakoceras vergum n. sp. 7 specimens (MB.C.18962.1–7)

Progoniatites uncus n. sp. 3 specimens (MB.C.18963.1–3)

Progoniatites pilus n. sp. 1 specimen (MB.C.18964)

Progoniatites paenacutus n. sp. 4 specimens (MB.C.18965.1–4)

Habadraites weyeri n. sp. 1 specimen (MB.C.18966)

Becanites inflateralis Korn et al., 2010 1 specimen (MB.C.18967)

Locality and sample MOU-E09:

<i>Pericyclus intercisus</i> n. sp.	8 specimens (MB.C.18968.1–8)
<i>Jerania jeranensis</i> n. sp.	9 specimens (MB.C.18969.1–9)
<i>Progoniatites pilus</i> n. sp.	1 specimen (MB.C.18070)
<i>Progoniatites paenacutus</i> n. sp.	2 specimens (MB.C.18971.1–2)
<i>Habadrates weyeri</i> n. sp.	1 specimen (MB.C.18972)
<i>Primogoniatites fundator</i> n. sp.	1 specimen (MB.C.18973)

Locality and sample MOU-E10:

<i>Pericyclus trochus</i> n. sp.	1 specimen (MB.C.18974)
<i>Pericyclus intercisus</i> n. sp.	1 specimen (MB.C.18975)
<i>Nodopericyclus deficerus</i> n. sp.	1 specimen (MB.C.18976)
<i>Muensteroceras multitudum</i> n. sp.	4 specimens (MB.C.18977.1–4)
<i>Eurites permutus</i> n. sp.	2 specimens (MB.C.18978.1–2)
<i>Dzhaprakoceras punctum</i> n. sp.	1 specimen (MB.C.18979)
<i>Dzhaprakoceras biconvexum</i> n. sp.	2 specimens (MB.C.18980.1–2)
<i>Antegoniatites anticiparis</i> n. sp.	1 specimen (MB.C.18981)

Locality and sample MOU-E11:

<i>Helicocyclus laxaris</i> n. sp.	2 specimens (MB.C.18982.1–2)
<i>Ouaoufilalites creber</i> n. sp.	3 specimens (MB.C.18983.1–3)
<i>Kusinia falcifera</i> n. sp.	8 specimens (MB.C.18984.1–8)
<i>Muensteroceras multitudum</i> n. sp.	28 specimens (MB.C.18985.1–28)
<i>Eurites permutus</i> n. sp.	7 specimens (MB.C.18986.1–5)
<i>Eurites doliaris</i> n. sp.	1 specimen (MB.C.18987)

Locality and sample MOU-E12:

<i>Helicocyclus formosus</i> n. sp.	9 specimens (MB.C.18988.1–9)
<i>Helicocyclus inornatus</i> n. sp.	1 specimen (MB.C.18989)
<i>Ouaoufilalites creber</i> n. sp.	4 specimens (MB.C.18990.1–4)
<i>Kusinia falcifera</i> n. sp.	4 specimens (MB.C.18991.1–4)
<i>Muensteroceras multitudum</i> n. sp.	29 specimens (MB.C.18992.1–29)
<i>Eurites permutus</i> n. sp.	26 specimens (MB.C.18993.1–26)
<i>Eurites doliaris</i> n. sp.	1 specimen (MB.C.18994)

Locality and sample MOU-E13 (26.6026° N; 3.8422° E); highest sample of the succession:

<i>Nodopericyclus deficerus</i> n. sp.	1 specimen (MB.C.18995)
<i>Ouaoufilalites creber</i> n. sp.	2 specimens (MB.C.18996.1–2)
<i>Muensteroceras multitudum</i> n. sp.	1 specimen (MB.C.18997)

Locality and sample MOU-E undifferentiated:

<i>Pericyclus trochus</i> n. sp.	2 specimens (MB.C.18998.1–2)
<i>Pericyclus intercisus</i> n. sp.	4 specimens (MB.C.18999.1–4)
<i>Temertassetia temertassetensis</i> n. sp.	2 specimens (MB.C.19000.1–2)
<i>Temertassetia decorata</i> n. sp.	7 specimens (MB.C.19001.1–7)
<i>Muensteroceras subparallelum</i> n. sp.	2 specimens (MB.C.19002–2)
<i>Follotites stelus</i> n. sp.	6 specimens (MB.C.19003–6)
<i>Progoniatites uncus</i> n. sp.	3 specimens (MB.C.19004–3)

Locality and sample MOU-F, south-west of Oued Temertasset (26.5945° N; 3.8606° E); Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	6 specimens (MB.C.19005.1–6)
<i>Pericyclus intercisus</i> n. sp.	6 specimens (MB.C.19006.1–6)
<i>Ouaoufilalites creber</i> n. sp.	1 specimen (MB.C.19007)
<i>Temertassetia decorata</i> n. sp.	8 specimens (MB.C.19008.1–8)
<i>Temertassetia coarta</i> n. sp.	2 specimens (MB.C.19009.1–2)
<i>Jerania pusillens</i> n. sp.	1 specimen (MB.C.19010)
<i>Jerania persimilis</i> n. sp.	2 specimens (MB.C.19011.1–2)
<i>Muensteroceras subparallelum</i> n. sp.	3 specimens (MB.C.19012.1–3)
<i>Mouydiria mouydirensis</i> n. sp.	6 specimens (MB.C.19013.1–6)
<i>Dzhaprakoceras biconvexum</i> n. sp.	4 specimens (MB.C.19014.1–4)
<i>Progoniatites uncus</i> n. sp.	5 specimens (MB.C.19015.1–5)

Locality and sample MOU-G, west of Hassi Habadra (26.5032° N; 3.9099° E); Upper *Pericyclus-Progoniatites* Assemblage:

<i>Pericyclus circulus</i> n. sp.	4 specimens (MB.C.19016.1–4)
<i>Pericyclus trochus</i> n. sp.	16 specimens (MB.C.19017.1–16)
<i>Pericyclus intercisus</i> n. sp.	11 specimens (MB.C.19018.1–11)
<i>Temertassetia coarta</i> n. sp.	8 specimens (MB.C.19019.1–8)

<i>Jerania sicilicula</i> n. sp.	2 specimens (MB.C.19020.1–2)
<i>Dzhaprakoceras vergum</i> n. sp.	2 specimens (MB.C.19021.1–2)

Locality and sample MOU-V, west of Hassi Habadra (26.5047° N; 3.9081° E); Lower *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	87 specimens (MB.C.19022.1–87)
<i>Imitoceras strictum</i> n. sp.	4 specimens (MB.C.19023.1–4)
<i>Triimitoceras tantulum</i> n. sp.	2 specimens (MB.C.19024.1–2)
<i>Acrocanites disparilis</i> n. sp.	52 specimens (MB.C.19025.1–52)
<i>Pericyclus tortuosus</i> n. sp.	11 specimens (MB.C.19026.1–11)
<i>Jerania subvexa</i> n. sp.	88 specimens (MB.C.19027.1–88)
<i>Dzhaprakoceras vergum</i> n. sp.	410 specimens (MB.C.19028.1–410)
<i>Progoniatites globulus</i> n. sp.	3 specimens (MB.C.19029.1–3)
<i>Habadraites weyeri</i> n. sp.	5 specimens (MB.C.19030.1–5)
<i>Habadraites supralatus</i> n. sp.	2 specimens (MB.C.19031.1–2)
<i>Becanites inflateralis</i> Korn et al., 2010	1 specimen (MB.C.19032)

Locality and sample MOU-X, south-east of Oued Temertasset (26.5875° N; 3.8617° E); *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Nodopericyclus circumnodosus</i> n. sp.	1 specimen (MB.C.19033)
<i>Helicocyclus formosus</i> n. sp.	6 specimens (MB.C.19034.1–6)
<i>Helicocyclus inornatus</i> n. sp.	60 specimens (MB.C.19035.1–60)
<i>Helicocyclus laxaris</i> n. sp.	19 specimens (MB.C.19036.1–19)
<i>Ouaoufilalites creber</i> n. sp.	3 specimens (MB.C.19037.1–3)
<i>Kusinia falcifera</i> n. sp.	81 specimens (MB.C.19038.1–81)
<i>Muensteroceras multitudum</i> n. sp.	382 specimens (MB.C.19039.1–382)
<i>Eurites permutus</i> n. sp.	106 specimens (MB.C.19040.1–106)
<i>Eurites doliaris</i> n. sp.	41 specimens (MB.C.19041.1–41)
<i>Rotopericyclus wendti</i> n. sp.	1 specimen (MB.C.19042)

Locality and sample MOU-Y, south of Oued Temertasset (26.5820° N; 3.8519° E); *Helicocyclus-Ouaoufilalites* Assemblage:

<i>Nodopericyclus circumnodosus</i> n. sp.	4 specimens (MB.C.19043.1–4)
<i>Nodopericyclus deficerus</i> n. sp.	15 specimens (MB.C.19044.1–15)
<i>Ouaoufilalites creber</i> n. sp.	1 specimen (MB.C.19045)
<i>Kusinia falcifera</i> n. sp.	5 specimens (MB.C.19046.1–5)
<i>Muensteroceras multitudum</i> n. sp.	31 specimens (MB.C.19047.1–31)
<i>Eurites permutus</i> n. sp.	25 specimens (MB.C.19048.1–25)
<i>Eurites doliaris</i> n. sp.	19 specimens (MB.C.19049.1–19)
<i>Dzhaprakoceras punctum</i> n. sp.	28 specimens (MB.C.19050.1–28)
<i>Dzhaprakoceras biconvexum</i> n. sp.	8 specimens (MB.C.19051.1–8)
<i>Antegoniatites anticiparis</i> n. sp.	19 specimens (MB.C.19052.1–19)

Locality and sample MOU-Z, south of Oued Temertasset, horizon below sample MOU-Y; Upper *Pericyclus-Progoniatites* Assemblage:

<i>Imitoceras dimidium</i> n. sp.	9 specimens (MB.C.19053.1–9)
<i>Pericyclus circulus</i> n. sp.	17 specimens (MB.C.19054.1–17)
<i>Pericyclus trochus</i> n. sp.	106 specimens (MB.C.19055.1–106)
<i>Pericyclus intercicus</i> n. sp.	55 specimens (MB.C.19056.1–55)
<i>Temertassetia coarta</i> n. sp.	33 specimens (MB.C.19057.1–33)
<i>Muensteroceras subparallelum</i> n. sp.	43 specimens (MB.C.19058.1–43)
<i>Progoniatites uncus</i> n. sp.	22 specimens (MB.C.19059.1–22)
<i>Progoniatites globulus</i> n. sp.	1 specimen (MB.C.19060)
<i>Habadraites weyeri</i> n. sp.	1 specimen (MB.C.19061)
<i>Becanites inflateralis</i> Korn et al., 2010	1 specimen (MB.C.19062)

Locality and sample undifferentiated from the area of Oued Temertasset (bulk sample):

<i>Imitoceras dimidium</i> n. sp.	19 specimens (MB.C.19063.1–11)
<i>Imitoceras strictum</i> n. sp.	2 specimens (MB.C.19064.1–2)
<i>Jdaidites cultellus</i> n. sp.	1 specimen (MB.C.19065)
<i>Pericyclus circulus</i> n. sp.	18 specimens (MB.C.19066.1–18)
<i>Pericyclus trochus</i> n. sp.	12 specimens (MB.C.19067.1–12)
<i>Pericyclus intercicus</i> n. sp.	15 specimens (MB.C.19068.1–15)
<i>Nodopericyclus circumnodosus</i> n. sp.	1 specimen (MB.C.19069)
<i>Ouaoufilalites creber</i> n. sp.	6 specimens (MB.C.19070.1–6)
<i>Temertassetia temertassetensis</i> n. sp.	25 specimens (MB.C.19071.1–25)
<i>Temertassetia decorata</i> n. sp.	4 specimens (MB.C.19072.1–4)
<i>Temertassetia coarta</i> n. sp.	7 specimens (MB.C.19073.1–7)
<i>Jerania persimilis</i> n. sp.	30 specimens (MB.C.19074.1–30)
<i>Jerania subvexa</i> n. sp.	2 specimens (MB.C.19075.1–2)
<i>Muensteroceras subparallelum</i> n. sp.	6 specimens (MB.C.19076.1–6)

Follotites folloti n. sp.
Mouydiria mouydirensis n. sp.
Dzhaprakoceras vergum n. sp.
Progoniatites uncus n. sp.
Progoniatites paenacutus n. sp.

1 specimen (MB.C.19077)
 2 specimens (MB.C.19078.1–2)
 22 specimens (MB.C.19079.1–22)
 2 specimens (MB.C.19080.1–2)
 1 specimen (MB.C.19081)

Stratigraphy

Ammonoid faunas of Late Tournaisian and Early to Middle Viséan age are often characterised by rather specific compositions, and time equivalent assemblages of neighbouring localities may significantly differ. Furthermore, Lazarus taxa are very common (Korn et al. 2005).

The ammonoid faunas from the Argiles de Teguentour are representative, in a global context, for the *Pericyclus-Progoniatites* Genus Zone and the newly proposed *Helicocyclus-Ouaoufilalites* Genus Zone (Fig. 2). The latter, however, is only represented by the occurrence of an early species of *Ammonellipsites*. The stratigraphic scheme for the North African occurrences of Early Carboniferous ammonoids proposed by Korn et al. (2007) included two faunal bands (assemblages) within this genus zone, i.e. the *Kazakhstania-Acrocanites* Assemblage (known from the Grès de Kahla supérieur near Timimoun; Korn et al. 2010a) at the base and the *Pericyclus-Progoniatites* Assemblage (known from the Oued Snaïgui Formation of Bouhamed in the Anti-Atlas; Korn et al. 2003a) in the upper part. The fauna from Bouhamed contains genera also known

from Oued Temertasset, except for *Irinoceras* and *Orthocyclus*, which are not known from the Mouydir.

We can separate at least three major faunal complexes within the *Pericyclus-Progoniatites* Assemblage in the Argiles de Teguentour. These complexes can best be recognised in the successive samples MOU-E01 to MOU-E13 (and supported by some of the other samples), in ascending order:

Lower *Pericyclus-Progoniatites* Assemblage: Sample MOU-E01–MOU-E03 (and complimented by sample MOU-V): with the species *Dzhaprakoceras vergum*, *Jerania subvexa*, *Pericyclus tortuosus*, and *Acrocanites disparilis*, but without *Progoniatites* and *Temertassetia*.

Upper *Pericyclus-Progoniatites* Assemblage: Sample MOU-E04–MOU-E10: with the common genera *Pericyclus*, *Progoniatites*, *Temertassetia*, and *Jerania*, but without *Ouaoufilalites* and *Helicocyclus*.

Helicocyclus-Ouaoufilalites Assemblage: Sample MOU-E11–MOU-E13: with the genera *Ouaoufilalites*, *Nodopericyclus*, *Mouydiria*, *Kusinia*, *Rotopericyclus*, *Ammonellipsites*, and *Helicocyclus*.

Most of the other samples can easily be correlated with this simplified scheme, which can probably be refined.

chronostrat.		ammonoid genus zones	possible position of ammonoid assemblages
MISSISSIPPIAN	SERPUKHOVIAN	<i>Eumorphoceras</i> - <i>Cravenoceratoides</i>	
		<i>Tumulites</i> - <i>Cravenoceras</i>	
	VISÉAN	<i>Lusitanoceras</i> - <i>Lyrogoniatites</i>	★ <i>Ferganoceras torridum</i> Assemblage ★ <i>Platygonyatites rhanemensis</i> Assemblage ★ <i>Dombarites granofalcatus</i> Assemblage
		<i>Arnsbergites</i> - <i>Neoglyphioceras</i>	
		<i>Gonyatites</i> - <i>Eoglyphioceras</i>	★ <i>Gonyatites gerberi</i> Assemblage ★ <i>Gonyatites rodioni</i> Assemblage ★ <i>Gonyatites tympanus</i> Assemblage
		<i>Entogonites</i>	★ <i>Entogonites-Maxigonyatites</i> Assemblage
		(<i>Bollandites</i> - <i>Bollandoceras</i>)	★ upper <i>Bollandoceras-Bollandites</i> Assemblage ★ lower <i>Bollandoceras-Bollandites</i> Assemblage
	TOURNAISIAN	<i>Fascipericyclus-Ammonellipsites</i>	★ <i>Ammonellipsites-Merocanites</i> Assemblage
		<i>Pericyclus-Progoniatites</i>	★ <i>Helicocyclus-Ouaoufilalites</i> Assemblage ★ <i>Pericyclus-Progoniatites</i> Assemblages
		<i>Goniocyclus-Protocanites</i>	★ <i>Kazakhstania-Acrocanites</i> Assemblage ★ <i>Goniocyclus-Protocanites</i> Assemblage
		<i>Gattendorfia-Eocanites</i>	★ <i>Gattendorfia-Kahlacanites</i> Assemblage ★ <i>Gattendorfia-Eocanites</i> Assemblage ★ <i>Acutimitoceras-Postclymenia</i> Assemblage

Figure 2. Stratigraphic scheme of the Early Carboniferous (Mississippian) chronostratigraphy and ammonoid zonation with correlation to the North African ammonoid assemblages (after Korn et al. 2004, 2007). Highlighted the position of the assemblages from the Argiles de Teguentour.

Systematic Palaeontology

The descriptive part of this monograph will mainly focus on the illustration and morphometric analysis of the spe-

cies, with particular attention to their ontogenetic development. The key for the description of the species, including explanation of methods, is published by Korn (2010). Sutural terminology follows Korn et al. (2003b).

Order **Goniatitida** Hyatt, 1884

Suborder **Tornoceratina** Wedekind, 1914

Superfamily **Prionocerataceae** Hyatt, 1884

Family **Prionoceratidae** Hyatt, 1884

Subfamily **Imitoceratinae** Ruzhencev, 1950

Imitoceras Schindewolf, 1923

For a detailed discussion of the genus, see Korn et al. (2010a).

Imitoceras dimidium n. sp.

Figures 3, 4

Derivation of name. From Latin *dimidium* = the half, because of the short external lobe.

Holotype. Specimen MB.C.18821.1, illustrated in Figure 3E.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C4 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 383 specimens, conch diameter up to 48 mm.

Diagnosis. *Imitoceras* with thickly pachyconic or thinly globular conch in the early juvenile stage, conch width index continuously reduced during ontogeny and thinly discoidal in the adult stage; early growth stage subinvolute, closure of the umbilicus at 5 mm dm; aperture low or moderately high in juveniles and high or very high in adults; umbilicus funnel-shaped with oblique umbilical margin, flanks converging towards the narrowly rounded venter. Internal mould without constrictions. Suture line with small, slightly pouched external lobe; ventrolateral saddle strongly asymmetric, ventrally inclined; adventive lobe strongly asymmetric with slightly convex ventral side and concave dorsal side.

Table 1. Conch ontogeny (Figs 4A–F, K–M) of *Imitoceras dimidium* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic to thinly globular; subinvolute (ww/dm = 0.75–0.95; uw/dm = 0.15–0.25)	moderately to strongly depressed; very strongly embracing (ww/wh 1.50–2.10; IZR = 0.45–0.55)	low to moderate (WER = 1.60–1.90)
8 mm	thickly discoidal to thinly pachyconic; involute (ww/dm = 0.55–0.64; uw/dm = 0.00–0.05)	weakly compressed to weakly depressed; very strongly embracing (ww/wh = 0.95–1.15; IZR = 0.45–0.55)	moderate to high (WER = 1.85–2.25)
20 mm	thinly to thickly discoidal; involute (ww/dm = 0.43–0.52; uw/dm = 0.00–0.05)	weakly compressed; strongly embracing (ww/wh = 0.75–0.95; IZR = 0.35–0.45)	high to very high (WER = 2.10–2.35)
30 mm	thinly discoidal; involute (ww/dm = 0.40–0.45; uw/dm = 0.00–0.05)	weakly compressed; strongly embracing (ww/wh = 0.70–0.80; IZR = 0.35–0.45)	high to very high (WER = 2.20–2.35)
48 mm	thinly discoidal; involute (ww/dm ~ 0.42; uw/dm = 0.00)	weakly compressed; strongly embracing (ww/wh ~ 0.70; IZR ~ 0.40)	very high (WER ~ 2.45)

Table 2. Conch dimensions (in mm) and proportions for reference specimens of *Imitoceras dimidium* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18821.1	35.5	14.9	20.1	0.9	12.3	0.42	0.74	0.03	2.33	0.39
paratype MB.C.18779.1	31.8	13.6	17.8	1.1	10.9	0.43	0.76	0.04	2.31	0.39
paratype MB.C.19053.2	28.2	12.6	16.4	0.5	9.8	0.45	0.77	0.02	2.35	0.40
paratype MB.C.18859.3	27.8	13.1	15.7	0.4	9.4	0.47	0.83	0.01	2.28	0.40
paratype MB.C.19053.3	23.8	11.6	13.6	0.8	8.0	0.49	0.85	0.03	2.28	0.41
paratype MB.C.19053.1	16.6	8.3	9.2	0.5	5.6	0.50	0.90	0.03	2.28	0.39
paratype MB.C.18859.2	13.3	7.3	7.2	0.3	4.1	0.55	1.02	0.02	2.09	0.43
paratype MB.C.18859.1	11.5	6.5	6.3	0.4	3.6	0.57	1.04	0.03	2.12	0.43



Figure 3. *Imitoceras dimidium* n. sp.; all $\times 2$. **A.** Paratype MB.C.18779.1 from locality MOU-B0. **B.** Paratype MB.C.18859.1 from locality MOU-D1. **C.** Paratype MB.C.18859.2 from locality MOU-D1. **D.** Paratype MB.C.19053.1 from locality MOU-Z. **E.** Holotype MB.C.18821.1 from locality MOU-C4. **F.** Paratype MB.C.19053.2 from locality MOU-Z. **G.** Paratype MB.C.18859.3 from locality MOU-D1. **H.** Paratype MB.C.19053.3 from locality MOU-Z.

Table 3. Suture line proportions (Figs 4G–J) for *Imitoceras dimidium* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18821.1	33.8 mm	0.32	0.46	0.55	0.00	0.70	E lobe very short
paratype MB.C.19053.2	23.0 mm	0.34	0.45	0.66	0.00	0.75	
paratype MB.C.18859.1	15.5 mm	0.29	0.46	0.67	0.00	0.63	E lobe comparatively narrow
paratype MB.C.19053.1	12.4 mm	0.38	0.57	0.56	0.00	0.67	A lobe comparatively wide

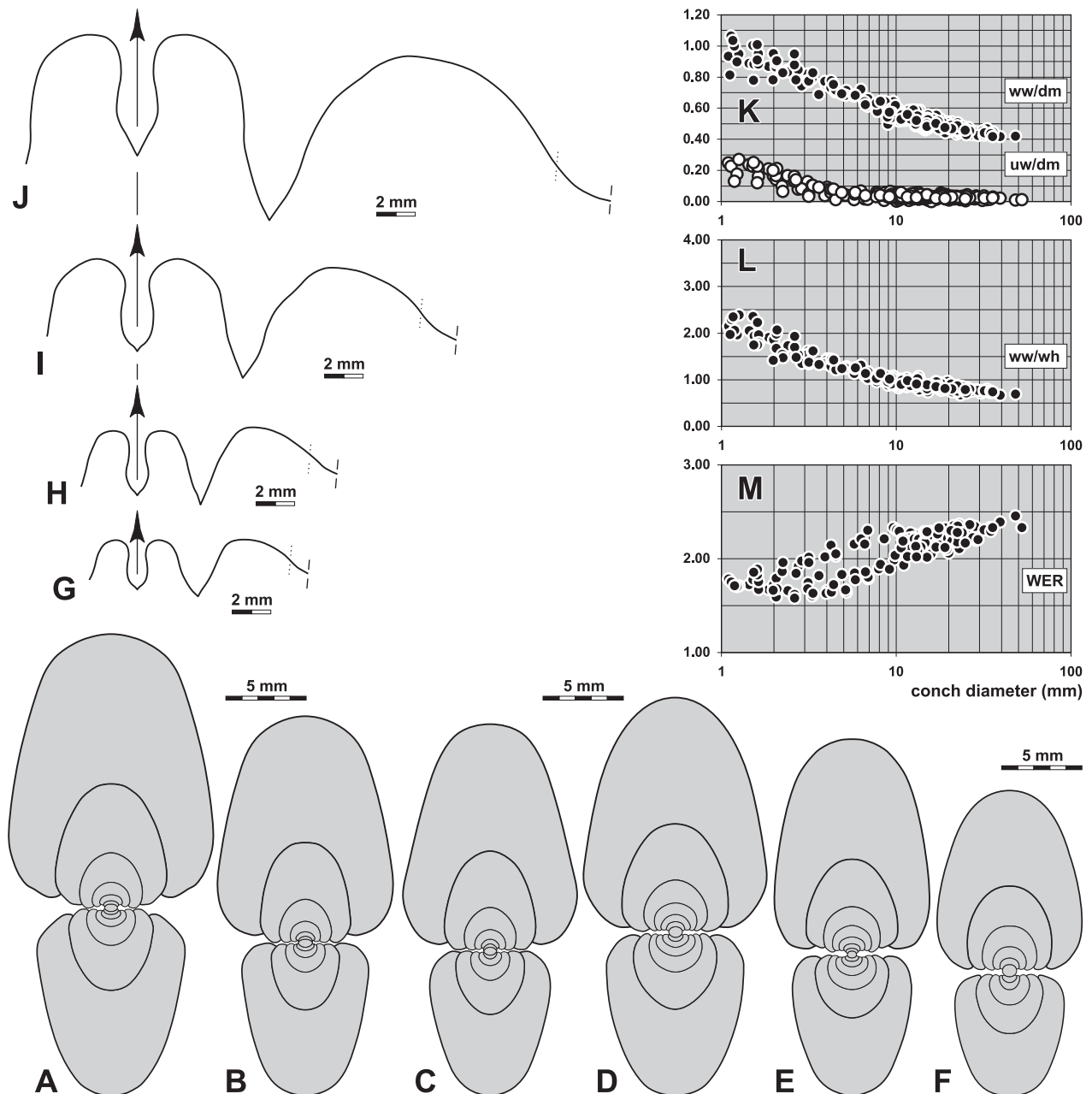


Figure 4. *Imitoceras dimidium* n. sp. **A.** Cross section of paratype MB.C.18884.1 from locality MOU-D2; $\times 2.5$. **B.** Cross section of paratype MB.C.18943.1 from locality MOU-E07; $\times 2.5$. **C.** Cross section of paratype MB.C.18859.4 from locality MOU-D1; $\times 2.5$. **D.** Cross section of paratype MB.C.19053.4 from locality MOU-Z; $\times 2.5$. **E.** Cross section of paratype MB.C.18859.5 from locality MOU-D1; $\times 2.5$. **F.** Cross section of paratype MB.C.18884.2 from locality MOU-D2; $\times 2.5$. **G.** Suture line of paratype MB.C.19053.1 from locality MOU-Z, at 12.4 mm dm, 7.4 mm ww, 7.6 mm wh; $\times 3.0$. **H.** Suture line of paratype MB.C.18859.1 from locality MOU-D1, at 15.5 mm dm, 8.1 mm ww, 9.5 mm wh; $\times 3.0$. **I.** Suture line of paratype MB.C.19053.2 from locality MOU-Z, at 23.0 mm dm, 11.5 mm ww, 14.2 mm wh; $\times 3.0$. **J.** Suture line of holotype MB.C.18821.1 from locality MOU-C4, at 33.8 mm dm, 15.1 mm ww, 20.7 mm wh; $\times 3.0$. **K–M.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Discussion. *Imitoceras dimidium* differs from *I. altilobatum* Korn, Ebbighausen & Bockwinkel, 2010 from the area of Timimoun in the shallower external lobe, the more asymmetric adventive lobe, and in the umbilicus, which in *I. altilobatum* is not funnel-shaped as in *I. dimidium*. *I. dimidium* has, in comparable growth stages, a more slender conch than *I. altilobatum* ($ww/dm = 0.60$ in *I. altilobatum* but 0.50 in *I. dimidium* and *I. strictum* at 15 mm dm). *I. strictum* possesses steinkern constrictions and is thus clearly separated from *I. dimidium*.

I. dimidium differs from *I. ixion* (Hall, 1860) and *I. rotatorium* (de Koninck, 1844) in the less asymmetric adventive lobe, but particularly in the funnel-shaped umbilicus (*I. ixion* and *I. rotatorium* possess a broadly rounded umbilical margin).

***Imitoceras strictum* n. sp.**

Figures 5, 6

Derivation of name. From Latin *strictum* = constricted, because of the steinkern constrictions.

Holotype. Specimen MB.C.18885.1, illustrated in Figure 5A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D2 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 70 specimens, conch diameter up to 20 mm .

Diagnosis. *Imitoceras* with thickly pachyconic or thinly globular conch in the early juvenile stage, conch width index continuously reduced during ontogeny and thinly discoidal in the adult stage; early growth stage subinvolute, closure of the umbilicus at 3 mm dm ; aperture low in juveniles and high in adults; umbilicus funnel-shaped with oblique umbilical margin, flanks converging towards the narrowly rounded venter. Internal mould with gently biconvex constrictions. Suture line with small, slightly pouched external lobe; ventrolateral saddle strongly asymmetric, ventrally inclined; adventive lobe slightly asymmetric with slightly convex ventral side and concave dorsal side.

Table 4. Conch ontogeny (Figs 6A, B, F–H) of *Imitoceras strictum* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute ($ww/dm \sim 0.82$; $uw/dm = 0.18\text{--}0.23$)	moderately depressed; very strongly embracing ($ww/wh\ 1.90$; $IZR \sim 0.52$)	low ($WER \sim 1.60$)
8 mm	thickly discoidal to thinly pachyconic; involute ($ww/dm = 0.55\text{--}0.65$; $uw/dm = 0.00\text{--}0.05$)	weakly compressed to weakly depressed; very strongly embracing ($ww/wh = 0.90\text{--}1.10$; $IZR = 0.45\text{--}0.55$)	moderate to high ($WER = 1.80\text{--}2.10$)
20 mm	thinly to thickly discoidal; involute ($ww/dm = 0.42\text{--}0.50$; $uw/dm = 0.00\text{--}0.05$)	weakly compressed; strongly embracing ($ww/wh \sim 0.80$; $IZR \sim 0.44$)	high ($WER \sim 2.20$)

Table 5. Conch dimensions (in mm) and proportions for reference specimens of *Imitoceras strictum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18885.1	17.8	9.4	9.7	0.5	5.5	0.53	0.97	0.03	2.08	0.44
paratype MB.C.18885.2	16.9	7.8	9.9	0.5	5.2	0.46	0.78	0.03	2.11	0.47
paratype MB.C.18885.3	9.8	5.6	5.7	0.3	3.0	0.57	0.98	0.03	2.10	0.47

Table 6. Suture line proportions (Figs 6C–E) for *Imitoceras strictum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18885.1	17.4 mm	0.43	0.62	0.81	0.00	0.69	
paratype MB.C.18885.2	16.4 mm	0.46	0.62	0.73	0.00	0.73	
paratype MB.C.18885.3	9.7 mm	0.29	0.43	0.61	0.00	0.68	E lobe very narrow

Discussion. *Imitoceras strictum* differs from the co-occurring *I. dimidium* in the steinkern constrictions. The same character distinguishes the new species from most of the other members of the genus. *I. abundans* Miller & Colinson, 1951 possesses constrictions, but these are almost linear in their course, in contrast to the biconvex constrictions of *I. strictum*.

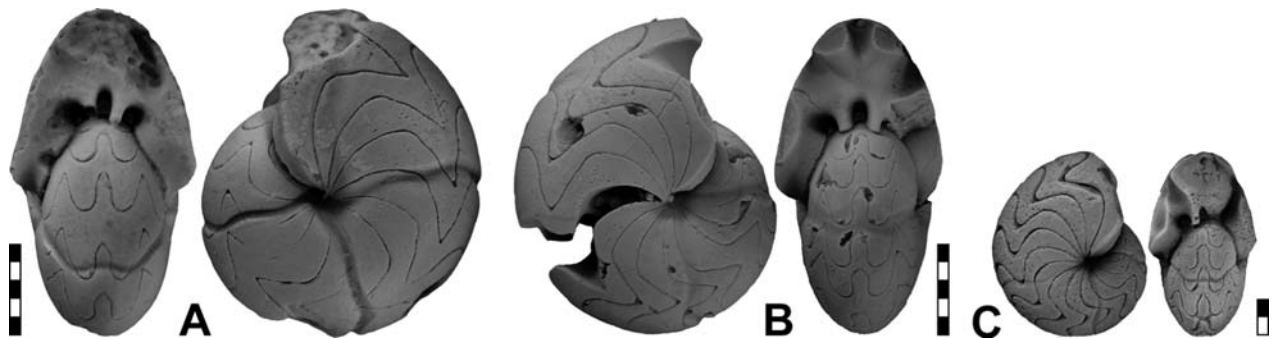


Figure 5. *Imitoceras strictum* n. sp. from locality MOU-D2; all $\times 2$. **A.** Holotype MB.C.18885.1. **B.** Paratype MB.C.18885.2. **C.** Paratype MB.C.18885.3.

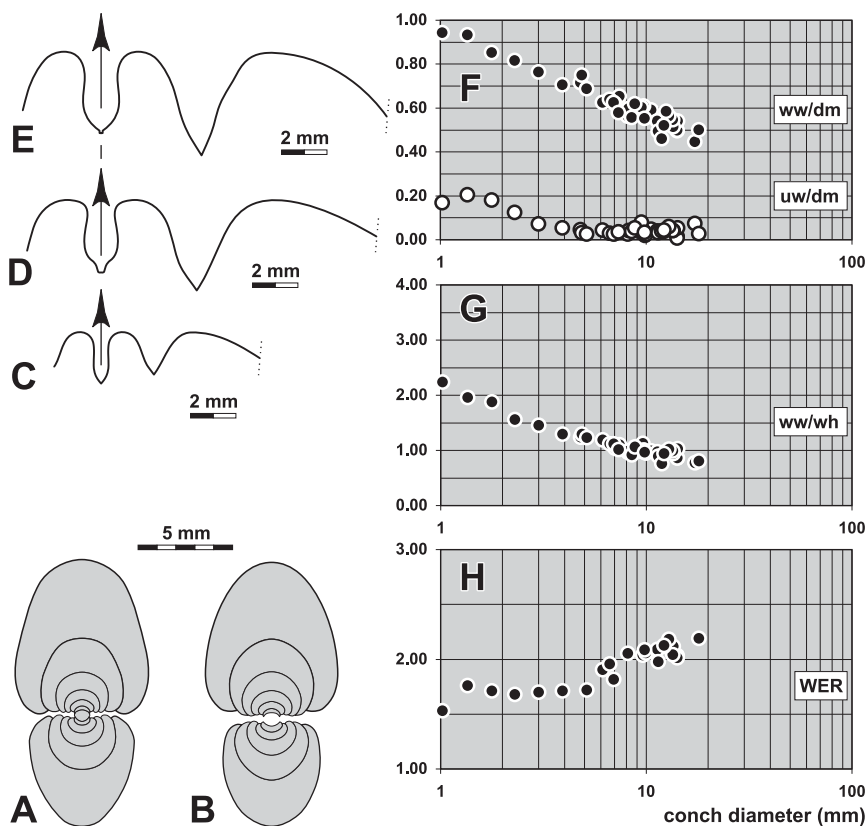


Figure 6. *Imitoceras strictum* n. sp. **A.** Cross section of paratype MB.C.18720.1 from locality A264; $\times 2.5$. **B.** Cross section of paratype 3488 from locality MOU-D2; $\times 2.5$. **C.** Suture line of paratype MB.C.18885.3 from locality MOU-D2, at 9.7 mm dm, 5.1 mm ww, 5.9 mm wh; $\times 3.0$. **D.** Suture line of paratype MB.C.18885.2 from locality MOU-D2, at 16.4 mm dm, 8.1 mm ww, 10.4 mm wh; $\times 3.0$. **E.** Suture line of holotype MB.C.18885.1 from locality MOU-D2, at 17.4 mm dm, 9.3 mm ww, 10.5 mm wh; $\times 3.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Triimitoceras* Korn, Bockwinkel, Ebbighausen & Klug, 2003**

For a detailed discussion of the genus, see Korn et al. (2010a).

***Triimitoceras tantulum* n. sp.**

Figures 7, 8

Derivation of name. From Latin tantulum = small, because of the small size.

Holotype. Specimen MB.C.18721, illustrated in Figure 7A.

Type locality and horizon. Oued Temertasset, locality and sample A264 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. Five specimens, conch diameter up to 19 mm.

Diagnosis. *Triimitoceras* with thickly pachyconic conch in the early juvenile stage, conch width index continuously reduced during ontogeny and being thinly discoidal at 18 mm dm; aperture very low or low. Internal mould with concavo-convex constrictions with small ventral sinus. Suture line with lanceolate, deep external lobe; ventrolateral saddle slightly asymmetric; adventive lobe V-shaped, almost symmetric.

Table 7. Conch shape (Figs 8A, C–E) of *Triimitoceras tantulum* n. sp.

dm	conch shape	whorl cross section shape	aperture
4 mm	thickly pachyconic; involute (ww/dm ~ 0.80; uw/dm ~ 0.06)	moderately depressed; very strongly embracing (ww/wh ~ 1.55; IZR ~ 0.60)	very low (WER ~ 1.48)
10 mm	thickly discoidal; involute (ww/dm ~ 0.58; uw/dm ~ 0.06)	weakly depressed; very strongly embracing (ww/wh ~ 1.10; IZR ~ 0.60)	low (WER ~ 1.55)
18 mm	thickly discoidal; involute (ww/dm ~ 0.48; uw/dm ~ 0.06)	weakly compressed; very strongly embracing (ww/wh ~ 0.90; IZR ~ 0.58)	low (WER ~ 1.65)

Table 8. Conch dimensions (in mm) and proportions for reference specimens of *Triimitoceras tantulum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.19024.2	18.3	8.7	9.6	1.1	4.2	0.48	0.91	0.06	1.68	0.57
holotype MB.C.18721	10.2	6.1	5.4	0.7	2.1	0.60	1.13	0.06	1.58	0.61
paratype MB.C.19024.1	8.2	5.2	4.6	0.4	–	0.63	1.12	0.05	–	–

Table 9. Suture line proportions (Fig. 8B) for *Triimitoceras tantulum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18721	9.2 mm	0.37	0.65	0.48	0.00	0.57	E lobe as deep as A lobe

Discussion. *Triimitoceras tantulum* differs from the type species *T. epiwocklumeriforme* Korn, Bockwinkel, Ebbighausen & Klug, 2003 in the lanceolate external lobe (which is pouched in the adult stage of *T. epiwocklumeriforme*). *T. tantulum* differs from *T. amplisellatum* Korn, Ebbighausen & Bockwinkel, 2010 mainly in the less strongly tripartite inner whorls and in the lower aperture in comparable growth stages (at 15 mm dm: WER = 1.60 in *T. tantulum* but 1.95 in *T. amplisellatum*).

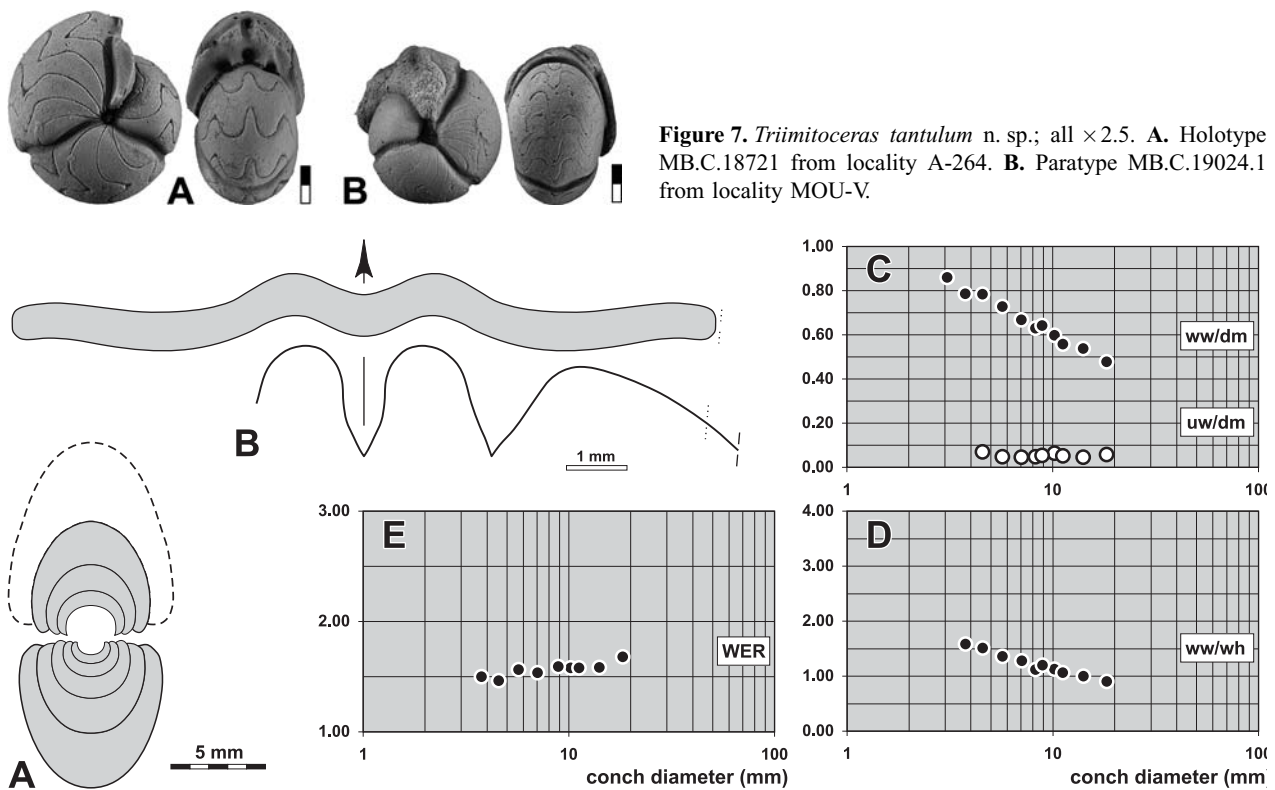


Figure 8. *Triimitoceras tantulum* n. sp. **A.** Cross section of paratype MB.C.19024.2 from locality MOU-V; $\times 2.5$. **B.** Suture line and constriction of holotype MB.C.18721 from locality A-264, at 9.2 mm dm, 5.8 mm ww, 4.6 mm wh; $\times 8.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Family **Acrocanitidae** Korn, Bockwinkel & Ebbighausen, 2007

Family definition. Prionocerataceae with lenticular, evolute to almost involute conch form. Suture line multilobate with increasing number of lateral lobes.

Included genera.

Acrocanites Schindewolf, 1922

Jdaidites Korn, Bockwinkel & Ebbighausen, 2007

***Acrocanites* Schindewolf, 1922**

For a detailed discussion of the genus, see Korn et al. (2007, 2010a).

***Acrocanites disparilis* n. sp.**

Figures 9, 10

Derivation of name. From Latin *disparilis* = unequal, because of the size of the lobes on the flank.

Holotype. Specimen MB.C.18855, illustrated in Figure 9A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D0 (Mouydir, South Algeria); lower part of the *Pericyclus-Progoniatites* Assemblage.

Material. 63 specimens, conch diameter up to 22 mm.

Diagnosis. *Acrocanites* with thinly pachyconic conch in the earliest juvenile stage (1 mm dm), becoming rapidly slender during ontogeny and being extremely discoidal at 20 mm dm; conch evolute in all stages with a slight reduction of the umbilical width in the adult stage; venter broadly rounded in juveniles and narrowly rounded in adults; aperture low or very low. Steinkern smooth except for a very shallow radial folding on the flanks. Suture line in the adult stage with lanceolate external lobe; five pouched and acute lobes on the flank, saddles between these lobes strongly inflated; two or three small, V-shaped and acute lobes on the umbilical wall.

Table 10. Conch ontogeny (Figs 10A, B, G–I) of *Acrocanites disparilis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly discoidal; evolute (ww/dm ~ 0.40; uw/dm ~ 0.55)	moderately depressed; weakly embracing (ww/wh ~ 1.60; IZR ~ 0.10)	low (WER ~ 1.65)
8 mm	extremely discoidal; evolute (ww/dm ~ 0.28; uw/dm = 0.55–0.60)	weakly depressed; moderately embracing (ww/wh = 1.10–1.25; IZR = 0.15–0.20)	very low (WER = 1.45–1.50)
20 mm	extremely discoidal; evolute (ww/dm ~ 0.22; uw/dm = 0.48–0.52)	weakly compressed; strongly embracing (ww/wh ~ 0.70; IZR ~ 0.32)	low (WER ~ 1.65)

Table 11. Conch dimensions (in mm) and proportions for reference specimens of *Acrocanites disparilis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18855	25.4	5.0	7.9	11.6	5.5	0.20	0.63	0.46	1.62	0.31
paratype MB.C.19025.1	22.0	4.9	7.3	10.5	5.0	0.22	0.68	0.48	1.67	0.32
paratype MB.C.19025.2	11.1	2.6	2.9	6.3	2.3	0.23	0.91	0.57	1.57	0.21
paratype MB.C.18861.1	10.8	2.8	2.8	5.8	2.2	0.26	0.97	0.53	1.58	0.23

Table 12. Suture line characteristics (Figs 10C–F) for *Acrocanites disparilis* n. sp.

specimen	at dm	EL w/d	external lobe	adventive lobe	lateral lobes
holotype MB.C.18855	25.0 mm	0.50	spatulate	almost symmetric, subacute	7, all acute, inner three small
dto.	c. 18.0 mm	0.46	spatulate	almost symmetric, subacute	5, mostly acute, inner one small
paratype MB.C.19025.1	21.8 mm	0.50	spatulate	slightly asymmetric, acute	6, some acute, inner two small
paratype MB.C.19025.2	9.8 mm	0.35	spatulate	slightly asymmetric, acute	3, outer two rounded

Discussion. *Acrocanites disparilis* differs from *A. imperfectus* Korn, Ebbighausen & Bockwinkel, 2010 from Timimoun in the higher number of sutural elements. *A. disparilis* possesses five large lobes on the flank and two or three small lobes on the umbilical wall, whereas *A. imperfectus* shows only three large lobes on the flank and one or two small lobes on the umbilical wall. The external lobe is subparallel in *A. disparilis* but pouched in *A. imperfectus*.

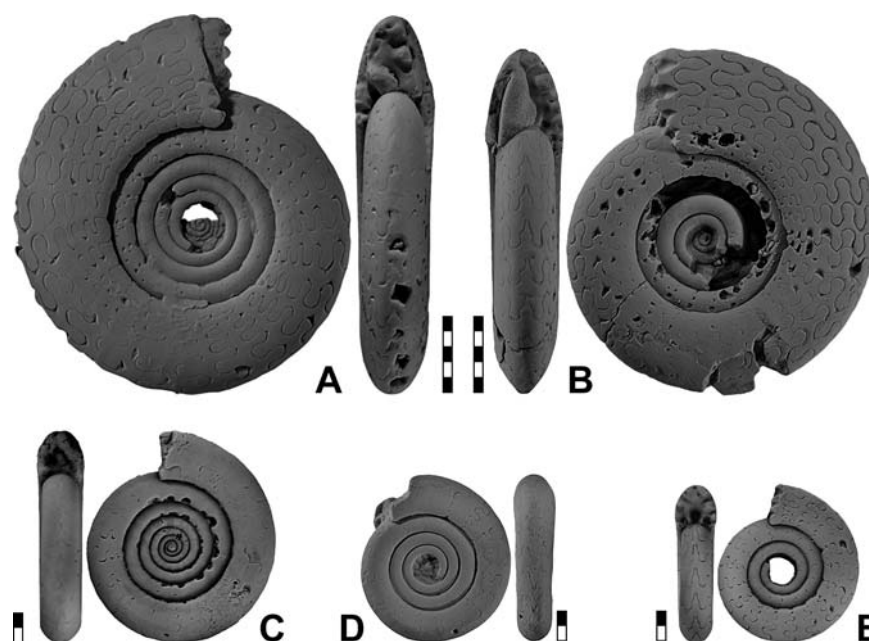


Figure 9. *Acrocanites disparilis* n. sp.; all $\times 2$. **A.** Holotype MB.C.18855 from locality MOU-D0. **B.** Paratype MB.C.19025.1 from locality MOU-V. **C.** Paratype MB.C.18822 from locality MOU-C4. **D.** Paratype MB.C.19025.2 from locality MOU-V. **E.** Paratype MB.C.18861.1 from locality MOU-D1.

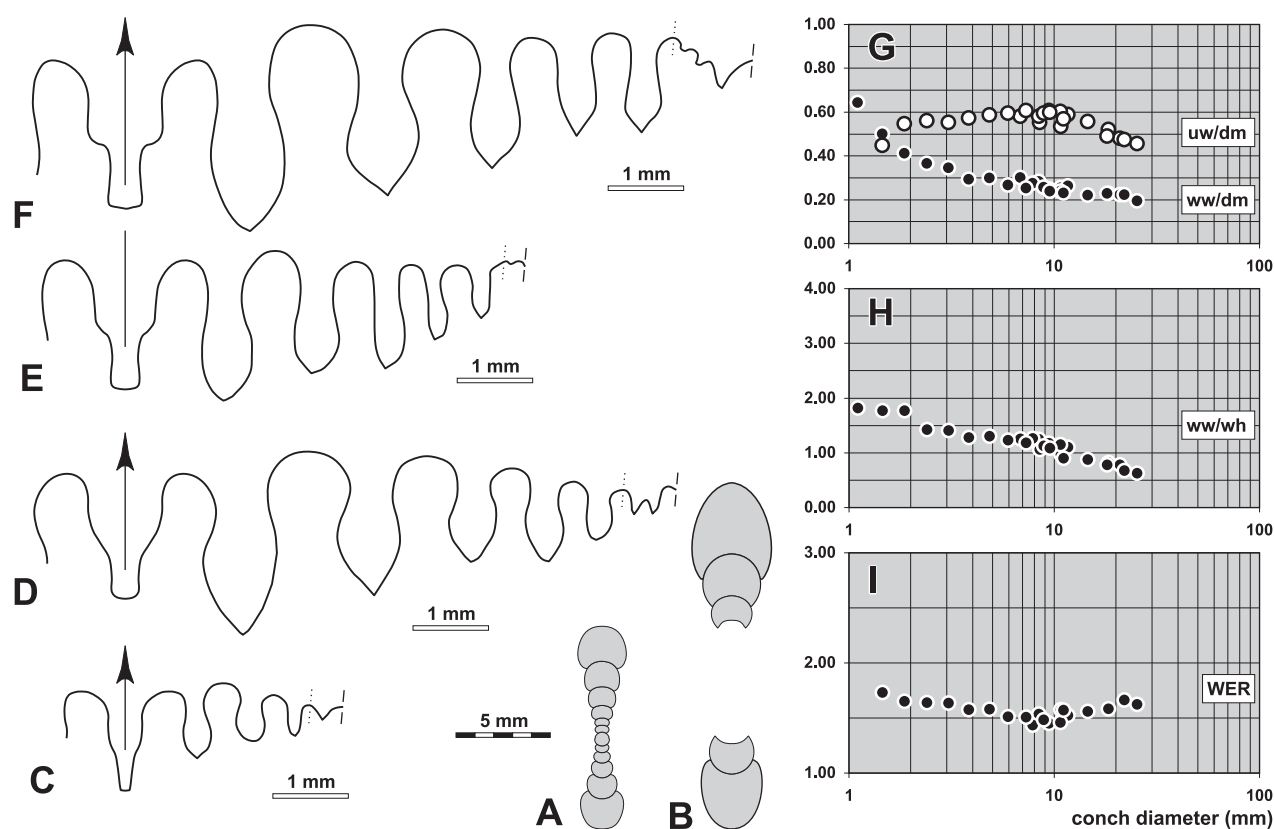


Figure 10. *Acrocanites disparilis* n. sp. **A.** Cross section of paratype MB.C.19025.3 from locality MOU-V; $\times 2.5$. **B.** Cross section of paratype MB.C.19025.4 from locality MOU-V; $\times 2.5$. **C.** Suture line of paratype MB.C.19025.2 from locality MOU-V, at 9.8 mm dm, 2.6 mm ww, 2.0 mm wh; $\times 10.0$. **D.** Suture line of paratype MB.C.19025.1 from locality MOU-V, at 21.8 mm dm, 4.5 mm ww, 6.8 mm wh; $\times 10.0$. **E.** Suture line of holotype MB.C.18855 from locality MOU-D0, at 4.1 mm ww, 4.5 mm wh; $\times 10.0$. **F.** Suture line of holotype MB.C.18855 from locality MOU-D0, at 25.0 mm dm, 5.4 mm ww, 7.4 mm wh; $\times 10.0$. **G–I.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

The two species *A. multilobatus* Schindewolf, 1926 and *A. tornacensis* Delépine, 1940 are problematic because they are based on poorly preserved material. Both species have a V-shaped external lobe, in contrast to the external lobe with subparallel flanks in *A. disparilis*.

***Jdaidites* Korn, Bockwinkel & Ebbighausen, 2007**

Type species. *Jdaidites serpentinus* Korn, Bockwinkel & Ebbighausen, 2007 (OD).

Genus definition. Acrocanitidae with extremely discoidal, subinvolute or subevolute conch, venter acute. Six or seven lobes on the flank and the umbilical wall.

Included species.

cultellus: *Jdaidites cultellus* n. sp.; Mouydir, Algeria.

serpentinus: *Jdaidites serpentinus* Korn, Bockwinkel & Ebbighausen, 2007, p. 140; Anti-Atlas, Morocco.

Discussion. In the suture line, *Jdaidites* is most similar to advanced species of the genus *Acrocanites*, such as *A. multilobatus* Schindewolf, 1922; the number of lobes and their shapes are nearly identical. The conch shape of the two genera, however, is very different; *Acrocanites* is rather widely umbilicate and *Jdaidites* is narrowly umbilicate.

***Jdaidites cultellus* n. sp.**

Figures 11, 12

Derivation of name. From Latin cultellus = a little knife, because of the conch shape.

Holotype. Specimen MB.C.18823, illustrated in Figure 11.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C4 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. Only the holotype with 19 mm conch diameter and one whorl fragment.

Diagnosis. *Jdaidites* with extremely discoidal, subevolute conch. Suture line with six lanceolate or V-shaped, subacute or acute lobes on the flank and the umbilical wall.

Table 13. Conch shape (Fig. 12A) of *Jdaidites cultellus* n. sp.

dm	conch shape	whorl cross section shape	aperture
19 mm	extremely discoidal; subevolute (ww/dm ~ 0.16; uw/dm ~ 0.38)	strongly compressed; moderately embracing (ww/wh ~ 0.38; IZR ~ 0.28)	high (WER ~ 2.02)

Table 14. Conch dimensions (in mm) and proportions for reference specimens of *Jdaidites cultellus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18823	19.2	3.0	7.9	7.3	5.7	0.16	0.38	0.38	2.02	0.28

Table 15. Suture line proportions (Figs 12B, C) for *Jdaidites cultellus* n. sp.

specimen	at dm	EL w/d	external lobe	adventive lobe	lateral lobes
holotype MB.C.18823	18.6 mm	0.29	spatulate	inflated, rounded	5, all acute, first pouched
dto.	c. 13.0 mm	0.21	spatulate	inflated, rounded	4, inner three acute, first rounded

Discussion. *Jdaidites cultellus* differs from the type species in the much wider umbilicus.



Figure 11. *Jdaidites cultellus* n. sp., holotype MB.C.18823 from locality MOU-C4; $\times 2.0$.

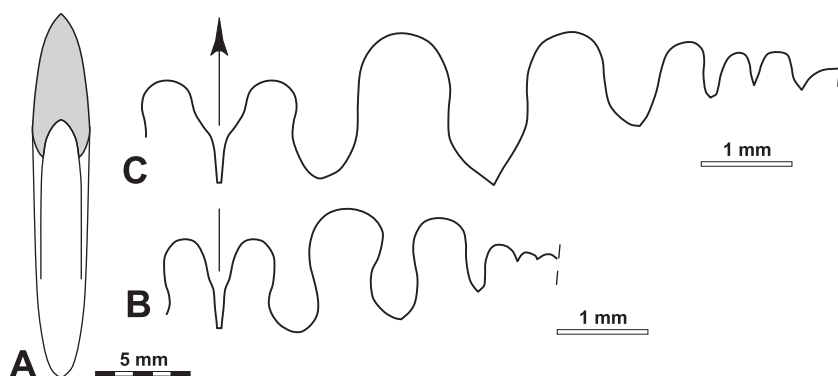


Figure 12. *Jdaidites cultellus* n. sp. from locality MOU-C4. **A.** Dorsal view of holotype MB.C.18823; $\times 2.5$. **B.** Suture line of holotype MB.C.18823, at 2.1 mm ww, 3.6 mm wh; $\times 12.0$. **C.** Suture line of the same specimen, at 18.6 mm dm, 2.9 mm ww, 6.8 mm wh; $\times 12.0$.

Suborder **Goniatitina** Hyatt, 1884
 Superfamily **Pericyclaceae** Hyatt, 1900
 Family **Pericyclidae** Hyatt, 1900
 Subfamily **Pericyclinae** Hyatt, 1900

***Pericyclus* Mojsisovics, 1882**

Type species. *Goniatites princeps* de Koninck, 1844, p. 579 [OD].

Genus definition. Pericyclinae with pachyconic or thickly discoidal conch, reaching up to 70 mm conch diameter. Conch subinvolute, subevolute or evolute with minor ontogenetic changes. Steinkern with strong, usually sharp ribs with concavo-convex course and rursiradiate direction, rib splitting and rib intercalation common; without or with weak convex or concavo-convex constrictions. Suture line with parallel-sided, very narrow external lobe (EL w/d = 0.32–0.42; EL/AL = 0.80–1.30) and low median saddle (MS h = 0.20–0.35); ventrolateral saddle broadly rounded; adventive lobe V-shaped and narrow, slightly asymmetric.

Included species.

circulus: *Pericyclus circulus* n. sp.; Mouydir, Algeria.

dilatatus: *Pericyclus dilatatus* Schindewolf, 1926, p. 78; Thuringia.

interciscus: *Pericyclus interciscus* n. sp.; Mouydir, Algeria.

latumbilicatus: *Pericyclus latumbilicatus* Kusina, 2000, p. 20; North Urals.

mercatorius: *Pericyclus mercatorius* Korn, Bockwinkel, Ebbighausen & Klug 2003, p. 85; Anti-Atlas, Morocco.

princeps: *Goniatites princeps* de Koninck, 1844, p. 579; Belgium.

tortuosus: *Pericyclus tortuosus* n. sp.; Mouydir, Algeria.

trochus: *Pericyclus trochus* n. sp.; Mouydir, Algeria.

Separation of the new species. The four species of *Pericyclus* from Oued Temertasset can be separated by means of conch morphology and the suture line. In the conch proportions, they differ as follows:

- *P. tortuosus* – at 15 mm dm: mean value of the uw/dm ratio = 0.52; umbilical margin rounded.
- *P. circulus* – at 20–30 mm dm: mean value of the uw/dm ratio = 0.45, of the ww/wh ratio = 1.60; umbilical margin rounded.
- *P. trochus* – at 20–30 mm dm: mean value of the uw/dm ratio = 0.36, of the ww/wh ratio = 1.40; umbilical margin subangular.
- *P. interciscus* – at 20–30 mm dm: mean value of the uw/dm ratio = 0.28, of the ww/wh ratio = 1.20; umbilical margin subangular.

The steinkern surface offers more differences:

- *P. tortuosus* – 25–35 very coarse, sharp, slightly biconvex ribs with rursiradiate direction; rib splitting very common; deep steinkern constrictions.
- *P. circulus* – 30–40 coarse, sharp concavo-convex ribs with rursiradiate direction; rib splitting is rare, splitting occurs on the umbilical margin; adult conchs above 15 mm usually without constrictions.
- *P. trochus* – 40–50 coarse, sharp concavo-convex ribs (tendency towards biconvex course) with slightly rursiradiate direction; rib splitting is common, splitting occurs on the inner flank near the umbilicus, intercalatory ribs are introduced in the inner flank area; well-developed constrictions.
- *P. interciscus* – 50–60 shallow rounded concavo-convex ribs (tendency towards biconvex course) with rursiradiate direction; rib splitting and intercalation very common; splitting occurs on the inner flank; well-developed constrictions.

Discussion. The genus *Pericyclus* has for long been used as a pool for any ribbed ammonoids of late Tournaisian age, until Turner (1948) and Schindewolf (1951) introduced a number of new genera. The genus must now be defined by its type species *P. princeps*, meaning that many of the species previously attributed to *Pericyclus* will now be placed in other genera or even other families.

Pericyclus differs from *Goniocyclus* Gordon, 1986 in the higher median saddle of the suture line and in the less well-developed ventral sinus of the ribs, which form a chevron-like form in *Goniocyclus*. *Bouhamedites* Korn, Bockwinkel, Ebbighausen & Klug, 2003 differs in the subacute venter and the closure of the umbilicus. *Nodopericyclus* n. gen. is separated from *Pericyclus* in the strikingly bifurcating ribs.

***Pericyclus tortuosus* n. sp.**

Figures 13, 14

Derivation of name. From Latin tortuosus = full of whorls, because of the wide umbilicus.*Holotype.* Specimen MB.C.19026.1, illustrated in Figure 13A.*Type locality and horizon.* Oued Temertasset, sample MOU-V (Mouydir, South Algeria); lower part of the *Pericyclus-Progoniatites* Assemblage.*Material.* 12 specimens, conch diameter up to 15 mm.

Diagnosis. *Pericyclus* with thinly to thickly discoidal and evolute conch throughout ontogeny; whorl cross section usually depressed crescent-shaped; umbilical margin narrowly rounded; flanks and broad venter widely rounded. Ornament with 25–35 very coarse, sharp ribs extending in rursiradiate direction; rib course slightly biconvex with a shallow ventral sinus; the ribs begin on the umbilical wall; rib splitting is common, splitting occurs on the umbilical margin producing nodes. Steinkern with deep constrictions. Suture line with parallel-sided, very narrow and deep external lobe; median saddle very low, ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped.

Table 16. Conch ontogeny (Figs 14A, C–E) of *Pericyclus tortuosus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly discoidal; evolute (ww/dm ~ 0.50; uw/dm ~ 0.58)	strongly depressed; moderately embracing (ww/wh ~ 2.10; IZR ~ 0.20)	low (WER ~ 1.50)
8 mm	thickly discoidal; evolute (ww/dm ~ 0.50; uw/dm ~ 0.50)	moderately depressed; moderately embracing (ww/wh ~ 1.75; IZR ~ 0.24)	low (WER ~ 1.60)
15 mm	thinly discoidal; evolute (ww/dm ~ 0.47; uw/dm ~ 0.53)	moderately depressed; moderately embracing (ww/wh ~ 1.83; IZR ~ 0.20)	low (WER ~ 1.60)

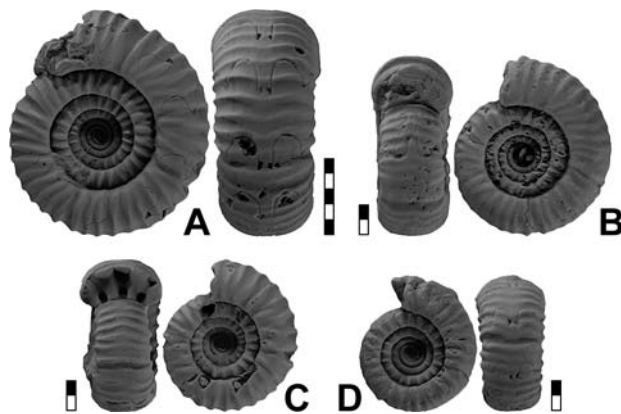


Figure 13. *Pericyclus tortuosus* n. sp.; all $\times 2$. **A.** Holotype MB.C.19026.1 from locality MOU-D2. **B.** Paratype MB.C.19026.2 from locality MOU-V. **C.** Paratype MB.C.18824 from locality MOU-C4. **D.** Paratype MB.C.19026.3 from locality MOU-V.

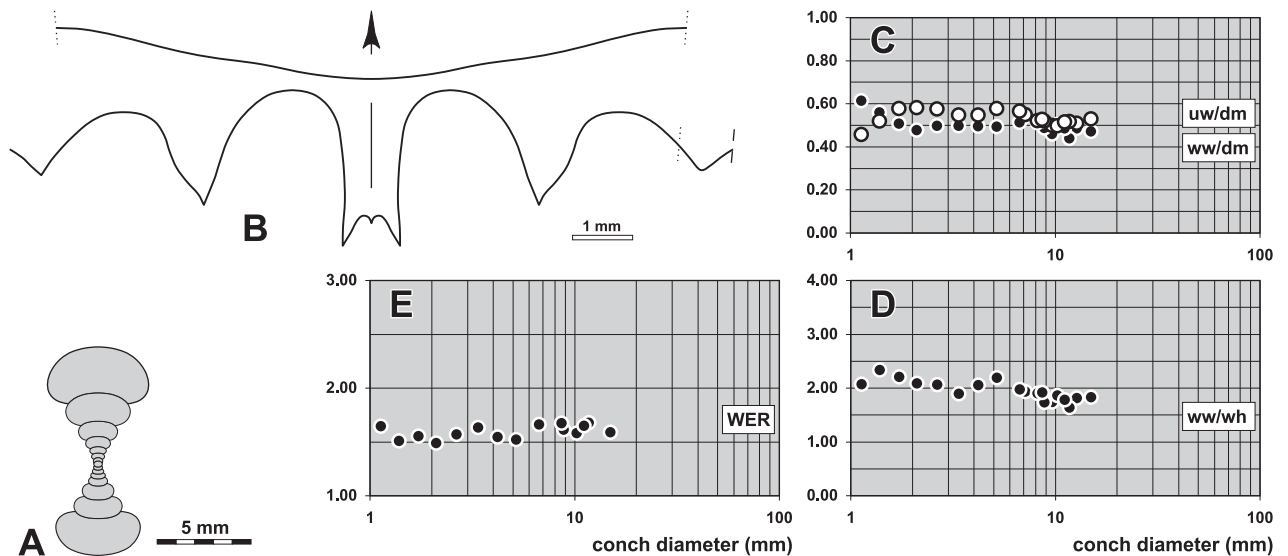


Figure 14. *Pericyclus tortuosus* n. sp. **A.** Cross section of paratype MB.C.19026.4 from locality MOU-V; $\times 2.5$. **B.** Suture line and rib course of holotype MB.C.19026.1 from locality MOU-V, at 14.3 mm dm, 6.5 mm ww, 3.7 mm wh; $\times 8.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 17. Conch dimensions (in mm) and proportions for reference specimens of *Pericyclus tortuosus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19026.1	15.0	7.0	3.8	7.9	3.1	0.47	1.83	0.53	1.59	0.19
paratype MB.C.19026.2	11.7	5.1	3.1	6.1	2.7	0.44	1.64	0.52	1.68	0.15
paratype MB.C.18824	10.2	5.2	2.8	5.1	2.1	0.50	1.87	0.50	1.58	0.24
paratype MB.C.19026.3	8.8	4.3	2.5	4.6	1.9	0.49	1.74	0.52	1.61	0.24

Table 18. Suture line proportions (Fig. 14B) for *Pericyclus tortuosus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19026.1	14.3 mm	0.36	0.45	0.98	0.19	0.80	A lobe small, E lobe very deep

Discussion. *Pericyclus tortuosus* has a much wider umbilicus than the other species of the genus, with an uw/dm ratio higher than 0.50 throughout ontogeny. The adult stage of *P. circulus* resembles *P. tortuosus*, but this species has a subevolute intermediate growth stage (uw/dm = 0.33–0.42 at 8 mm dm). *P. latumbilicatus* closely resembles *P. tortuosus*, but it possesses a much wider external lobe and a narrower umbilicus (uw/dm = 0.47).

Pericyclus circulus n. sp.

Figures 15, 16

Derivation of name. From Latin circulus = ring, because of the ornamented conch.

Holotype. Specimen MB.C.18862.1, illustrated in Figure 15B.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 332 specimens, conch diameter up to 36 mm.

Diagnosis. *Pericyclus* with thinly pachyconic and subevolute conch up to 10 mm dm; thereafter becoming thickly discoidal and evolute; whorl cross section usually depressed crescent-shaped; umbilical margin narrowly rounded; flanks and venter widely rounded. Ornament with 30–40 coarse, sharp ribs extending in rursiradiate direction; rib course concavo-convex with a shallow subangular ventral sinus; the ribs begin on the umbilical wall; rib splitting is rare, splitting occurs on the umbilical margin. Steinkern with constrictions in the juvenile stage, adult conch above 15 mm dm usually without constrictions. Suture line with parallel-sided, very narrow and deep external lobe; median saddle low, ventro-lateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped, narrow.

Table 19. Conch ontogeny (Figs 16A–D, G–J) of *Pericyclus circulus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly pachyconic; subevolute (ww/dm = 0.60–0.68; uw/dm = 0.30–0.45)	moderately to strongly depressed; moderately embracing (ww/wh = 1.60–2.10; IZR = 0.20–0.30)	low (WER = 1.55–1.70)
8 mm	thinly pachyconic; subevolute (ww/dm = 0.60–0.72; uw/dm = 0.33–0.42)	moderately to strongly depressed; strongly embracing (ww/wh = 1.60–2.10; IZR = 0.35–0.40)	low (WER = 1.55–1.70)
20 mm	thinly to thickly discoidal; subevolute to evolute (ww/dm = 0.45–0.60; uw/dm = 0.40–0.52)	weakly to moderately depressed; moderately to strongly embracing (ww/wh = 1.40–2.00; IZR = 0.25–0.45)	low (WER = 1.50–1.70)
30 mm	thinly to thickly discoidal; subevolute to evolute (ww/dm = 0.42–0.52; uw/dm = 0.40–0.52)	weakly to moderately depressed; moderately to strongly embracing (ww/wh = 1.40–1.80; IZR = 0.20–0.40)	low (WER = 1.50–1.70)

Table 20. Conch dimensions (in mm) and proportions for reference specimens of *Pericyclus circulus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18886.1	35.2	17.0	10.1	16.5	7.9	0.48	1.69	0.47	1.66	0.22
holotype MB.C.18862.1	30.3	15.2	8.7	14.3	6.4	0.50	1.74	0.47	1.61	0.27
paratype MB.C.18743.1	23.7	11.9	6.8	11.2	4.7	0.50	1.73	0.47	1.55	0.31
paratype MB.C.18862.4	20.4	11.0	6.6	9.3	4.4	0.54	1.68	0.46	1.62	0.33
paratype MB.C.18862.2	15.6	9.1	5.8	6.0	3.3	0.58	1.55	0.38	1.61	0.43
paratype MB.C.18862.3	12.3	7.9	4.5	4.8	2.7	0.65	1.75	0.39	1.64	0.40

Table 21. Suture line proportions (Figs 16E, F) for *Pericyclus circulus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18862.1	28.0 mm	0.36	0.53	1.30	0.33	0.67	A lobe small, E lobe very deep
paratype MB.C.18886.2	c. 18.0 mm	0.36	0.52	0.97	0.24	0.69	

Discussion. *Pericyclus circulus* has a conch shape similar to *P. latumbilicatus* ($ww/dm = 0.42$, $uw/dm = 0.47$ at 21 mm dm), but is stouter ($ww/dm = 0.45–0.60$, $uw/dm = 0.40–0.52$ at the same diameter in *P. circulus*). Furthermore, *P. latumbilicatus* possesses, unlike *P. circulus*, strong steinkern constrictions.

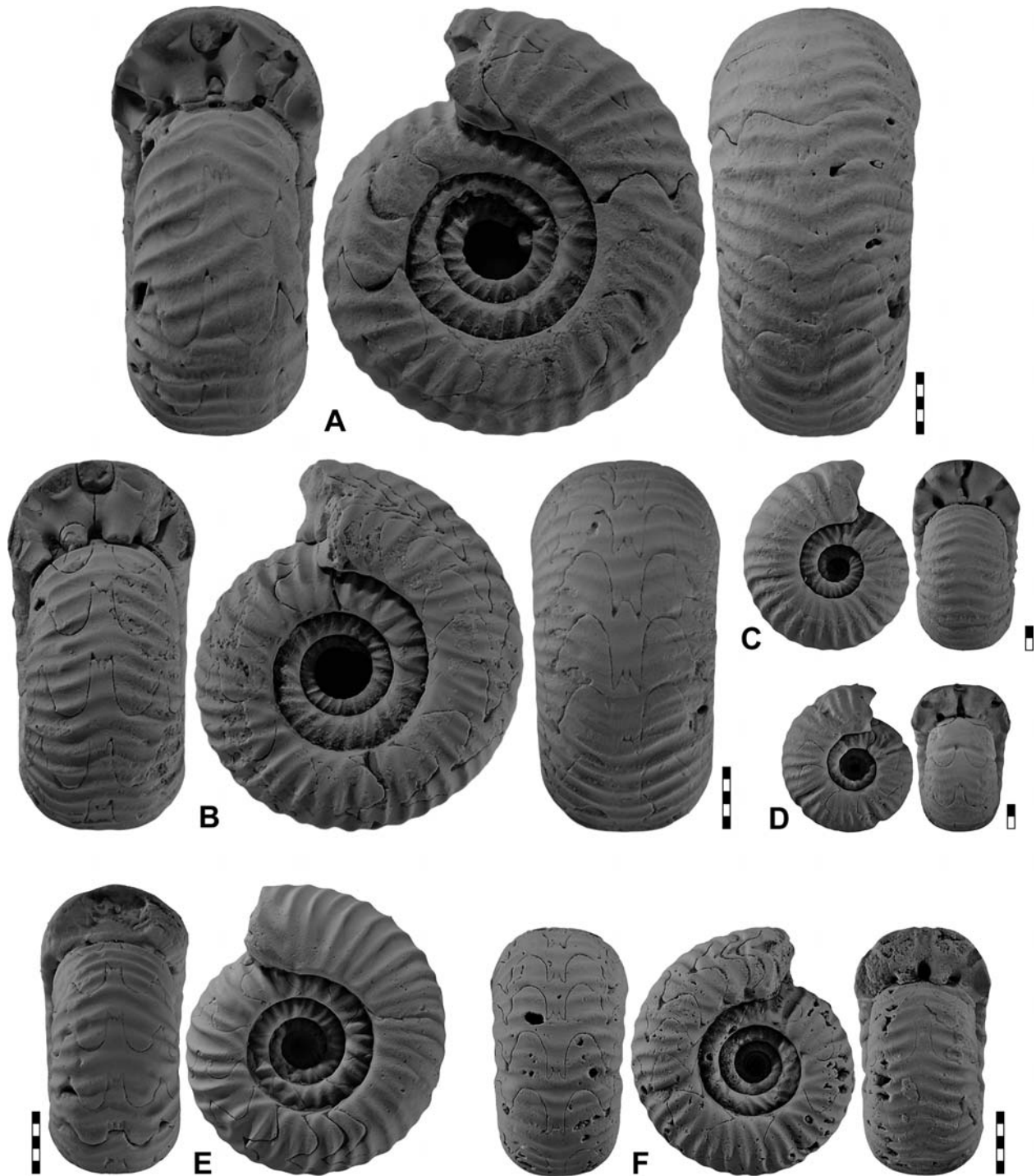


Figure 15. *Pericyclus circulus* n. sp.; all $\times 2$. **A.** Paratype MB.C.18886.1 from locality MOU-D2. **B.** Holotype MB.C.18862.1 from locality MOU-D1. **C.** Paratype MB.C.18862.2 from locality MOU-D1. **D.** Paratype MB.C.18862.3 from locality MOU-D1. **E.** Paratype MB.C.18743.1 from locality A321. **F.** Paratype MB.C.18862.4 from locality MOU-D1.

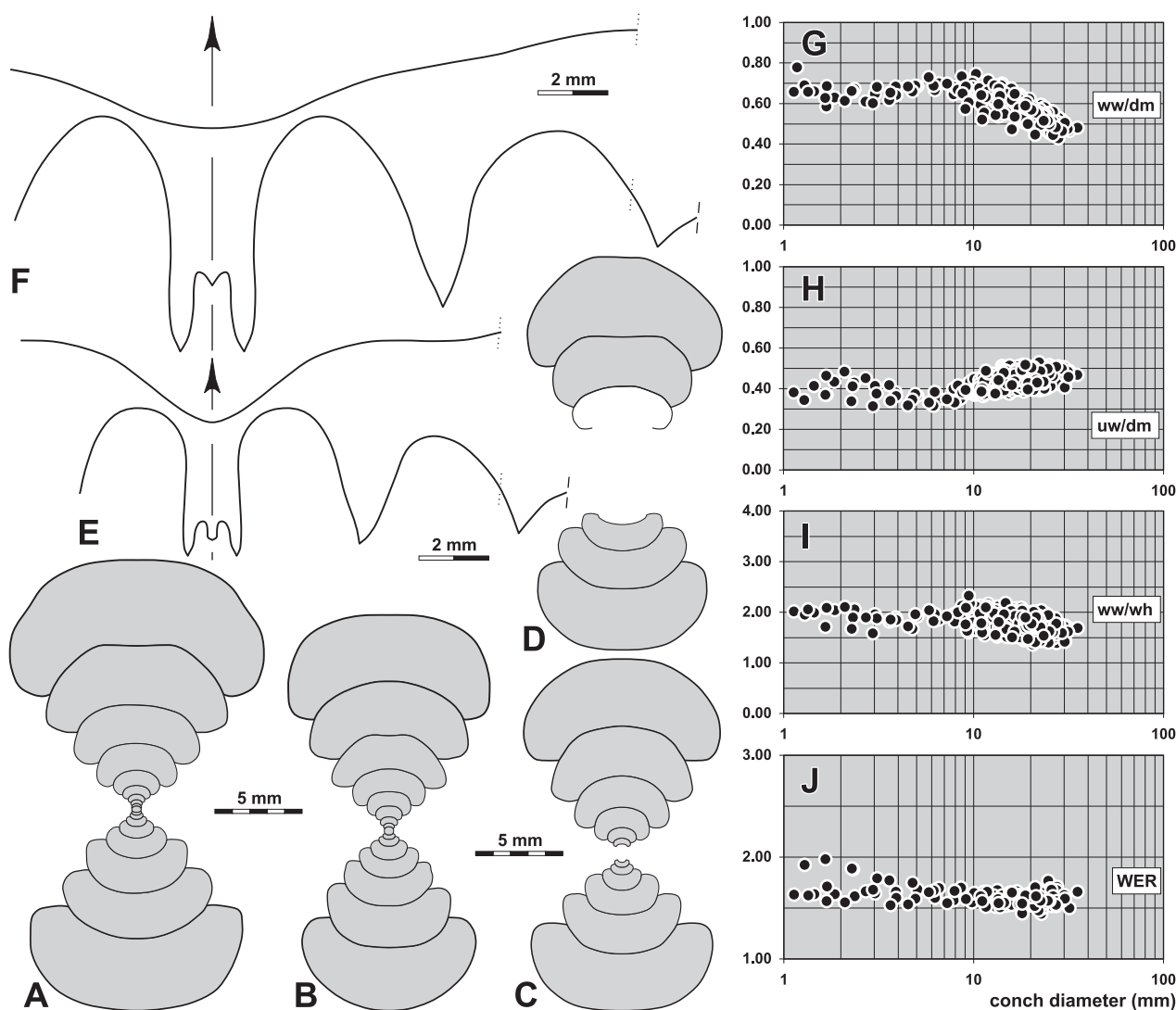


Figure 16. *Pericyclus circulus* n. sp. **A.** Cross section of paratype MB.C.18862.5 from locality MOU-D1; $\times 2.5$. **B.** Cross section of paratype MB.C.18862.6 from locality MOU-D1; $\times 2.5$. **C.** Cross section of paratype MB.C.18862.7 from locality MOU-D1; $\times 2.5$. **D.** Cross section of paratype MB.C.18929 from locality MOU-E05; $\times 2.5$. **E.** Suture line and rib course of paratype MB.C.18886.2 from locality MOU-D2, at 11.2 mm ww, 8.1 mm wh; $\times 5.0$. **F.** Suture line and rib course of holotype MB.C.18862.1 from locality MOU-D1, at 28.0 mm dm, 14.8 mm ww, 8.8 mm wh; $\times 5.0$. **G–J.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Pericyclus trochus n. sp.

Figures 17, 18

Derivation of name. From Latin trochus = a wheel ornamented with rings, because of the ornamentation.

Holotype. Specimen MB.C.18863.1, illustrated in Figure 17C.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 494 specimens, conch diameter up to 36 mm.

Diagnosis. *Pericyclus* with thinly pachyconic conch up to 10 mm dm, thereafter becoming thickly discoidal; conch subevolute throughout ontogeny except for a subinvolute interval between 3 and 10 mm dm; whorl cross section crescent-shaped to circular; umbilical margin subangular; flanks and venter broadly rounded. Ornament with 40–50 coarse, sharp ribs extending in a slightly rursiradiate direction; rib course concavo-convex with tendency to biconvexity with a shallow subangular ventral sinus; the ribs begin outside the umbilical wall; rib splitting is common, splitting occurs on the inner flank near the umbilicus, intercalatory ribs introduced in the inner flank area. Steinkern with well-developed constrictions. Suture line with parallel-sided, very narrow and deep external lobe; median saddle very low or low, ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped, narrow.

Table 22. Conch ontogeny (Figs 18A–D, G–J) of *Pericyclus trochus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly to thickly pachyconic; subevolute (ww/dm = 0.60–0.75; uw/dm = 0.35–0.45)	moderately to strongly depressed; strongly embracing (ww/wh = 1.70–2.10; IZR = 0.30–0.40)	low to moderate (WER = 1.60–1.80)
8 mm	thinly pachyconic; subinvolute to subevolute (ww/dm = 0.60–0.72; uw/dm = 0.25–0.35)	moderately depressed; strongly embracing (ww/wh = 1.50–1.90; IZR = 0.35–0.45)	low to moderate (WER = 1.60–1.80)
20 mm	thickly discoidal; subevolute (ww/dm = 0.48–0.60; uw/dm = 0.30–0.45)	weakly to moderately depressed; strongly embracing (ww/wh = 1.25–1.80; IZR = 0.30–0.45)	low to moderate (WER = 1.50–1.80)
30 mm	thickly discoidal; subevolute (ww/dm = 0.48–0.60; uw/dm = 0.30–0.45)	weakly to moderately depressed; strongly embracing (ww/wh = 1.10–1.60; IZR = 0.30–0.45)	low (WER = 1.50–1.70)

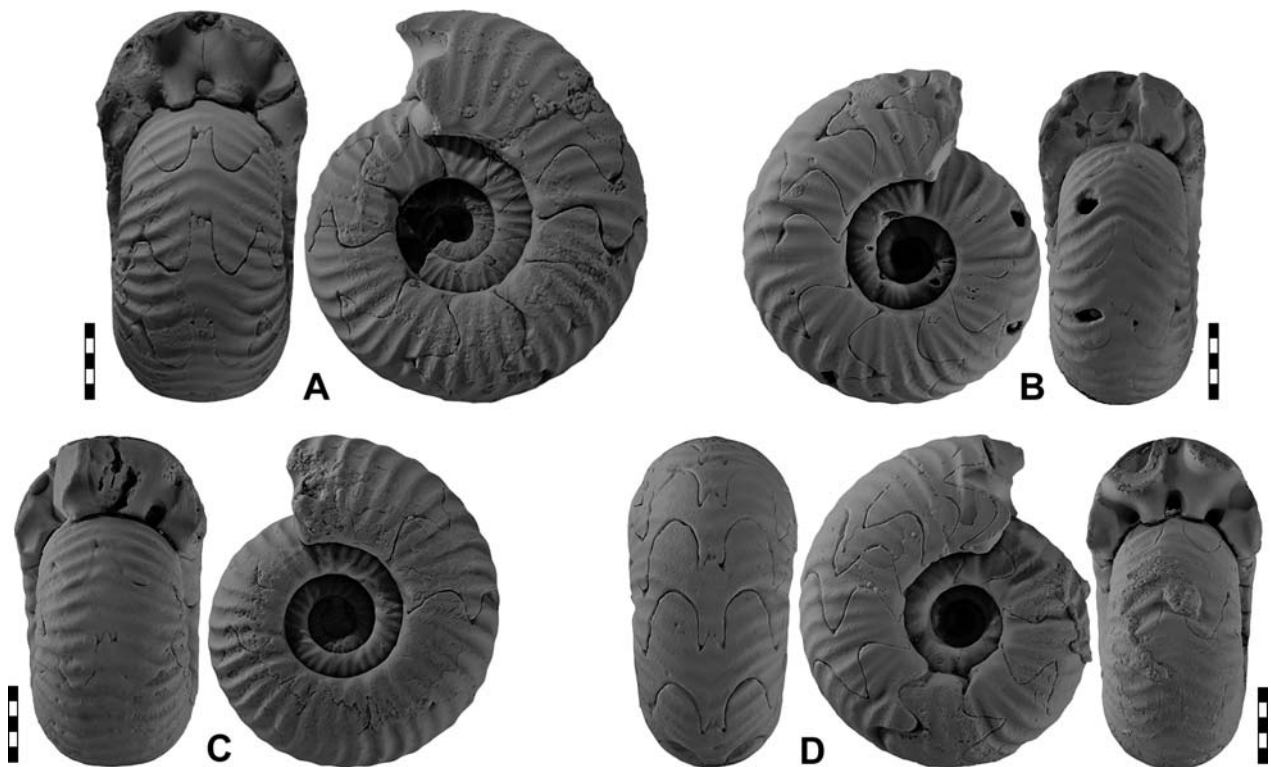
Table 23. Conch dimensions (in mm) and proportions for reference specimens of *Pericyclus trochus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18863.2	26.1	12.9	8.2	10.1	5.1	0.50	1.57	0.39	1.55	0.38
holotype MB.C.18863.1	22.2	12.5	7.4	8.7	4.9	0.56	1.68	0.39	1.65	0.34
paratype MB.C.18863.3	22.0	11.1	8.2	8.5	4.9	0.50	1.36	0.38	1.65	0.40
paratype MB.C.18863.4	22.0	11.4	7.9	8.0	5.0	0.52	1.44	0.37	1.68	0.37

Table 24. Suture line proportions (Figs 18E, F) for *Pericyclus trochus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18863.9	30.1 mm	0.32	0.54	0.81	0.27	0.60	
holotype MB.C.18863.1	20.1 mm	0.38	0.62	1.08	0.18	0.61	

Discussion. *Pericyclus trochus* resembles *P. princeps* in the conch proportions (ww/dm = 0.53, uw/dm = 0.31 at 35 mm dm), but differs in the much more pronounced ventral sinus of the ribs and the much weaker constrictions.

**Figure 17.** *Pericyclus trochus* n. sp. from locality MOU-D1; all $\times 2$. **A.** Paratype MB.C.18863.2. **B.** Paratype MB.C.18863.3. **C.** Holotype MB.C.18863.1. **D.** Paratype MB.C.18863.4.

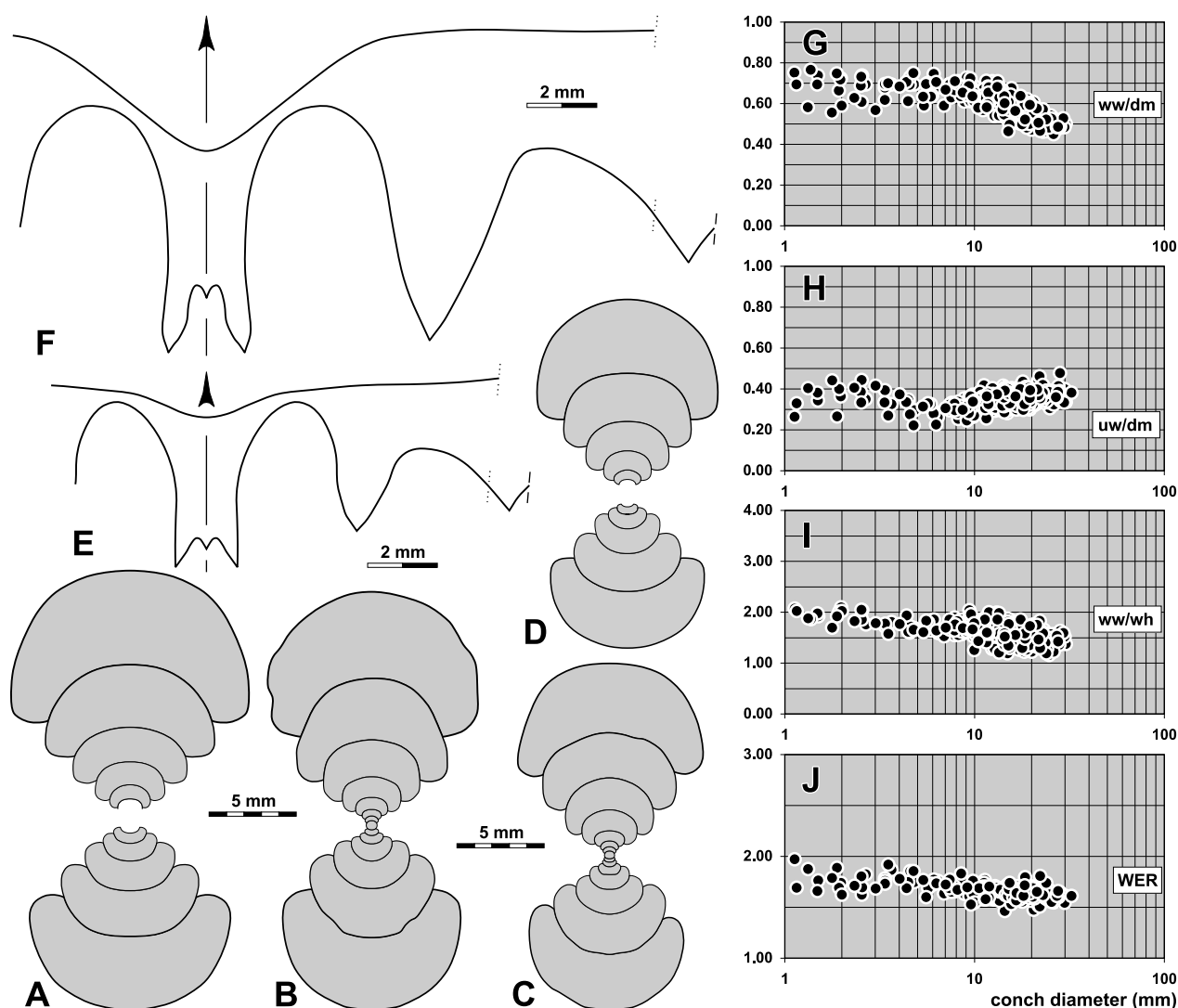


Figure 18. *Pericyclus trochus* n. sp. from locality MOU-D1. **A.** Cross section of paratype MB.C.18863.5; $\times 2.5$. **B.** Cross section of paratype MB.C.18863.6; $\times 2.5$. **C.** Cross section of paratype MB.C.18863.7; $\times 2.5$. **D.** Cross section of paratype MB.C.18863.8; $\times 2.5$. **E.** Suture line and rib course of holotype MB.C.18863.1, at 20.1 mm dm, 11.7 mm ww, 7.2 mm wh; $\times 5.0$. **F.** Suture line and rib course of paratype MB.C.18863.9, at 30.1 mm dm, 13.9 mm ww, 11.2 mm wh; $\times 5.0$. **G–J.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Pericyclus intercisis n. sp.

Figures 19, 20

Derivation of name. From Latin *intercisis* = interrupted, because of the lack of ribs on the venter.

Holotype. Specimen MB.C.18864.1, illustrated in Figure 19D.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 371 specimens, conch diameter up to 31 mm.

Diagnosis. *Pericyclus* with thinly or thickly pachyconic conch up to 10 mm dm, thereafter becoming thinly discoidal at 30 mm dm; conch subevolute in the juvenile stage and subinvolute or subevolute above 4 mm dm; whorl cross section in adults circular to subcircular; umbilical margin subangular; flanks and venter broadly rounded. Ornament with 50–60 shallow ribs; rib course concavo-convex with tendency to biconvexity with a moderately deep ventral sinus, direction rursiradial; the ribs begin outside the umbilical wall; rib splitting and intercalation very common; splitting occurs on the inner flank. Steinkern with well-developed constrictions. Suture line with parallel-sided or V-shaped, very narrow external lobe; median saddle low, ventrolateral saddle asymmetric, broadly rounded; adventive lobe V-shaped, asymmetric with stronger curved ventral flank.

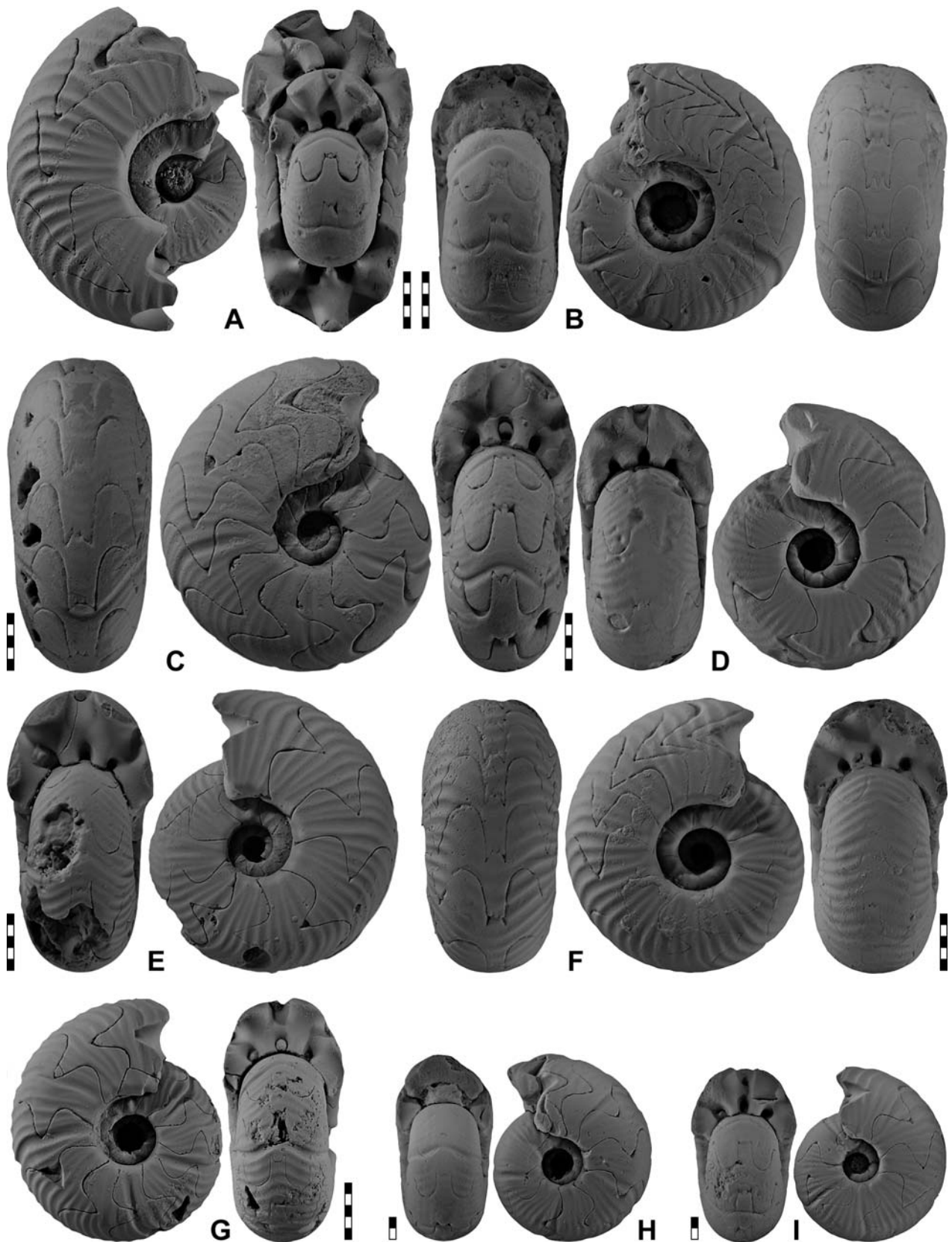


Figure 19. *Pericyclus intercisus* n. sp.; all $\times 2$. **A.** Paratype MB.C.19056.1 from locality MOU-Z. **B.** Paratype MB.C.18864.2 from locality MOU-D1. **C.** Paratype MB.C.18864.3 from locality MOU-D1. **D.** Holotype MB.C.18864.1 from locality MOU-D1. **E.** Paratype MB.C.18864.4 from locality MOU-D1. **F.** Paratype MB.C.18888.1 from locality MOU-D2. **G.** Paratype MB.C.18864.5 from locality MOU-D1. **H.** Paratype MB.C.18864.7 from locality MOU-D1. **I.** Paratype MB.C.18864.6 from locality MOU-D1.

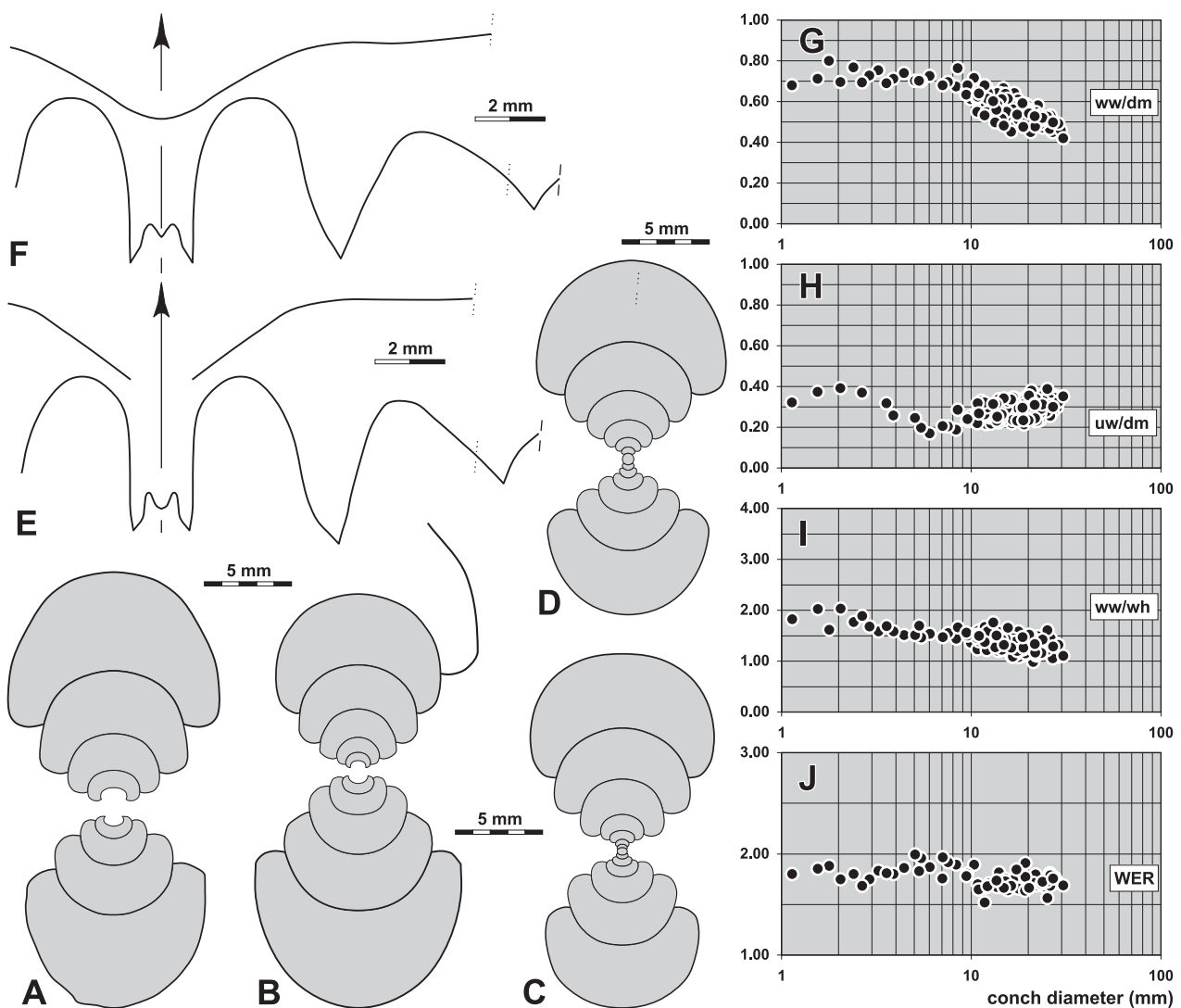


Figure 20. *Pericyclus intercisus* n. sp. **A.** Cross section of paratype MB.C.18864.8 from locality MOU-D1; $\times 2.5$. **B.** Cross section of paratype MB.C.18864.9 from locality MOU-D1; $\times 2.5$. **C.** Cross section of paratype MB.C.18864.10 from locality MOU-D1; $\times 2.5$. **D.** Cross section of paratype MB.C.19056.2 from locality MOU-D1; $\times 2.5$. **E.** Suture line and rib course of paratype MB.C.19056.1 from locality MOU-Z, at 11.9 mm ww, 10.2 mm wh; $\times 5.0$. **F.** Suture line and rib course of holotype MB.C.18864.1 from locality MOU-D1, at 21.9 mm dm, 11.9 mm ww, 7.7 mm wh; $\times 5.0$. **G–J.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 25. Conch ontogeny (Figs 20A–D, G–J) of *Pericyclus intercisus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subevolute (ww/dm = 0.70–0.80; uw/dm = 0.35–0.40)	moderately depressed; strongly embracing (ww/wh = 1.60–2.00; IZR = 0.30–0.40)	moderate (WER = 1.75–1.90)
8 mm	thinly to thickly pachyconic; subinvolute (ww/dm = 0.65–0.75; uw/dm = 0.20–0.30)	weakly or moderately depressed; strongly embracing (ww/wh = 1.40–1.70; IZR = 0.35–0.45)	moderate (WER = 1.75–1.95)
20 mm	thinly to thickly discoidal; subinvolute to subevolute (ww/dm = 0.45–0.60; uw/dm = 0.20–0.35)	weakly depressed; strongly embracing (ww/wh = 1.00–1.50; IZR = 0.30–0.45)	low to moderate (WER = 1.65–1.90)
30 mm	thinly to thickly discoidal; subevolute (ww/dm = 0.40–0.50; uw/dm = 0.30–0.35)	weakly depressed; strongly embracing (ww/wh = 1.00–1.40; IZR = 0.30–0.45)	low to moderate (WER = 1.65–1.80)

Table 26. Conch dimensions (in mm) and proportions for reference specimens of *Pericyclus intercisus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18864.3	28.4	13.1	12.1	8.4	6.8	0.46	1.08	0.30	1.72	0.44
paratype MB.C.18864.4	25.0	12.7	10.4	6.9	6.0	0.51	1.22	0.28	1.72	0.43
holotype MB.C.18864.1	24.2	12.4	9.4	8.1	5.5	0.51	1.32	0.34	1.68	0.41
paratype MB.C.18864.2	24.0	12.2	8.6	7.9	5.6	0.51	1.42	0.33	1.70	0.35
paratype MB.C.18864.5	21.8	11.0	9.6	6.3	5.6	0.50	1.14	0.29	1.80	0.42
paratype MB.C.18864.7	16.7	8.6	7.4	4.3	4.0	0.52	1.17	0.26	1.74	0.45
paratype MB.C.18864.6	15.2	9.2	6.8	3.8	3.7	0.60	1.35	0.25	1.75	0.45

Table 27. Suture line proportions (Figs 20E, F) for *Pericyclus intercisus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18864.1	21.9 mm	0.41	0.63	0.91	0.23	0.66	flanks of E lobe slightly diverging
paratype MB.C.19056.1	c. 19.0 mm	0.41	0.61	1.02	0.29	0.68	E lobe parallel-sided

Discussion. *Pericyclus princeps* has a similar conch morphology, but differs in the much sharper ribs from *P. intercisus*. *P. intercisus* shows some resemblance to species of the genus *Temertassetia*, such as *Temertassetia secunda* and *Temertassetia decorata*. Both species, however, possess weaker ribs and differ mainly in the suture line, which in the genus *Temertassetia* possesses a V-shaped external lobe with sinuous flanks.

P. mercatorius from the Anti-Atlas of Morocco has a similar conch and ornament, but differs in the lack of steinkern constrictions in the adult stage from the new species.

***Nodopericyclus* n. gen.**

Derivation of name. After the type species.

Type species. *Nodopericyclus circumnodosus* n. sp.

Genus definition. Pericyclinae with small conch, reaching approximately 40 mm diameter; conch ontogeny simple, conch thinly pachyconic and subevolute, aperture low; umbilical margin angular, venter broadly rounded. Ornament with sharp biconvex ribs and intercalatory riblets; biconvex constrictions of the internal mould. Suture line with parallel-sided, very narrow external lobe (EL w/d ~ 0.40; EL/AL ~ 0.80) with straight or incurved flanks and very low median saddle (MS h ~ 0.18); ventrolateral saddle broadly rounded; adventive lobe V-shaped, almost symmetric and acute.

Included species.

circumnodosus: *Nodopericyclus circumnodosus* n. sp.; Mouydir, Algeria.

deficerus: *Nodopericyclus deficerus* n. sp.; Mouydir, Algeria.

Separation of the new species. The two species of *Nodopericyclus* can be separated by means of conch morphology, ornament, and suture line:

- *N. circumnodosus* – at 15 mm dm: ww/dm slightly higher than 0.70, ribs very strong and sharp, external lobe parallel-sided;
- *N. deficerus* – at 15 mm dm: ww/dm less than 0.60, ribs weak and rounded, external lobe V-shaped.

Discussion. *Nodopericyclus* is easily separable from *Pericyclus* by its strongly bifurcating ribs. A genus with a similar conch ornament is *Fascipericyclus* Turner, 1948, but this genus shows a modification of the suture line, in which, in the preadult stage, a V-shaped external lobe and a narrowly rounded ventrolateral saddle is present (Tilsley & Korn 2009).

***Nodopericyclus circumnodosus* n. sp.**

Figures 21, 22

Derivation of name. From Latin circum = all around and nodosus = nodes, because of the ornamentation.

Holotype. Specimen MB.C.19033, illustrated in Figure 21A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-X (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. Nine specimens, conch diameter up to 23 mm.

Diagnosis. *Nodopericyclus* with almost stable conch morphology between 9 and 20 mm dm; conch thinly pachyconic and subevolute; umbilical margin angular, umbilical wall flattened, slightly oblique; aperture low. Steinkern with sharp, slightly biconvex ribs that form prominent umbilical nodes, rib splitting and intercalation frequent near the umbilical margin, rather strong constrictions parallel to the ribs. Suture line with very narrow, parallel-sided or subparallel-sided external lobe and very low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, almost symmetric.

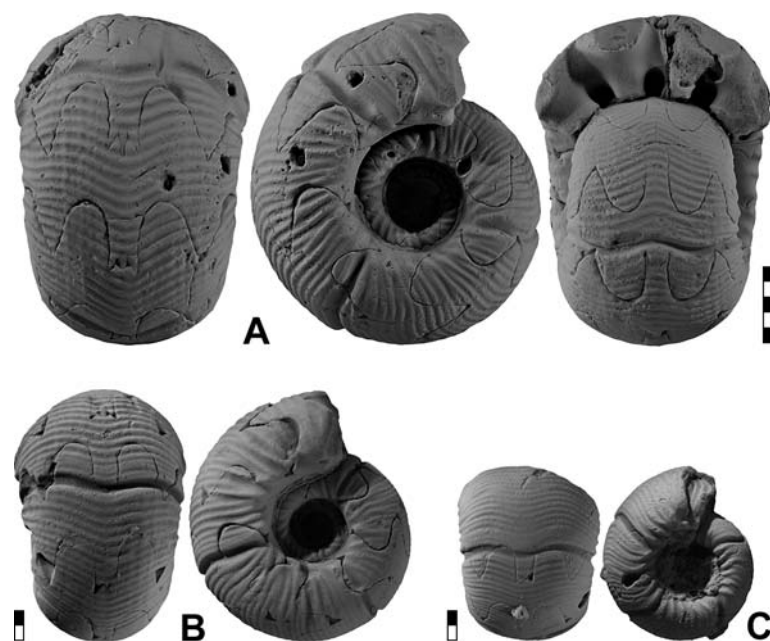


Figure 21. *Nodopercyclus circumnodosus* n. sp.; all $\times 2$. **A.** Holotype MB.C.19033 from locality MOU-X. **B.** Paratype MB.C.18783.1 from locality MOU-B0. **C.** Paratype MB.C.19043.1 from locality MOU-Y.

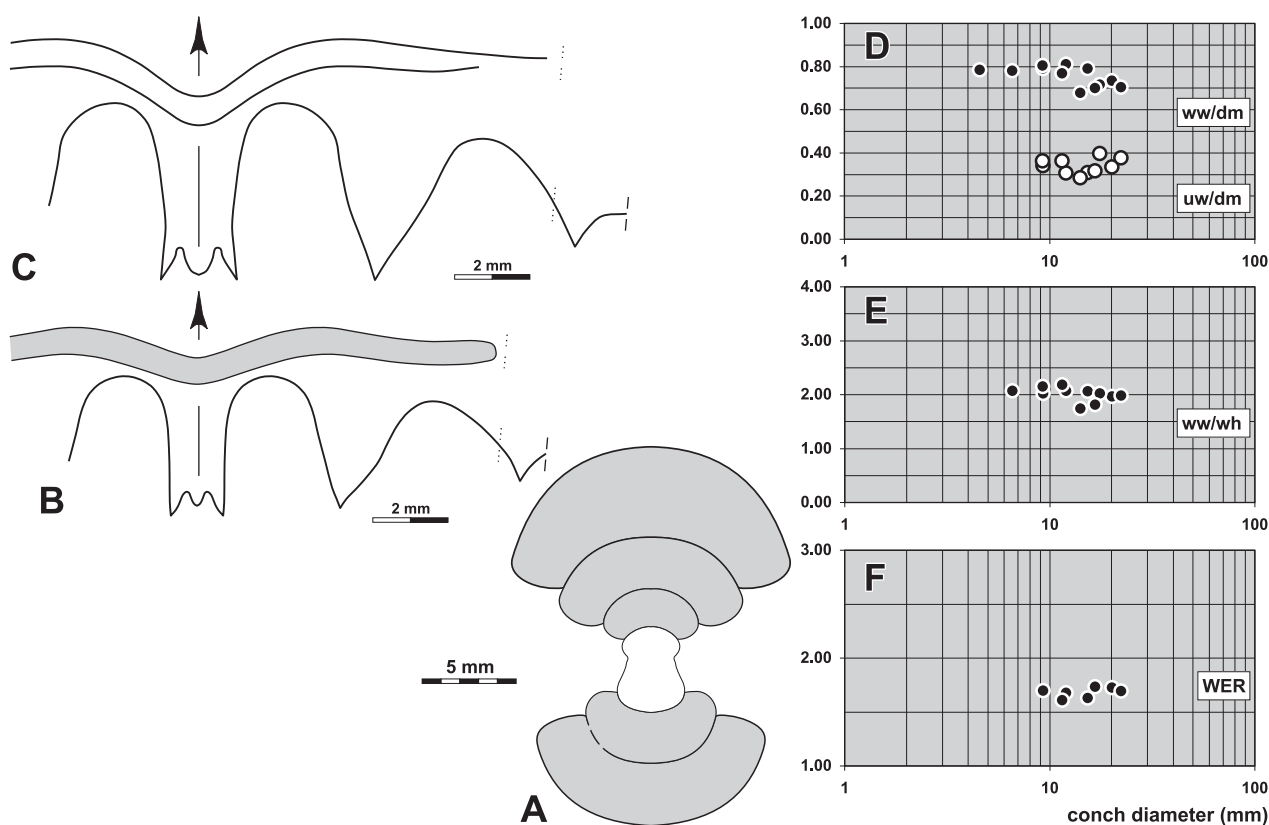


Figure 22. *Nodopercyclus circumnodosus* n. sp. **A.** Cross section of paratype MB.C.18783.2 from locality MOU-B0; $\times 2.5$. **B.** Suture line and constriction of paratype MB.C.18783.1 from locality MOU-B0, at 15.8 mm dm, 10.7 mm ww, 6.2 mm wh; $\times 5.0$. **C.** Suture line and rib course of holotype MB.C.19033 from locality MOU-X, at 19.2 mm dm, 14.2 mm ww, 7.3 mm wh; $\times 5.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 28. Conch ontogeny (Figs 22A, D–F) of *Nodopercyclus circumnodosus* n. sp.

dm	conch shape	whorl cross section shape	aperture
9 mm	thickly pachyconic; subevolute (ww/dm ~ 0.80; uw/dm ~ 0.35)	strongly depressed; moderately embracing (ww/wh ~ 2.10; IZR ~ 0.30)	low (WER = 1.70)
20 mm	thinly pachyconic; subevolute (ww/dm ~ 0.70; uw/dm ~ 0.35)	moderately depressed; strongly embracing (ww/wh ~ 1.95; IZR ~ 0.35)	low (WER = 1.70)

Table 29. Conch dimensions (in mm) and proportions for reference specimens of *Nodopercyclus circumnodosus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19033	22.2	15.7	7.9	8.4	5.2	0.70	1.98	0.38	1.69	0.35
paratype MB.C.18783.2	20.1	14.8	7.5	6.7	4.8	0.73	1.97	0.33	1.73	0.36
paratype MB.C.18783.1	16.6	11.6	6.4	5.3	4.0	0.70	1.82	0.32	1.73	0.38
paratype MB.C.19043.1	11.5	8.9	4.1	4.2	2.4	0.77	2.19	0.36	1.61	0.40

Table 30. Suture line proportions (Figs 22B, C) for *Nodopercyclus circumnodosus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19033	19.2 mm	0.42	0.67	0.84	0.18	0.62	flanks of E lobe slightly incurved
paratype MB.C.18783.1	15.8 mm	0.40	0.59	0.82	0.18	0.68	E lobe almost parallel-sided

***Nodopercyclus deficerus* n. sp.**

Figures 23, 24

Derivation of name. From Latin deficerus = less intensive, because of the weaker ornament.*Holotype.* Specimen MB.C.19044.1, illustrated in Figure 23A.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-Y (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.*Material.* 18 specimens, conch diameter up to 15 mm.

Diagnosis. *Nodopercyclus* with almost stable conch morphology between 9 and 15 mm dm; conch thickly discoidal or thinly pachyconic and subevolute; umbilical margin angular, umbilical wall flattened, slightly oblique; aperture low. Steinkern with rounded, slightly biconvex ribs that form weak umbilical nodes, rib splitting and intercalation regular near the umbilical margin, rather strong constrictions parallel to the ribs. Suture line with very narrow, V-shaped external lobe and very low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, symmetric.

Table 31. Conch ontogeny (Fig. 24A) of *Nodopercyclus deficerus* n. sp.

dm	conch shape	whorl cross section shape	aperture
9 mm	thinly pachyconic; subevolute (ww/dm ~ 0.66; uw/dm ~ 0.32)	moderately depressed; strongly embracing (ww/wh ~ 1.60; IZR ~ 0.42)	low (WER = 1.70)
15 mm	thickly discoidal; subevolute (ww/dm ~ 0.57; uw/dm ~ 0.34)	moderately depressed; strongly embracing (ww/wh ~ 1.50; IZR ~ 0.37)	low (WER = 1.70)

Table 32. Conch dimensions (in mm) and proportions for reference specimens of *Nodopercyclus deficerus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19044.1	14.6	8.3	5.5	4.9	3.5	0.57	1.51	0.34	1.71	0.37
paratype MB.C.18995	8.9	5.9	3.7	2.8	2.1	0.66	1.61	0.32	1.72	0.42

Table 33. Suture line proportions (Figs 24B) for *Nodopercyclus deficerus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19044.1	c. 12.0 mm	0.49	0.60	0.77	0.12	0.82	flanks of E lobe incurved

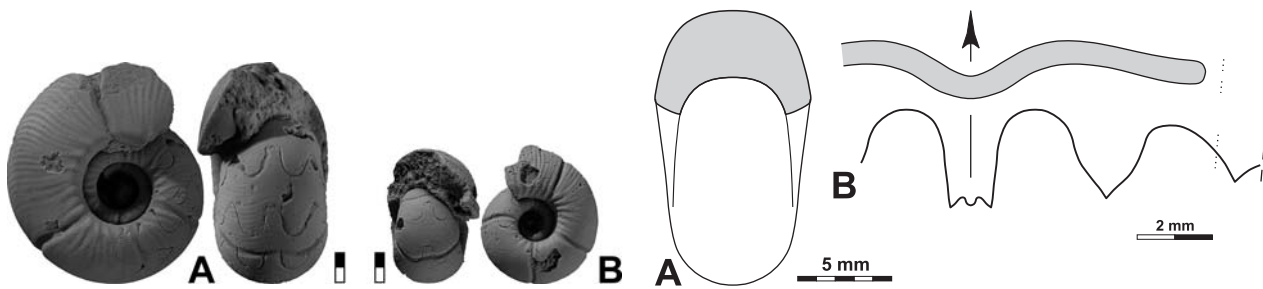


Figure 23. *Nodopericyclus deficerus* n. sp.; all $\times 2$. **A.** Holotype MB.C.19044.1 from locality MOU-Y. **B.** Paratype MB.C.18995 from locality MOU-E13.

Figure 24. *Nodopericyclus deficerus* n. sp. from locality MOU-Y. **A.** Dorsal view of holotype MB.C.19044.1; $\times 2.5$. **B.** Suture line and constriction of holotype MB.C.19044.1, at 7.5 mm ww, 4.7 mm wh; $\times 5.0$.

Subfamily **Ammonellipsitinae** Riley, 1996

***Ammonellipsites* Parkinson, 1822**

For a detailed discussion of the genus, see Ebbighausen et al. (2010).

***Ammonellipsites serus* n. sp.**

Figures 25, 26

Derivation of name. From Latin *serus* = late, because of the late presence of ribs.

Holotype. Specimen MB.C.18817.1, illustrated in Figure 25.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C3 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. Four specimens, conch diameter up to 48 mm.

Diagnosis. *Ammonellipsites* with a subinvolute conch, changing from thinly pachyconic to thickly discoidal between 20 and 40 mm dm; aperture moderately high in the middle growth stage and high in the adult stage. Ornament with 50 weak equidistant ribs per volution, course convex and rectiradial with moderately deep ventral sinus; ribs absent in the stage below 20 mm dm. Suture line with narrow, V-shaped external lobe with gently sinuous flanks and moderately low median saddle; ventrolateral saddle narrowly rounded, adventive lobe V-shaped, asymmetric with strongly sinuous dorsal flank.

Table 34. Conch ontogeny (Figs 26A, C–E) of *Ammonellipsites serus* n. sp.

dm	conch shape	whorl cross section shape	aperture
20 mm	thinly pachyconic; subinvolute (ww/dm ~ 0.64 ; uw/dm ~ 0.22)	weakly depressed; strongly embracing (ww/wh ~ 1.00 ; IZR ~ 0.34)	moderate (WER ~ 1.95)
40 mm	thickly discoidal; subinvolute (ww/dm ~ 0.50 ; uw/dm ~ 0.24)	weakly depressed; strongly embracing (ww/wh ~ 1.25 ; IZR ~ 0.44)	high (WER ~ 2.15)

Table 35. Conch dimensions (in mm) and proportions for the holotype of *Ammonellipsites serus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18817.1	43.9	22.1	21.3	10.7	14.0	0.50	1.03	0.24	2.16	0.34
dto.	33.1	18.0	15.7	7.6	9.7	0.54	1.14	0.23	2.00	0.38
dto.	21.9	14.0	11.1	4.9	6.2	0.64	1.26	0.22	1.95	0.44

Table 36. Suture line proportions (Fig. 26B) for *Ammonellipsites serus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18817.1	14.0 mm	0.66	1.21	1.16	0.36	0.54	A lobe very asymmetric

Discussion. *Ammonellipsites serus* differs from the other species of the genus in the late ontogenetic development of the ribs. The species from the Dalle à *Merocanites*, for instance, are ribbed already in the juvenile stage (Ebbighausen et al. 2010).



Figure 25. *Ammonellipsites serus* n. sp. from locality MOU-C3, holotype MB.C.18817.1; $\times 1.25$.

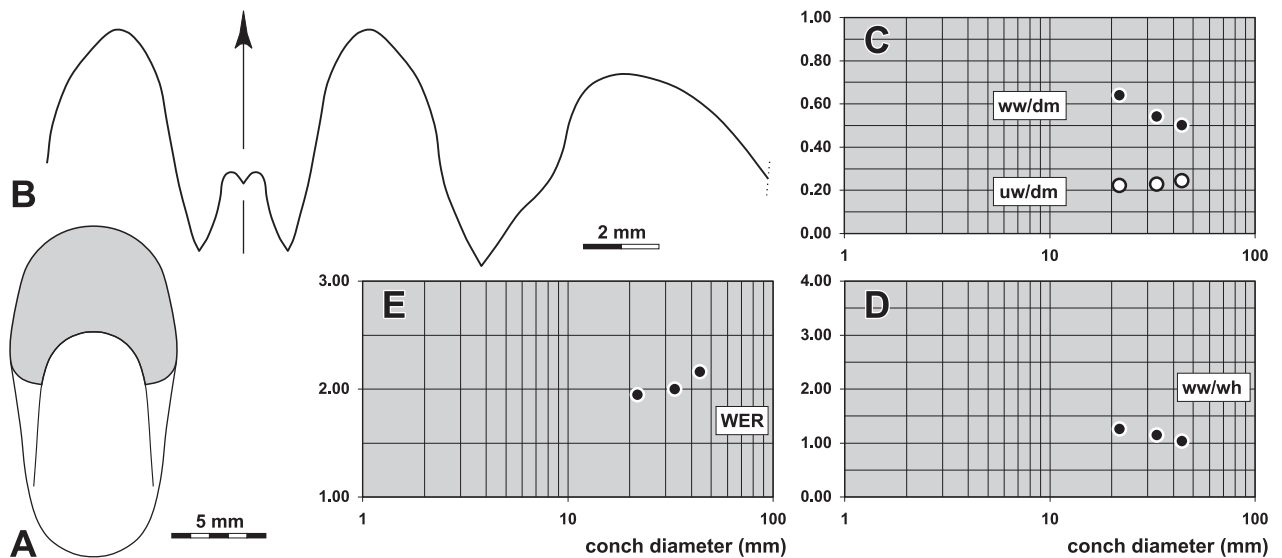


Figure 26. *Ammonellipsites serus* n. sp. from locality MOU-C3. **A.** Dorsal view of holotype MB.C.18817.1; $\times 1.0$. **B.** Suture line of holotype MB.C.18817.1, at 22.2 mm dm, 14.3 mm ww, 12.5 mm wh; $\times 5.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of the holotype.

Helicocyclus Schindewolf, 1951

Type species. *Pericyclus (Helicocyclus) gracillimus* Schindewolf, 1951 [OD].

Genus definition. Pericyclidae with small thinly pachyconic or discoidal conch, reaching up to 50 mm in diameter. Conch subevolute or evolute with minor ontogenetic changes. Steinkern in some species with moderately coarse, rounded ribs with almost linear course and rectiradial direction, rib splitting and rib intercalation rare; without or with weak convex or linear constrictions. Suture line with V-shaped, narrow or moderately narrow external lobe (EL w/d = 0.55–0.80; EL/AL = 1.00–1.90) and low or moderately low median saddle (MS h = 0.30–0.40); ventrolateral saddle narrowly rounded or subacute; adventive lobe V-shaped and usually asymmetric.

Included species.

aberratus: *Helicocyclus aberratus* Kusina & Konovalova, 2004, p. 88; North Urals.

divergens: *Helicocyclus divergens* Riley, 1996, p. 74; Lancashire.

evolutus: *Pericyclus evolutus* Librovitch, 1927, p. 28; Tien Shan. [Synonym of *H. tianshanicus*]

formosus: *Helicocyclus formosus* n. sp.; Mouydir, Algeria.

fuscus: *Helicocyclus fuscus* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 84; Anti-Atlas, Morocco.

gracillimus: *Pericyclus (Helicocyclus) gracillimus* Schindewolf, 1951, p. 79; Harz.

inornatus: *Helicocyclus inornatus* n. sp.; Mouydir, Algeria.

involutus: *Helicocyclus involutus* Kusina in Shimansky & Kusina, 1977, p. 88; North Urals.

laxaris: *Helicocyclus laxaris* n. sp.; Mouydir, Algeria.

tianshanicus: *Pericyclus tianshanicus* Librovitch, 1927, p. 29; Tien Shan.

Separation of the new species. The three species of *Helicocyclus* from Oued Temertasset can be separated by means of conch morphology and the suture line. In the conch proportions and ontogeny, they differ as follows:

- *H. formosus* and *H. inornatus* – thickly discoidal and evolute in juveniles, thinly discoidal and subevolute in the adult stage.
- *H. laxaris* – thinly pachyconic in juveniles, thickly discoidal in the adult stage; subevolute throughout ontogeny.

The steinkern surface offers more differences:

- *H. formosus* – 60 moderately coarse, rounded linear ribs with rectiradial direction; rib splitting is rare; rather deep, almost linear constrictions.
- *H. inornatus* – without ribs, weak linear constrictions.
- *H. laxaris* – without ribs or constrictions.

Discussion. The suture line shows that *Helicocyclus* is closely related to the genera *Ammonellipsites* (which possesses a stouter conch with a narrower umbilicus) and *Fascipericyclus* (which possesses very coarse bifurcating ribs).

***Helicocyclus formosus* n. sp.**

Figures 27, 28

Derivation of name. From Latin *formosus* = beautiful, because of the beautiful ornament.

Holotype. Specimen MB.C.19034.1, illustrated in Figure 27C.

Type locality and horizon. Oued Temertasset, locality and sample MOU-X (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 16 specimens, conch diameter up to 20 mm.

Diagnosis. *Helicocyclus* with thickly discoidal and subevolute juvenile conch up to 8 mm dm, thereafter thinly discoidal and evolute; umbilical wall rounded; aperture low throughout ontogeny. Steinkern with coarse, almost linear constrictions and 60 ribs, rib splitting occurs occasionally. Suture line with narrow external lobe with subparallel flanks; median saddle low; ventrolateral saddle asymmetric, subacute; adventive lobe asymmetric with a stronger curved dorsal flank.

Table 37. Conch ontogeny (Figs 28A, B, D–G) of *Helicocyclus formosus* n. sp.

dm	conch shape	whorl cross section shape	aperture
10 mm	thickly discoidal; subevolute (ww/dm ~ 0.50; uw/dm ~ 0.42)	weakly depressed; strongly embracing (ww/wh ~ 1.50; IZR ~ 0.30)	low (WER ~ 1.60)
20 mm	thinly discoidal; evolute (ww/dm ~ 0.45; uw/dm ~ 0.46)	weakly depressed; strongly embracing (ww/wh ~ 1.50; IZR ~ 0.35)	low (WER ~ 1.55)

Table 38. Conch dimensions (in mm) and proportions for reference specimens of *Helicocyclus formosus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.188746	19.9	–	6.0	9.1	3.9	–	–	0.46	1.54	0.35
paratype MB.C.19034.2	15.3	7.0	4.7	6.9	3.0	0.46	1.50	0.45	1.56	0.35
holotype MB.C.19034.1	14.6	7.2	4.8	6.2	2.8	0.49	1.50	0.42	1.53	0.41
paratype MB.C.18988.1	13.6	6.2	4.2	5.6	2.7	0.45	1.48	0.41	1.55	0.36

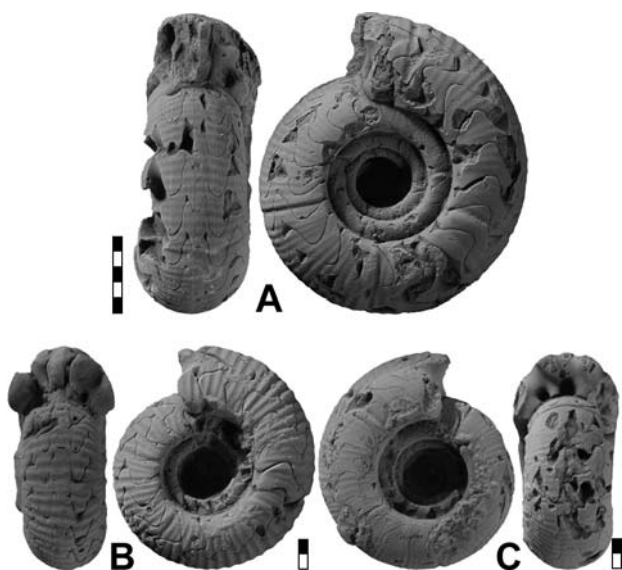


Figure 27. *Helicocyclus formosus* n. sp.; all $\times 2$. **A.** Paratype MB.C.188746 from locality A321. **B.** Paratype MB.C.19034.2 from locality MOU-X. **C.** Holotype MB.C.19034.1 from locality MOU-X.

Table 39. Suture line proportions (Fig. 28C) for *Helicocyclus formosus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19034.1	14.0 mm	0.55	1.06	1.27	0.40	0.52	VL saddle subacute

Discussion. *Helicocyclus formosus* shows some resemblance to *H. tianshanicus*, but that species shows much weaker and more numerous ribs.

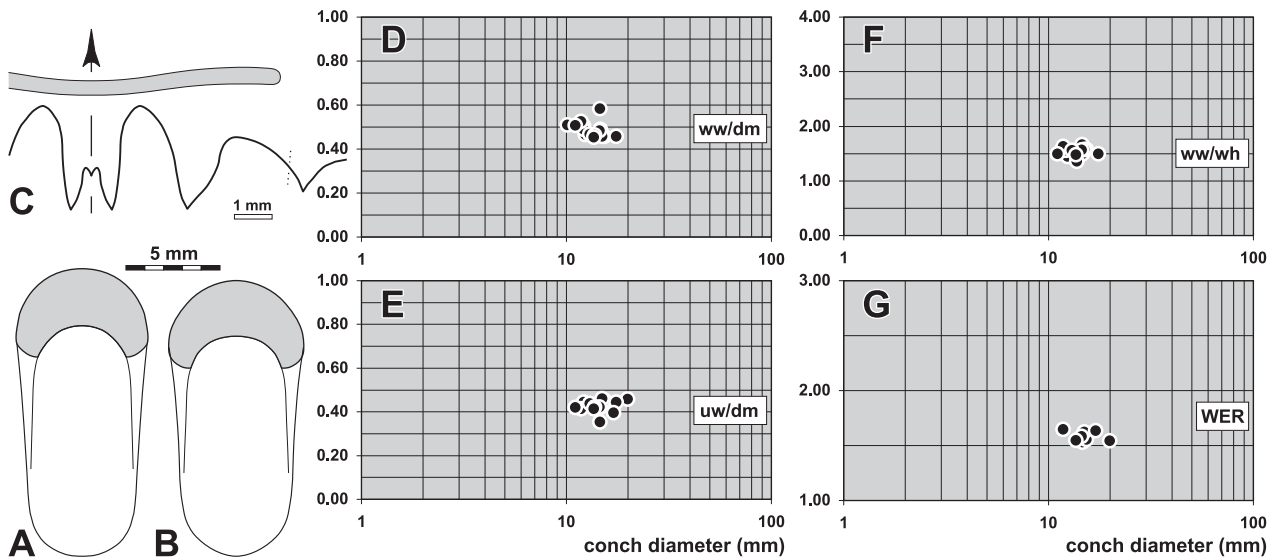


Figure 28. *Helicocyclus formosus* n. sp. **A.** Dorsal view of paratype MB.C.19034.2 from locality MOU-X; $\times 2.5$. **B.** Dorsal view of holotype MB.C.19034.1 from locality MOU-X; $\times 2.5$. **C.** Suture line and constriction of holotype MB.C.19034.1 from locality MOU-X, at 14.0 mm dm, 7.3 mm ww, 5.0 mm wh; $\times 5.0$. **D–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Helicocyclus inornatus n. sp.

Figures 29, 30

Derivation of name. From Latin *inornatus* = undecorated, because of the weak ornament.

Holotype. Specimen MB.C.19035.1, illustrated in Figure 29A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-X (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 108 specimens, conch diameter up to 14 mm.

Diagnosis. *Helicocyclus* with thickly discoidal and evolute juvenile conch up to 8 mm dm, thereafter thinly discoidal and subevolute; umbilical wall rounded; aperture low throughout ontogeny. Steinkern with weak, almost linear constrictions, without ribs. Suture line with moderately narrow V-shaped external lobe with almost straight flanks; median saddle low; ventrolateral saddle symmetric, narrowly rounded; adventive lobe asymmetric with a stronger curved dorsal flank.

Table 40. Conch ontogeny (Figs 30A, B, D–G) of *Helicocyclus inornatus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly discoidal; evolute (ww/dm \sim 0.50; uw/dm \sim 0.50)	moderately depressed; moderately embracing (ww/wh \sim 1.70; IZR \sim 0.20)	low (WER \sim 1.70)
8 mm	thinly to thickly discoidal; subevolute (ww/dm = 0.42–0.50; uw/dm = 0.36–0.43)	weakly depressed; strongly embracing (ww/wh = 1.25–1.40; IZR \sim 0.33)	low (WER \sim 1.70)
13 mm	thinly discoidal; subevolute (ww/dm \sim 0.42; uw/dm = 0.40–0.45)	weakly depressed; strongly embracing (ww/wh = 1.25–1.40; IZR \sim 0.33)	low (WER \sim 1.60)

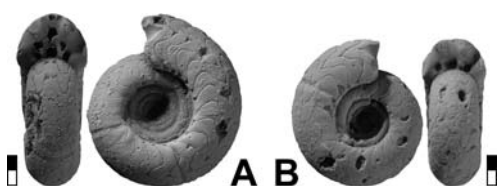
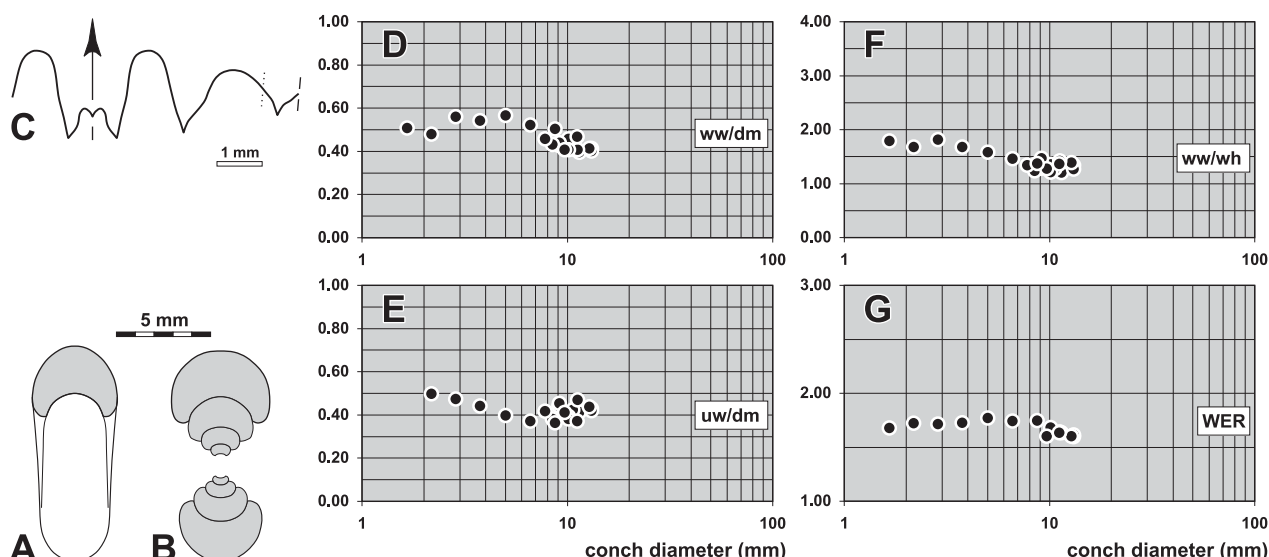
Table 41. Conch dimensions (in mm) and proportions for reference specimens of *Helicocyclus inornatus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.19035.4	13.1	5.2	4.1	5.5	2.8	0.40	1.27	0.42	1.62	0.33
holotype MB.C.19035.1	11.4	4.5	3.7	4.7	2.5	0.40	1.21	0.41	1.63	0.34
paratype MB.C.19035.3	11.2	5.2	3.8	4.1	2.4	0.47	1.37	0.37	1.64	0.36
paratype MB.C.19035.2	9.7	4.0	3.1	4.0	2.0	0.41	1.27	0.41	1.60	0.34

Table 42. Suture line proportions (Fig. 30C) for *Helicocyclus inornatus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19035.1	11.1 mm	0.78	1.51	1.87	0.34	0.52	E lobe considerably wide

Discussion. *Helicocyclus inornatus* belongs to the species within the genus without ribs. It is similar to *H. fuscus*, but that species has stronger, forwardly directed constrictions. *H. laxaris* has a stouter, narrower umbilicate conch.

**Figure 29.** *Helicocyclus inornatus* n. sp. from locality MOU-X; all × 2. **A.** Holotype MB.C.19035.1. **B.** Paratype MB.C.19035.2.**Figure 30.** *Helicocyclus inornatus* n. sp. from locality MOU-X. **A.** Dorsal view of holotype MB.C.19035.1; × 2.5. **B.** Cross section of paratype MB.C.19035.3; × 2.5. **C.** Suture line of holotype MB.C.19035.1, at 11.1 mm dm, 4.6 mm ww, 3.8 mm wh; × 6.0. **D–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Helicocyclus laxaris n. sp.

Figures 31, 32

Derivation of name. From Latin *laxaris* = widened, because of the rather stout conch.

Holotype. Specimen MB.C.19036.1, illustrated in Figure 31A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-X (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 22 specimens, conch diameter up to 13 mm.

Diagnosis. *Helicocyclus* with thinly pachyconic and subevolute juvenile conch up to 8 mm dm, thereafter thickly discoidal and subevolute; umbilical wall rounded; aperture low throughout ontogeny. Steinkern without constrictions or ribs. Suture line with narrow V-shaped external lobe with gently curved flanks; median saddle low; ventrolateral saddle symmetric, narrowly rounded; adventive lobe almost symmetric.

Table 43. Conch ontogeny (Figs 32A, B, D–G) of *Helicocyclus laxaris* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly discoidal; subevolute (ww/dm \sim 0.57; uw/dm \sim 0.38)	moderately depressed; moderately embracing (ww/wh \sim 1.75; IZR \sim 0.28)	low (WER \sim 1.70)
8 mm	thickly discoidal to thinly pachyconic; subevolute (ww/dm = 0.55–0.63; uw/dm = 0.30–0.38)	moderately depressed; strongly embracing (ww/wh = 1.50–1.75; IZR \sim 0.35)	low (WER = 1.55–1.75)
13 mm	thickly discoidal; subevolute (ww/dm \sim 0.55; uw/dm \sim 0.35)	moderately depressed; strongly embracing (ww/wh \sim 1.50; IZR \sim 0.42)	low (WER \sim 1.60)

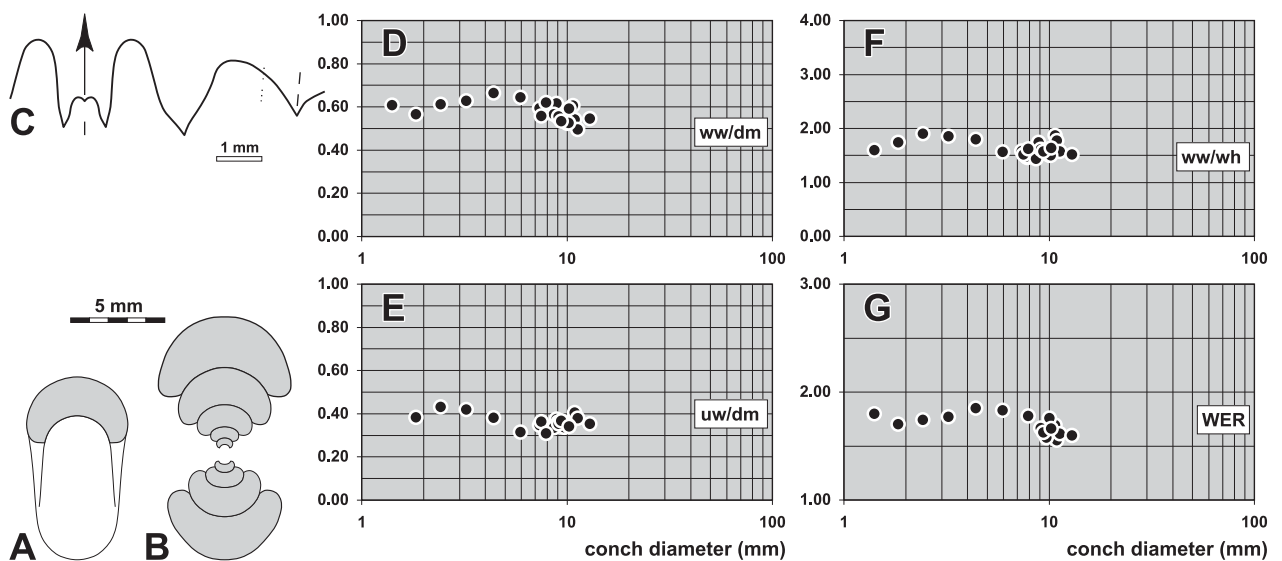
Table 44. Conch dimensions (in mm) and proportions for reference specimens of *Helicocyclus laxaris* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.19036.3	12.9	7.0	4.6	4.6	2.7	0.55	1.52	0.35	1.60	0.42
paratype MB.C.18844	11.3	5.6	3.7	4.3	2.4	0.50	1.49	0.38	1.62	0.36
holotype MB.C.19036.1	9.7	5.4	3.5	3.3	2.0	0.55	1.53	0.34	1.58	0.43
paratype MB.C.19036.2	9.1	5.1	3.1	3.2	2.1	0.56	1.61	0.35	1.67	0.35

Table 45. Suture line proportions (Fig. 32C) for *Helicocyclus laxaris* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19036.1	9.4 mm	0.63	1.29	1.02	0.34	0.49	A lobe deeper than E lobe

Discussion. The new species has a much stouter conch than *Helicocyclus laxaris* and *H. fuscus* and is therefore easily separated.

**Figure 31.** *Helicocyclus laxaris* n. sp. from locality MOU-X; all $\times 2$. **A.** Holotype MB.C.19036.1. **B.** Paratype MB.C.19036.2.**Figure 32.** *Helicocyclus laxaris* n. sp. from locality MOU-X. **A.** Dorsal view of holotype MB.C.19036.1; $\times 2.5$. **B.** Cross section of paratype MB.C.19036.3; $\times 2.5$. **C.** Suture line of holotype MB.C.19036.1, at 9.4 mm dm, 5.4 mm ww, 4.3 mm wh; $\times 6.0$. **D–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Ouaoufilalites* Korn, Bockwinkel, Ebbighausen & Klug, 2003**

Type species. *Ouaoufilalites ouaoufilalensis* Korn, Bockwinkel, Ebbighausen & Klug, 2003 (OD)

Genus definition. Ammonellipsitinae with a small conch, reaching approximately 50 mm conch diameter; conch ontogeny complex; shape thickly pachyconic in juveniles and thinly pachyconic in the adult stage; juvenile stage subevolute, intermediate stage with closure of the umbilicus, adult stage again subevolute. Ornament almost smooth or with convex riblets. Suture line with V-shaped, very narrow or narrow external lobe (EL w/d = 0.45–0.65; EL/AL = 0.90–1.20) with slightly diverging flanks; median saddle low (MS h = 0.25–0.35); ventrolateral saddle broadly rounded; adventive lobe deeper than external lobe, V-shaped.

Included species.

creber: *Ouaoufilalites creber* n. sp.; Mouydir, Algeria.

ouaoufilalensis: *Ouaoufilalites ouaoufilalensis* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 84; Anti-Atlas, Morocco.

Discussion. *Ouaoufilalites* was attributed by Korn et al. (2003) to the family Maxigoniatiidae. However, the shape of the external lobe (V-shaped with slightly sinuous flanks) and the ventrolateral saddle (narrowly rounded at the top) as well as the presence of ribs in the new material suggests that the genus belongs to the ammonellipsitin ammonoids.

***Ouaoufilalites creber* n. sp.**

Figures 33, 34

Derivation of name. From Latin *creber* = condensed, because of the crowded septa.

Holotype. Specimen MB.C.18733.1, illustrated in Figure 33C.

Type locality and horizon. Oued Temertasset, locality and sample A320–5 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 55 specimens, conch diameter up to 26 mm.

Diagnosis. *Ouaoufilalites* with thickly pachyconic conch up to 12 mm dm, thereafter becoming thinly pachyconic at 20 mm dm; conch subevolute in the early juvenile stage (up to 2 mm dm), subinvolute in an intermediate growth interval (2–18 mm dm), and subevolute in the adult stage; umbilical margin, flanks and venter broadly rounded. Ornament with 50 weak, shallow ribs; rib course slightly convex with wide and shallow ventral sinus. Steinkern with weak or without constrictions. Suture line with V-shaped, very narrow or narrow external lobe; median saddle low; ventrolateral saddle narrowly rounded; adventive lobe deep, V-shaped.

Discussion. *Ouaoufilalites creber* differs from *O. ouaoufilalensis* in the stouter conch at comparable sizes (ww/dm = 0.66 in *O. ouaoufilalensis* but 0.75 in *O. creber* at 13 mm dm). The steinkern of *O. ouaoufilalensis* has weak constrictions, which cannot be seen in *O. creber*. Instead, *O. creber* possesses weak riblets, which are absent in *O. ouaoufilalensis*.

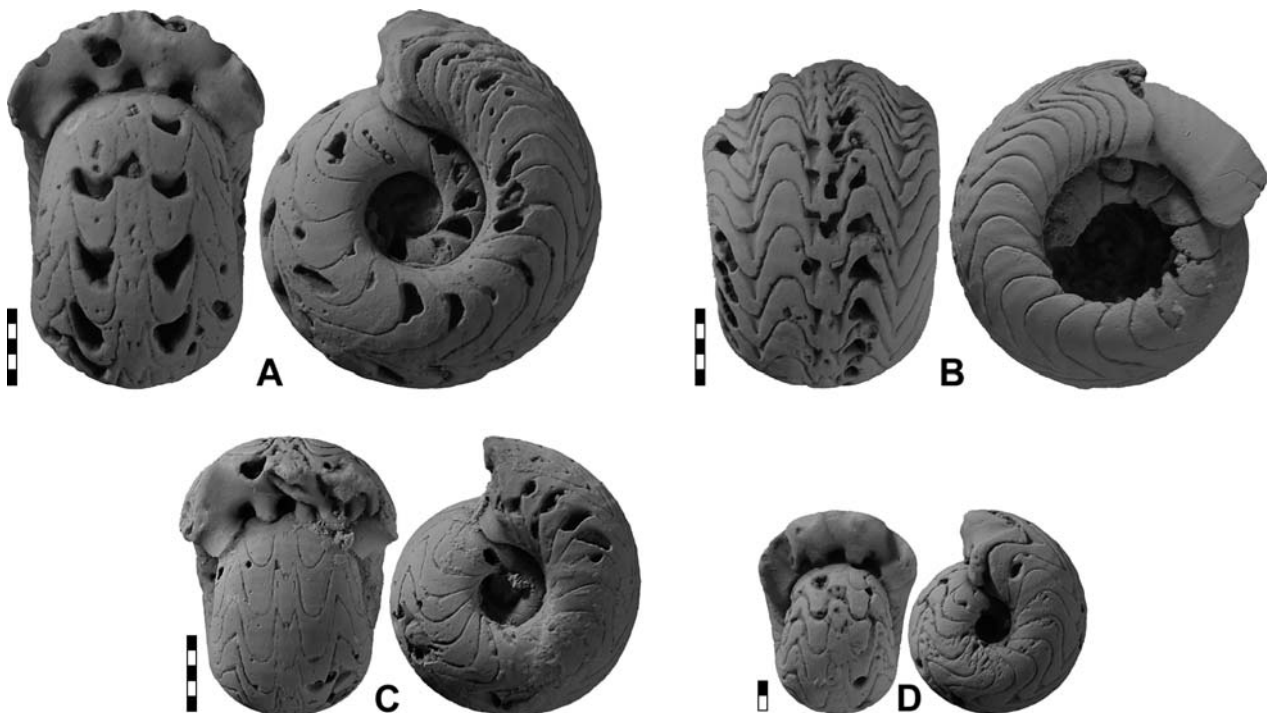


Figure 33. *Ouaoufilalites creber* n. sp. from locality A320–5; all $\times 2$. **A.** Paratype MB.C.18733.2. **B.** Paratype MB.C.18733.3. **C.** Holotype MB.C.18733.1. **D.** Paratype MB.C.18733.4.

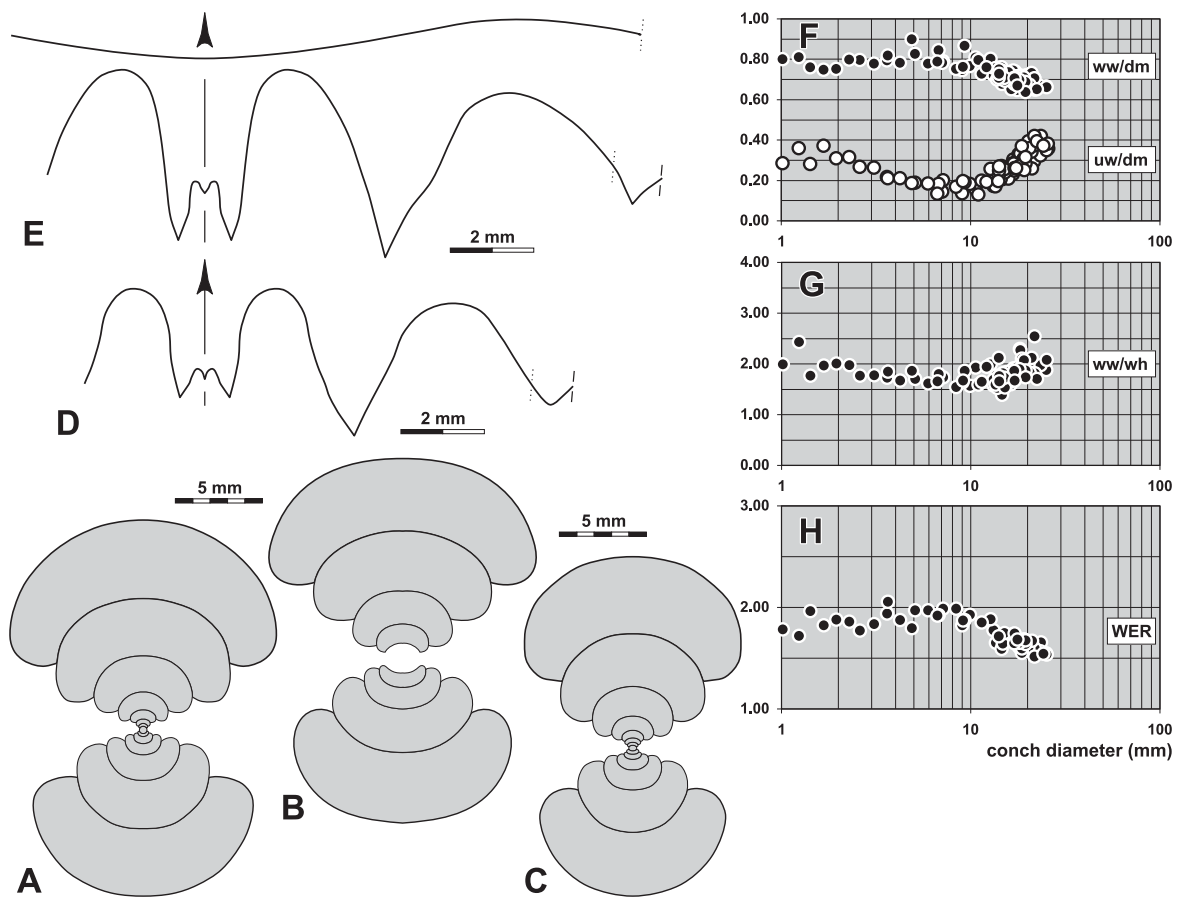


Figure 34. *Ouaoufilalites creber* n. sp. **A.** Cross section of paratype MB.C.18733.5 from locality A320–5; $\times 2.5$. **B.** Cross section of paratype MB.C.18733.6 from locality A320–5; $\times 2.5$. **C.** Cross section of paratype MB.C.19070.1 from an unrecorded locality; $\times 2.5$. **D.** Suture line of paratype MB.C.18733.4 from locality A320–5, at 12.8 mm dm, 10.1 mm ww, 5.9 mm wh; $\times 6.0$. **E.** Suture line and rib course of holotype MB.C.18733.1 from locality A320–5, at 18.2 mm dm, 13.6 mm ww, 7.1 mm wh; $\times 6.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 46. Conch ontogeny (Figs 34A–C, F–H) of *Ouaoufilalites creber* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subevolute (ww/dm = 0.75–0.80; uw/dm = 0.30–0.35)	moderately depressed; strongly embracing (ww/wh = 1.90–2.00; IZR \sim 0.30)	moderate (WER \sim 1.85)
8 mm	thickly pachyconic; subinvolute (ww/dm = 0.75–0.85; uw/dm = 0.15–0.20)	moderately depressed; strongly embracing (ww/wh = 1.50–1.90; IZR = 0.40–0.45)	moderate (WER \sim 1.95)
20 mm	thinly pachyconic; subinvolute to subevolute (ww/dm = 0.64–0.72; uw/dm = 0.25–0.40)	moderately to strongly depressed; strongly embracing (ww/wh = 1.75–2.25; IZR = 0.30–0.45)	low (WER = 1.55–1.70)
25 mm	thinly pachyconic; subevolute (ww/dm \sim 0.65; uw/dm = 0.35–0.42)	moderately to strongly depressed; strongly embracing (ww/wh = 1.85–2.25; IZR = 0.40–0.45)	low (WER \sim 1.55)

Table 47. Conch dimensions (in mm) and proportions for reference specimens of *Ouaoufilalites creber* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18733.2	25.0	16.7	8.9	9.0	4.9	0.67	1.88	0.36	1.55	0.45
paratype MB.C.18733.7	23.4	15.7	7.9	7.6	4.7	0.67	1.98	0.32	1.57	0.40
paratype MB.C.18733.3	21.8	15.4	7.2	9.2	4.1	0.71	2.13	0.42	1.51	0.44
holotype MB.C.18733.1	18.6	13.4	6.4	5.5	3.7	0.72	2.10	0.30	1.55	0.42
paratype MB.C.18733.4	13.6	10.1	5.7	2.9	3.0	0.74	1.77	0.21	1.65	0.47
paratype MB.C.18733.8	9.0	6.7	4.1	1.2	2.3	0.75	1.64	0.14	1.82	0.43

Table 48. Suture line proportions (Figs 34D, E) for *Ouaoufilalites creber* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18733.1	18.2 mm	0.49	0.76	1.01	0.35	0.64	
paratype MB.C.18733.4	12.8 mm	0.63	0.95	0.90	0.26	0.66	A lobe much deeper than E lobe

Family **Temertassetiidae** n. fam.

Family definition. Pericyclid ammonoids with usually thickly discoidal or thinly pachyconic, involute to subevolute conch, rarely discoidal. Umbilical margin often angular; aperture moderately high or high. Steinkern often with strong constrictions, weak ribs in some species. Suture line with V-shaped external lobe with slightly sinuous flanks; prongs of the external lobe often hook-shaped; median saddle very low to moderately low.

Included genera.

Temertassetia n. gen.

Jerania n. gen.

Kusinia n. gen.

Bouhamedites Korn, Bockwinkel, Ebbighausen & Klug, 2003.

Discussion. The new family differs from the families Pericyclidae and Muensteroceratidae mainly in the suture line, which possesses flexed flanks of the external lobe. Such a shape of the external lobe is also known from the stratigraphically younger subfamilies Maxigoniitinae Korn, Klug & Mapes, 1999 and Bollanditinae Bockwinkel, Korn & Ebbighausen, 2010. The members of these two subfamilies, however, differ strikingly in their conch ontogeny with a prolonged evolute juvenile stage and their much weaker ornament. The shape of the external lobe is therefore treated as homoplastic character.

***Temertassetia* n. gen.**

Derivation of name. After Oued Temertasset in the Mouydir.

Type species. *Temertassetia temertassetensis* n. sp.

Genus definition. Temertassetiidae with rather small conch, reaching a maximum conch diameter of 50 mm. Conch subinvolute or subevolute, narrowing of the umbilicus in juvenile stages, some species with adult re-opening of the umbilicus. Steinkern with prominent concavo-convex or biconvex constrictions; faint or sharp riblets between the steinkern constrictions. Suture line with V-shaped, very narrow or narrow external lobe (EL w/d = 0.40–0.70; EL/AL = 0.90–1.40) and very low or low median saddle (MS h = 0.18–0.25); ventrolateral saddle rounded, symmetric or slightly asymmetric; adventive lobe V-shaped, symmetric or asymmetric.

Included species.

coarta: *Temertassetia coarta* n. sp.; Mouydir, Algeria.

decorata: *Temertassetia decorata* n. sp.; Mouydir, Algeria.

minima: *Pericyclus minimus* Hind, 1910, p. 107; Derbyshire.

multiplicatus: *Pericyclus princeps* var. *multiplicatus* Delépine, 1940, p. 40; Belgium.

secunda: *Temertassetia secunda* n. sp.; Mouydir, Algeria.

temertassetensis: *Temertassetia temertassetensis* n. sp.; Mouydir, Algeria.

Separation of the new species. The four species of *Temertassetia* from Oued Temertasset can be separated by their conch morphology and suture line. In the conch shape and its ontogenetic development, they are characterised as follows:

- *T. temertassetensis* – ww/dm ~ 0.36 in the adult stage (28 mm dm) and ~ 0.60 in the intermediate stage (8 mm dm); uw/dm ~ 0.25 in the adult stage (28 mm dm) and ~ 0.20 in the intermediate stage (8 mm dm);
- *T. secunda* – ww/dm ~ 0.45 in the adult stage (20 mm dm) and ~ 0.60 in the intermediate stage (8 mm dm); uw/dm ~ 0.30 in the adult stage (20 mm dm) and ~ 0.30 in the intermediate stage (8 mm dm);
- *T. decorata* – ww/dm ~ 0.45 in the adult stage (20 mm dm) and ~ 0.70 in the intermediate stage (8 mm dm); uw/dm ~ 0.40 in the adult stage (20 mm dm) and ~ 0.28 in the intermediate stage (8 mm dm);
- *T. coarta* – ww/dm ~ 0.43 in the adult stage (30 mm dm) and ~ 0.68 in the intermediate stage (8 mm dm); uw/dm ~ 0.20 in the adult stage (30 mm dm) and ~ 0.22 in the intermediate stage (8 mm dm).

The steinkern surface differs in the four specimens:

- *T. temertassetensis* – biconvex constrictions; faint riblets, additional riblets intercalated in the midflank area;
- *T. secunda* – concavo-convex constrictions; weak but sharp riblets, without intercalated riblets;
- *T. decorata* – concavo-convex constrictions; sharp riblets, additional riblets intercalate in the midflank area;
- *T. coarta* – concavo-convex constrictions; faint riblets, riblets split or intercalate on the midflank.

The suture line offers more distinguishing characters (in specimens larger than 12 mm dm):

- *T. temertassetensis* – external lobe narrow (EL w/d = 0.60–0.70); median saddle low (MS h ~ 0.20);
- *T. secunda* – external lobe narrow (EL w/d = 0.55–0.70); median saddle low (MS h = 0.20–0.25);
- *T. decorata* – external lobe narrow (EL w/d = 0.55–0.70); median saddle very low (MS h < 0.20);
- *T. coarta* – external lobe very narrow (EL w/d = 0.40–0.50); median saddle low (MS h ~ 0.25).

Discussion. *Temertassetia* shows relationships to the genus *Pericyclus*, and some of the species of *Temertassetia* (particularly *T. decorata*) show riblets very similar to *Pericyclus*. The boundary between the two genera is drawn at the border, when steinkern constrictions become more important than ribs. *Jerania* differs in the lack of riblets, and *Kusinia* has a lenticular, very narrowly umbilicate conch that differs strikingly from *Temertassetia*.

Polaricyclus Riley, 1991 (type species: *Ammonellipsites (Fascipericyclus) polaris* Gordon, 1957) shows some similarities, but differs in the involute inner whorls (in the type species and in *P. canadensis* Work & Nassichuk, 2000) and the external lobe with rather straight flanks, in contrast to the sinuous flanks in *Temertassetia*.

***Temertassetia temertassetensis* n. sp.**

Figures 35, 36

Derivation of name. After the type locality.

Holotype. Specimen MB.C.18947.1, illustrated in Figure 35A.

Type locality and horizon. Oued Temertasset, sample MOU-E07 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 183 specimens, conch diameter up to 28 mm.

Diagnosis. *Temertassetia* with thickly pachyconic conch in the juvenile stage and continuously becoming more slender and being thinly discoidal at 28 mm dm; conch subinvolute in all growth stages with a weak trend towards a widening of the umbilicus in the adult stage; umbilical margin subangular, umbilical wall oblique and flat; aperture moderate throughout ontogeny without changes. Steinkern with slightly biconvex constrictions that extend, in the adult stage, with very low projections and a shallow lateral sinus across the flanks forming a deep and narrow ventral sinus; faint riblets between the constrictions on the flanks, additional riblets intercalated in the midflank area. Suture line with narrow V-shaped external lobe and low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, acute.

Table 49. Conch ontogeny (Figs 36A, B, F–H) of *Temertassetia temertassetensis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.75; uw/dm ~ 0.20)	moderately depressed; strongly embracing (ww/wh ~ 1.65; IZR ~ 0.40)	moderate (WER ~ 1.85)
8 mm	thinly pachyconic; subinvolute (ww/dm ~ 0.60; uw/dm ~ 0.20)	weakly depressed; strongly embracing (ww/wh = 1.30–1.40; IZR ~ 0.40)	moderate (WER = 1.75–1.85)
20 mm	thinly discoidal; subinvolute (ww/dm = 0.40–0.48; uw/dm = 0.20–0.30)	weakly compressed to weakly depressed; strongly embracing (ww/wh = 0.90–1.15; IZR = 0.35–0.45)	moderate (WER = 1.75–1.90)
28 mm	thinly discoidal; subinvolute (ww/dm ~ 0.36; uw/dm ~ 0.25)	weakly compressed; strongly embracing (ww/wh ~ 0.85; IZR ~ 0.40)	moderate (WER ~ 1.75)

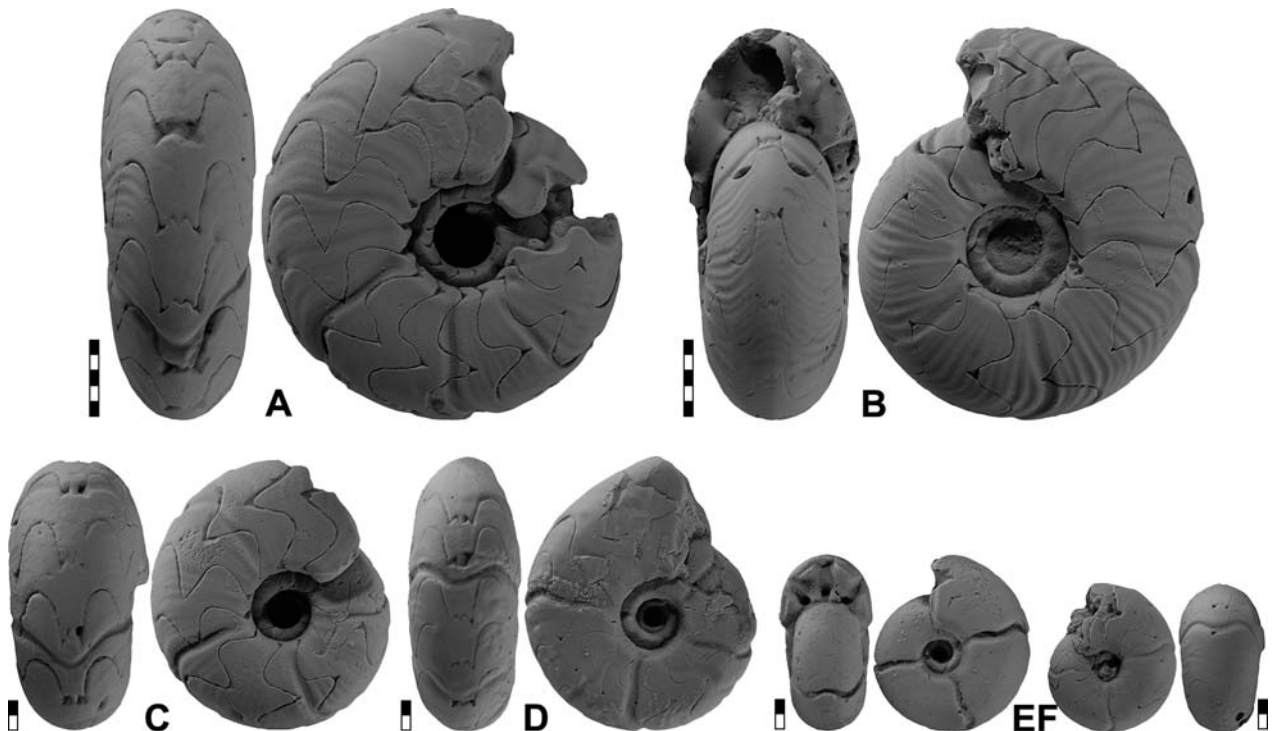


Table 50. Conch dimensions (in mm) and proportions for reference specimens of *Temertassetia temertassetensis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18947.1	27.3	10.0	11.6	6.8	6.5	0.37	0.86	0.25	1.72	0.44
paratype MB.C.18936	25.8	10.8	10.0	7.5	6.0	0.42	1.08	0.29	1.70	0.40
paratype MB.C.18865.1	18.2	8.9	7.4	4.7	4.3	0.49	1.21	0.26	1.72	0.42
paratype MB.C.18947.2	17.4	7.2	7.4	4.3	4.2	0.42	0.98	0.25	1.74	0.43
paratype MB.C.18947.3	11.9	6.1	4.8	3.1	2.7	0.51	1.26	0.26	1.68	0.43
paratype MB.C.18865.2	9.1	5.2	4.0	1.9	2.2	0.57	1.30	0.21	1.73	0.45

Table 51. Suture line proportions (Figs 36C–E) for *Temertassetia temertassetensis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18947.1	24.2 mm	0.67	0.82	1.40	0.21	0.82	prongs of E lobe hook-shaped
paratype MB.C.18947.2	15.7 mm	0.60	0.88	0.94	0.20	0.69	
paratype MB.C.18947.3	10.9 mm	0.66	0.84	1.21	0.13	0.79	M saddle very low

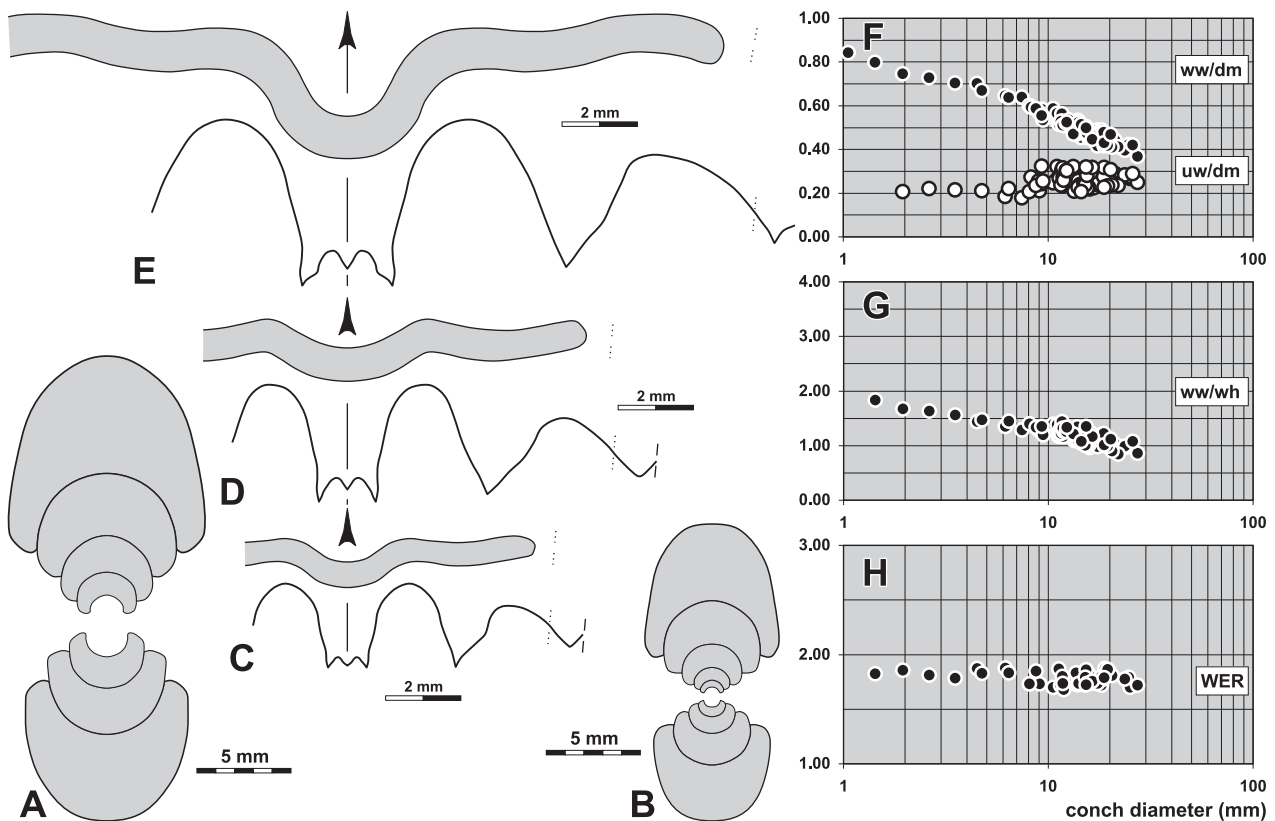


Figure 36. *Temertassetia temertassetensis* n. sp. **A.** Cross section of paratype MB.C.18865.3 from locality MOU-D1; $\times 2.5$. **B.** Cross section of paratype MB.C.18947.4 from locality MOU-E07; $\times 2.5$. **C.** Suture line and constriction of paratype MB.C.18947.3 from locality MOU-E07, at 10.9 mm dm, 5.5 mm ww, 5.5 mm wh; $\times 5.0$. **D.** Suture line and constriction of paratype MB.C.18947.2 from locality MOU-E07, at 15.7 mm dm, 7.2 mm ww, 7.2 mm wh; $\times 5.0$. **E.** Suture line and constriction of holotype MB.C.18947.1 from locality MOU-E07, at 24.2 mm dm, 9.7 mm ww, 10.8 mm wh; $\times 5.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.



Figure 35. *Temertassetia temertassetensis* n. sp.; all $\times 2$. **A.** Holotype MB.C.18947.1 from locality MOU-E07. **B.** Paratype MB.C.18936 from locality MOU-E06. **C.** Paratype MB.C.18865.1 from locality MOU-D1. **D.** Paratype MB.C.18947.2 from locality MOU-E07. **E.** Paratype MB.C.18947.3 from locality MOU-E07. **F.** Paratype MB.C.18865.2 from locality MOU-D1.

***Temertassetia secunda* n. sp.**

Figures 37, 38

Derivation of name. From Latin *secunda* = the second, it accompanies the type species.*Holotype.* Specimen MB.C.18948.1, illustrated in Figure 37A.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-E07 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.*Material.* 107 specimens, conch diameter up to 27 mm.

Diagnosis. *Temertassetia* with thickly pachyconic conch in the juvenile stage and continuously becoming more slender and being thinly discoidal at 20 mm dm; conch subinvolute in early and intermediate growth stages, widening of the umbilicus causes a subinvolute or subevolute conch in the adult stage; umbilical margin subangular, umbilical wall steep and flattened; aperture moderate or low throughout ontogeny without significant changes. Steinkern with concavo-convex constrictions that extend, in the adult stage, with a very shallow lateral sinus across the flanks and form a moderately deep and narrow ventral sinus; weak but rather sharp riblets between the constrictions on the flanks, without intercalated riblets. Suture line with narrow, V-shaped external lobe and low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, strongly asymmetric.

Table 52. Conch ontogeny (Figs 38A, B, F–H) of *Temertassetia secunda* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly or thickly pachyconic; subinvolute (ww/dm = 0.68–0.75; uw/dm ~ 0.24)	moderately depressed; strongly embracing (ww/wh ~ 1.70; IZR ~ 0.40)	low (WER ~ 1.65)
8 mm	thickly discoidal to thinly pachyconic; subinvolute to subevolute (ww/dm = 0.55–0.65; uw/dm = 0.27–0.35)	weakly depressed; strongly embracing (ww/wh = 1.40–1.50; IZR ~ 0.42)	moderate (WER ~ 1.80)
20 mm	thinly discoidal; subinvolute to subevolute (ww/dm = 0.40–0.50; uw/dm = 0.27–0.35)	weakly depressed; strongly embracing (ww/wh = 1.00–1.30; IZR = 0.35–0.45)	low (WER = 1.60–1.75)

Table 53. Conch dimensions (in mm) and proportions for reference specimens of *Temertassetia secunda* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18948.1	23.1	9.8	8.8	7.6	4.6	0.42	1.11	0.33	1.56	0.47
paratype MB.C.18948.2	18.4	8.5	7.6	5.1	4.2	0.46	1.12	0.28	1.69	0.44
paratype MB.C.18948.3	10.6	5.8	4.3	2.8	2.3	0.55	1.34	0.27	1.64	0.46

Table 54. Suture line proportions (Figs 38C–E) for *Temertassetia secunda* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18948.1	21.7 mm	0.60	0.86	1.19	0.20	0.69	A lobe very asymmetric
paratype MB.C.18948.2	16.6 mm	0.55	0.82	1.26	0.25	0.67	M saddle comparatively high
paratype MB.C.18948.3	10.1 mm	0.70	0.89	1.21	0.14	0.78	E lobe with incurved flanks

**Figure 37.** *Temertassetia secunda* n. sp. from locality MOU-E07; all $\times 2$. **A.** Holotype MB.C.18948.1. **B.** Paratype MB.C.18948.2. **C.** Paratype MB.C.18948.3.

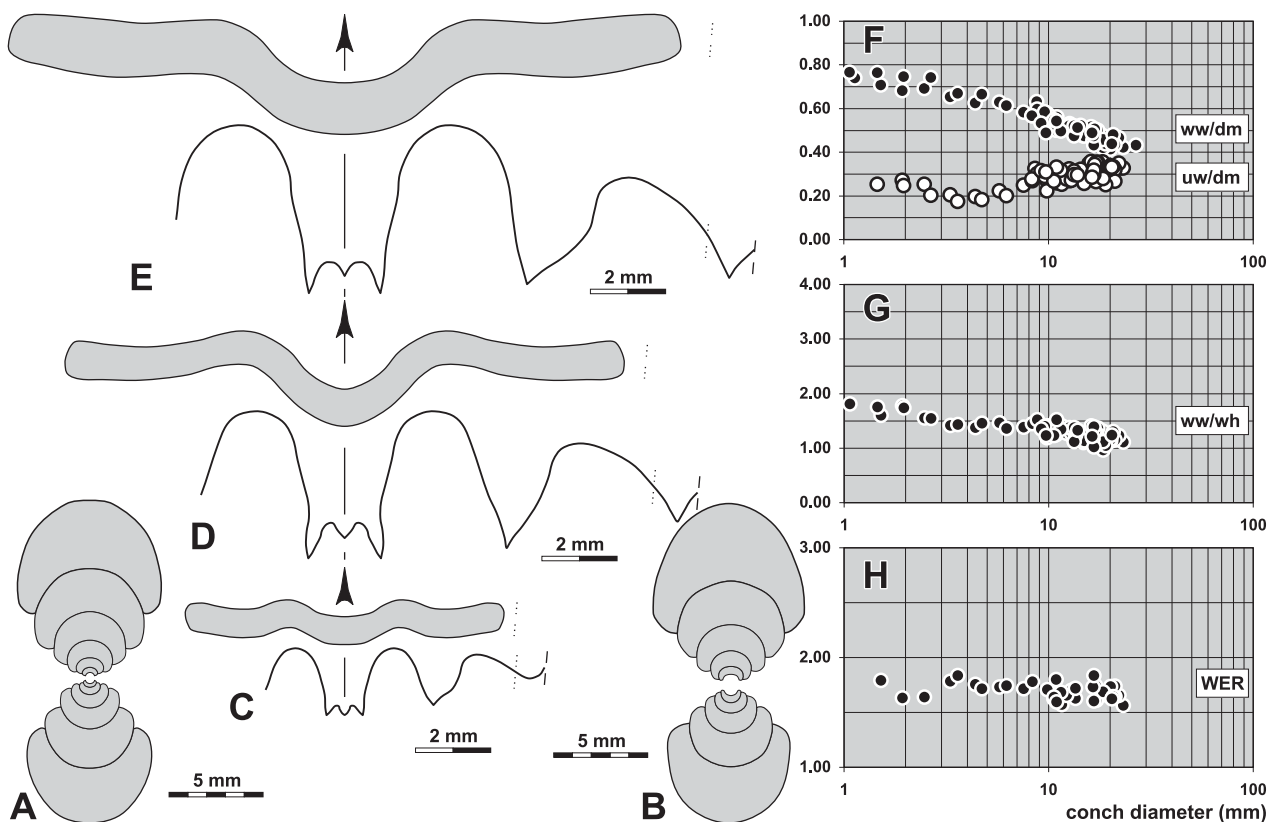


Figure 38. *Temertassetia secunda* n. sp. from locality MOU-E07. **A.** Cross section of paratype MB.C.18948.4; $\times 2.5$. **B.** Cross section of paratype MB.C.18948.5; $\times 2.5$. **C.** Suture line and constriction of paratype MB.C.18948.3, at 10.1 mm dm, 5.6 mm ww, 4.2 mm wh; $\times 5.0$. **D.** Suture line and constriction of paratype MB.C.18948.2, at 16.6 mm dm, 8.4 mm ww, 7.8 mm wh; $\times 5.0$. **E.** Suture line and constriction of holotype MB.C.18948.1, at 21.7 mm dm, 9.7 mm ww, 8.8 mm wh; $\times 5.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Temertassetia decorata n. sp.

Figures 39, 40

Derivation of name. From Latin *decorata*, because of the well-decorated conch.

Holotype. Specimen MB.C.19072.1, illustrated in Figure 39B.

Type locality and horizon. Oued Temertasset, locality and sample MOU-Les (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 149 specimens, conch diameter up to 26 mm.

Diagnosis. *Temertassetia* with thickly pachyconic conch in the early juvenile stage, above 4 mm dm continuously becoming more slender and being thinly discoidal at 25 mm dm; conch subevolute throughout ontogeny with a subinvolute interval between 3 and 9 mm dm; umbilical margin subangular, umbilical wall steep and flattened; aperture low throughout ontogeny without significant changes. Steinkern with concavo-convex constrictions, often arranged in distances of 90° , course with a shallow lateral sinus across the flanks and a deep sinus on the venter; sharp riblets between the constrictions on the flanks, additional riblets intercalate in the midflank area. Suture line with narrow, V-shaped external lobe with a very low median saddle and hook-shaped secondary prongs; ventrolateral saddle almost symmetric, narrowly rounded; adventive lobe V-shaped, asymmetric.

Table 55. Conch ontogeny (Figs 40A, B, E–H) of *Temertassetia decorata* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly pachyconic; subevolute (ww/dm \sim 0.70; uw/dm \sim 0.35)	moderately depressed; strongly embracing (ww/wh \sim 1.80; IZR \sim 0.40)	low (WER \sim 1.70)
8 mm	thickly discoidal; subinvolute (ww/dm \sim 0.60; uw/dm \sim 0.28)	moderately depressed; strongly embracing (ww/wh = 1.50–1.75; IZR \sim 0.40)	low (WER \sim 1.70)
20 mm	thinly discoidal; subevolute (ww/dm = 0.40–0.50; uw/dm = 0.33–0.45)	weakly to moderately depressed; strongly embracing (ww/wh = 1.10–1.65; IZR = 0.30–0.40)	low (WER = 1.50–1.70)

Table 56. Conch dimensions (in mm) and proportions for reference specimens of *Temertassetia decorata* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18725	24.8	10.2	9.2	8.9	5.7	0.41	1.11	0.36	1.68	0.38
holotype MB.C.19072.1	21.9	9.7	7.3	9.5	4.4	0.44	1.33	0.43	1.56	0.40
paratype MB.C.18949.1	21.2	9.5	7.1	10.2	4.4	0.45	1.34	0.48	1.59	0.38
paratype MB.C.19072.2	18.5	9.0	5.8	8.3	3.4	0.49	1.57	0.45	1.50	0.41
paratype MB.C.18867.1	14.4	8.1	5.1	6.1	3.2	0.56	1.60	0.42	1.65	0.37
paratype MB.C.18891.1	14.0	7.6	4.6	6.7	2.8	0.55	1.68	0.48	1.56	0.39
paratype MB.C.18891.2	13.0	6.3	4.7	5.2	2.8	0.48	1.34	0.40	1.61	0.41

Table 57. Suture line proportions (Figs 40C, D) for *Temertassetia decorata* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18949.4	24.2 mm	0.59	0.95	1.22	0.19	0.62	
paratype MB.C.18949.3	15.7 mm	0.70	0.91	1.18	0.20	0.77	prongs of E lobe narrowly rounded

Discussion. *Temertassetia decorata* shows some resemblance to species of the genera *Pericyclus* and *Helicocyclus*. The co-occurrence of sharp ribs and steinkern constrictions is also known from *Pericyclus intercisus*, but this species has a wider conch and shows clear differences in the suture line: the external lobe has almost parallel flanks and possesses lanceolate secondary prongs, unlike the hook-shaped prongs of *T. decorata*. *H. formosus* has weaker ribs and a suture line with a wider external lobe and a much higher median saddle.

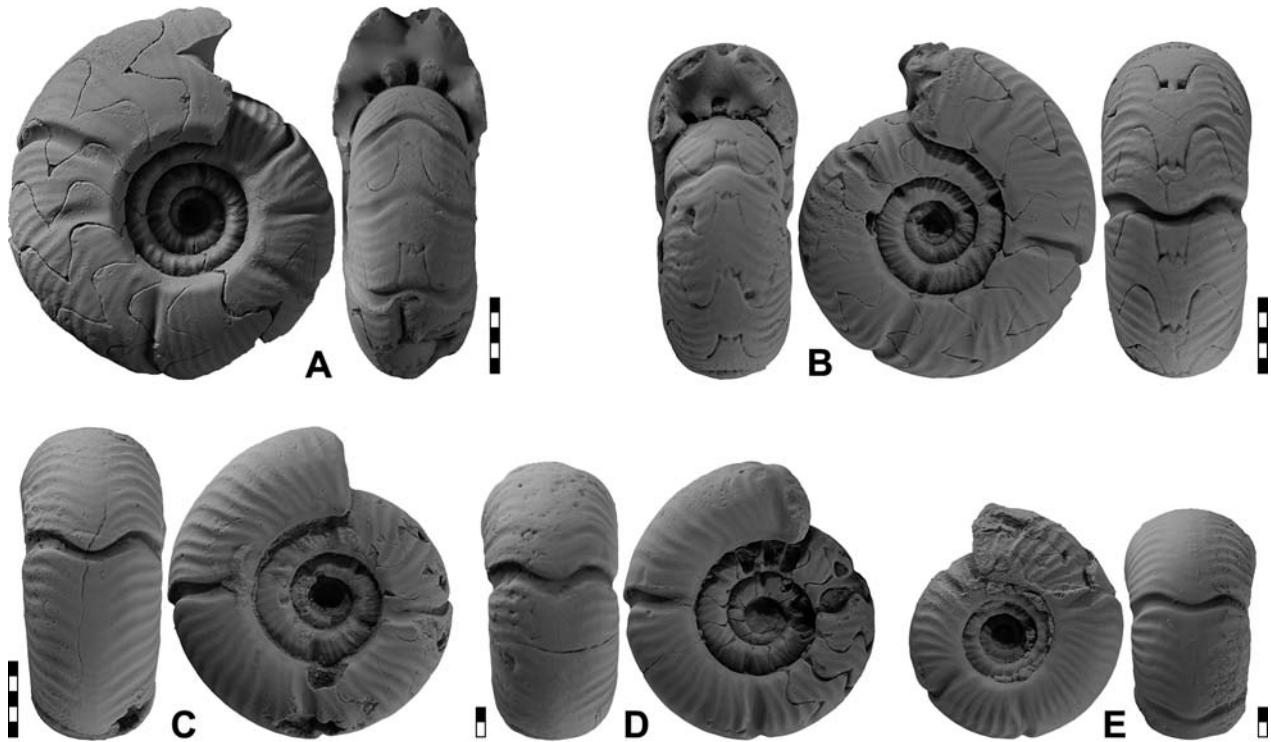


Figure 39. *Temertassetia decorata* n. sp.; all $\times 2$. **A.** Paratype MB.C.18725 from locality A-264. **B.** Holotype MB.C.19072.1 from an unrecorded locality. **C.** Paratype MB.C.18949.1 from locality MOU-E07. **D.** Paratype MB.C.19072.2 from an unrecorded locality. **E.** Paratype MB.C.18867.1 from locality MOU-D1.

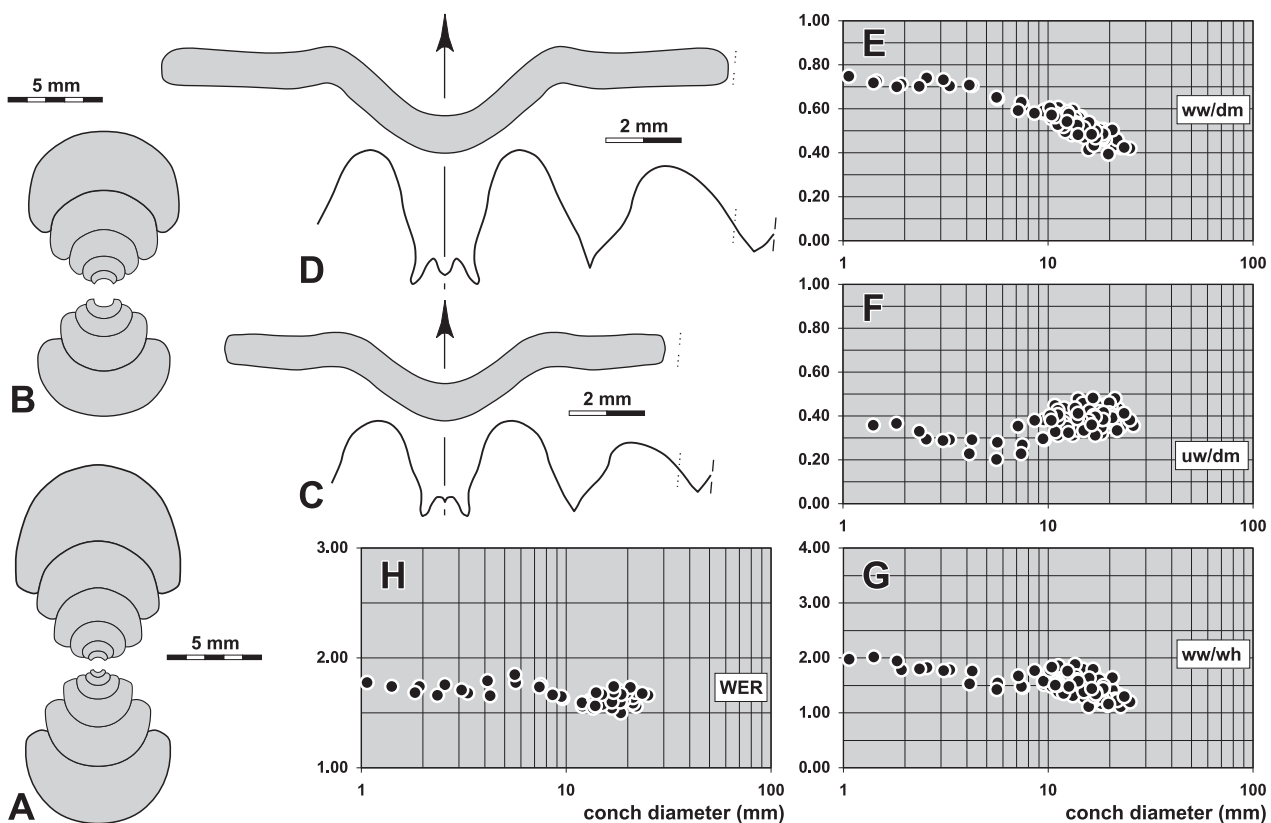


Figure 40. *Temertassetia decorata* n. sp. **A.** Cross section of paratype MB.C.18949.2 from locality MOU-E07; $\times 2.5$. **B.** Cross section of paratype MB.C.18867.2 from locality MOU-D1; $\times 2.5$. **C.** Suture line and constriction of paratype MB.C.18949.3 from locality MOU-E07, at 14.1 mm dm, 7.5 mm ww, 5.7 mm wh; $\times 5.0$. **D.** Suture line and constriction of paratype MB.C.18949.4 from locality MOU-E07, at 19.2 mm dm, 9.0 mm ww, 7.8 mm wh; $\times 5.0$. **E–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Temertassetia coarta n. sp.

Figures 41, 42

Derivation of name. From Latin co-artus = narrowing, because of the narrow external lobe.

Holotype. Specimen MB.C.18868.1, illustrated in Figure 41A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 183 specimens, conch diameter up to 34 mm.

Diagnosis. *Temertassetia* with thinly pachyconic conch in the early juvenile stage, above 8 mm dm continuously becoming more slender and being thinly discoidal at 30 mm dm; conch subevolute in early juveniles up to 3 mm dm and later subinvolute; umbilical margin subangular, umbilical wall steep and flat; aperture low or moderate throughout ontogeny without significant changes. Steinkern with constrictions of different prominence, course concavo-convex with a wide projection across the flanks and a rather deep, narrow ventral sinus; faint riblets between the constrictions on the flanks, they often split or intercalate on the midflank. Suture line with very narrow external lobe with subparallel flanks and low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped with almost straight flanks.

Table 58. Conch ontogeny (Figs 42A–E, I–K) of *Temertassetia coarta* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly to thickly pachyconic; subevolute (ww/dm = 0.67–0.74; uw/dm = 0.35–0.40)	moderately depressed; strongly embracing (ww/wh \sim 1.95; IZR \sim 0.30)	low to moderate (WER = 1.70–1.80)
8 mm	thinly pachyconic; subinvolute (ww/dm = 0.65–0.70; uw/dm = 0.18–0.25)	weakly or moderately depressed; strongly embracing (ww/wh = 1.30–1.60; IZR \sim 0.38)	moderate (WER = 1.80–1.90)
20 mm	thickly discoidal; subinvolute (ww/dm = 0.48–0.55; uw/dm = 0.18–0.30)	weakly depressed; strongly embracing (ww/wh = 1.00–1.40; IZR = 0.38–0.45)	low to moderate (WER = 1.70–1.90)
30 mm	thinly discoidal; subinvolute (ww/dm \sim 0.43; uw/dm = 0.15–0.25)	weakly depressed; strongly embracing (ww/wh = 1.00–1.10; IZR = 0.40–0.45)	moderate (WER = 1.80–1.90)

Table 59. Conch dimensions (in mm) and proportions for reference specimens of *Temertassetia coarta* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18868.9	28.2	13.6	13.0	5.4	7.3	0.48	1.04	0.19	1.82	0.44
holotype MB.C.18868.1	26.0	12.3	12.8	5.5	6.8	0.47	0.96	0.21	1.83	0.47
paratype MB.C.18868.2	21.9	11.4	10.7	4.4	6.0	0.52	1.07	0.20	1.91	0.44
paratype MB.C.19073.1	18.3	9.3	7.5	5.4	4.3	0.51	1.24	0.29	1.71	0.43
paratype MB.C.18868.3	15.7	8.6	6.8	3.3	4.0	0.55	1.27	0.21	1.81	0.41
paratype MB.C.19073.2	13.3	7.4	5.5	3.9	3.0	0.56	1.35	0.30	1.67	0.45

Table 60. Suture line proportions (Figs 42F–H) for *Temertassetia coarta* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18868.1	24.5 mm	0.39	0.54	1.12	0.24	0.73	flanks of A lobe almost straight
paratype MB.C.18868.2	21.8 mm	0.49	0.64	1.36	0.27	0.77	E lobe slightly pouched
paratype MB.C.18868.3	14.8 mm	0.46	0.59	0.97	0.25	0.77	

Discussion. *Temertassetia coarta* has, within the genus *Temertassetia*, a similar position like *Jerania persimilis* in the genus *Jerania*, i.e. it is a homeomorph of a species that is only clearly separable by the suture line. As *J. persimilis* differs from *J. jeranensis*, *T. coarta* differs from *T. temertassetensis* in the very narrow external lobe with subparallel flanks. This mosaic pattern in the distribution of characters cannot be explained at this time.

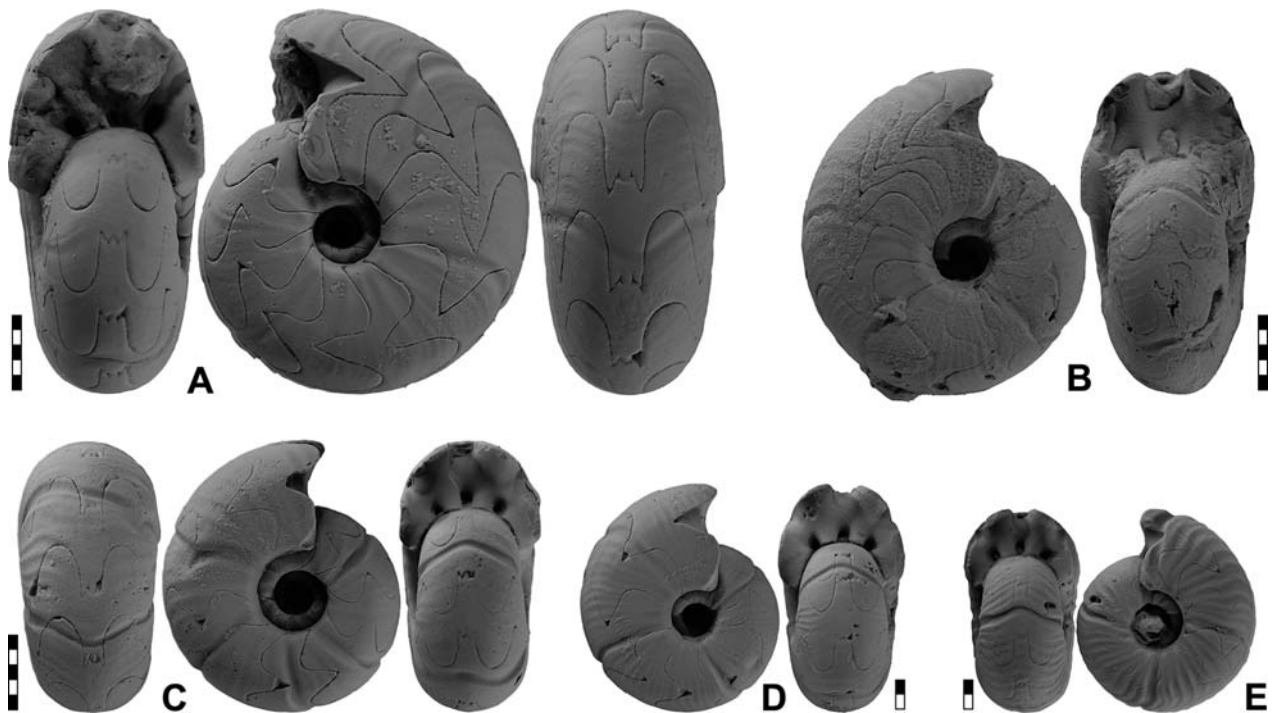


Figure 41. *Temertassetia coarta* n. sp.; all $\times 2$. **A.** Holotype MB.C.18868.1 from locality MOU-D1. **B.** Paratype MB.C.18868.2 from locality MOU-D1. **C.** Paratype MB.C.19073.1 from locality MOU-Les. **D.** Paratype MB.C.18868.3 from locality MOU-D1. **E.** Paratype MB.C.19073.2 from locality MOU-Les.

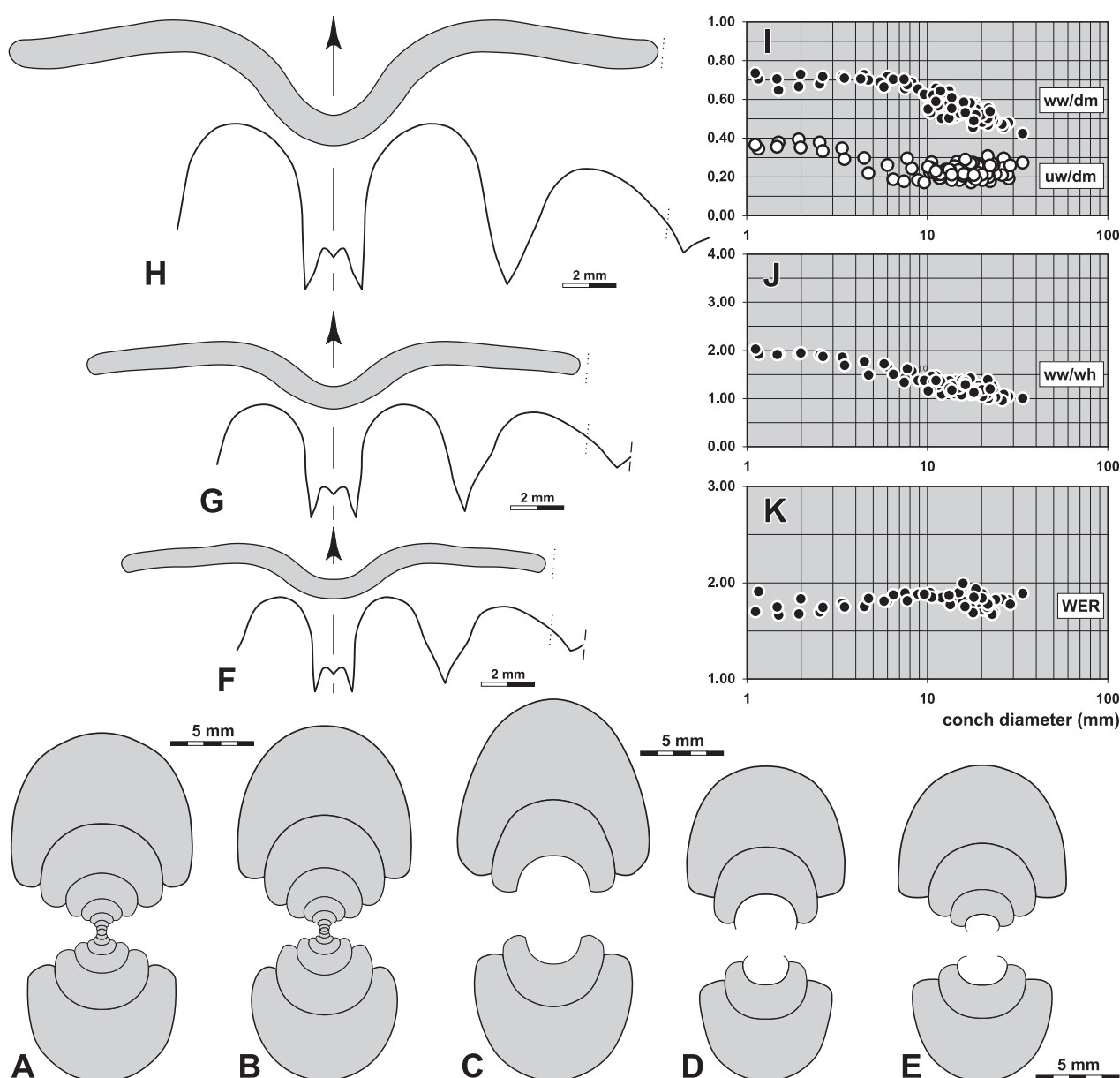


Figure 42. *Temertassetia coarta* n. sp. **A.** Cross section of paratype MB.C.18868.4 from locality MOU-D1; $\times 2.5$. **B.** Cross section of paratype MB.C.18868.5 from locality MOU-D1; $\times 2.5$. **C.** Cross section of paratype MB.C.18868.6 from locality MOU-D1; $\times 2.5$. **D.** Cross section of paratype MB.C.18868.7 from locality MOU-D1; $\times 2.5$. **E.** Cross section of paratype MB.C.18868.8 from locality MOU-D1; $\times 2.5$. **F.** Suture line and constriction of paratype MB.C.18868.3 from locality MOU-D1, at 14.8 mm dm, 8.2 mm ww, 6.8 mm wh; $\times 4.0$. **G.** Suture line and constriction of paratype MB.C.18868.2 from locality MOU-D1, at 21.8 mm dm, 11.8 mm ww, 10.9 mm wh; $\times 4.0$. **H.** Suture line and constriction of holotype MB.C.18868.1 from locality MOU-D1, at 24.5 mm dm, 11.8 mm ww, 11.9 mm wh; $\times 4.0$. **I–K.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Jerania n. gen.

Derivation of name. After Djebel El Jerane in the Mouydir.

Type species. *Jerania jeranensis* n. sp.

Genus definition. Temertassetiidae with rather small conch, reaching a conch diameter of 50 mm. Early whorls subinvolute, slight closure of the umbilicus in juvenile stages smaller than 5 mm conch diameter. Steinkern with prominent biconvex constrictions. Suture line with V-shaped, very narrow or narrow external lobe (EL w/d = 0.45–0.75; EL/AL = 0.85–1.35) and very low or low median saddle (MS h = 0.08–0.35); ventrolateral saddle rounded, slightly asymmetric; adventive lobe V-shaped, symmetric or asymmetric.

Included species.

antiatlanteum: *Winchelloceras antiatlanteum* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 87; Anti-Atlas, Morocco.

complanatum: *Goniatis complanatus* de Koninck, 1880, p. 106; Belgium.

jeranensis: *Jerania jeranensis* n. sp.; Mouydir, Algeria.

persimilis: *Jerania persimilis* n. sp.; Mouydir, Algeria.

pusillens: *Jerania pusillens* n. sp.; Mouydir, Algeria.

sicilicula: *Jerania sicilicula* n. sp.; Mouydir, Algeria.

Separation of the new species. The four species of *Jerania* from Oued Temertasset can be separated by means of conch morphology and the suture line. Based on conch morphology, they can be distinguished as follows:

- *J. jeranensis* and *J. persimilis* – uw/dm ratio rather constant between 10 and 30 mm diameter, with an average value close to 0.20 and a range between 0.15 and 0.24;
- *J. sicilicula* – uw/dm ratio amounts, between 10 and 30 mm diameter, an average value of 0.12;
- *J. pusillens* and *J. subvexa* – uw/dm ratio always low, ranging between 0.05 and 0.12.

The suture line offers further differences:

- *J. jeranensis* – width/height ratio of the external lobe is, in specimens larger than 10 mm dm, between about 0.60 and 0.75; the median saddle reaches, in the largest specimens (30 mm dm) a height of 0.35 of the external lobe depth;
- *J. sicilicula* – width/height ratio of the external lobe is, in specimens larger than 10 mm dm, between about 0.55 and 0.70; the median saddle reaches, in the largest specimens (17 mm dm) a height of 0.10 of the external lobe depth;
- *J. pusillens* – width/height ratio of the external lobe is, in specimens of 10 mm dm, about 0.55; the median saddle reaches, in the largest specimens (10 mm dm) a height of 0.15 of the external lobe depth, adventive lobe V-shaped and acute;
- *J. subvexa* – width/height ratio of the external lobe is, in specimens of 20 mm dm, about 0.50; the median saddle reaches, in the largest specimens (20 mm dm) a height of 0.15 of the external lobe depth, adventive lobe V-shaped and blunt;
- *J. persimilis* – width/height ratio of the external lobe is, in specimens larger than 10 mm dm, slightly less than 0.50; the median saddle reaches, in the largest specimens (20–30 mm dm) a height of 0.25 of the external lobe depth.

Discussion. Some species of *Jerania* resemble species of the genus *Temertassetia* in conch shape and ornament. *Temertassetia temertassetensis*, for example is a species that has a wider umbilicus (uw/dm ~ 0.28) than *Jerania jeranensis* (uw/dm ~ 0.20), and the aperture is slightly lower (WER 1.80 at 20 mm dm in *Temertassetia temertassetensis*, 1.95 in *Jerania jeranensis*). The ornament shows more differences, with stronger riblets in *Temertassetia temertassetensis*; more and deeper steinkern constrictions and a riblet-like folding on the flanks between the constrictions. The umbilical margin is sharper, sometimes rim-like, in *Temertassetia*.

Winchelloceras Ruzhencev, 1965 (type species: *Goniatites allei* Winchell, 1862) has a very similar conch morphology and also ornament, but possesses a much wider external lobe. *Winchelloceras* may be a close relative of *Jerania*, being derived by significant widening of the external lobe.

Jerania jeranensis n. sp.

Figures 43, 44

Derivation of name. After Djebel El Jerane near the type locality.

Holotype. Specimen MB.C.18950.1, illustrated in Figure 43D.

Type locality and horizon. Oued Temertasset, locality and sample MOU-E07 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 180 specimens, conch diameter up to 46 mm.

Diagnosis. *Jerania* with thickly pachyconic conch in the early juvenile stage, continuously becoming more slender and being thinly discoidal at 30 mm dm; conch subinvolute throughout ontogeny with an involute interval between 4 and 7 mm dm; umbilicus funnel-shaped with subangular margin and oblique umbilical wall; aperture moderately high throughout ontogeny. Steinkern with biconvex constrictions that extend with low projections and a shallow lateral sinus across the flanks and form a deep and narrow ventral sinus. Suture line with narrow, V-shaped external lobe and very low or low median saddle; ventrolateral saddle slightly asymmetric, rounded; adventive lobe V-shaped, acute, with flexed dorsal side and concavely incurved ventral flank.

Table 61. Conch ontogeny (Figs 44A, B, F–H) of *Jerania jeranensis* n. sp.

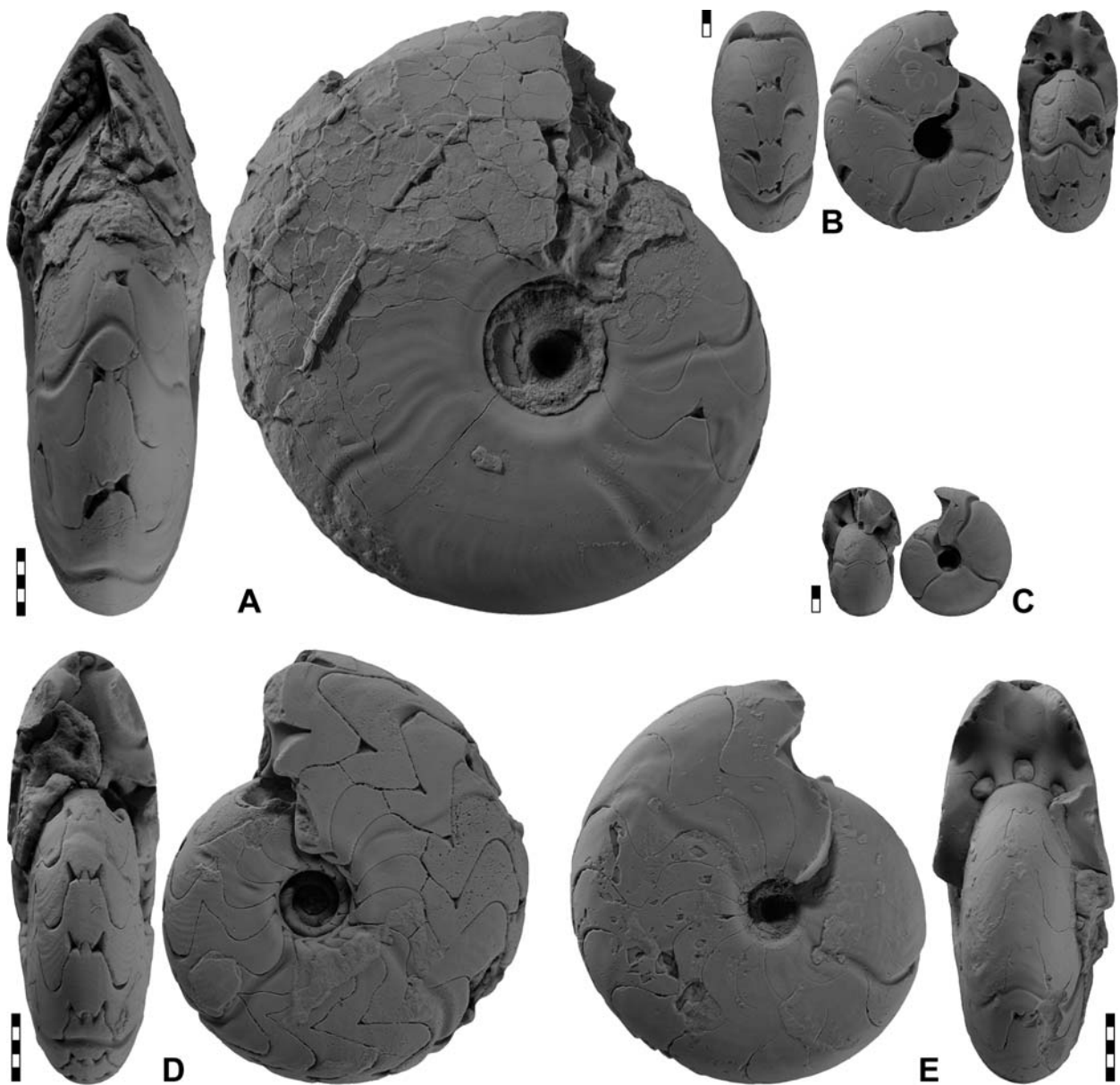
dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.75; uw/dm ~ 0.23)	moderately depressed; strongly embracing (ww/wh ~ 1.65; IZR ~ 0.40)	moderate (WER ~ 1.85)
8 mm	thinly pachyconic; subinvolute (ww/dm = 0.60–0.68; uw/dm = 0.15–0.20)	weakly depressed; strongly embracing (ww/wh = 1.20–1.40; IZR = 0.40–0.45)	moderate (WER ~ 1.95)
20 mm	thinly discoidal; subinvolute (ww/dm = 0.40–0.45; uw/dm = 0.15–0.25)	weakly compressed to weakly depressed; strongly embracing (ww/wh = 0.85–1.20; IZR = 0.35–0.45)	low to moderate (WER = 1.70–2.00)
30 mm	thinly discoidal; subinvolute (ww/dm = 0.35–0.42; uw/dm = 0.15–0.22)	weakly compressed; strongly embracing (ww/wh = 0.75–0.90; IZR = 0.35–0.45)	moderate (WER = 1.80–2.00)

Table 62. Conch dimensions (in mm) and proportions for reference specimens of *Jerania jeranensis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18788.1	38.9	13.6	16.6	9.0	–	0.35	0.82	0.23	–	–
holotype MB.C.18950.1	32.0	10.8	14.3	6.6	9.0	0.34	0.76	0.21	1.94	0.37
paratype MB.C.18726.1	30.5	12.9	15.0	4.4	8.0	0.42	0.86	0.14	1.84	0.47
paratype MB.C.18950.2	16.9	7.6	7.8	3.1	4.7	0.45	0.97	0.18	1.93	0.40
paratype MB.C.18950.3	9.8	5.3	4.3	2.0	2.4	0.54	1.24	0.20	1.73	0.45

Table 63. Suture line proportions (Figs 44C–E) for *Jerania jeranensis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18950.1	30.5 mm	0.72	1.18	1.44	0.32	0.61	E lobe flanks strongly curved
paratype MB.C.18950.2	15.7 mm	0.62	0.95	1.04	0.15	0.65	M saddle comparatively low
paratype MB.C.18950.3	8.8 mm	0.57	0.74	1.29	0.20	0.78	VL saddle broadly rounded

**Figure 43.** *Jerania jeranensis* n. sp.; all $\times 2$. **A.** Paratype MB.C.18788.1 from locality MOU-B. **B.** Paratype MB.C.18950.2 from locality MOU-E07. **C.** Paratype MB.C.18950.3 from locality MOU-E07. **D.** Holotype MB.C.18950.1 from locality MOU-E07. **E.** Paratype MB.C.18726.1 from locality A-264.

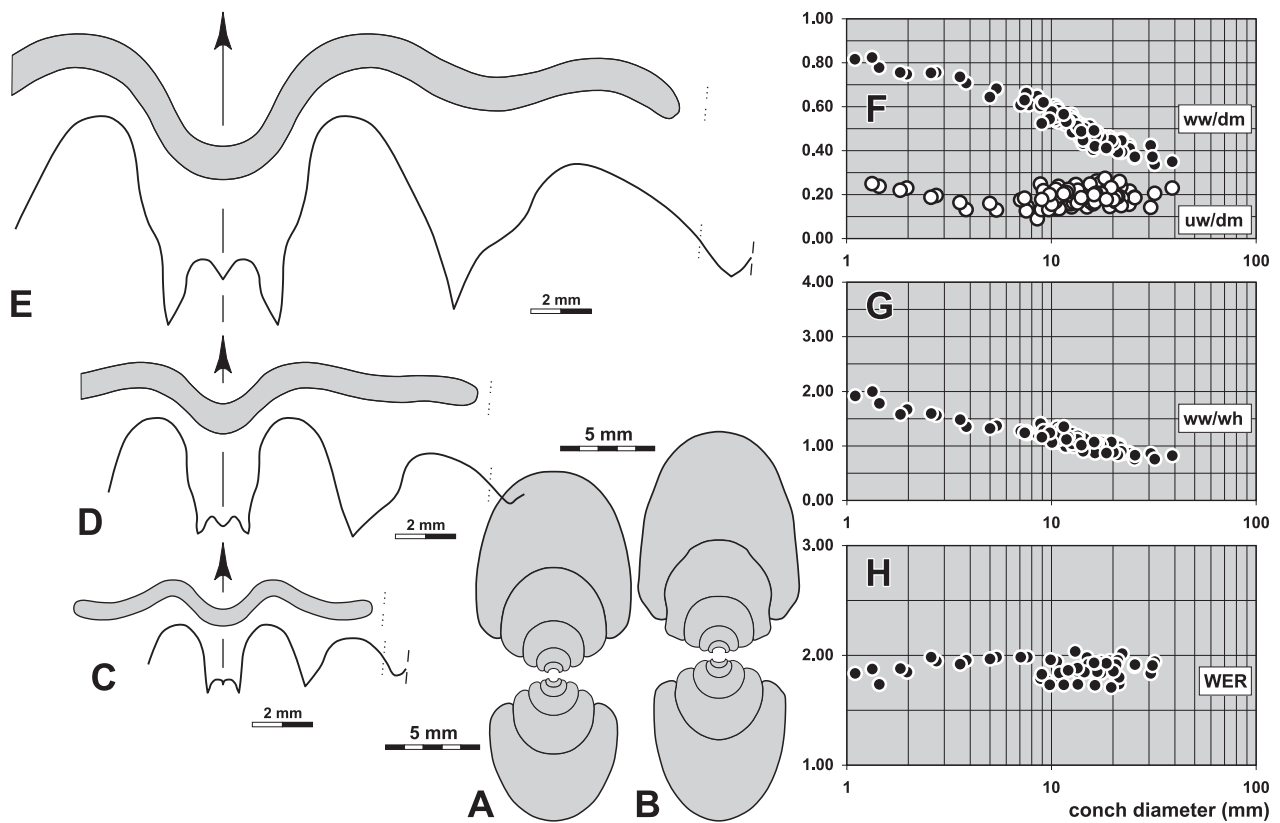


Figure 44. *Jerania jeranensis* n. sp. **A.** Cross section of paratype MB.C.18950.4 from locality MOU-E07; $\times 2.5$. **B.** Cross section of paratype MB.C.18869.1 from locality MOU-D1; $\times 2.5$. **C.** Suture line and constriction of paratype MB.C.18950.3 from locality MOU-E07, at 8.8 mm dm, 5.7 mm ww, 4.7 mm wh; $\times 4.0$. **D.** Suture line and constriction of paratype MB.C.18950.2 from locality MOU-E07, at 15.7 mm dm, 7.6 mm ww, 8.3 mm wh; $\times 4.0$. **E.** Suture line and constriction of holotype MB.C.18950.1 from locality MOU-E07, at 30.5 mm dm, 10.8 mm ww, 14.9 mm wh; $\times 4.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Jerania sicilicula n. sp.

Figures 45, 46

Derivation of name. From Latin sicilicula = a small sickle, because of the constrictions.

Holotype. Specimen MB.C.18870.1, illustrated in Figure 45B.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 199 specimens, conch diameter up to 33 mm.

Diagnosis. *Jerania* with a thickly pachyconic conch in the early juvenile stage, continuously becoming more slender and being thinly discoidal at 30 mm dm; conch subinvolute in the juvenile stage up to 5 mm dm, thereafter involute; umbilicus funnel-shaped with subangular margin and oblique umbilical wall; aperture moderate except for low early juvenile stage. Steinkern with biconvex constrictions that extend with a shallow lateral sinus, a rather prominent ventrolateral projection, and deep ventral sinus. Suture line with narrow, V-shaped external lobe with almost straight flanks and very low median saddle; ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe rather wide and V-shaped, with almost straight flanks.

Table 64. Conch ontogeny (Figs 46A–C, F–H) of *Jerania sicilicula* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm \sim 0.75; uw/dm \sim 0.21)	moderately depressed; very strongly embracing (ww/wh \sim 1.65; IZR \sim 0.50)	low (WER \sim 1.70)
8 mm	thickly discoidal; involute (ww/dm = 0.55–0.60; uw/dm = 0.10–0.15)	weakly depressed; very strongly embracing (ww/wh = 1.00–1.20; IZR = 0.45–0.50)	moderate (WER = 1.80–2.00)
20 mm	thinly discoidal; involute (ww/dm = 0.40–0.45; uw/dm = 0.10–0.15)	weakly compressed; very strongly embracing (ww/wh = 0.80–1.00; IZR = 0.45–0.50)	moderate (WER = 1.80–2.00)
30 mm	thinly discoidal; involute (ww/dm = 0.36–0.43; uw/dm = 0.10–0.15)	weakly compressed; very strongly embracing (ww/wh = 0.70–0.80; IZR = 0.45–0.50)	moderate (WER \sim 1.90)

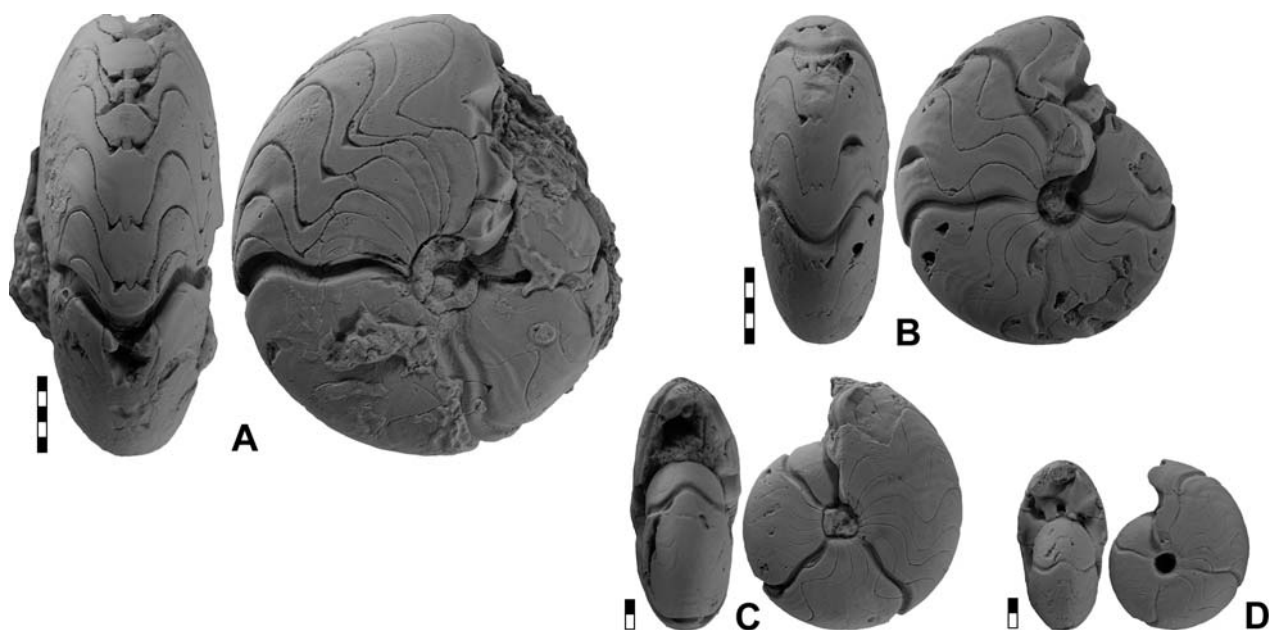


Figure 45. *Jerania sicilicula* n. sp.; all $\times 2$. **A.** Paratype MB.C.18894.1 from locality MOU-D2. **B.** Holotype MB.C.18870.1 from locality MOU-D1. **C.** Paratype MB.C.18951.1 from locality MOU-E07. **D.** Paratype MB.C.18951.2 from locality MOU-E07.

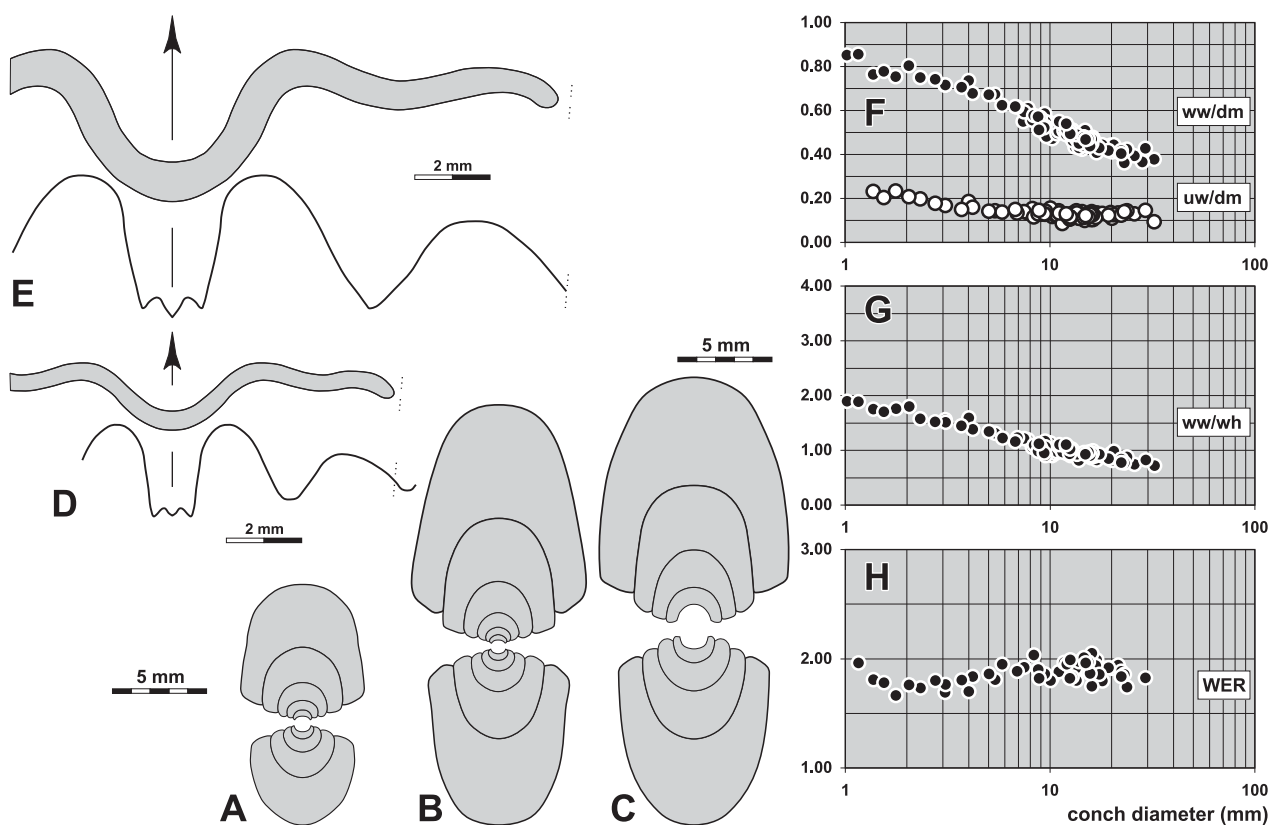


Figure 46. *Jerania sicilicula* n. sp. **A.** Cross section of paratype MB.C.18951.3 from locality MOU-E07; $\times 2.5$. **B.** Cross section of paratype MB.C.18951.4 from locality MOU-E07; $\times 2.5$. **C.** Cross section of paratype MB.C.18951.5 from locality MOU-E07; $\times 2.5$. **D.** Suture line and constriction of paratype MB.C.18951.2 from locality MOU-E07, at 10.4 mm dm, 5.4 mm ww, 5.5 mm wh; $\times 4.0$. **E.** Suture line and constriction of paratype MB.C.18951.6 from locality MOU-E07, at 17.1 mm dm, 7.6 mm ww, 9.4 mm wh; $\times 4.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 65. Conch dimensions (in mm) and proportions for reference specimens of *Jerania sicilicula* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18894.1	29.3	12.5	15.2	4.3	7.9	0.43	0.82	0.15	1.88	0.48
holotype MB.C.18870.1	21.5	8.8	10.5	2.9	6.1	0.41	0.84	0.13	1.94	0.42
paratype MB.C.18951.1	16.9	6.9	8.4	2.2	4.8	0.41	0.82	0.13	1.99	0.42
paratype MB.C.18951.2	11.1	5.6	5.3	1.6	3.0	0.51	1.06	0.14	1.88	0.43

Table 66. Suture line proportions (Figs 46D, E) for *Jerania sicilicula* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18951.6	17.1 mm	0.69	0.85	0.88	0.08	0.81	
paratype MB.C.18951.2	10.4 mm	0.58	0.77	0.88	0.09	0.75	A lobe rounded at base

***Jerania pusillens* n. sp.**

Figures 47, 48

Derivation of name. From Latin *pusilla* = small and *lens* = lentil, because of the conch shape.*Holotype.* Specimen MB.C.18871.1, illustrated in Figure 47B.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.*Material.* 26 specimens, conch diameter up to 20 mm.

Diagnosis. *Jerania* with very small, thickly pachyconic conch in the early juvenile stage, rapidly becoming more slender and being thinly discoidal at 16 mm dm; conch subinvolute in the early juvenile stage up to 2 mm dm, thereafter involute; umbilicus funnel-shaped with narrowly rounded margin and oblique umbilical wall; aperture moderate except for low early juvenile stage. Steinkern with slightly biconvex constrictions that extend with a very shallow lateral sinus, a low ventrolateral projection, and moderately deep ventral sinus. Suture line with narrow, V-shaped external lobe and very low median saddle; ventrolateral saddle slightly asymmetric, rounded; adventive lobe V-shaped, acute, with almost straight flanks.

Table 67. Conch ontogeny (Figs 48A, C–E) of *Jerania pusillens* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; involute (ww/dm ~ 0.75; uw/dm ~ 0.12)	weakly depressed; very strongly embracing (ww/wh ~ 1.45; IZR ~ 0.55)	low (WER ~ 1.70)
8 mm	thinly discoidal; involute (ww/dm = 0.44–0.50; uw/dm = 0.05–0.15)	weakly compressed; very strongly embracing (ww/wh = 0.85–1.00; IZR = 0.45–0.55)	moderate (WER = 1.75–1.90)
16 mm	thinly discoidal; involute (ww/dm ~ 0.36; uw/dm ~ 0.10)	weakly compressed; very strongly embracing (ww/wh ~ 0.75; IZR ~ 0.50)	moderate (WER = 1.75–1.85)

Table 68. Conch dimensions (in mm) and proportions for reference specimens of *Jerania pusillens* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18764.1	12.5	5.0	6.6	1.6	3.5	0.40	0.75	0.13	1.93	0.47
holotype MB.C.18871.1	11.2	4.9	5.5	1.4	2.8	0.43	0.88	0.13	1.78	0.49
paratype MB.C.18871.2	8.3	3.7	4.3	0.5	2.2	0.44	0.87	0.06	1.82	0.49

Table 69. Suture line proportions (Fig. 48B) for *Jerania pusillens* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18871.1	10.6 mm	0.56	0.67	1.25	0.14	0.83	

Discussion. *Jerania pusillens* is mainly distinguished from the other species of the genus by its small lenticular conch. Only *J. subvexa* has a very similar conch, but differs in the very shallow, blunt adventive lobe.

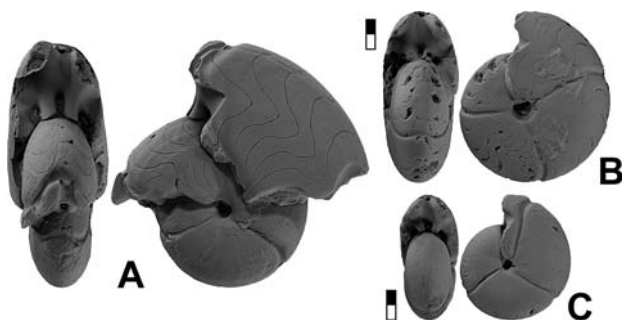


Figure 47. *Jerania pusillens* n. sp.; all $\times 2$. **A.** Paratype MB.C.18764.1 from locality MOU-A. **B.** Holotype MB.C.18871.1 from locality MOU-D1. **C.** Paratype MB.C.18871.2 from locality MOU-D1.

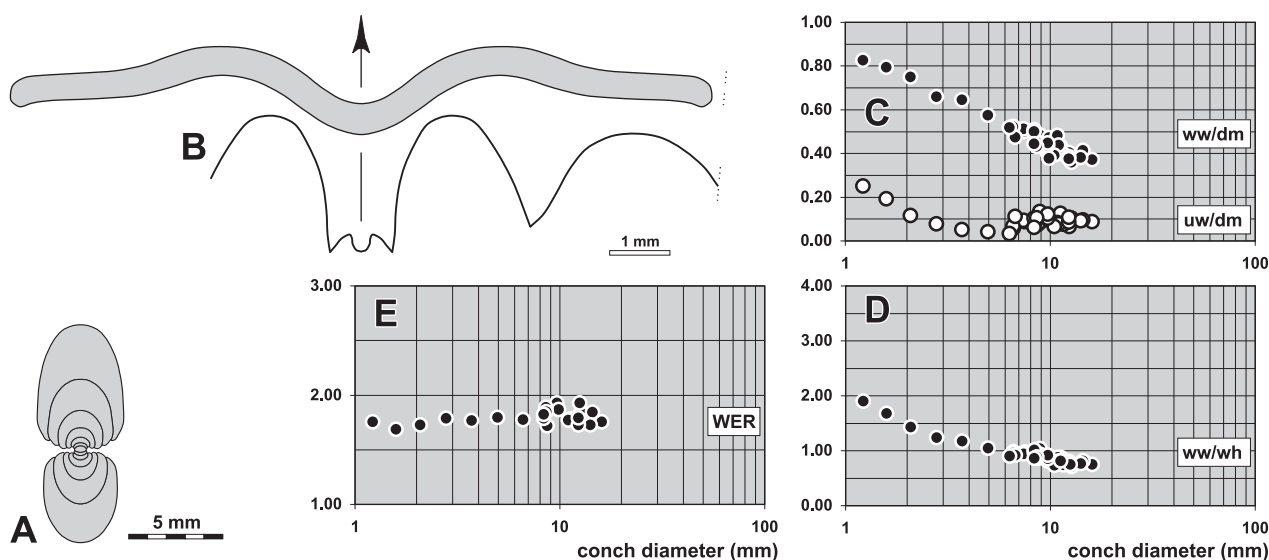


Figure 48. *Jerania pusillens* n. sp. **A.** Cross section of paratype MB.C.18871.3 from locality MOU-D1; $\times 2.5$. **B.** Suture line and constriction of holotype MB.C.18871.1 from locality MOU-D1, at 10.6 mm dm, 5.0 mm ww, 6.0 mm wh; $\times 8.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Jerania persimilis n. sp.

Figures 49, 50

Derivation of name. From Latin persimilis = very similar, because of the resemblance with the type species.

Holotype. Specimen MB.C.18940.1, illustrated in Figure 49A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-E06 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 71 specimens, conch diameter up to 37 mm.

Diagnosis. *Jerania* with thickly pachyconic conch in the early juvenile stage, almost continuously becoming more slender and being thinly discoidal at 20 mm dm; conch subinvolute throughout ontogeny; umbilicus funnel-shaped with subangular margin and oblique umbilical wall; aperture moderate throughout ontogeny except for a low early juvenile aperture. Steinkern with biconvex constrictions with shallow lateral sinus and deep ventral sinus; weak riblets between the constrictions. Suture line with very narrow external lobe with subparallel flanks and low median saddle; ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped.

Table 70. Conch ontogeny (Figs 50A, D–F) of *Jerania persimilis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly pachyconic; subinvolute (ww/dm \sim 0.70; uw/dm \sim 0.25)	moderately depressed; very strongly embracing (ww/wh \sim 1.75; IZR \sim 0.45)	low (WER \sim 1.65)
8 mm	thinly pachyconic; subinvolute (ww/dm \sim 0.60; uw/dm \sim 0.18)	weakly depressed; very strongly embracing (ww/wh \sim 1.30; IZR \sim 0.45)	moderate (WER \sim 1.80)
20 mm	thinly discoidal; subinvolute (ww/dm = 0.40–0.50; uw/dm = 0.18–0.25)	weakly compressed; strongly embracing (ww/wh = 0.95–1.00; IZR = 0.40–0.45)	moderate (WER = 1.80–1.90)
30 mm	thinly discoidal; subinvolute (ww/dm = 0.36–0.40; uw/dm = 0.18–0.25)	weakly compressed; strongly embracing (ww/wh = 0.75–1.00; IZR = 0.40–0.45)	moderate (WER = 1.80–1.90)

Table 71. Conch dimensions (in mm) and proportions for reference specimens of *Jerania persimilis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18790.1	33.1	11.8	15.4	6.9	8.0	0.36	0.77	0.21	1.73	0.48
holotype MB.C.18940.1	32.5	12.0	13.9	7.2	8.3	0.37	0.86	0.22	1.80	0.40
paratype MB.C.18872.2	28.4	11.4	13.0	5.9	7.4	0.40	0.88	0.21	1.83	0.43
paratype MB.C.18749.1	23.5	10.4	10.5	4.4	6.2	0.44	0.99	0.19	1.85	0.41
paratype MB.C.18872.1	20.4	9.4	9.2	4.2	5.1	0.46	1.02	0.21	1.78	0.44

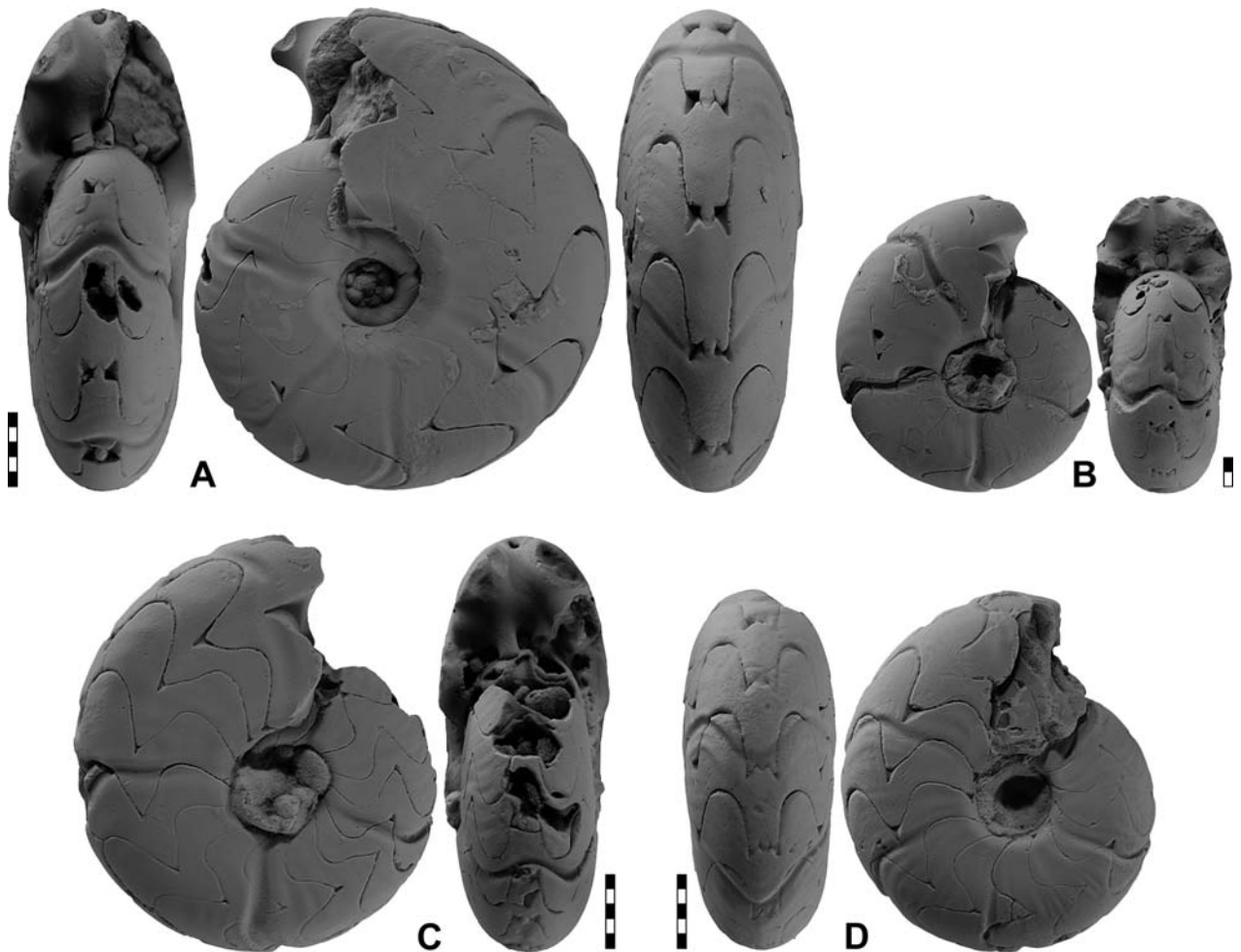
**Figure 49.** *Jerania persimilis* n. sp.; all $\times 2$. **A.** Holotype MB.C.18940.1 from locality MOU-E06. **B.** Paratype MB.C.18872.1 from locality MOU-D1. **C.** Paratype MB.C.18872.2 from locality MOU-D1. **D.** Paratype MB.C.18749.1 from locality A321.

Table 72. Suture line proportions (Figs 50B, C) for *Jerania persimilis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18790.2	32.9 mm	0.48	0.87	1.12	0.23	0.55	A lobe asymmetric
paratype MB.C.18790.1	20.1 mm	0.49	0.59	1.35	0.20	0.83	A lobe symmetric V-shaped

Discussion. *Jerania persimilis* is very similar to *J. jeranensis*, and the two species are hard to separate solely on the basis of conch morphology. Only the suture line provides clear distinguishing characters, with *J. jeranensis* possessing a much wider, V-shaped external lobe with curved flanks, in contrast to the much narrower external lobe with subparallel flanks in *J. persimilis*.

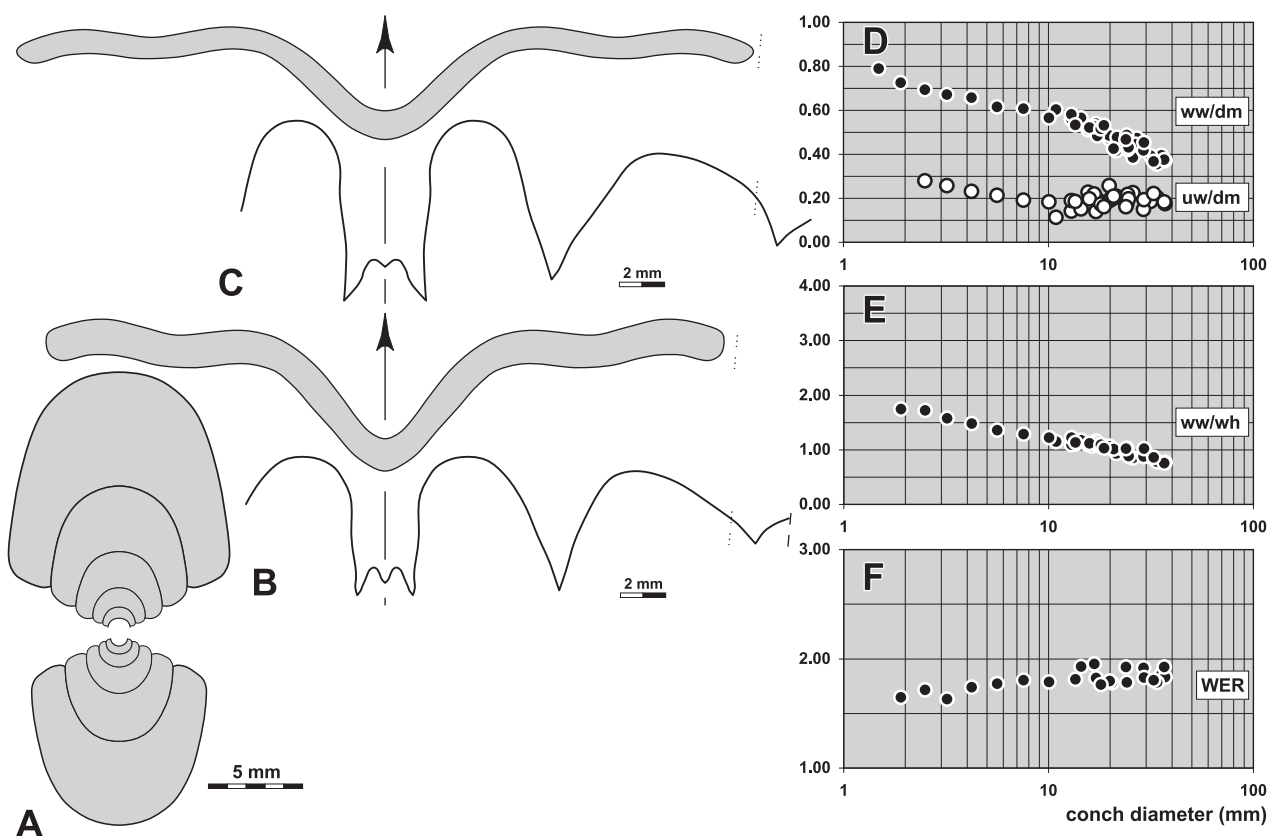


Figure 50. *Jerania persimilis* n. sp. **A.** Cross section of paratype MB.C.18896 from locality MOU-D2; $\times 2.5$. **B.** Suture line and constriction of paratype MB.C.18790.1 from locality MOU-B0, at 31.8 mm dm, 11.7 mm ww, 15.4 mm wh; $\times 3.0$. **C.** Suture line and constriction of paratype MB.C.18790.2 from locality MOU-B0, at 34.2 mm dm, 12.4 mm ww, 16.0 mm wh; $\times 3.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Jerania subvexa n. sp.

Figures 51, 52

Derivation of name. From Latin subvexa = oblique, because of the umbilical wall.

Holotype. Specimen MB.C.19027.1, illustrated in Figure 51C.

Type locality and horizon. Oued Temertasset, locality and sample MOU-V (Mouydir, South Algeria); lower part of the *Pericyclus-Progoniatites* Assemblage.

Material. 180 specimens, conch diameter up to 24 mm.

Diagnosis. *Jerania* with small, thickly pachyconic conch in the early juvenile stage, rapidly becoming more slender and being thinly discoidal at 10 mm dm; conch subinvolute in the early juvenile stage up to 2 mm dm, thereafter involute with a trend towards slight re-opening of the umbilicus above 8 mm dm; umbilicus funnel-shaped with narrowly rounded margin and oblique umbilical wall; aperture moderate except for low early juvenile stage. Steinkern with slightly biconvex constrictions that extend with a very shallow lateral sinus, a low ventrolateral projection, and moderately deep ventral sinus. Suture line with narrow, V-shaped external lobe and very low median saddle; ventrolateral saddle slightly asymmetric, rounded; adventive lobe very shallow, V-shaped, blunt at its base, with convex flanks.

Table 73. Conch ontogeny (Figs 52A–C, G–I) of *Jerania subvexa* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; involute (ww/dm \sim 0.75; uw/dm = 0.10–0.15)	weakly depressed; very strongly embracing (ww/wh \sim 1.45; IZR \sim 0.50)	moderate (WER \sim 1.80)
8 mm	thickly discoidal; involute (ww/dm = 0.50–0.55; uw/dm = 0.08–0.12)	weakly compressed; very strongly embracing (ww/wh = 0.90–1.00; IZR = 0.45–0.55)	moderate (WER = 1.75–1.90)
20 mm	thinly discoidal; involute (ww/dm \sim 0.36; uw/dm \sim 0.12)	weakly compressed; very strongly embracing (ww/wh \sim 0.75; IZR \sim 0.50)	moderate (WER \sim 1.75)

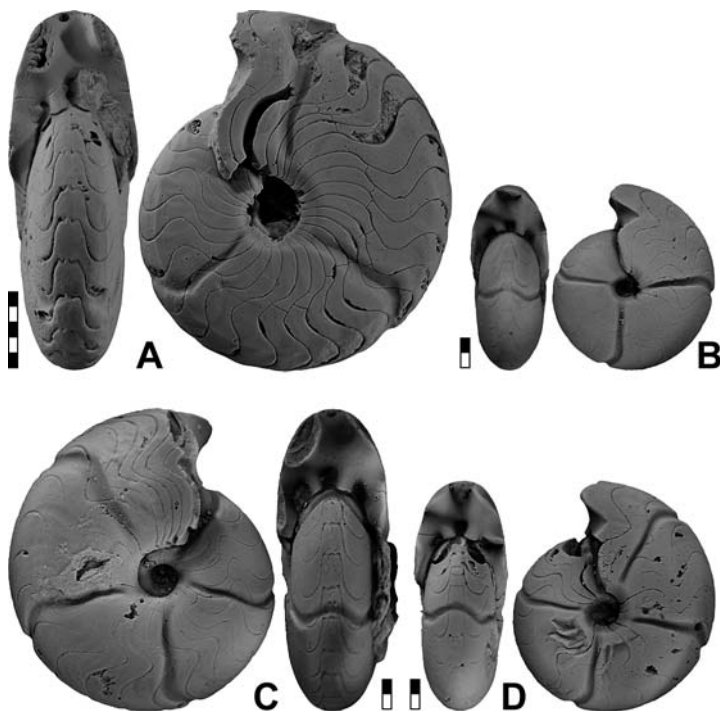
Table 74. Conch dimensions (in mm) and proportions for reference specimens of *Jerania subvexa* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.19027.2	23.6	8.0	11.5	3.2	5.8	0.34	0.69	0.14	1.76	0.50
holotype MB.C.19027.1	20.3	7.5	9.6	2.4	4.9	0.37	0.78	0.12	1.75	0.49
paratype MB.C.19027.4	15.1	5.9	7.2	2.2	3.8	0.39	0.82	0.14	1.78	0.48
paratype MB.C.19027.3	12.3	5.2	6.1	1.4	3.0	0.42	0.85	0.11	1.75	0.50

Table 75. Suture line proportions (Figs 52D–F) for *Jerania subvexa* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19027.1	19.6 mm	0.51	0.53	0.75	0.15	0.96	A lobe much shorter than E lobe
paratype MB.C.19027.4	14.7 mm	0.60	0.63	0.94	0.13	0.96	
paratype MB.C.19027.3	12.0 mm	0.55	0.55	0.80	0.13	0.99	E lobe very narrow at the base

Discussion. *Jerania subvexa* is easily distinguished from all the other species of the genus by its very shallow, blunt adventive lobe. In the conch shape, *J. pusillens* is very similar to *J. subvexa* making it very hard to separate them with regards to this character.

**Figure 51.** *Jerania subvexa* n. sp. from locality MOU-V; all $\times 2$. **A.** Paratype MB.C.19027.2. **B.** Paratype MB.C.19027.3. **C.** Holotype MB.C.19027.1. **D.** Paratype MB.C.19027.4.

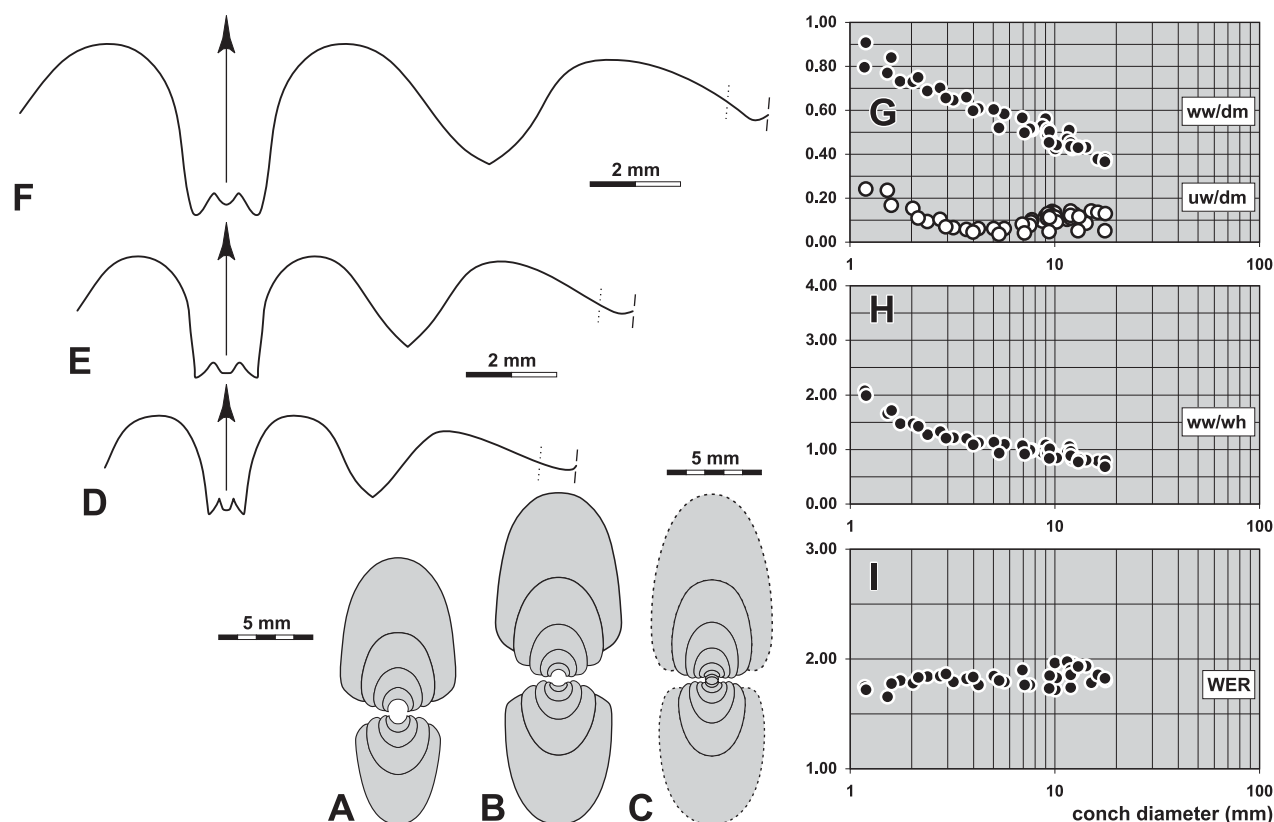


Figure 52. *Jerania subvexa* n. sp. from locality MOU-V. **A.** Cross section of paratype MB.C.19027.5; $\times 2.5$. **B.** Cross section of paratype MB.C.19027.6; $\times 2.5$. **C.** Cross section of paratype MB.C.19027.7; $\times 2.5$. **D.** Suture line of paratype MB.C.19027.3, at 12.0 mm dm, 5.3 mm ww, 6.3 mm wh; $\times 6.0$. **E.** Suture line of paratype MB.C.19027.4, at 14.7 mm dm, 5.8 mm ww, 15.2 mm wh; $\times 7.3$. **F.** Suture line of holotype MB.C.19027.1, at 19.6 mm dm, 7.4 mm ww, 9.5 mm wh; $\times 6.0$. **G–I.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Kusinia n. gen.

Derivation of name. After the late Lidiya Kusina (\dagger 2009), in honour of her contribution to the knowledge of the Tournaisian ammonoids.

Type species. *Kusinia falcifera* n. sp.

Genus definition. Temertassetiidae with small conch, reaching approximately 35 mm diameter; conch ontogeny simple, juvenile stage thickly pachyconic and subinvolute, adult stage thinly discoidal and involute with narrowly rounded venter. Ornament with strongly biconvex riblets and intercalatory riblets; strong biconvex constrictions of the internal mould. Suture line with V-shaped, narrow external lobe (EL w/d ~ 0.60 ; EL/AL ~ 1.00 in the adult stage) and very low median saddle (MS h ~ 0.20); ventrolateral saddle rounded; adventive lobe wide, V-shaped, asymmetric and acute.

Included species. *falcifera*: *Kusinia falcifera* n. sp.; Mouydir, Algeria.

Discussion. *Kusinia* has some superficial resemblance with *Nigrocyclus* Korn & Feist, 2007 (type species: *Pericyclus niger* Delépine, 1935), but that genus possesses ribs with a more or less convex course and a very narrow external lobe with strongly diverging flanks. *Kusinia* is related to *Jerania*, but differs in the presence of sharp ribs.

Kusinia falcifera n. sp.

Figures 53, 54

Derivation of name. From Latin *falcifera* = sickle bearing, because of the ornament.

Holotype. Specimen MB.C.19046.1, illustrated in Figure 53A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-Y (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 452 specimens, conch diameter up to 22 mm.

Diagnosis. *Kusinia* with thickly pachyconic or globular conch in the early juvenile stage, becoming rapidly slender during ontogeny and being thinly discoidal at 20 mm dm; conch subinvolute in the early juvenile stage and involute above 2 mm dm; umbilical margin rounded; aperture low in juveniles and very high in the adult stage. Steinkern with strongly biconvex riblets and constrictions with shallow lateral sinus and a very deep and narrow ventral sinus; rib splitting and intercalated ribs common, adult stage without riblets. Suture line with narrow, V-shaped external lobe and very low median saddle in the adult stage; ventrolateral saddle asymmetric, broadly rounded; adventive lobe V-shaped, asymmetric with strongly curved ventral flank.

Table 76. Conch ontogeny (Figs 54A–D, G–I) of *Kusinia falcifera* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; involute (ww/dm = 0.75–0.80; uw/dm = 0.12–0.15)	moderately depressed; very strongly embracing (ww/wh = 1.50–1.60; IZR = 0.50–0.58)	low (WER = 1.60–1.70)
8 mm	thickly discoidal; involute (ww/dm = 0.50–0.55; uw/dm = 0.05–0.10)	weakly compressed; very strongly embracing (ww/wh = 0.90–1.00; IZR ~ 0.50)	moderate (WER = 1.80–2.00)
20 mm	thinly discoidal; involute (ww/dm ~ 0.36; uw/dm ~ 0.05)	weakly compressed; strongly embracing (ww/wh ~ 0.60; IZR ~ 0.40)	very high (WER ~ 2.40)

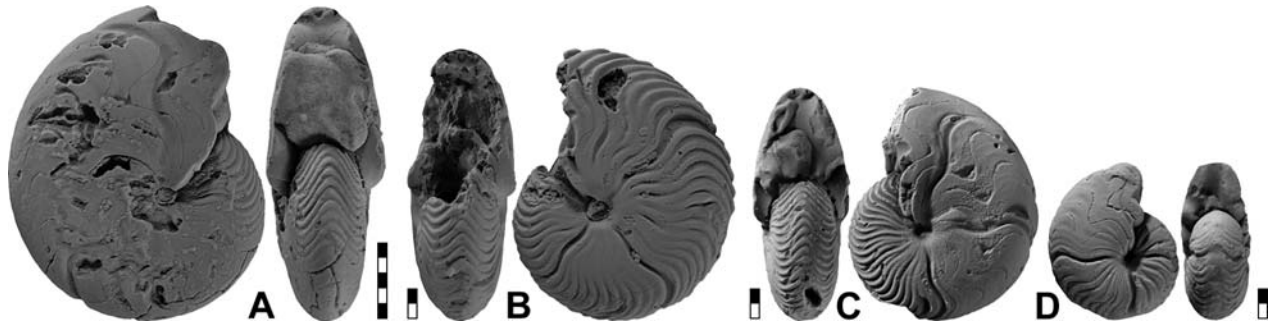
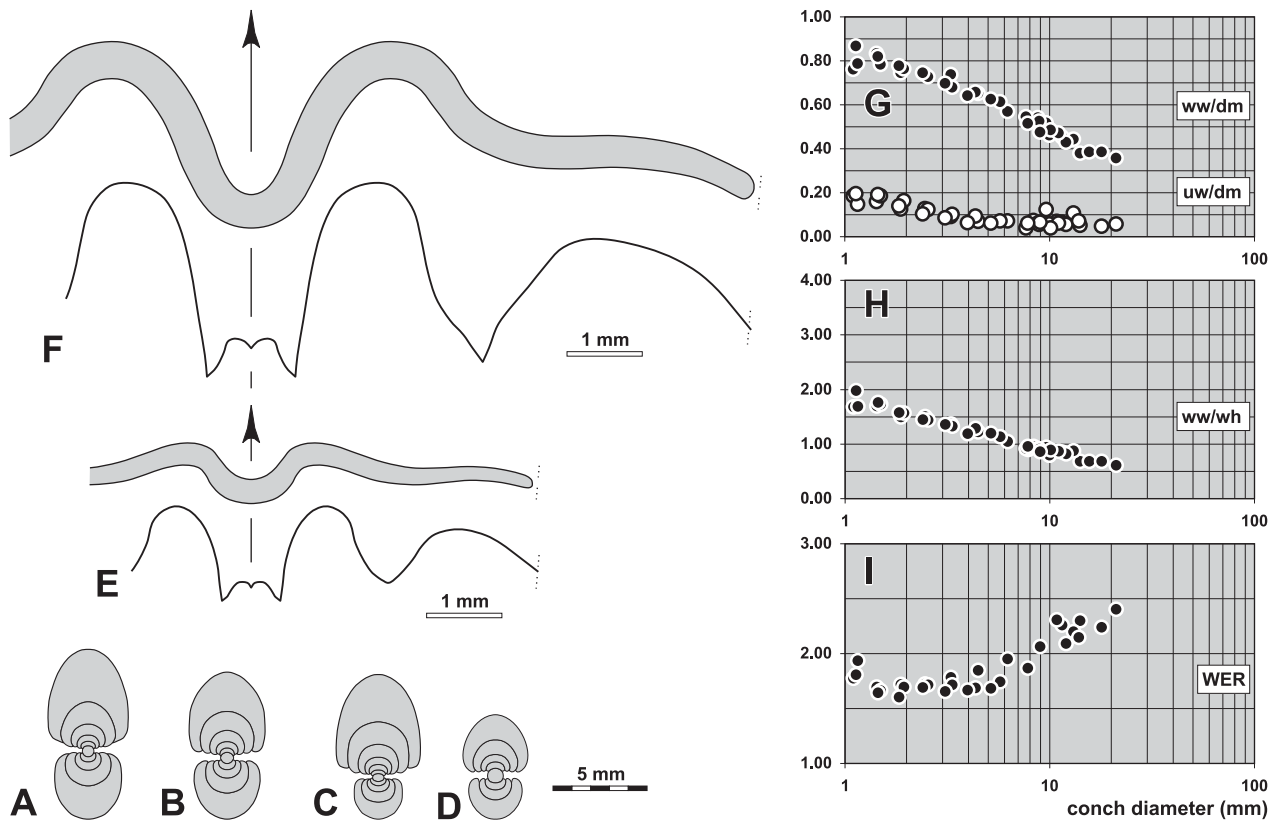
**Figure 53.** *Kusinia falcifera* n. sp.; all $\times 2$. **A.** Holotype MB.C.19046.1 from locality MOU-Y. **B.** Paratype MB.C.19046.2 from locality MOU-Y. **C.** Paratype MB.C.19038.1 from locality MOU-X. **D.** Paratype MB.C.19038.2 from locality MOU-X.**Figure 54.** *Kusinia falcifera* n. sp. **A.** Cross section of paratype MB.C.19038.3 from locality MOU-X; $\times 2.5$. **B.** Cross section of paratype MB.C.19038.4 from locality MOU-X; $\times 2.5$. **C.** Cross section of paratype MB.C.19038.5 from locality MOU-X; $\times 2.5$. **D.** Cross section of paratype MB.C.18812.1 from locality MOU-C2; $\times 2.5$. **E.** Suture line and constriction of paratype MB.C.18984.1 from locality MOU-E11, at 10.3 mm dm, 5.2 mm ww, 6.0 mm wh; $\times 10.0$. **F.** Suture line and constriction of holotype MB.C.19046.1 from locality MOU-Y, at 20.1 mm dm, 7.9 mm ww, 12.9 mm wh; $\times 10.0$. **G–I.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 77. Conch dimensions (in mm) and proportions for reference specimens of *Kusinia falcifera* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19046.1	21.1	7.6	12.4	1.2	7.5	0.36	0.61	0.06	2.40	0.39
paratype MB.C.19046.2	17.9	6.9	10.2	0.9	5.9	0.39	0.68	0.05	2.24	0.41
paratype MB.C.18984.1	11.0	5.2	6.0	0.7	3.6	0.47	0.87	0.06	2.23	0.39
paratype MB.C.18984.2	10.8	4.5	5.9	0.8	3.7	0.42	0.77	0.07	2.31	0.37

Table 78. Suture line proportions (Figs 54E, F) for *Kusinia falcifera* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19046.1	19.0 mm	0.60	0.97	1.05	0.20	0.62	A lobe strikingly asymmetric
paratype MB.C.18984.1	11.4 mm	0.77	1.00	1.11	0.20	0.77	E lobe comparatively wide

Discussion. *Kusinia falcifera* can easily be separated from any other species from Oued Temertasset by its combination of sickle-shaped ribs and biconvex constrictions on a discoidal conch. A similar conch, but not decorated with coarse ornamentation, can be seen in *Jerania pusillens*, which also possesses a similar suture line.

***Bouhamedites* Korn, Bockwinkel, Ebbighausen & Klug, 2003**

Type species. *Bouhamedites enigmaticus* Korn, Bockwinkel, Ebbighausen & Klug, 2003

Genus definition. Temertassetiidae with small conch, reaching approximately 40 mm conch diameter; conch ontogeny simple, juvenile stage thickly pachyconic or globular and subinvolute, adult stage discoidal and involute with subacute venter. Ornament with biconvex riblets and intercalatory riblets. Suture line with V-shaped, narrow external lobe (EL w/d ~ 0.60; EL/AL ~ 0.75) and very low median saddle (MS h < 0.20); ventrolateral saddle broadly rounded; adventive lobe wide, V-shaped.

Included species.

enigmaticus: *Bouhamedites enigmaticus* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 87; Anti-Atlas, Morocco.

insalahensis: *Bouhamedites insalahensis* n. sp.; Mouydir, Algeria.

ryckholtii: *Goniatis* *Ryckholtii* De Koninck, 1880, p. 100. Belgium.

Discussion. *Bouhamedites* can easily be separated from the other genera of the family by its subacute venter.

***Bouhamedites insalahensis* n. sp.**

Figures 55, 56

Derivation of name. After the town In Salah north-west of the Mouydir.

Holotype. Specimen MB.C.18772, illustrated in Figure 55.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D2 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. Two specimens, conch diameter 19 and 11 mm.

Diagnosis. *Bouhamedites* with thinly globular conch up to 4 mm dm, thereafter rapidly becoming thickly discoidal at 20 mm dm; conch subinvolute in the early juvenile stage and involute in the adult stage; umbilical margin rounded, venter becoming oxyconic in the adult stage. Ornament with 50 weak, shallow ribs; rib course biconvex with very shallow lateral sinus and wide and deep ventral sinus; rib splitting on the inner flank. Steinkern without constrictions. Suture line with V-shaped, narrow external lobe with slowly diverging flanks; median saddle very low; ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped, very wide.

Table 79. Conch ontogeny (Figs 56A, C–E) of *Bouhamedites insalahensis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm ~ 0.88; uw/dm ~ 0.25)	moderately depressed; very strongly embracing (ww/wh ~ 2.00; IZR ~ 0.50)	low (WER ~ 1.65)
8 mm	thickly pachyconic; involute (ww/dm ~ 0.75; uw/dm ~ 0.15)	weakly depressed; very strongly embracing (ww/wh ~ 1.50; IZR ~ 0.50)	moderate (WER ~ 1.78)
20 mm	thickly discoidal; involute (ww/dm ~ 0.53; uw/dm ~ 0.10)	weakly depressed; very strongly embracing (ww/wh ~ 1.10; IZR ~ 0.50)	moderate (WER ~ 1.78)

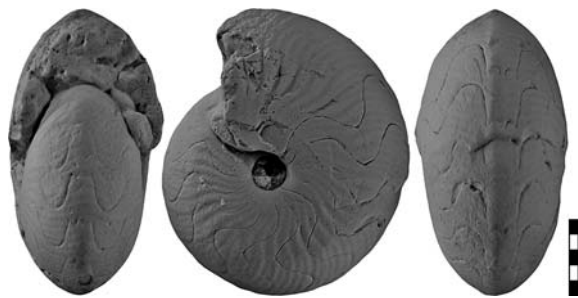
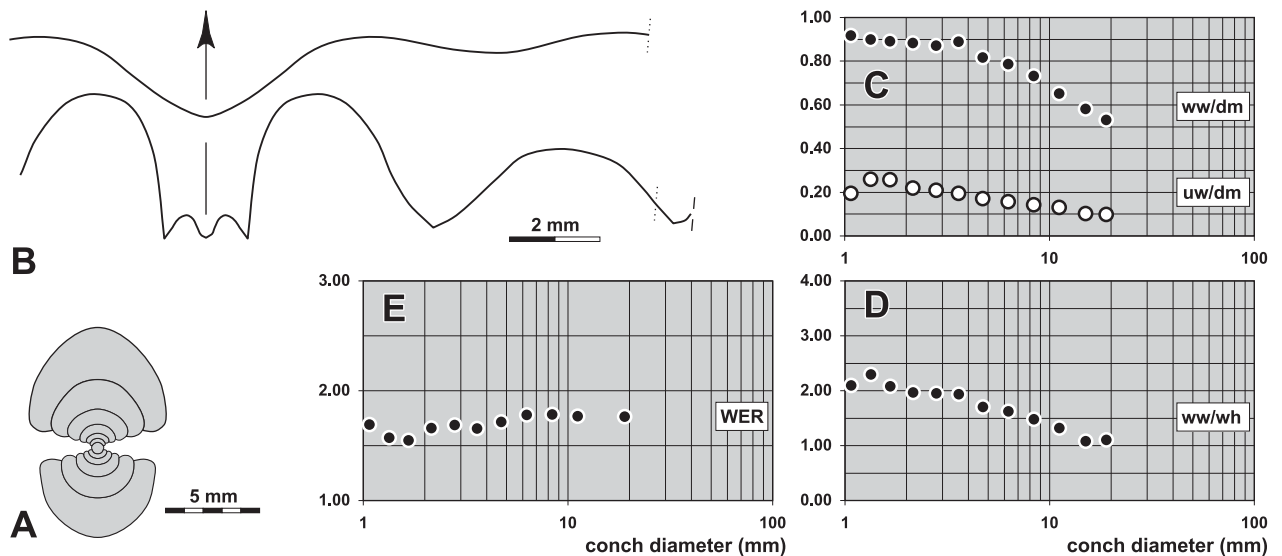
Table 80. Conch dimensions (in mm) and proportions for reference specimens of *Bouhamedites insalahensis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18772	18.9	10.0	9.1	1.9	4.7	0.53	1.10	0.10	1.77	0.49
paratype MB.C.18766	11.2	7.3	5.5	1.5	2.8	0.65	1.32	0.13	1.77	0.50

Table 81. Suture line proportions (Fig. 56B) for *Bouhamedites insalahensis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18772	17.1 mm	0.60	0.67	0.74	0.16	0.89	sutural elements rather low

Discussion. *Bouhamedites insalahensis* differs from the type species *B. enigmaticus* in its thicker conch and the coarser but shallower ribs. *B. ryckholti* is only poorly known and possesses a stouter conch and a narrowly rounded venter.

**Figure 55.** *Bouhamedites insalahensis* n. sp., holotype MB.C.18772 from locality MOU-D2; $\times 2.0$.**Figure 56.** *Bouhamedites insalahensis* n. sp. **A.** Cross section of paratype MB.C.18766 from locality MOU-A; $\times 2.5$. **B.** Suture line and rib course of holotype MB.C.18772 from locality MOU-D2, at 17.1 mm dm, 9.4 mm ww, 9.2 mm wh; $\times 6.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Family Muensteroceratidae Librovitch, 1957

Family definition. Muensteroceratid ammonoids with usually discoidal and involute or subinvolute conch, rarely pachyconic or globular. Suture line with subparallel-sided or parallel-sided external lobe with straight flanks (external lobe V-shaped in ancestral forms); prongs of the external lobe lanceolate; median saddle very low to moderately low.

Included genera.

Muensteroceras Hyatt, 1884

Follotites n. gen.

Xinjiangites Ruan, 1995

Akeshakeceras Liang & Wang, 1991
Cluthoceras Currie, 1954
Eoglyphioceras Brünig, 1923
Itimaites Korn & Ebbighausen, 2006
Terektytes Librovitch, 1957
Beyrichoceratoides Bisat, 1924

***Muensteroceras* Hyatt, 1884**

Type species. Goniatites oweni var. *parallela* Hall, 1860 (OD).

Included species.

barroisi: *Glyphioceras Barroisi* Holzapfel, 1889, p. 30; Rhenish Mountains.
beniabbesense: *Muensteroceras beniabbesense* Korn, Ebbighausen & Bockwinkel, 2010; Saoura Valley, Algeria.
collinsoni: *Muensteroceras collinsoni* Gordon, 1965, p. 178; Arkansas.
compressum: *Muensteroceras kazakhstanicum* var. *compressa* Librovitch, 1940, p. 106; Karaganda.
cordatum: *Glyphioceras cordatum* Crick, 1899, p. 445; Ireland.
esbaughi: *Muensteroceras esbaughi* Miller, Downs & Youngquist, 1949, p. 604; Missouri.
fabrei: *Muensteroceras fabrei* Ebbighausen, Korn & Bockwinkel, 2010; Gourara, Algeria.
frequens: *Muensteroceras frequens* Kusina, 1973, p. 18; North Urals.
inconstans: *Goniatites inconstans* de Koninck, 1880, p. 120; Belgium. [homonym of *Goniatites inconstans* Phillips, 1841; synonym of *M. koninckianum*]
jenkinsi: *Muensteroceras jenkinsi* Campbell, Brown & Coleman, 1983, p. 86; New South Wales.
kazakhstanicum: *Muensteroceras kazakhstanicum* Librovitch, 1940, p. 99; Karaganda.
koninckianum: *Münsteroceras koninckianum* Schindewolf, 1951, p. 64; Belgium.
kozhimense: *Muensteroceras kozhimense* Kusina, 1980, p. 45; North Urals.
malladae: *Goniatites Malladae* Barrois, 1882, p. 293; Cantabrian Mountains.
medium: *Münsteroceras medium* Miller & Collinson, 1951, p. 472; Missouri.
merlewoodense: *Muensteroceras merlewoodense* Campbell, Brown & Coleman, 1983, p. 88; New South Wales.
multiseptatum: *Muensteroceras kazakhstanicum* var. *multiseptata* Librovitch, 1940, p. 108; Karaganda.
multituum: *Muensteroceras multituum* n. sp.; Mouydir, Algeria.
nandanense: *Muensteroceras nandanense* Chao & Liang, 1964, p. 87; Guangxi.
occidentale: *Glyphioceras (Beyrichoceras) occidentale* Foord, 1903, p. 170; Ireland.
oweni: *Goniatites oweni* Hall, 1860, p. 100; Indiana.
pachydiscus: *Muensteroceras pachydiscus* Kusina, 1980, p. 43; North Urals.
parallelum: *Goniatites oweni* var. *parallela* Hall, 1860, p. 100; Indiana.
parvulum: *Muensteroceras parvulum* Kusina, 1983, p. 92; North Urals.
pergibbosum: *Münsteroceras pergibbosum* Miller & Garner, 1955, p. 140; Michigan.
pfefferae: *Imitoceras pfefferae* Miller & Werner, 1942, p. 480; Illinois.
quadriconstrictum: *Muensteroceras quadriconstrictum* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 80; Anti-Atlas.
recticonstrictum: *Muensteroceras recticonstrictum* Kusina, 1973, p. 17; North Urals.
roemeri: *Glyphioceras Roemeri* Holzapfel, 1889, p. 27; Rhenish Mountains.
rowleyi: *Muensteroceras rowleyi* Miller & Furnish, 1958, p. 272; Missouri.
stoliczkai: *Karakoramoceras stoliczkai* Miller, 1931, p. 423; Kashmir.
subparallelum: *Muensteroceras subparallelum* n. sp.; Mouydir, Algeria.
? holmesii: *Goniatites Holmesii* Swallow, 1860, p. 659; Missouri.
? mitchelli: *Münsteroceras mitchelli* Miller, 1935, p. 435; Missouri.
? morganense: *Goniatites Morganensis* Swallow, 1860, p. 659; Missouri.
? pygmaeum: *Münsteroceras pygmaeus* Winchell, 1862, p. 366; Michigan.

Separation of the new species. The two species of *Muensteroceras* from Oued Temertasset can be separated by means of conch morphology and the steinkern constrictions:

- *M. subparallelum* – conch at 8 mm dm thickly discoidal; involute (ww/dm = 0.55–0.60; uw/dm 0.10–0.15); at 20 mm dm thinly discoidal; involute (ww/dm = 0.45–0.50; uw/dm = 0.10–0.15); constrictions rectiradial, usually convex.
- *M. multituum* – conch at 8 mm dm thinly pachyconic; involute or subinvolute (ww/dm = 0.60–0.75; uw/dm = 0.10–0.25); at 18 mm dm thickly discoidal; involute (ww/dm = 0.50–0.58; uw/dm = 0.12–0.15); constrictions prorsiradial, concavo-convex.

Discussion. Many of the species attributed to the genus *Muensteroceras* are insufficiently described and require revision. Characters of the inner whorls, for instance, are poorly known for many of them, casting doubts on their correct assignment. Particularly the stratigraphically younger species with rather stout conches have to be investigated in greater detail, because some of them might belong to the new genera proposed here.

***Muensteroceras subparallelum* n. sp.**

Figures 57, 58

Derivation of name. From Latin parallelus, because of the not perfectly parallel flanks of the external lobe.

Holotype. Specimen MB.C.19058.1, illustrated in Figure 57A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-F (Mouydir, South Algeria); upper *Periclycus-Progoniatites* Assemblage.

Material. 267 specimens, conch diameter up to 41 mm.

Diagnosis. *Muensteroceras* with thickly pachyconic conch in early juveniles, thereafter continuous transformation into a thinly discoidal conch at 20 mm dm; conch subinvolute in the early juvenile stage and involute in stages above 8 mm dm; umbilicus funnel-shaped, umbilical margin subangular, umbilical wall flattened and oblique; aperture low in juveniles and moderately high above 6 mm dm. Steinkern with sharp rectiradiate constrictions, coarse convex or slightly biconvex with extremely shallow lateral sinus and deep ventral sinus; weak riblets occur occasionally between the constrictions. Suture line with very narrow, parallel-sided external lobe and very low median saddle (external lobe with slightly diverging flanks rare in adults and more common in juveniles); ventrolateral saddle broadly rounded and asymmetric; adventive lobe V-shaped, almost symmetric with slightly curved flanks.

Table 82. Conch ontogeny (Figs 58A–F, I–K) of *Muensteroceras subparallelum* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm = 0.70–0.85; uw/dm = 0.22–0.30)	moderately depressed; very strongly embracing (ww/wh = 1.55–1.75; IZR = 0.45–0.50)	low to moderate (WER = 1.65–1.85)
8 mm	thickly discoidal; involute (ww/dm = 0.55–0.60; uw/dm = 0.10–0.15)	weakly depressed; very strongly embracing (ww/wh = 1.10–1.25; IZR = 0.45–0.50)	moderate (WER = 1.80–2.00)
20 mm	thinly discoidal; involute (ww/dm = 0.45–0.50; uw/dm = 0.10–0.15)	weakly compressed; very strongly embracing (ww/wh = 0.85–1.00; IZR = 0.45–0.50)	moderate (WER = 1.75–1.95)
30 mm	thinly discoidal; involute (ww/dm = 0.42–0.48; uw/dm = 0.12–0.15)	weakly compressed; very strongly embracing (ww/wh = 0.85–1.00; IZR = 0.45–0.50)	moderate (WER ~ 1.80)

Table 83. Conch dimensions (in mm) and proportions for reference specimens of *Muensteroceras subparallelum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype 1798	40.4	18.3	19.0	6.6	10.6	0.45	0.96	0.16	1.84	0.44
holotype MB.C.19058.1	25.8	11.3	12.3	4.1	–	0.44	0.92	0.16	–	–
paratype MB.C.18874.1	22.6	10.7	11.0	3.2	5.7	0.47	0.97	0.14	1.79	0.48
paratype MB.C.19058.2	17.1	9.2	8.0	2.4	4.4	0.54	1.16	0.14	1.83	0.44
paratype MB.C.18874.2	13.3	8.1	5.8	2.5	3.2	0.61	1.39	0.19	1.74	0.45

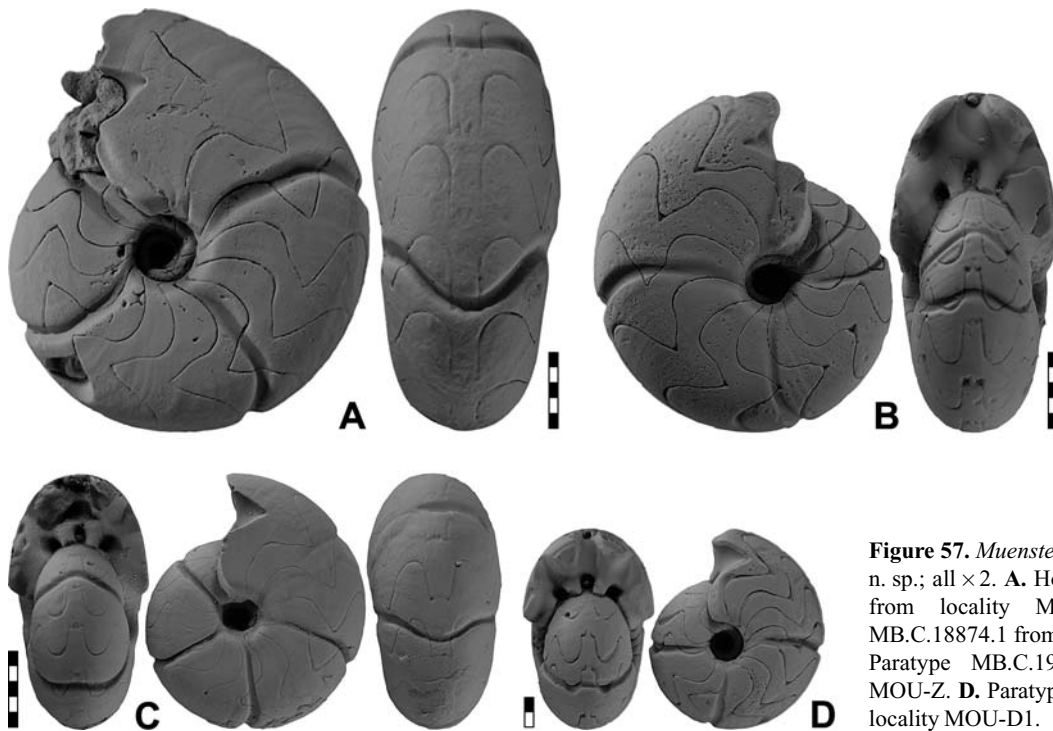


Figure 57. *Muensteroceras subparallelum* n. sp.; all $\times 2$. **A.** Holotype MB.C.19058.1 from locality MOU-F. **B.** Paratype MB.C.18874.1 from locality MOU-D1. **C.** Paratype MB.C.19058.2 from locality MOU-Z. **D.** Paratype MB.C.18874.2 from locality MOU-D1.

Table 84. Suture line proportions (Figs 58G, H) for *Muensteroceras subparallelum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19058.1	23.7 mm	0.38	0.47	0.61	0.17	0.80	A lobe with almost straight flanks
paratype MB.C.18874.1	19.1 mm	0.34	0.44	0.72	0.19	0.78	A lobe with curved flanks

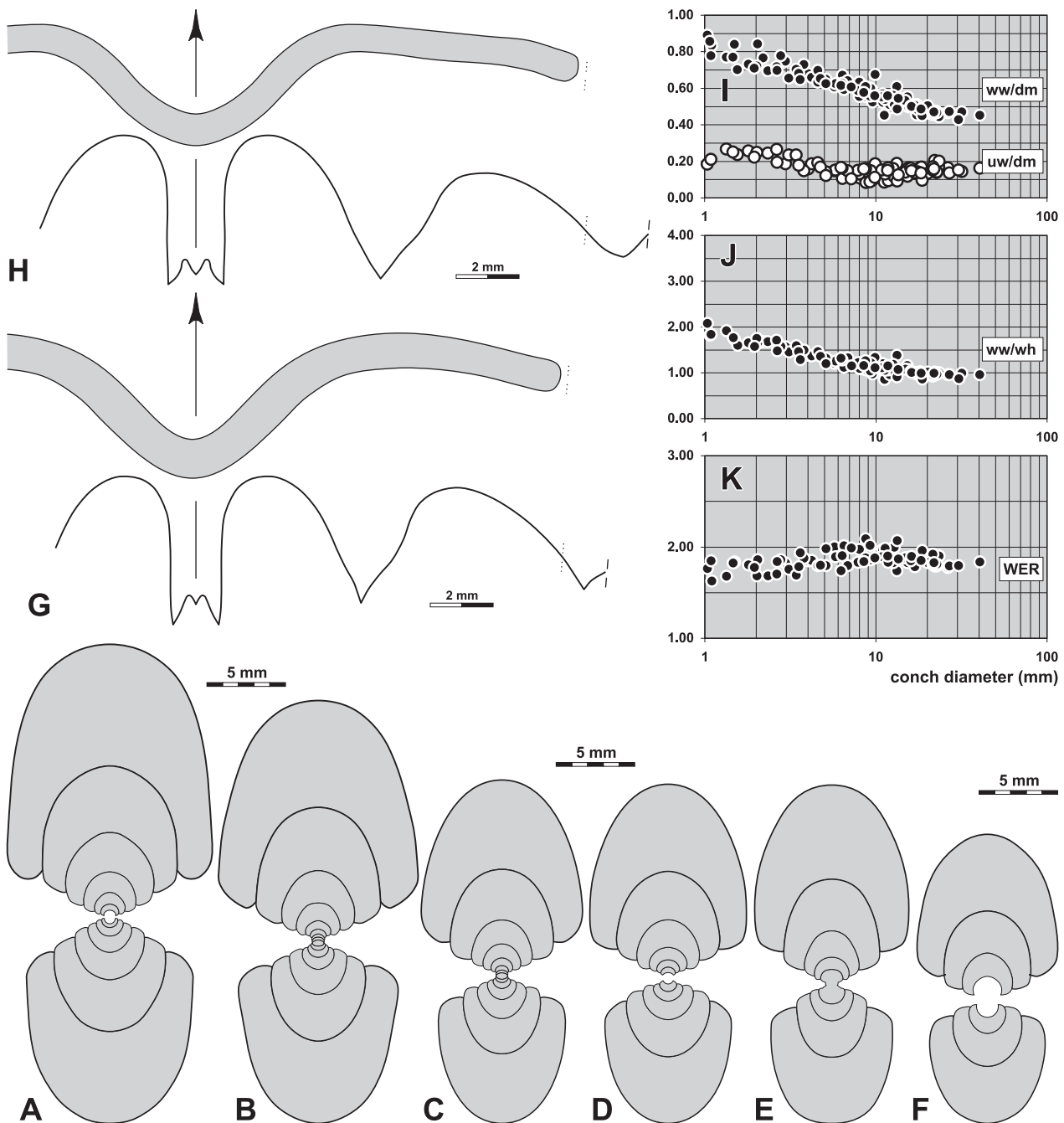


Figure 58. *Muensteroceras subparallelum* n. sp. **A.** Cross section of paratype MB.C.18874.3 from locality MOU-D1; $\times 2.5$. **B.** Cross section of paratype MB.C.18874.4 from locality MOU-D1; $\times 2.5$. **C.** Cross section of paratype MB.C.19058.3 from locality MOU-Z; $\times 2.5$. **D.** Cross section of paratype MB.C.19058.4 from locality MOU-Z; $\times 2.5$. **E.** Cross section of paratype MB.C.19012.1 from locality MOU-F; $\times 2.5$. **F.** Cross section of paratype MB.C.18874.5 from locality MOU-D1; $\times 2.5$. **G.** Suture line and constriction of paratype MB.C.18874.1 from locality MOU-D1, at 19.1 mm dm, 10.5 mm ww, 10.7 mm wh; $\times 5.0$. **H.** Suture line and constriction of holotype MB.C.19058.1 from locality MOU-Z, at 23.7 mm dm, 11.1 mm ww, 11.8 mm wh; $\times 5.0$. **I–K.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Discussion. *Muensteroceras subparallelum* belongs to the narrowly umbilicate species of the genus and is thus separated from most of the other species (see Korn et al. 2003 for a discussion of *M. quadriconstrictum*). *M. quadriconstrictum* from the Anti-Atlas is similar but has a much narrower umbilicus (at 20 mm dm: uw/dm usually less than 0.10 in *M. quadriconstrictum* but around 0.15 in *M. subparallelum*).

M. subparallelum resembles the type species of the genus in the ornament and suture line, but has a more slender juvenile conch (at 10 mm dm: ww/dm = 0.50–0.55 in *M. subparallelum* but 0.65–0.70 in *M. parallelum*).

***Muensteroceras multitudum* n. sp.**

Figures 59, 60

Derivation of name. From Latin multitudum = large number, because of the frequency of the species.

Holotype. Specimen MB.C.18848.1, illustrated in Figure 59D.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 1,170 specimens, conch diameter up to 28 mm.

Diagnosis. *Muensteroceras* with thickly pachyconic conch in the early juvenile stage, almost continuously becoming more slender and being thickly discoidal at 18 mm dm; conch subinvolute in the juvenile stage and later becoming involute; umbilical margin and umbilical wall rounded; aperture low to moderate in juveniles and becoming high during ontogeny. Steinkern with prorsiradiate constrictions, course slightly biconvex with shallow lateral sinus, moderately high ventrolateral projection, and deep ventral sinus. Suture line with very narrow, parallel-sided external lobe and very low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, acute.

Table 85. Conch ontogeny (Figs 60A–H, L–N) of *Muensteroceras multitudum* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm = 0.75–0.85; uw/dm = 0.15–0.25)	moderately depressed; strongly or very strongly embracing (ww/wh = 1.50–1.90; IZR = 0.40–0.50)	low to moderate (WER = 1.65–1.80)
8 mm	thinly to thickly pachyconic; involute or subinvolute (ww/dm = 0.60–0.75; uw/dm = 0.10–0.25)	weakly or moderately depressed; strongly embracing (ww/wh = 1.15–1.65; IZR = 0.30–0.45)	moderate to high (WER = 1.85–2.10)
20 mm	thickly discoidal; involute (ww/dm = 0.50–0.58; uw/dm = 0.12–0.15)	weakly compressed or weakly depressed; strongly embracing (ww/wh = 0.90–1.10; IZR = 0.30–0.40)	high (WER = 2.00–2.15)

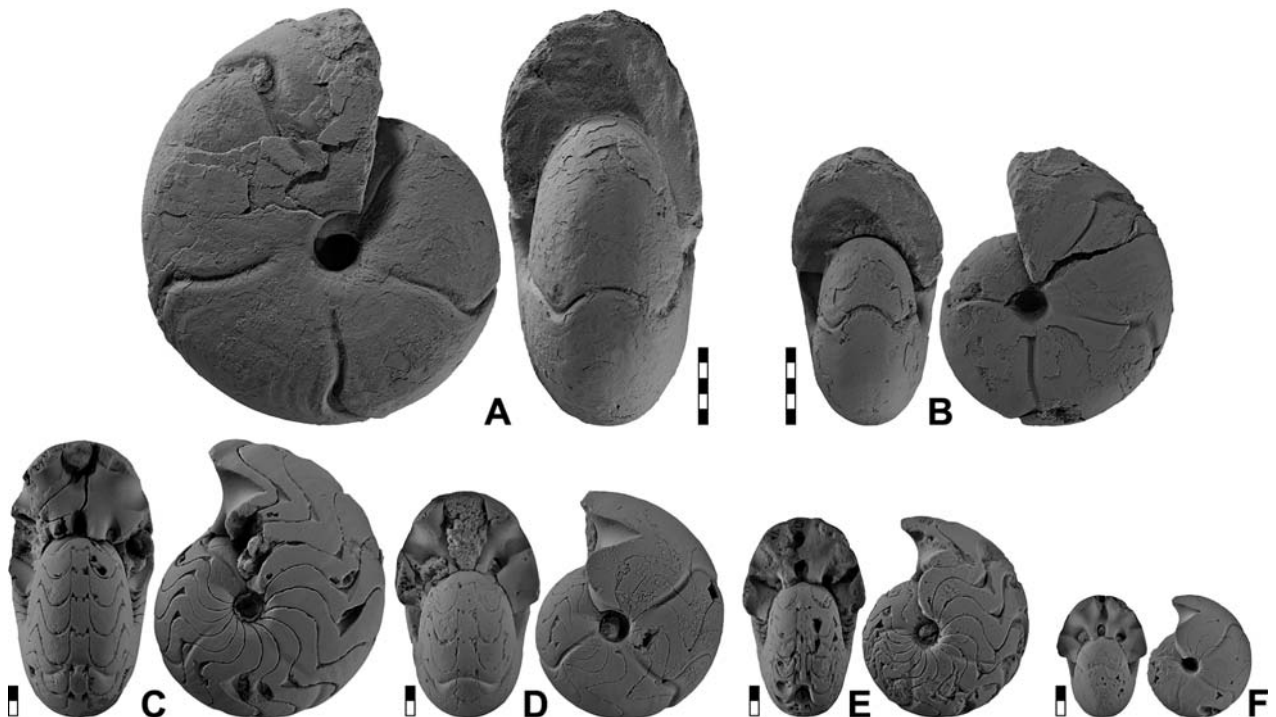


Figure 59. *Muensteroceras multitudum* n. sp.; all $\times 2$. **A.** Paratype MB.C.18818.1 from locality MOU-C3. **B.** Paratype MB.C.18818.2 from locality MOU-C3. **C.** Paratype MB.C.18992.1 from locality MOU-E12. **D.** Holotype MB.C.18848.1 from locality MOU-C. **E.** Paratype MB.C.18848.2 from locality MOU-C. **F.** Paratype MB.C.18848.3 from locality MOU-C.

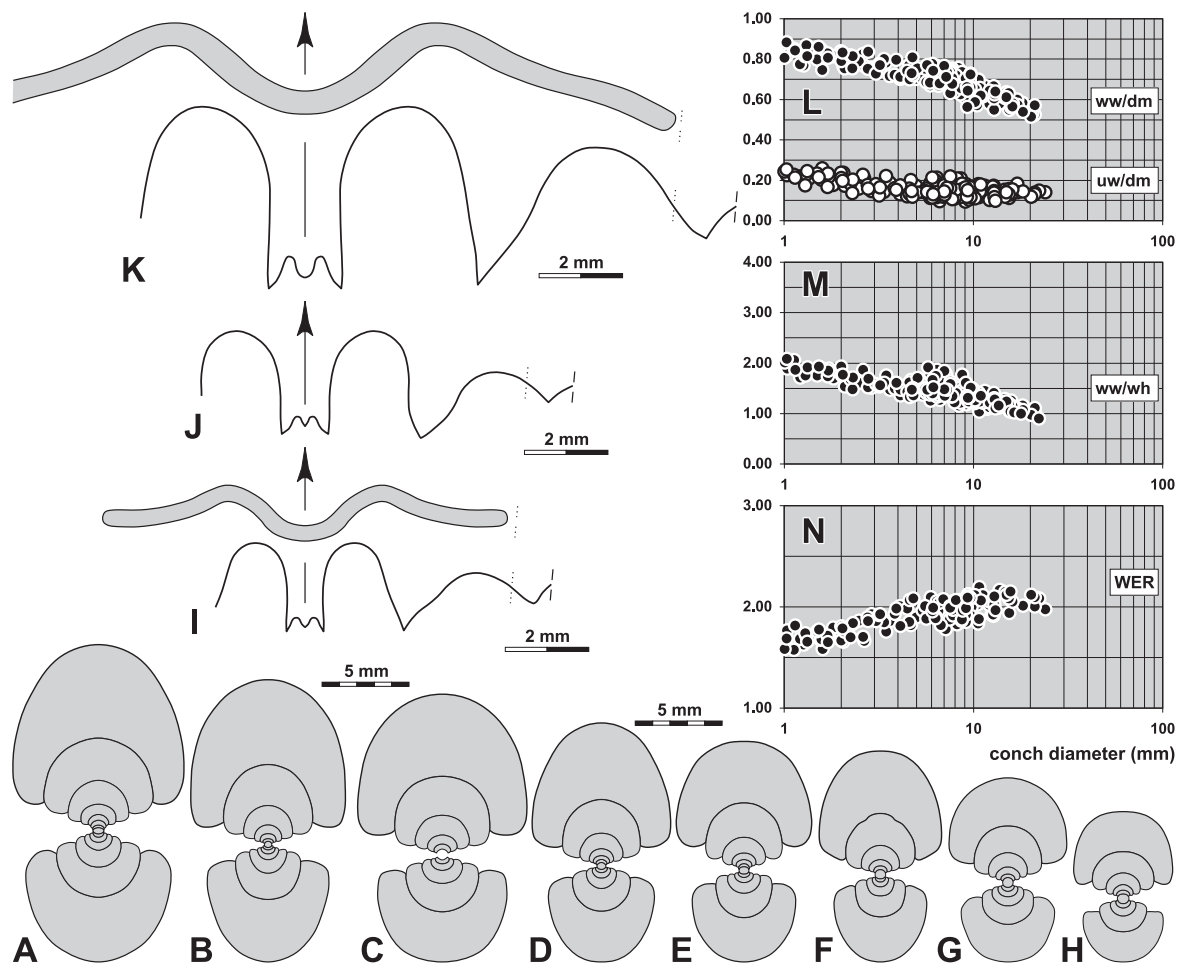


Figure 60. *Muensteroceras multitudum* n. sp. **A.** Cross section of paratype MB.C.19039.1 from locality MOU-X; $\times 2.5$. **B.** Cross section of paratype MB.C.19039.2 from locality MOU-X; $\times 2.5$. **C.** Cross section of paratype MB.C.19039.3 from locality MOU-X; $\times 2.5$. **D.** Cross section of paratype MB.C.19039.4 from locality MOU-X; $\times 2.5$. **E.** Cross section of paratype MB.C.19039.5 from locality MOU-X; $\times 2.5$. **F.** Cross section of paratype MB.C.19039.6 from locality MOU-X; $\times 2.5$. **G.** Cross section of paratype MB.C.19039.7 from locality MOU-X; $\times 2.5$. **H.** Cross section of paratype MB.C.19039.8 from locality MOU-X; $\times 2.5$. **I.** Suture line and constriction of paratype MB.C.18848.3 from locality MOU-C4 + 5, at 7.9 mm dm, 5.6 mm ww, 4.1 mm wh; $\times 6.0$. **J.** Suture line of holotype MB.C.18848.1 from locality MOU-C4 + 5, at 5.9 mm ww, 4.2 mm wh; $\times 6.0$. **K.** Suture line and constriction of holotype MB.C.18848.1 from locality MOU-C4 + 5, at 13.3 mm dm, 8.6 mm ww, 7.5 mm wh; $\times 6.0$. **L–N.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 86. Conch dimensions (in mm) and proportions for reference specimens of *Muensteroceras multitudum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18818.1	27.5	13.3	13.8	3.7	7.8	0.48	0.96	0.14	1.95	0.43
paratype MB.C.18818.2	18.2	9.8	8.9	1.9	5.9	0.54	1.10	0.10	2.18	0.34
paratype MB.C.18992.1	17.1	9.0	8.4	2.0	5.5	0.53	1.08	0.12	2.16	0.35
holotype MB.C.18848.1	15.0	9.1	7.4	2.1	4.7	0.61	1.24	0.14	2.12	0.36
paratype MB.C.18848.2	12.9	7.8	6.0	1.8	3.8	0.61	1.30	0.14	2.02	0.36
paratype MB.C.18848.3	8.1	5.6	4.0	1.0	2.5	0.70	1.40	0.12	2.07	0.39

Table 87. Suture line proportions (Figs 60I–K) for *Muensteroceras multitudum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18848.1	14.9 mm	0.38	0.55	0.98	0.17	0.69	A lobe asymmetric
dto.	c. 8.0 mm	0.50	0.66	0.95	0.17	0.76	A lobe lanceolate
paratype MB.C.18848.3	7.7 mm	0.41	0.56	0.65	0.16	0.73	A lobe V-shaped, wide

Discussion. *Muensteroceras multitudum* has a marginal position within the genus because of its prorsiradiate steinkern constrictions, which separates the new species from all other species that possess, if at all, rectiradiate constrictions.

***Follotites* n. gen.**

Derivation of name. After Jacques Follot, in honour to his discovery of the Tournaisian ammonoid occurrence at Oued Temertasset.

Type species. *Follotites folloti* n. sp.

Genus definition. Muensteroceratidae with rather small conch, reaching 50 mm conch diameter. Conch pachyconic, subinvolute or involute with moderate ontogenetic changes. Steinkern without or with weak convex or concavo-convex constrictions. Suture line with parallel-sided, very narrow external lobe (EL w/d = 0.35–0.45; EL/AL = 0.60–0.90) and very low median saddle (MS h = 0.15–0.20); ventrolateral saddle broadly rounded, slightly asymmetric; adventive lobe V-shaped, slightly asymmetric.

Included species.

flexus: *Follotites flexus* n. sp.; Mouydir, Algeria.

folloti: *Follotites folloti* n. sp.; Mouydir, Algeria.

stelus: *Follotites stelus* n. sp.; Mouydir, Algeria.

Separation of the new species. The three species of *Follotites* from Oued Temertasset can be separated by means of conch morphology and the suture line. In the conch ontogeny, they can be distinguished as follows:

- *F. folloti* – the uw/dm ratio remains, between 1 and 8 mm dm, stable at 0.14–0.20, followed by a slight decrease to 0.07–0.11 in larger stages; the ww/dm ratio is rather stable up to 13 mm dm (0.83–0.88) with a subsequent decrease to 0.70–0.75 at 20–30 mm dm; the aperture height is not constant during ontogeny with a value between 1.80 and 2.00 above 10 mm dm.
- *F. stelus* – the uw/dm ratio amounts, between 1 and 8 mm dm, to approximately 0.14, followed by a slight increase to 0.17–0.24 in larger stages; the ww/dm ratio is rather stable up to 16 mm dm (0.83–0.86) with a subsequent decrease to 0.64–0.68 at 20–30 mm dm; the aperture height is not constant during ontogeny and the whorl expansion rate ranges between 1.60 and 1.80 above 10 mm dm.
- *F. flexus* – the uw/dm ratio ranges, throughout ontogeny, between 0.10 and 0.15, with the exception of a growth interval between 5 and 20 mm dm in which the umbilicus is opened wider (uw/dm up to 0.26); the ww/dm ratio is unstable up to 13 mm dm (0.83–0.98) with a subsequent reduction to 0.65 at 20–30 mm dm; the aperture height is rather constant during ontogeny with a slight increase to 1.80 and 2.00 above 20 mm dm.

The steinkern surface displays more differences:

- *F. folloti* and *F. stelus* – constrictions are, if present at all, very weak; they are convex with a wide and low projection on the flank and a wide and shallow ventral sinus.
- *F. flexus* – constrictions are strong; they form a weak lateral sinus, a low ventrolateral projection, and a wide and shallow ventral sinus.

Discussion. *Follotites* differs from *Muensteroceras* in the much stouter conch and the different ontogeny of the umbilicus; in *Muensteroceras* the umbilicus is normally slightly opened in the adult stage, whereas it is being closed in *Follotites*. Species of *Eurites* possess also a stout conch, but in these species, the umbilicus is almost constantly opened during ontogeny with a temporary acceleration in the intermediate growth stage. *Trimorphoceras* Ebbighausen et al., 2010 shows an adult closure of the umbilicus, but differs from *Follotites* in the much more conspicuous ontogenetic changes.

***Follotites folloti* n. sp.**

Figures 61, 62

Derivation of name. After Jaques Follot.

Holotype. Specimen MB.C.18734.1, illustrated in Figure 61A.

Type locality and horizon. Oued Temertasset, locality and sample A320–5 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 13 specimens, conch diameter up to 35 mm.

Diagnosis. *Follotites* with thickly pachyconic or globular and subinvolute conch up to 8 mm dm, thereafter transformation into a thinly pachyconic and involute adult conch; umbilical margin rounded, umbilical wall convex; aperture low in juveniles and moderate in the adult stage. Steinkern without or with very weak convex constrictions with moderately deep and wide ventral sinus. Suture line with very narrow, subparallel-sided or parallel-sided external lobe and very low median saddle; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe V-shaped, almost symmetric.

Table 88. Conch ontogeny (Figs 62A, E–G) of *Follotites folloti* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm ~ 0.85; uw/dm ~ 0.18)	moderately depressed; very strongly embracing (ww/wh ~ 1.80; IZR ~ 0.50)	low (WER ~ 1.70)
8 mm	thinly globular; subinvolute (ww/dm ~ 0.90; uw/dm ~ 0.15)	moderately depressed; very strongly embracing (ww/wh ~ 1.80; IZR ~ 0.50)	low (WER ~ 1.75)
20 mm	thickly pachyconic; involute (ww/dm = 0.70–0.80; uw/dm = 0.05–0.10)	weakly to moderately depressed; very strongly embracing (ww/wh = 1.40–1.60; IZR = 0.45–0.50)	moderate (WER ~ 1.95)
30 mm	thickly pachyconic; involute (ww/dm ~ 0.75; uw/dm ~ 0.10)	weakly depressed; very strongly embracing (ww/wh ~ 1.40; IZR ~ 0.50)	moderate (WER ~ 1.90)

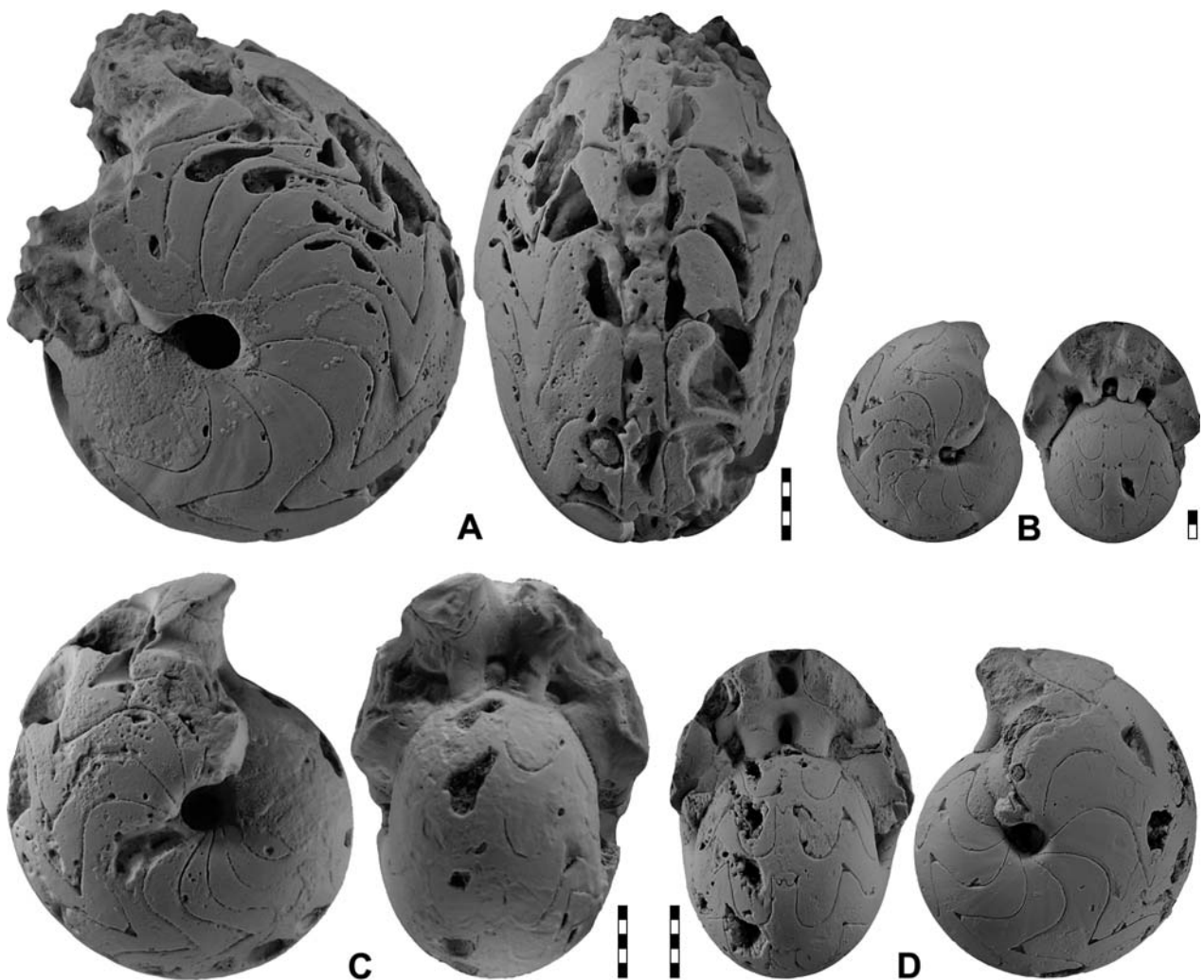
Table 89. Conch dimensions (in mm) and proportions for reference specimens of *Follotites folloti* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18734.1	34.2	25.2	18.5	3.8	9.6	0.74	1.36	0.11	1.93	0.48
paratype MB.C.18734.2	27.4	20.0	14.7	3.1	7.2	0.73	1.36	0.11	1.84	0.51
paratype MB.C.18734.3	23.0	16.6	12.5	1.8	6.1	0.72	1.33	0.08	1.86	0.51
paratype MB.C.18734.5	19.8	15.2	10.4	1.4	5.6	0.77	1.46	0.07	1.93	0.47
paratype MB.C.18792.1	15.3	11.9	9.1	1.0	4.2	0.78	1.32	0.07	1.91	0.53

Table 90. Suture line proportions (Figs 62B–D) for *Follotites folloti* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18734.1	c. 28.0 mm	0.39	0.57	0.81	0.20	0.68	E lobe wider at base
paratype MB.C.18734.2	21.5 mm	0.36	0.46	0.64	0.17	0.79	E lobe exactly parallel-sided
paratype MB.C.18734.3	18.1 mm	0.37	0.52	0.72	0.20	0.72	E lobe wider at base

Discussion. *Follotites folloti* differs from the other species of *Follotites* from the Argiles de Teguentour in the thickly discoidal and involute adult conch, which does not show steinkern constrictions.

**Figure 61.** *Follotites folloti* n. sp.; all $\times 2$. **A.** Holotype MB.C.18734.1 from locality A320–5. **B.** Paratype MB.C.18792.1 from locality MOU-B0. **C.** Paratype MB.C.18734.2 from locality A320–5. **D.** Paratype MB.C.18734.3 from locality A320–5.

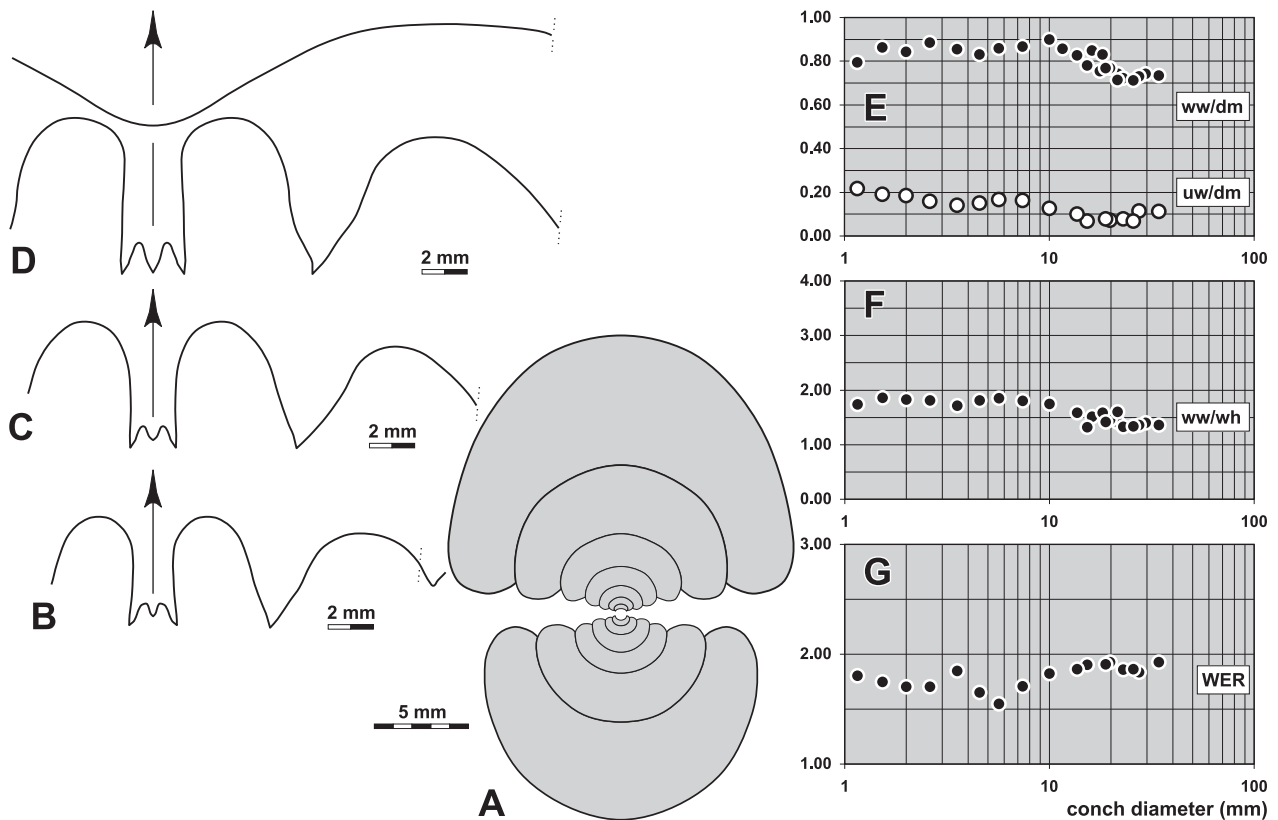


Figure 62. *Follotites folloti* n. sp. from locality A320–5. **A.** Cross section of paratype MB.C.18734.4 from locality A320–5; $\times 2.5$. **B.** Suture line of paratype MB.C.18734.3, at 18.1 mm dm, 15.1 mm ww, 10.5 mm wh; $\times 3.0$. **C.** Suture line of paratype MB.C.18734.2, at 21.5 mm dm, 16.6 mm ww, 11.1 mm wh; $\times 3.0$. **D.** Suture line and growth line course of holotype MB.C.18734.1, at 19.6 mm ww, 12.6 mm wh; $\times 3.0$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Follotites stelus n. sp.

Figures 63, 64

Derivation of name. From Latin stelus = pillar, because of the shape of the external lobe.

Holotype. Specimen MB.C.18793.1, illustrated in Figure 63B.

Type locality and horizon. Oued Temertasset, locality and sample MOU-B6 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 22 specimens, conch diameter up to 35 mm.

Diagnosis. *Follotites* with thickly pachyconic or globular conch up to 16 mm dm, thereafter transforming into a thinly pachyconic adult conch; conch involute in juveniles, becoming subinvolute at 6 mm dm; umbilical margin subangular, umbilical wall convex; aperture moderate in juveniles and low in the adult stage. Steinkern without or with very weak convex constrictions with moderately deep and wide ventral sinus. Suture line with very narrow, subparallel-sided external lobe and very low median saddle; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe V-shaped, slightly asymmetric.

Table 91. Conch ontogeny (Figs 64A, B, D–F) of *Follotites stelus* n. sp.

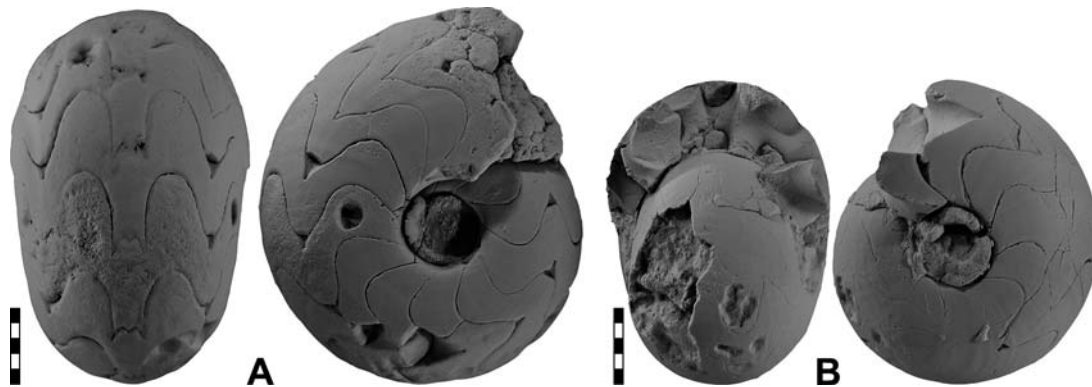
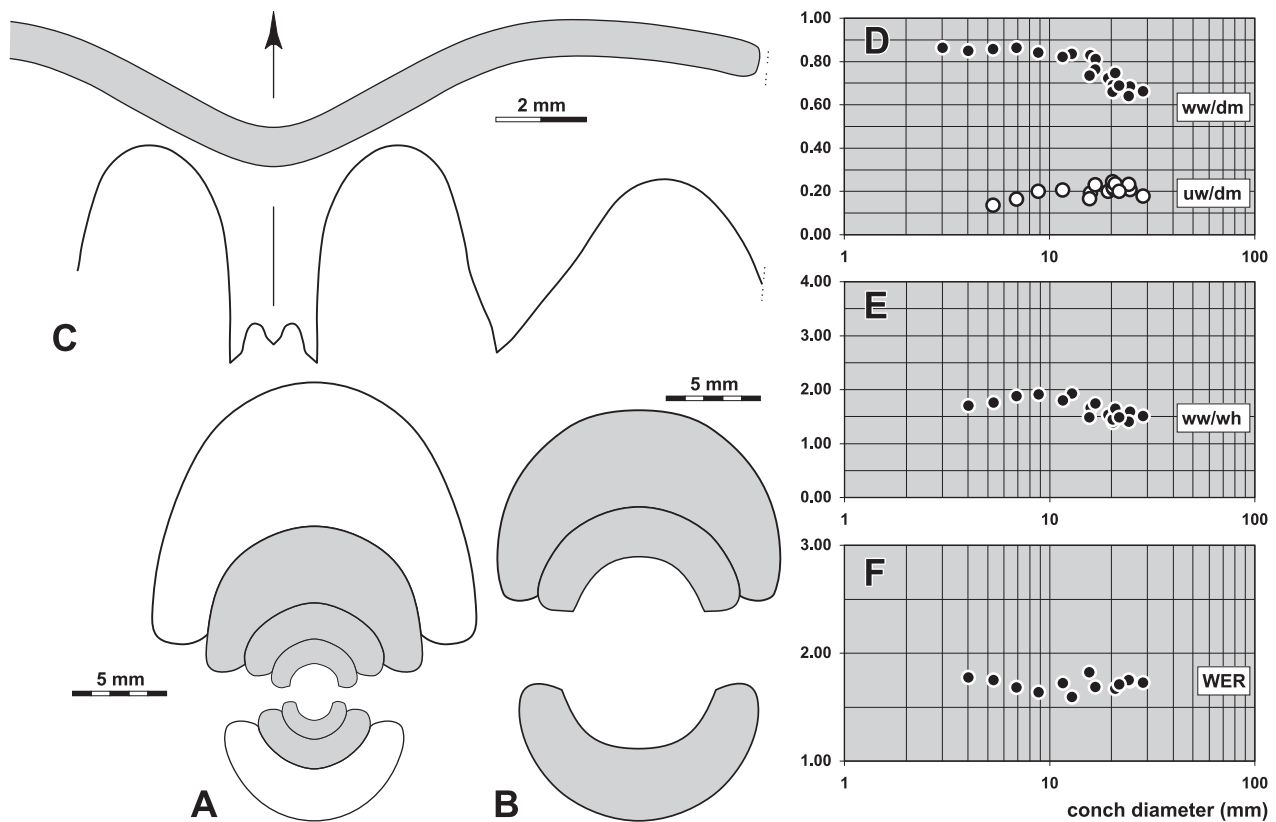
dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; involute (ww/dm ~ 0.85 ; uw/dm ~ 0.14)	moderately depressed; very strongly embracing (ww/wh ~ 1.70 ; IZR ~ 0.50)	moderate (WER ~ 1.80)
8 mm	thinly globular; subinvolute (ww/dm ~ 0.85 ; uw/dm ~ 0.20)	moderately depressed; very strongly embracing (ww/wh ~ 1.90 ; IZR ~ 0.50)	low (WER ~ 1.65)
20 mm	thinly to thickly pachyconic; subinvolute (ww/dm = 0.65 – 0.75 ; uw/dm = 0.20 – 0.25)	weakly to moderately depressed; very strongly embracing (ww/wh = 1.40 – 1.65 ; IZR ~ 0.50)	low (WER ~ 1.70)
30 mm	thinly pachyconic; subinvolute (ww/dm ~ 0.65 ; uw/dm ~ 0.18)	weakly depressed; very strongly embracing (ww/wh ~ 1.50 ; IZR ~ 0.45)	low (WER ~ 1.70)

Table 92. Conch dimensions (in mm) and proportions for reference specimens of *Follotites stelus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18769.1	24.3	15.6	11.1	5.7	5.9	0.64	1.40	0.23	1.75	0.47
holotype MB.C.18793.1	20.9	15.6	9.5	4.9	4.7	0.75	1.65	0.24	1.67	0.50

Table 93. Suture line proportions (Fig. 64C) for *Follotites stelus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18793.1	17.5 mm	0.43	0.64	0.79	0.18	0.67	flanks of E lobe slightly incurved

**Figure 63.** *Follotites stelus* n. sp.; all $\times 2$. **A.** Paratype MB.C.18769.1 from locality MOU-A. **B.** Holotype MB.C.18793.1 from locality MOU-B6.**Figure 64.** *Follotites stelus* n. sp. **A.** Cross section of paratype MB.C.18793.2 from locality MOU-B0; $\times 2.5$. **B.** Cross section of paratype MB.C.18793.3 from locality MOU-B0; $\times 2.5$. **C.** Suture line and constriction of holotype MB.C.18793.1 from locality MOU-B6, at 17.5 mm dm, 13.9 mm ww, 7.9 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Follotites flexus* n. sp.**

Figures 65, 66

Derivation of name. From Latin flexus = bow, because of the wide ventral sinus of the constrictions.

Holotype. Specimen MB.C.18735.1, illustrated in Figure 65A.

Type locality and horizon. Oued Temertasset, locality and sample A320–5 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 13 specimens, conch diameter up to 35 mm.

Diagnosis. *Follotites* with thickly pachyconic or globular conch up to 12 mm dm, thereafter transforming into a thinly pachyconic adult conch; conch involute with a subinvolute interval between 5 and 20 mm dm; umbilical margin narrowly rounded, umbilical wall convex; aperture moderately high throughout ontogeny. Steinkern with very weak concavo-convex constrictions with low and wide ventral sinus. Suture line with very narrow, subparallel-sided external lobe and very low median saddle; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe V-shaped, slightly asymmetric.

Table 94. Conch ontogeny (Figs 66A, B, D–F) of *Follotites flexus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; involute (ww/dm ~ 0.90; uw/dm ~ 0.14)	moderately depressed; very strongly embracing (ww/wh ~ 1.80; IZR ~ 0.50)	moderate (WER ~ 1.80)
8 mm	thinly globular; subinvolute (ww/dm ~ 0.90; uw/dm ~ 0.25)	strongly depressed; very strongly embracing (ww/wh ~ 2.05; IZR ~ 0.50)	moderate (WER ~ 1.80)
20 mm	thinly pachyconic; subinvolute (ww/dm = 0.64–0.73; uw/dm = 0.15–0.20)	weakly depressed; very strongly embracing (ww/wh = 1.20–1.45; IZR ~ 0.50)	moderate (WER ~ 1.80)
30 mm	thinly pachyconic; involute (ww/dm ~ 0.65; uw/dm ~ 0.10)	weakly depressed; very strongly embracing (ww/wh ~ 1.25; IZR ~ 0.50)	moderate (WER ~ 1.90)

Table 95. Conch dimensions (in mm) and proportions for reference specimens of *Follotites flexus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18735.5	34.7	22.3	18.7	3.7	9.1	0.64	1.19	0.11	1.84	0.51
paratype MB.C.18735.6	23.9	15.2	12.1	3.3	6.0	0.64	1.25	0.14	1.79	0.50
holotype MB.C.18735.1	23.7	15.6	12.9	3.5	6.8	0.66	1.21	0.15	1.96	0.48

Table 96. Suture line proportions (Fig. 66C) for *Follotites flexus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18735.1	c. 16.0 mm	0.38	0.52	0.89	0.20	0.73	flanks of E lobe slightly incurved

**Figure 65.** *Follotites flexus* n. sp. from locality A320–5; all $\times 2$. **A.** Holotype MB.C.18735.1. **B.** Paratype MB.C.18735.2.

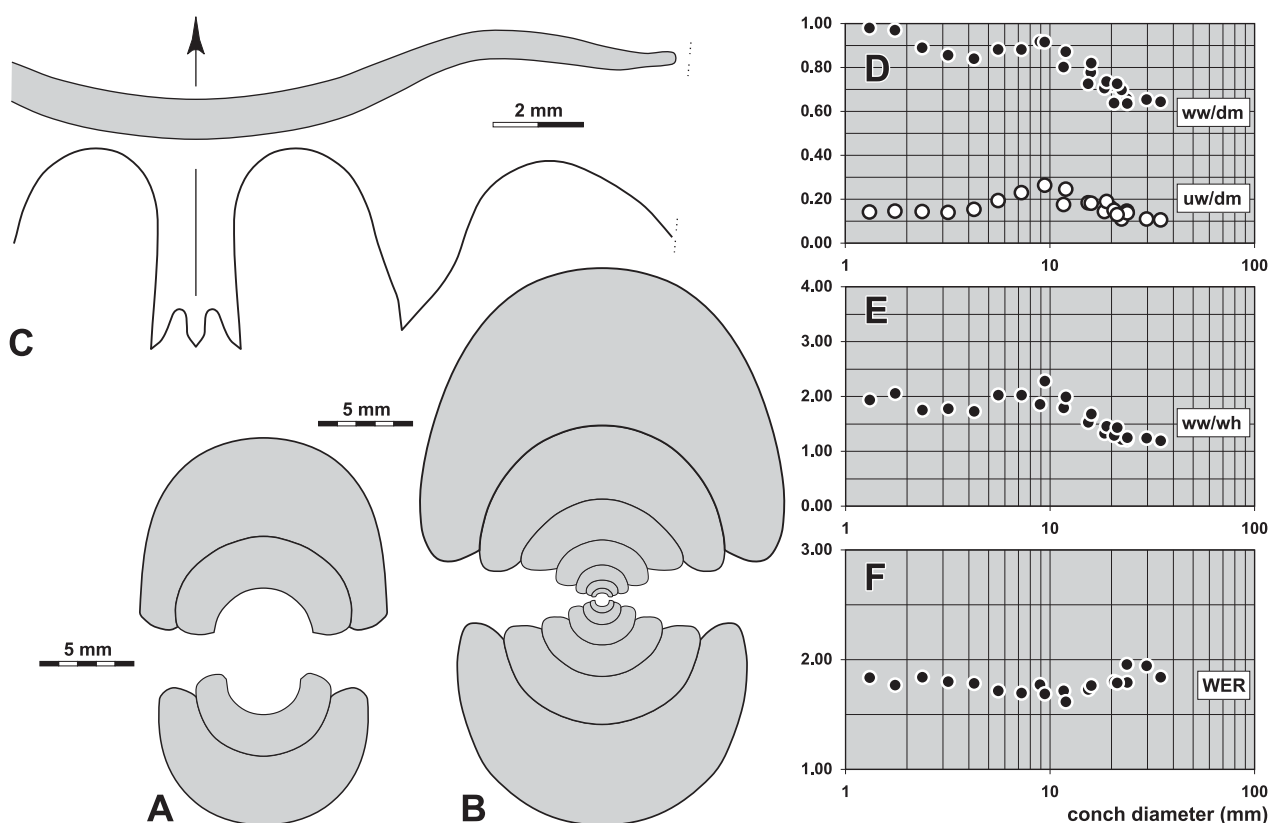


Figure 66. *Follotites flexus* n. sp. **A.** Cross section of paratype MB.C.18735.3 from locality A320–5; $\times 2.5$. **B.** Cross section of paratype MB.C.18735.4 from locality A320–5; $\times 2.5$. **C.** Suture line and constriction of holotype MB.C.18735.1 from locality A320–5, at 11.5 mm ww, 8.5 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Family **Rotopericyclidae** n. fam.

Family definition. Pericyclaceae with a conch ontogeny that includes an increase of the uw/dm ratio, beginning in the adult stage and progressing onto juveniles. Suture line with parallel-sided or V-shaped external lobe with subparallel flanks.

Included subfamilies.

Rotopericyclinae n. subfam.

Trimorphoceratinae Ebbighausen, Korn & Bockwinkel, 2010

Discussion. The spectrum of characters of the new family suggests that it derived from the family Muensteroceratidae by the modification of the conch ontogeny. While the conch ontogeny in the Muensteroceratidae is rather simple with a more or less stable umbilical width, an almost continuous decrease of the ww/dm and ww/wh ratio, and an almost continuous increase of the whorl expansion rate, it is much more complex in the Rotopericyclidae.

Subfamily **Rotopericyclinae** n. subfam.

Subfamily definition. Rotopericyclidae with a conch ontogeny that includes an increase of the uw/dm ratio in the intermediate or adult stage, without significant re-closure of the umbilicus in the adult stage.

Included genera.

Eurites Kusina, 1973

Mouydiria n. gen.

Rotopericyclus Turner, 1948

Rhnetites Bockwinkel, Korn & Ebbighausen, 2010

Parahammatocyclus Riley, 1996

Discussion. The members of the subfamily differ from the subfamily Trimorphoceratinae in the lack of an adult stage with re-closure of the umbilicus.

***Eurites* Kusina, 1973**

Type species. *Eurites latus* Kusina, 1973 (OD).

Genus definition. Rotopericyclidae with significant ontogenetic changes in the conch; shape pachyconic or globular, involute or subinvolute in juveniles and the adult stage, intermediate stage with striking opening of the umbilicus; flanks and venter broadly rounded with C-shaped whorl cross section; umbilical wall often flattened, umbilical margin narrowly rounded or subangular. Ornament with very fine, concavo-convex recti-radiate growth-lines with subangular ventrolateral projection and rather deep ventral sinus; often with shell constrictions parallel to the growth lines. Suture line with very narrow, parallel-sided external lobe and very low or low median saddle; ventrolateral saddle broadly rounded; adventive lobe V-shaped, symmetric or slightly asymmetric.

Included species.

commutatus: *Eurites commutatus* Ebbighausen, Korn & Bockwinkel, 2010; Gourara, Algeria.

corpulentissimus: *Münsteroceras corpulentissimum* Schindewolf, 1951: 65. Harz.

corpulentus: *Glyphioceras corpulentum* Crick, 1899: 447. Ireland.

doliaris: *Eurites doliaris* n. sp.; Mouydir, Algeria.

ellipsoidalis: *Glyphioceras ellipsoidale* Crick, 1899: 499. Ireland.

inflatus: *Münsteroceras inflatum* Delépine, 1940: 53. Belgium.

kusinae: *Eurites kusinae* Work & Nassichuk, 2000: 41. British Columbia.

latus: *Eurites latus* Kusina, 1973: 22. North Urals.

obesus: *Glyphioceras (Beyrichoceras) obesum* Foord, 1903: 198. Ireland.

permutus: *Eurites permutus* n. sp.; Mouydir, Algeria.

pondus: *Eurites pondus* Ebbighausen, Korn & Bockwinkel, 2010; Gourara, Algeria.

saginitus: *Münsteroceras saginitum* Gordon, 1957: 35. Alaska.

? *browni:* *Goniatis Browni* M'Coy, 1844: 12. Ireland.

Separation of the new species. The two species of *Eurites* from Oued Temertasset can be separated by means of conch morphology and the suture line. In the conch ontogeny, they can be distinguished as follows:

- *E. permutus* – the uw/dm ratio decreases almost continuously from 0.20 at 2 mm dm to 0.13–0.20 at 5 mm dm, thereafter an increase to 0.17–0.26 takes place until 20 mm dm; the ww/dm ratio decreases from 0.77–0.85 at 2 mm dm to 0.54–0.68 at 20 mm dm.
- *E. doliaris* – the uw/dm ratio increases almost continuously from 0.20 at 2 mm dm to 0.30 at 20 mm dm; the ww/dm ratio decreases, during the same interval, continuously from 0.80–0.90 to 0.70–0.75.

The suture line offers more differences:

- *E. permutus* – the external lobe has parallel flanks.
- *E. doliaris* – the external lobe has slightly incurved flanks; the adventive lobe is almost symmetric.

Discussion. The ontogenetic development of the species within the genus *Eurites* is known in great detail only from the two new Algerian species, and hence it is not clear if all the listed species in fact belong to this genus. A species that shows the ontogenetic loop with temporary opening of the umbilicus is *E. corpulentissimus* (Schindewolf, 1951), which, according to the figures and measurement list provided by Schindewolf (1951), resembles the Algerian species.

The type species *E. latus* Kusina, 1973 from the North Urals possesses a clear trend of strong umbilical opening during intervals of its ontogeny, but a closure of the umbilicus cannot be seen.

***Eurites permutus* n. sp.**

Figures 67, 68

Derivation of name. From Latin *permutus* = change, because of the significant ontogenetic changes.

Holotype. Specimen MB.C.19040.1, illustrated in Figure 67A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-X (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 383 specimens, conch diameter up to 44 mm.

Diagnosis. *Eurites* with thickly pachyconic conch in the early juvenile stage, becoming more slender during ontogeny and being thickly discoidal at 20 mm dm; conch subinvolute throughout ontogeny with an involute interval between 3 and 7 mm dm; umbilical margin subangular, umbilical wall steep; aperture low or moderate throughout ontogeny. Steinkern with concavo-convex, prorsiradiate constrictions with moderately high ventrolateral projection and moderately deep ventral sinus. Suture line with very narrow, parallel-sided external lobe and very low or low median saddle; ventrolateral saddle almost symmetric, broadly rounded; adventive lobe V-shaped, symmetric or asymmetric.

Table 97. Conch ontogeny (Figs 68A–D, H–J) of *Eurites permutus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm = 0.78–0.85; uw/dm ~ 0.20)	moderately depressed; very strongly embracing (ww/wh ~ 1.65; IZR = 0.45–0.50)	low to moderate (WER = 1.60–1.80)
8 mm	thickly pachyconic; involute or subinvolute (ww/dm = 0.70–0.80; uw/dm = 0.10–0.25)	weakly to moderately depressed; very strongly embracing (ww/wh = 1.25–1.75; IZR = 0.45–0.50)	low to moderate (WER = 1.70–2.00)
20 mm	thickly discoidal to thinly pachyconic; subinvolute (ww/dm = 0.54–0.68; uw/dm = 0.15–0.25)	weakly to moderately depressed; strongly embracing (ww/wh = 1.20–1.60; IZR = 0.40–0.45)	low to moderate (WER = 1.70–1.90)

Table 98. Conch dimensions (in mm) and proportions for reference specimens of *Eurites permutus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19040.1	19.8	12.8	9.1	4.2	4.9	0.65	1.41	0.21	1.77	0.46
paratype MB.C.18993.1	17.3	11.9	8.5	3.6	4.2	0.69	1.40	0.21	1.73	0.51
paratype MB.C.18978.1	14.0	10.5	7.0	3.1	3.5	0.75	1.49	0.22	1.78	0.50
paratype MB.C.18835.1	11.1	8.0	5.4	2.4	2.9	0.72	1.48	0.22	1.82	0.47
paratype MB.C.19040.2	7.7	5.9	3.4	1.7	1.8	0.77	1.76	0.23	1.72	0.46

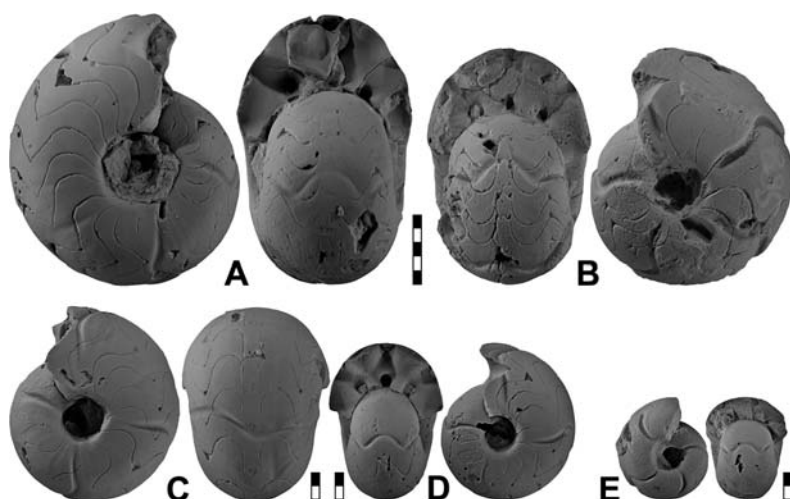
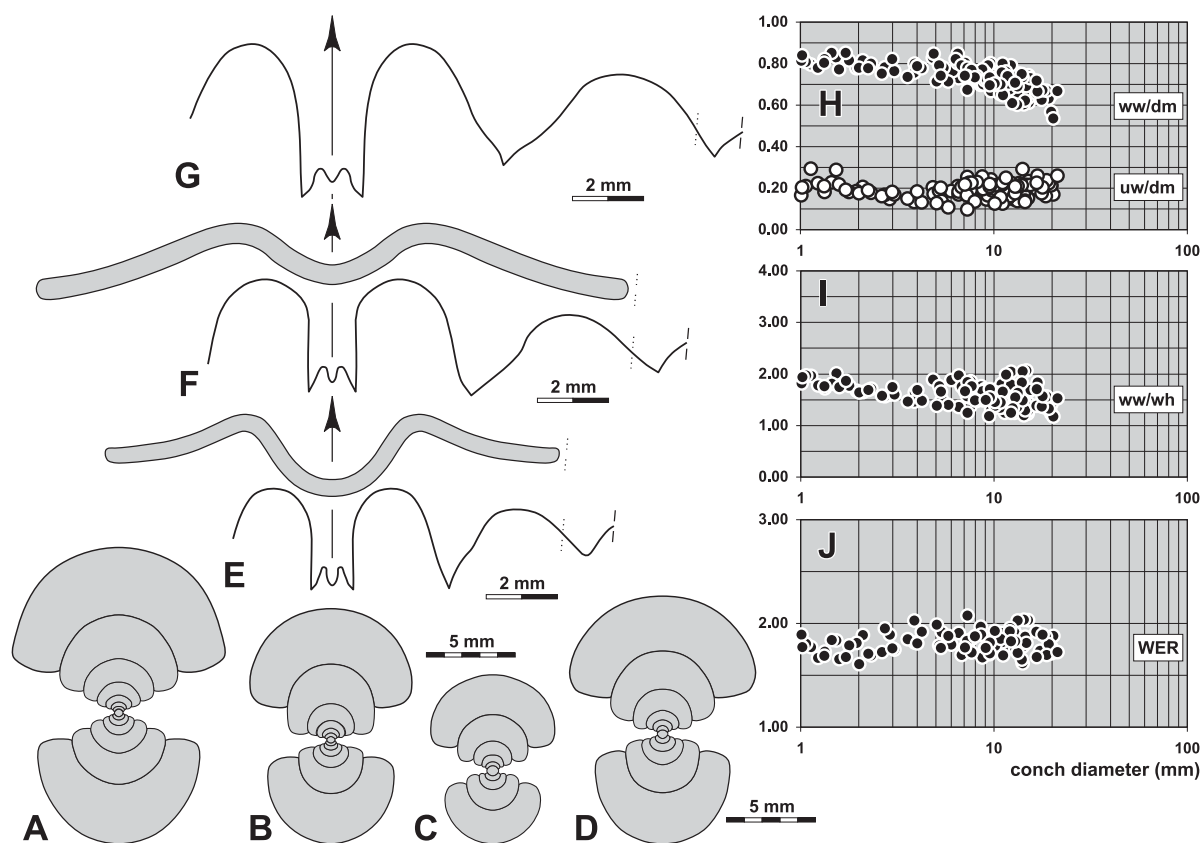
**Figure 67.** *Eurites permutus* n. sp.; all $\times 2$. **A.** Holotype MB.C.19040.1 from locality MOU-X. **B.** Paratype MB.C.18993.1 from locality MOU-E12. **C.** Paratype MB.C.18978.1 from locality MOU-E10. **D.** Paratype MB.C.18835.1 from locality MOU-C5. **E.** Paratype MB.C.19040.2 from locality MOU-X.**Figure 68.** *Eurites permutus* n. sp. **A.** Cross section of paratype MB.C.18849.1 from locality MOU-C4+5; $\times 2.5$. **B.** Cross section of paratype MB.C.19040.3 from locality MOU-X; $\times 2.5$. **C.** Cross section of paratype MB.C.19040.4 from locality MOU-X; $\times 2.5$. **D.** Cross section of paratype MB.C.19040.5 from locality MOU-X; $\times 2.5$. **E.** Suture line and constriction of paratype MB.C.18835.1 from locality MOU-C5, at 11.0 mm dm, 7.9 mm ww, 5.3 mm wh; $\times 5.0$. **F.** Suture line and constriction of paratype MB.C.18978.1 from locality MOU-E12, at 14.0 mm dm, 10.4 mm ww, 7.0 mm wh; $\times 5.0$. **G.** Suture line of holotype MB.C.19040.1 from locality MOU-X, at 19.0 mm dm, 12.5 mm ww, 9.0 mm wh; $\times 5.0$. **H–J.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 99. Suture line proportions (Figs 68E–G) for *Eurites permutus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19040.1	19.0 mm	0.44	0.62	0.68	0.18	0.71	A lobe very wide, symmetric
paratype MB.C.18978.1	14.0 mm	0.42	0.50	0.62	0.22	0.84	A lobe asymmetric
paratype MB.C.18835.1	11.0 mm	0.40	0.52	0.89	0.22	0.78	A lobe V-shaped, narrow

Discussion. *Eurites permutus* can be regarded as one of the earliest species of the genus, where the opening rate of the umbilicus is rather low. However, the cross sections show the trend towards opening of the umbilicus, and hence, the new species is attributed to *Eurites*.

***Eurites doliaris* n. sp.**

Figures 69, 70

Derivation of name. From Latin doliaris = barrel-like (or barrel-shaped), because of the conch shape.

Holotype. Specimen MB.C.18994, illustrated in Figure 69A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-E12 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 90 specimens, conch diameter up to 37 mm.

Diagnosis. *Eurites* with thickly pachyconic or globular conch in early juveniles, becoming slowly more slender during ontogeny; conch subinvolute in the juvenile stage and subevolute at 20 mm dm; umbilical margin subangular, umbilical wall rounded; aperture low or moderate throughout ontogeny. Steinkern with concavo-convex, prorsiradiate constrictions with moderately high ventrolateral projection and deep ventral sinus. Suture line with very narrow, parallel-sided external lobe with slightly incurved flanks and very low or low median saddle; ventrolateral saddle slightly asymmetric, broadly rounded; adventive lobe V-shaped with weakly curved flanks.

Table 100. Conch ontogeny (Figs 70A–C, F–H) of *Eurites doliaris* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic to thinly globular; subinvolute (ww/dm = 0.80–0.90; uw/dm ~ 0.20)	moderately depressed; very strongly embracing (ww/wh = 1.80–2.00; IZR = 0.45–0.50)	low (WER ~ 1.70)
8 mm	thickly pachyconic to thinly globular; subinvolute to subevolute (ww/dm = 0.72–0.88; uw/dm = 0.20–0.35)	moderately to strongly depressed; strongly to very strongly embracing (ww/wh = 1.75–2.25; IZR = 0.40–0.50)	low to moderate (WER = 1.60–1.85)
20 mm	thinly to thickly pachyconic; subevolute (ww/dm = 0.65–0.75; uw/dm = 0.30–0.35)	moderately depressed; strongly embracing (ww/wh = 1.50–2.00; IZR = 0.40–0.45)	low (WER ~ 1.70)

Table 101. Conch dimensions (in mm) and proportions for reference specimens of *Eurites doliaris* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18994	11.4	8.8	4.7	3.4	2.7	0.78	1.87	0.30	1.74	0.42
paratype MB.C.19041.1	10.7	8.1	4.4	2.9	2.8	0.76	1.84	0.27	1.85	0.36
paratype MB.C.18815.1	10.1	8.5	3.8	3.3	2.4	0.84	2.22	0.33	1.72	0.37
paratype MB.C.19041.2	9.9	7.7	4.2	3.0	2.3	0.78	1.84	0.30	1.70	0.45

Table 102. Suture line proportions (Figs 70D, E) for *Eurites doliaris* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18994	11.4 mm	0.43	0.57	0.87	0.25	0.76	A lobe shallow
paratype MB.C.18815.1	10.5 mm	0.46	0.49	0.86	0.19	0.94	A lobe very deep

Discussion. *Eurites doliaris* differs from *E. commutatus* of the Dalle à *Merocanites* in the constant increase of the uw/dm ratio and the decrease of the ww/dm rate above 15 mm dm (increasing in *E. commutatus*). *E. pondus* has also a rather constant increase of the uw/dm ratio, but differs in the angular umbilical margin and the wider conch. A comparison is difficult because of the significant size difference between the two occurrences; the largest specimens of *E. doliaris* reach only 23 mm in conch diameter, whereas *E. commutatus* and *E. pondus* specimens have diameters measuring up to three times larger.

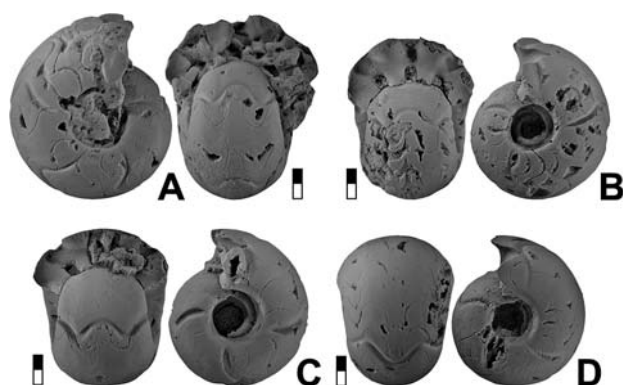


Figure 69. *Eurites doliaris* n. sp.; all $\times 2$. **A.** Holotype MB.C.18994 from locality MOU-E12. **B.** Paratype MB.C.19041.1 from locality MOU-X. **C.** Paratype MB.C.18815.1 from locality MOU-C2. **D.** Paratype MB.C.19041.2 from locality MOU-X.

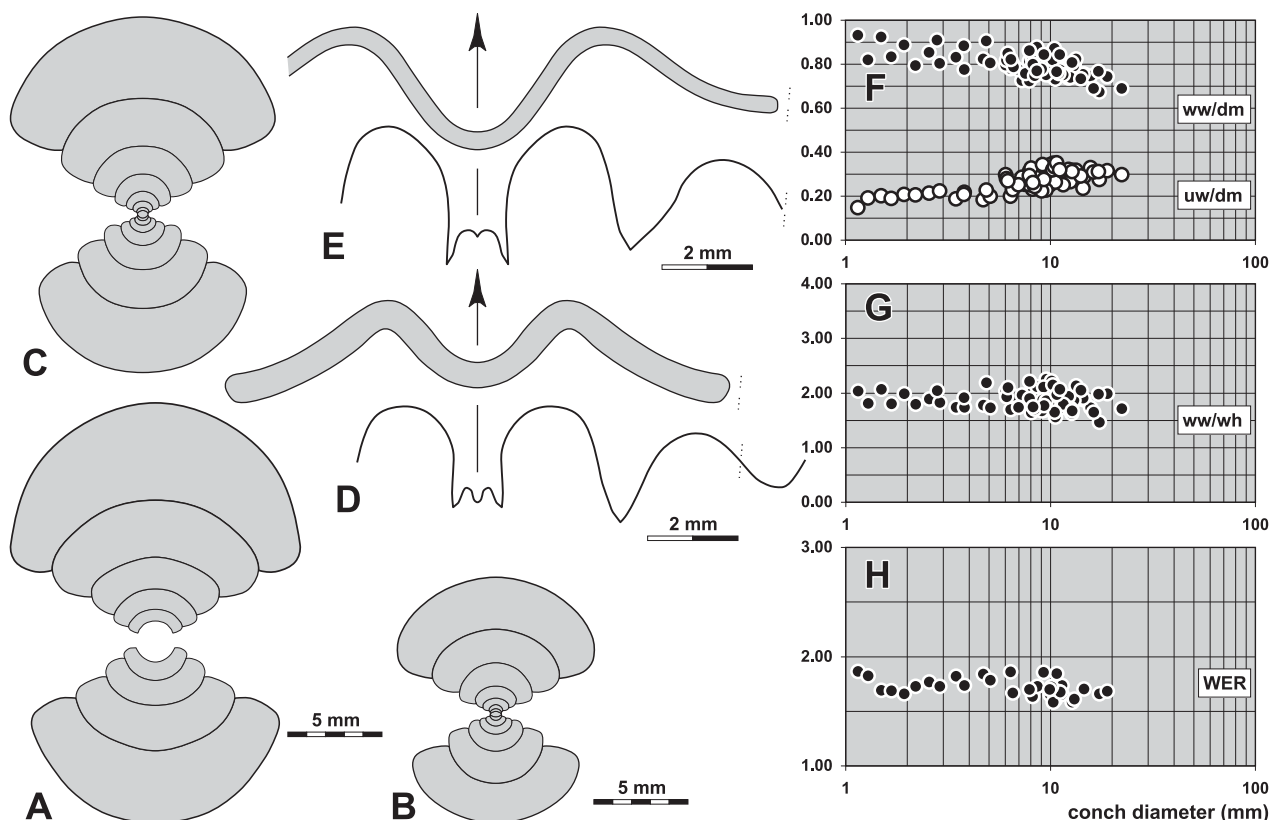


Figure 70. *Eurites doliaris* n. sp. **A.** Cross section of paratype MB.C.18850.1 from locality MOU-C4+5; $\times 2.5$. **B.** Cross section of paratype MB.C.18987 from locality MOU-E11; $\times 2.5$. **C.** Cross section of paratype MB.C.19041.3 from locality MOU-X; $\times 2.5$. **D.** Suture line and constriction of paratype MB.C.18815.1 from locality MOU-C2, at 11.5 mm ww, 8.5 mm wh; $\times 6.0$. **E.** Suture line and constriction of holotype MB.C.18994 from locality MOU-E12, at 11.5 mm ww, 8.5 mm wh; $\times 6.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Mouydiria n. gen.

Derivation of name. After the type region.

Type species. *Mouydiria mouydirensis* n. sp.

Genus definition. Rotopericyclidae with rather small, pachyconic or thickly discoidal conch, reaching a conch diameter of up to 50 mm. Early whorls subinvolute, ontogenetic opening of the umbilicus to form a subvolute conch. Steinkern with prominent convex or almost linear constrictions; rounded nodes on the umbilical margin. Suture line with parallel-sided, very narrow external lobe (EL w/d = 0.40–0.50; EL/AL = 0.80–1.00) and very low median saddle (MS h = 0.15–0.20); ventrolateral saddle broadly rounded, nearly symmetric; adventive lobe V-shaped, symmetric or asymmetric.

Included species.

bouhamedensis: *Eurites bouhamedensis* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 83; Anti-Atlas, Morocco.

mouydirensis: *Mouydiria mouydirensis* n. sp.; Mouydir, Algeria.

scutula: *Mouydiria scutula* n. sp.; Mouydir, Algeria.

Separation of the new species. The two species of *Mouydiria* from Oued Temertasset can be separated by means of conch morphology and the suture line. In the conch ontogeny, they can be distinguished as follows:

- *M. mouydirensis* – the uw/dm ratio remains, between 1 and 7 mm dm, stable at 0.20–0.24, followed by an increase to 0.40 at 30 mm dm; the ww/wh ratio is stable throughout ontogeny at a value of 1.60–1.80 (with intraspecific variability).
- *M. scutula* – the uw/dm ratio continuously increases from 0.20 at 1.3 mm dm to 0.40 at 9.5 mm dm; followed by a decrease to 0.30 at 24 mm dm; the ww/wh ratio increase to a value of 2.50 at 9 mm dm and thereafter decreases to 1.60 at 24 mm dm.

The suture line offers more differences:

- *M. mouydirensis* – the external lobe has parallel flanks; the adventive lobe is asymmetric with a steep ventral flank and a curved dorsal flank.
- *M. scutula* – the external lobe has slightly incurved flanks; the adventive lobe is symmetric.

Discussion. *Mouydiria* is closely related to *Eurites*, but a number of differences justify the separation. The course of growth lines and constrictions differs markedly; they extend almost linear with a very wide and shallow ventral sinus in *Mouydiria*, but form a prominent ventrolateral projection and a narrow and deep ventral sinus in *Eurites*.

***Mouydiria mouydirensis* n. sp.**

Figures 71, 72

Derivation of name. After the type region.

Holotype. Specimen MB.C.18736.1, illustrated in Figure 71A.

Type locality and horizon. Oued Temertasset, locality and sample A320–5 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 30 specimens, conch diameter up to 31 mm.

Diagnosis. *Mouydiria* with thickly pachyconic and subinvolute conch up to 7 mm in dm, thereafter transformation into a thickly discoidal and subevolute adult conch; umbilical margin narrowly rounded or subangular, umbilical wall steep, flattened; aperture moderate in juveniles and low in the adult stage. Steinkern with wide and deep, convex constrictions with very shallow and wide ventral sinus; umbilical margin with rounded nodes or short riblets in the intermediate growth interval. Suture line with very narrow, parallel-sided external lobe and very low or low median saddle; ventrolateral saddle broadly rounded and almost symmetric; adventive lobe V-shaped, usually asymmetric.

Table 103. Conch ontogeny (Figs 72A, D–F) of *Mouydiria mouydirensis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.80; uw/dm ~ 0.25)	moderately depressed; strongly embracing (ww/wh ~ 1.80; IZR ~ 0.40)	moderate (WER ~ 1.85)
8 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.75; uw/dm ~ 0.25)	moderately depressed; strongly embracing (ww/wh ~ 1.80; IZR ~ 0.40)	moderate (WER ~ 1.80)
20 mm	thinly pachyconic; subevolute (ww/dm = 0.60–0.70; uw/dm = 0.30–0.40)	moderately to strongly depressed; strongly embracing (ww/wh = 1.50–2.15; IZR = 0.30–0.40)	low (WER = 1.60–1.75)
30 mm	thickly discoidal; subevolute (ww/dm = 0.55–0.60; uw/dm = 0.35–0.45)	moderately depressed; strongly embracing (ww/wh = 1.50–2.00; IZR = 0.30–0.40)	low to moderate (WER = 1.60–1.80)

Table 104. Conch dimensions (in mm) and proportions for reference specimens of *Mouydiria mouydirensis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18736.1	29.5	17.0	10.7	12.2	7.0	0.58	1.59	0.41	1.72	0.35
paratype MB.C.18736.2	26.1	16.2	8.9	11.1	6.3	0.62	1.82	0.43	1.73	0.30
paratype MB.C.18736.3	23.9	13.8	8.4	8.3	5.4	0.58	1.64	0.35	1.68	0.35
paratype MB.C.18736.4	20.9	13.2	7.1	8.3	5.0	0.63	1.87	0.40	1.72	0.30

Table 105. Suture line proportions (Figs 72B, C) for *Mouydiria mouydirensis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18736.1	24.2 mm	0.49	0.66	0.92	0.19	0.74	A lobe asymmetric
paratype MB.C.18736.2	c. 20.0 mm	0.47	0.76	0.98	0.23	0.61	A lobe lanceolate, symmetric

Discussion. *Mouydiria mouydirensis* differs from *M. bouhamedensis* in the more slender conch (at 14 mm dm: ww/dm ~ 0.70 in *M. mouydirensis* and ~ 0.80 in *M. bouhamedensis*).

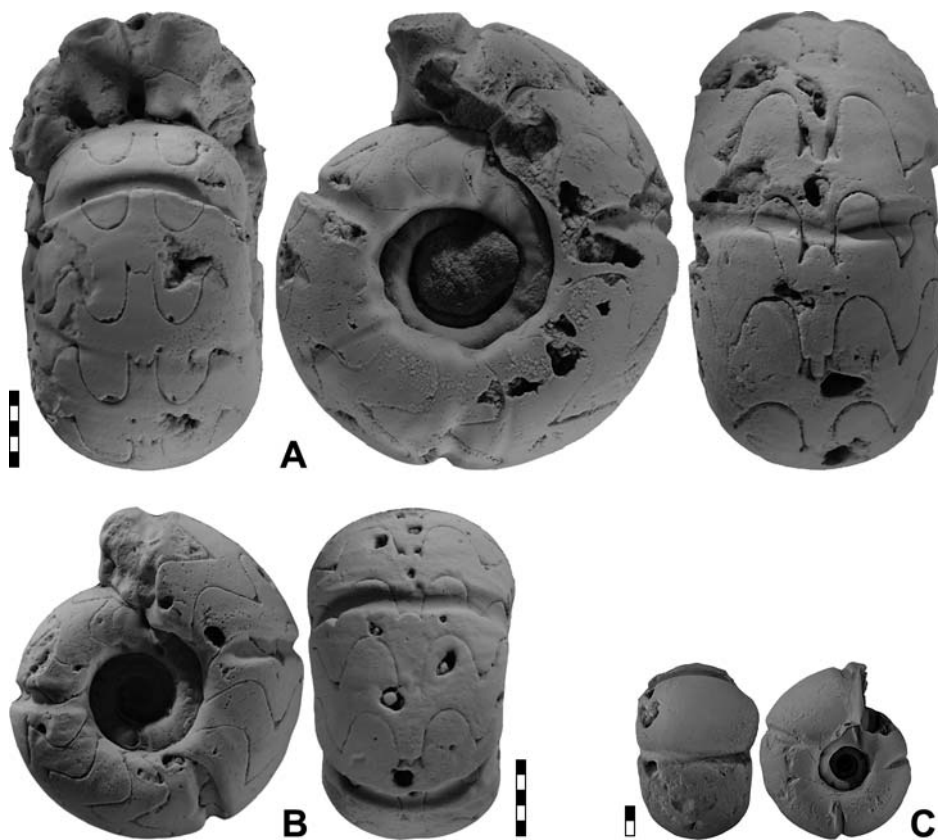


Figure 71. *Mouydiria mouydirensis* n. sp. from locality A320–5; all $\times 2$. **A.** Holotype MB.C.18736.1. **B.** Paratype MB.C.18736.4. **C.** Paratype MB.C.18898.

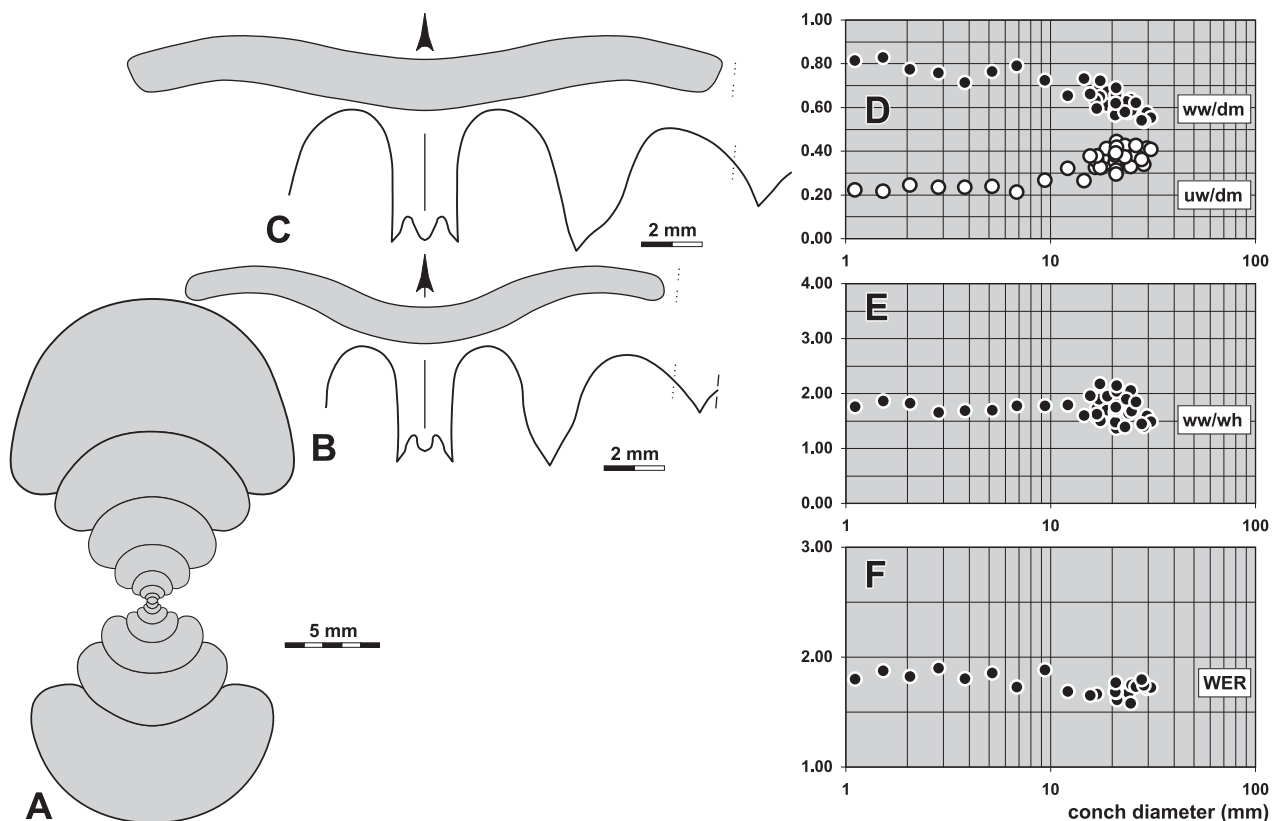


Figure 72. *Mouydiria mouydirensis* n. sp. **A.** Cross section of paratype MB.C.19013.1 from locality MOU-F; $\times 2.5$. **B.** Suture line and constriction of paratype MB.C.18736.2 from locality A320–5, at 21.1 mm dm, 13.7 mm ww, 6.6 mm wh; $\times 4.0$. **C.** Suture line and constriction of holotype MB.C.18736.1 from locality A320–5, at 27.8 mm dm, 16.3 mm ww, 9.1 mm wh; $\times 4.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Mouydiria scutula* n. sp.**

Figures 73, 74

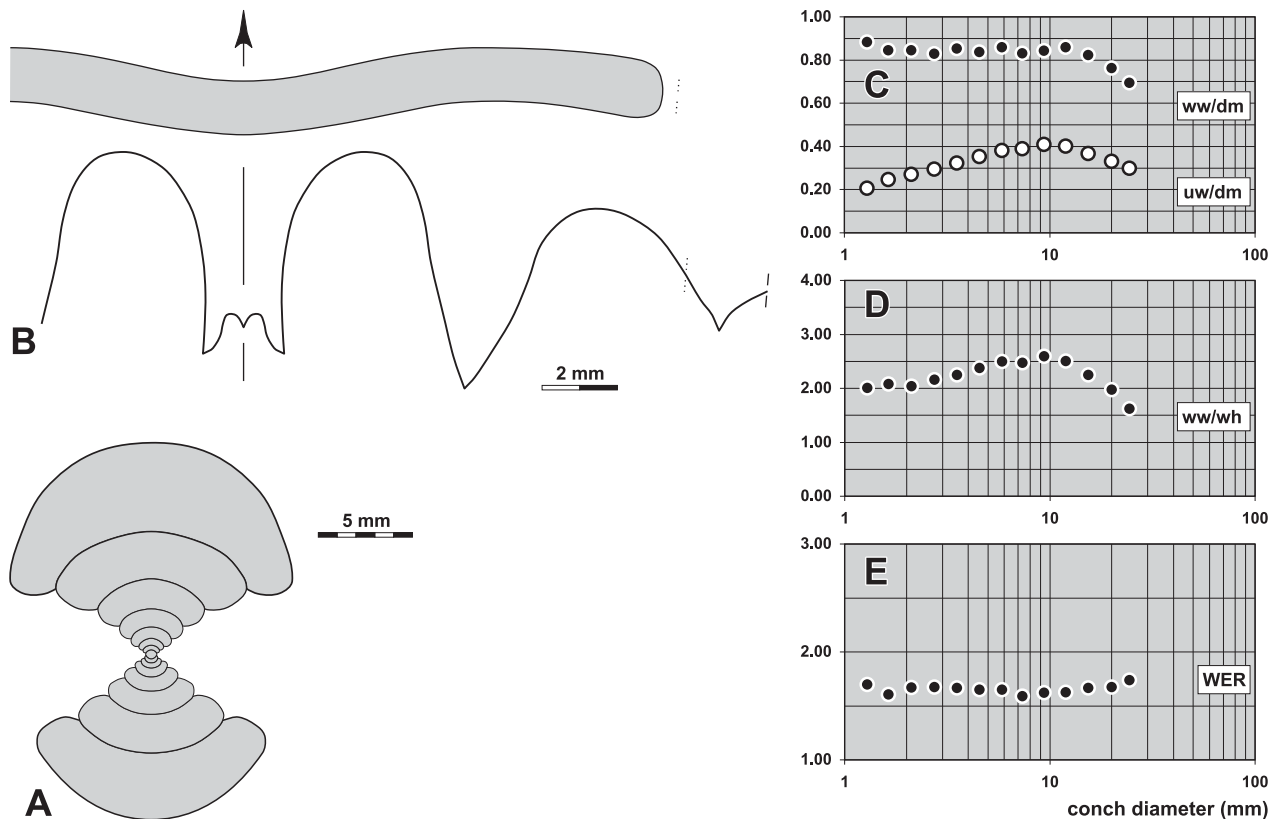
Derivation of name. From Latin *scutula* = roll, because of the conch shape.*Holotype.* Specimen MB.C.18899, illustrated in Figure 73.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-D2 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.*Material.* Two specimens, conch diameter up to 25 mm.*Diagnosis.* *Mouydiria* with a thickly pachyconic conch up to 20 mm in dm, thereafter becoming thinly pachyconic; conch subinvolute in the early juvenile stage and subevolute above 3 mm dm; umbilical margin subangular, umbilical wall steep, flattened; aperture low throughout ontogeny. Steinkern with wide and deep, convex constrictions with very shallow and wide ventral sinus; without ribs or nodes. Suture line with very narrow parallel-sided external lobe with slightly incurved flanks and very low median saddle; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe deep and V-shaped, symmetric.**Figure 73.** *Mouydiria scutula* n. sp., holotype MB.C.18899 from locality MOU-D2; $\times 2$.**Figure 74.** *Mouydiria scutula* n. sp. **A.** Cross section of paratype MB.C.18796 from locality MOU-B0; $\times 2.5$. **B.** Suture line and constriction of holotype MB.C.18899 from locality MOU-D2, at 18.9 mm dm, 15.6 mm ww, 8.5 mm wh; $\times 5.0$. **C–E.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 106. Conch ontogeny (Figs 74A, C–E) of *Mouydiria scutula* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.84; uw/dm ~ 0.26)	strongly depressed; very strongly embracing (ww/wh ~ 2.05; IZR ~ 0.46)	low (WER ~ 1.67)
8 mm	thickly pachyconic; subevolute (ww/dm ~ 0.84; uw/dm ~ 0.40)	very strongly depressed; strongly embracing (ww/wh ~ 2.60; IZR ~ 0.35)	low (WER ~ 1.62)
20 mm	thickly pachyconic; subevolute (ww/dm ~ 0.76; uw/dm ~ 0.33)	moderately depressed; strongly embracing (ww/wh = 1.98; IZR ~ 0.41)	low (WER = 1.68)

Table 107. Conch dimensions (in mm) and proportions for reference specimens of *Mouydiria scutula* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18899	24.4	16.9	10.4	7.3	5.9	0.69	1.63	0.30	1.74	0.44
paratype MB.C.18796	20.0	15.2	7.7	6.6	4.5	0.76	1.98	0.33	1.68	0.41

Table 108. Suture line proportions (Fig. 74B) for *Mouydiria scutula* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18899	24.2 mm	0.41	0.58	0.84	0.20	0.71	A lobe deeper than E lobe

Discussion. *Mouydiria scutula* resembles *M. bouhamedensis*, but has a wider umbilicus (at 14 mm dm: uw/dm ~ 0.40 in *M. scutula* and ~ 0.30 in *M. bouhamedensis*).

***Rotopericyclus* Turner, 1948**

Type species. *Pericyclus rotuliformis* Crick, 1899 (OD).

Genus definition. Rotopericyclidae with rather large conch, reaching more than 120 mm in diameter. Conch subinvolute or subevolute, narrowing of the umbilicus in juvenile stages, some species with adult re-opening of the umbilicus. Shell and steinkern particularly in the juvenile and preadult stage with prominent concavo-convex or biconvex constrictions, direction rursiradial; some species with rather prominent ribbing. Suture line with V-shaped or parallel-sided, very narrow external lobe (EL w/d = 0.30–0.45; EL/AL = 0.80–0.95) and very low or low median saddle (MS h = 0.15–0.30); ventrolateral saddle broadly rounded, symmetric or slightly asymmetric; adventive lobe V-shaped, almost asymmetric.

Included species.

baillyi: *Pericyclus Baillyi* Crick, 1899, p. 438; Ireland.

clanensis: *Pericyclus clanensis* Crick, 1899, p. 437; Ireland.

foordi: *Pericyclus Foordi* Crick, 1899, p. 430; Ireland.

kaufmanni: *Rotopericyclus kaufmanni* n. sp.; Mouydir, Algeria.

leesoni: *Pericyclus Leesoni* Crick, 1899, p. 451; Ireland.

lubesederi: *Rotopericyclus lubesederi* n. sp.; Mouydir, Algeria.

rathi: *Rotopericyclus rathi* n. sp.; Mouydir, Algeria.

rotuliformis: *Pericyclus rotuliformis* Crick, 1899, p. 434; Ireland.

subplicatilis: *Pericyclus subplicatilis* Crick, 1899, p. 442; Ireland.

trapezoidalis: *Pericyclus trapezoidalis* Crick, 1899, p. 432; Ireland.

wendtii: *Rotopericyclus wendtii* n. sp.; Mouydir, Algeria.

? *pinyonensis*: *Pericyclus (Rotopericyclus) pinyonensis* Gordon, 1986: 30. Nevada.

? *postremus*: *Rotopericyclus postremus* Riley, 1996, p. 81; Lancashire.

Separation of the new species. The four species of *Rotopericyclus* from Oued Temertasset can be separated by their conch morphology and suture line. In the conch shape and its ontogenetic development, they are characterised as follows:

- *R. kaufmanni* – ww/dm increasing from ~ 0.75 at 2 mm dm to ~ 0.90 at 20 mm, thereafter decreasing to ~ 0.50 at 90 mm dm; uw/dm ~ 0.30 throughout ontogeny with little variation; umbilical margin angular;
- *R. rathi* – ww/dm rather stable between 0.65 and 0.75 up to 45 mm dm, thereafter a rapid decrease to ~ 0.57 at 70 mm dm; uw/dm decreasing from ~ 0.20 at 2 mm dm to ~ 0.10 at 7 mm dm, thereafter increasing to ~ 0.35 at 50 mm dm; umbilical margin subangular;
- *R. wendtii* – ww/dm increasing from ~ 0.70 at 2 mm dm to 0.75–0.85 at 10 mm, thereafter decreasing to ~ 0.40 at 90 mm dm; uw/dm ~ 0.20 up to 5 mm dm, thereafter 0.25–0.33 with little variation; umbilical margin rounded;
- *R. lubesederi* – ww/dm rather stable at ~ 0.75 up to 10 mm dm, thereafter a continuous decrease to ~ 0.40 at 90 mm dm; uw/dm ~ 0.12 up to 6 mm dm, thereafter ~ 0.20 with little variation; umbilical margin rounded.

The steinkern surface differs in the four species:

- *R. kaufmanni* – numerous gently biconvex constrictions;
- *R. rathi* – numerous concavo-convex constrictions;
- *R. wendti* – numerous biconvex constrictions;
- *R. lubesederi* – adult stage without constrictions.

The suture line offers more distinguishing characters (in specimens larger than 24 mm dm):

- *R. kaufmanni* – external lobe V-shaped with gently sinuous flanks, median saddle very low, adventive lobe moderately wide;
- *R. rathi* – external lobe parallel-sided with slightly incurved flanks, median saddle low, adventive lobe narrow;
- *R. wendti* – external lobe parallel-sided with slightly sinuous flanks, median saddle low, adventive lobe very narrow;
- *R. lubesederi* – external lobe parallel-sided, median saddle very low, adventive lobe moderately wide.

Discussion. A revision of the Irish species is necessary to define the limits of the genus and to separate the species. The Algerian material demonstrates that the variability of conch ontogeny is rather wide among the species and that it is difficult to find clear apomorphic characters. Most of the species show a temporary increase of the uw/dm ratio during ontogeny, and many possess tendencies to increase the ww/dm ratio in an intermediate phase or in the adult stage.

The Algerian species appear to be very heterogeneous with respect to their conch morphology and suture line. However, they share some characters such as the rather complex conch ontogeny. While *R. lubesederi* is still rather close to species of the genus *Muensteroceras* (such as *M. multitudum*), species such as *R. kaufmanni* and *R. rathi* show a derived morphology with a rather widely umbilicate conch.

***Rotopericyclus kaufmanni* n. sp.**

Figures 75, 76

Derivation of name. After Bernd Kaufmann, who collected some of the material.

Holotype. Specimen MB.C.18806.1, illustrated in Figure 75A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C2 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 17 specimens, conch diameter up to 90 mm.

Diagnosis. *Rotopericyclus* with thickly pachyconic conch in the early juvenile stage, conch thinly globular between 7 and 20 mm dm, and becoming thickly discoidal at 60 mm dm; conch subinvolute or subevolute throughout ontogeny with minor changes; umbilical margin in the adult stage angular, umbilical wall flattened and oblique; aperture low throughout ontogeny. Ornament with coarse growth lines, coarse slightly biconvex with very low lateral sinus and shallow ventral sinus, direction slightly rursiradate; deep shell and steinkern constrictions parallel to the growth lines. Suture line with very narrow and V-shaped external lobe, median saddle very low; ventrolateral saddle broadly rounded and almost symmetric; adventive lobe V-shaped, symmetric.

Table 109. Conch ontogeny (Figs 76A–C, E–G) of *Rotopericyclus kaufmanni* n. sp.

dm	conch shape	whorl cross section shape	aperture
4 mm	thickly pachyconic; subinvolute or subevolute (ww/dm ~ 0.82; uw/dm = 0.28–0.32)	strongly depressed; very strongly embracing (ww/wh = 2.00–2.20; IZR = 0.45–0.50)	low (WER ~ 1.60)
10 mm	thinly globular; subinvolute (ww/dm ~ 0.90; uw/dm ~ 0.30)	strongly depressed; very strongly embracing (ww/wh = 2.25–2.40; IZR ~ 0.48)	low (WER ~ 1.55)
30 mm	thickly pachyconic to thinly globular; subinvolute (ww/dm = 0.75–0.90; uw/dm = 0.27–0.30)	strongly depressed; very strongly embracing (ww/wh = 2.00–2.15; IZR ~ 0.45)	low (WER ~ 1.65)
60 mm	thickly discoidal; subinvolute or subevolute (ww/dm = 0.55–0.60; uw/dm = 0.28–0.34)	moderately depressed; very strongly embracing (ww/wh = 1.50–1.60; IZR = 0.45–0.48)	low (WER ~ 1.60)
90 mm	discoidal; subevolute (ww/dm ~ 0.49; uw/dm ~ 0.31)	weakly depressed; very strongly embracing (ww/wh = 1.25; IZR ~ 0.45)	low (WER ~ 1.64)

Table 110. Conch dimensions (in mm) and proportions for reference specimens of *Rotopericyclus kaufmanni* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18806.1	88.8	43.3	35.1	27.9	19.4	0.49	1.23	0.31	1.64	0.45
paratype MB.C.18806.3	60.7	36.5	22.7	20.4	12.0	0.60	1.61	0.34	1.56	0.47
paratype MB.C.18806.2	57.4	33.3	22.4	16.1	12.6	0.58	1.49	0.28	1.64	0.44
paratype MB.C.18806.4	54.3	39.5	22.8	14.4	11.9	0.73	1.73	0.26	1.64	0.48

Table 111. Suture line proportions (Fig. 76D) for *Rotopericyclus kaufmanni* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18806.2	c. 33.0 mm	0.42	0.58	0.89	0.15	0.72	flanks of E lobe gently sinuous

Discussion. Among the Irish species, it is *Rotopericyclus rotuliformis* that most closely resembles *R. kaufmanni*, particularly with regard to the prominent constrictions. However, *R. rotuliformis* has a more slender conch at comparable diameters (at 60 mm dm: ww/dm \sim 0.43 in *R. rotuliformis* but 0.60 in *R. kaufmanni*). The other Irish species lack the strong constrictions.

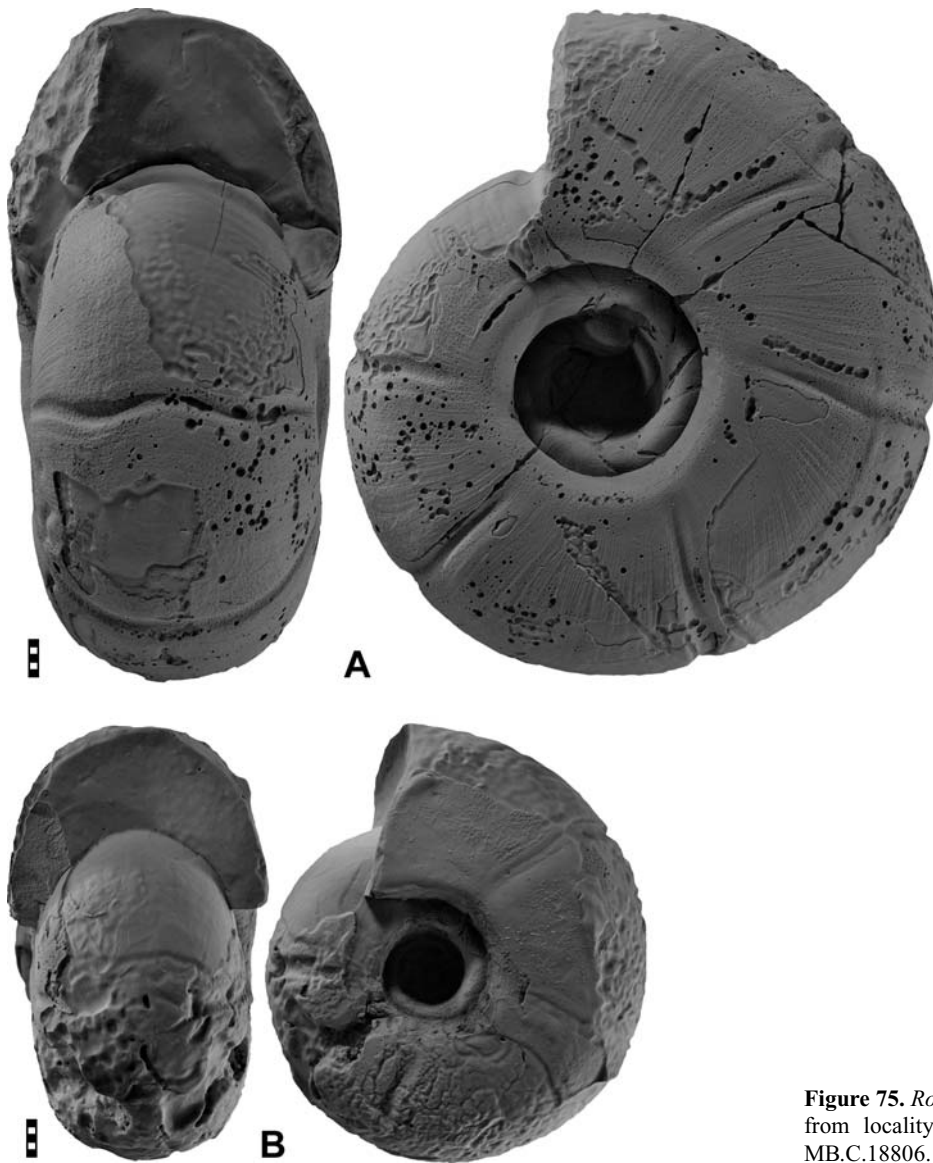


Figure 75. *Rotopericyclus kaufmanni* n. sp. from locality MOU-C1; all $\times 1$. **A.** Holotype MB.C.18806.1. **B.** Paratype MB.C.18806.2.

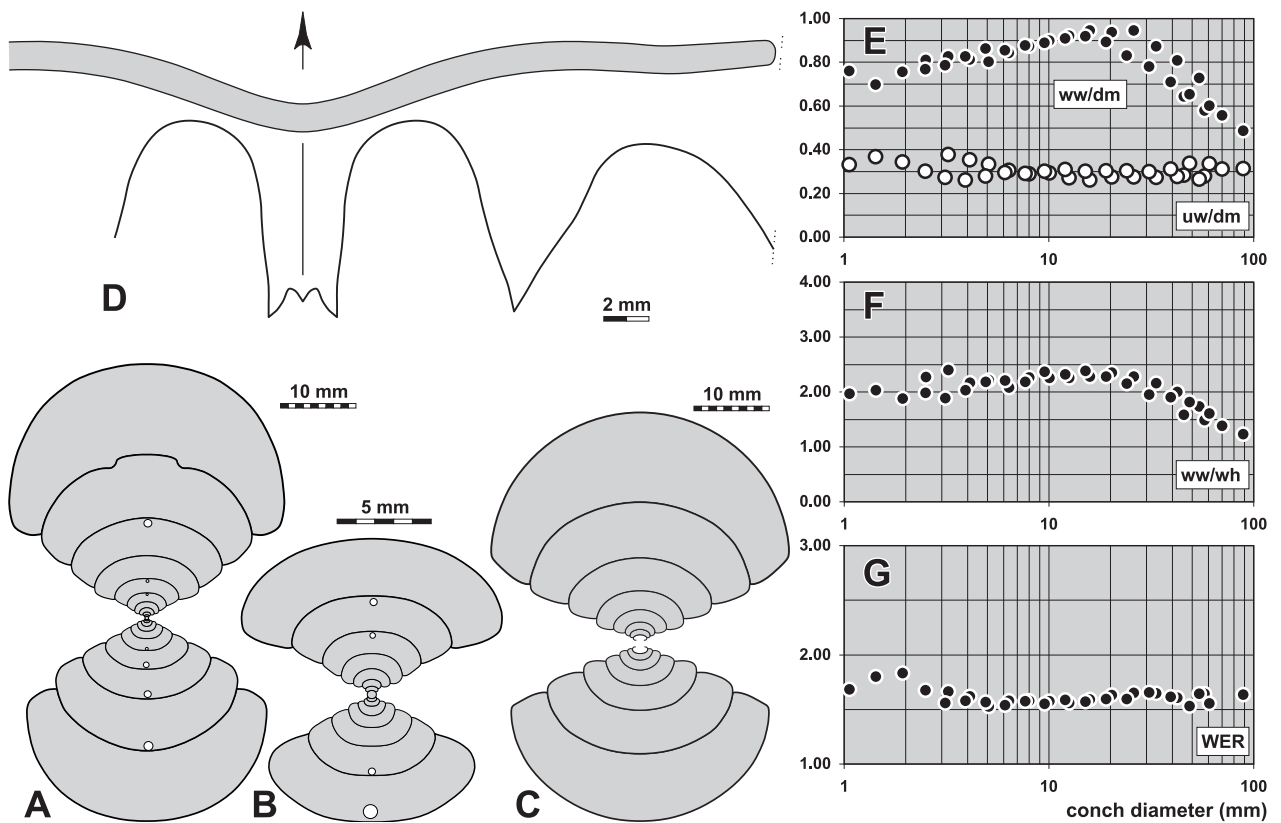


Figure 76. *Rotopericyclus kaufmanni* n. sp. from locality MOU-C1. **A.** Cross section of paratype MB.C.18806.3; $\times 1.0$. **B.** Cross section of the inner whorls of the same specimen; $\times 2.5$. **C.** Cross section of paratype MB.C.18806.4; $\times 1.0$. **D.** Suture line and constriction of paratype MB.C.18806.2, at 26.3 mm ww, 16.5 mm wh; $\times 3.0$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Rotopericyclus rathi n. sp.

Figures 77, 78

Derivation of name. After Jochen Rath, who collected some of the material.

Holotype. Specimen MB.C.18807.1, illustrated in Figure 77A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C2 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 13 specimens, conch diameter up to 70 mm.

Diagnosis. *Rotopericyclus* with thickly pachyconic conch up to 45 mm in dm, thereafter a continuous transformation into a thickly discoidal conch of about 70 mm in dm; conch involute or subinvolute in the juvenile and intermediate stage and subevolute in the adult stage; umbilical margin in the adult stage subangular, umbilical wall flattened and steep; aperture moderately high in juveniles and low above 25 mm dm. Ornament with coarse growth lines, coarse concavo-convex with very low lateral sinus and moderately deep ventral sinus, direction slightly rursiradial in the adult stage; deep shell and steinkern constrictions parallel to the growth lines. Suture line with very narrow parallel-sided external lobe, median saddle low; ventrolateral saddle broadly rounded and almost symmetric; adventive lobe V-shaped, narrow and symmetric.

Table 112. Conch ontogeny (Figs 78A, B, D–F) of *Rotopericyclus rathi* n. sp.

dm	conch shape	whorl cross section shape	aperture
4 mm	thickly pachyconic; involute (ww/dm ~ 0.75 ; uw/dm ~ 0.13)	weakly depressed; very strongly embracing (ww/wh ~ 1.45 ; IZR ~ 0.45)	moderate (WER ~ 1.90)
10 mm	thinly pachyconic; involute (ww/dm ~ 0.68 ; uw/dm ~ 0.14)	weakly depressed; strongly embracing (ww/wh ~ 1.38 ; IZR ~ 0.42)	moderate (WER ~ 1.95)
30 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.75 ; uw/dm ~ 0.27)	moderately depressed; very strongly embracing (ww/wh ~ 1.80 ; IZR ~ 0.48)	low (WER ~ 1.60)
60 mm	thinly pachyconic; subevolute (ww/dm ~ 0.65 ; uw/dm ~ 0.35)	moderately depressed; strongly embracing (ww/wh ~ 1.75 ; IZR ~ 0.40)	low (WER ~ 1.65)

Table 113. Conch dimensions (in mm) and proportions for reference specimens of *Rotopericyclus rathi* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18807.1	70.0	39.8	26.6	23.8	14.9	0.57	1.50	0.34	1.61	0.44
paratype MB.C.18807.3	58.9	38.4	21.9	20.3	13.6	0.65	1.75	0.35	1.69	0.38
paratype MB.C.18807.2	30.2	22.3	13.0	7.5	6.4	0.74	1.71	0.25	1.61	0.51

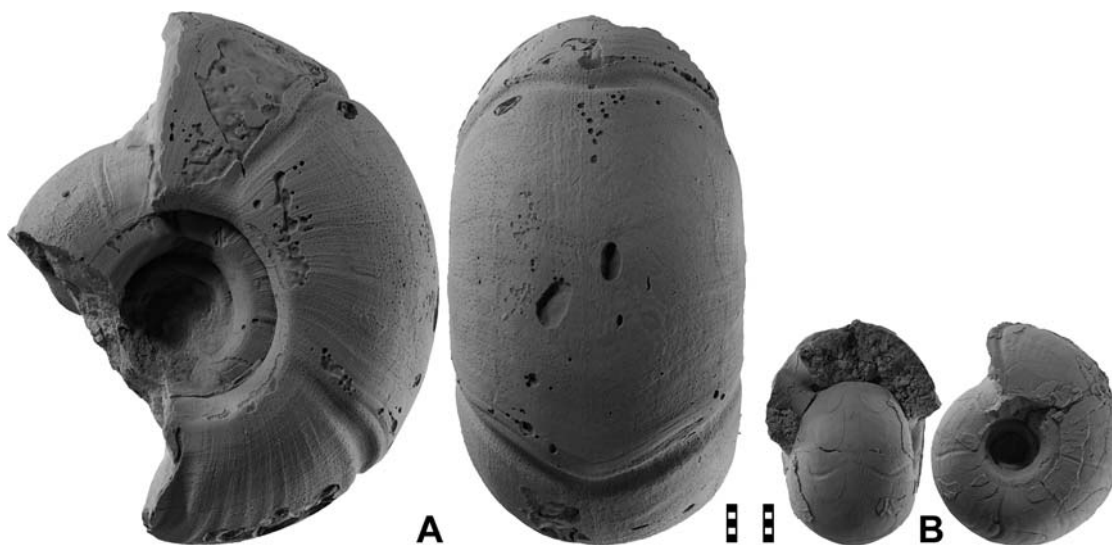
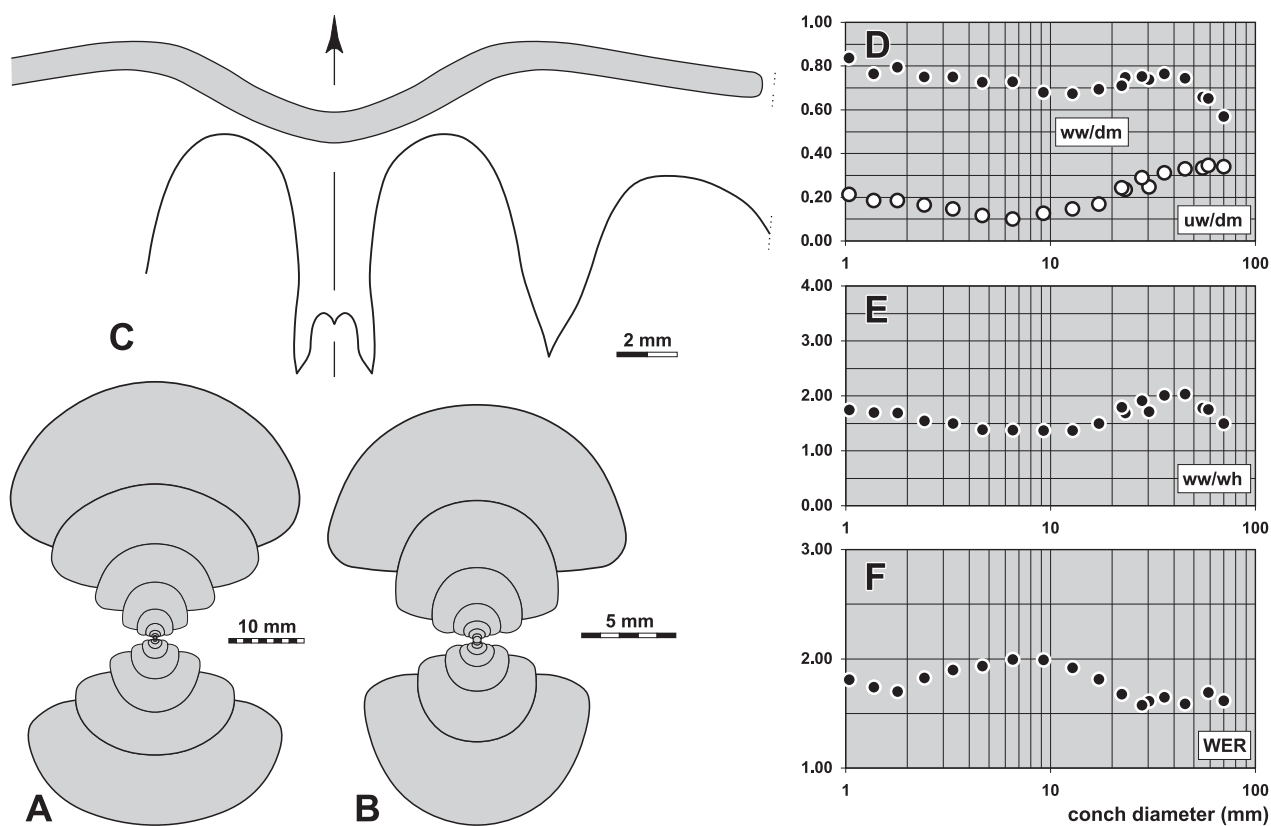
**Figure 77.** *Rotopericyclus rathi* n. sp. from locality MOU-C1; all $\times 1$. **A.** Holotype MB.C.18807.1. **B.** Paratype MB.C.18807.2.**Figure 78.** *Rotopericyclus rathi* n. sp. from locality MOU-C1. **A.** Cross section of paratype MB.C.18807.3; $\times 1.0$. **B.** Cross section of the inner whorls or the same specimen; $\times 2.5$. **C.** Suture line and constriction of paratype MB.C.18807.2, at 16.4 mm ww, 8.4 mm wh; $\times 4.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 114. Suture line proportions (Fig. 78C) for *Rotopericyclus rathi* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18807.2	c. 24.0 mm	0.31	0.51	0.91	0.25	0.62	flanks of E lobe slightly concave

Discussion. *Rotopericyclus rathi* differs from *R. rotuliformis* in the much stouter conch.

***Rotopericyclus wendti* n. sp.**

Figures 79, 80

Derivation of name. After Jobst Wendt (Tübingen), who led the first excursions during which the material was discovered.

Holotype. Specimen MB.C.18808.1, illustrated in Figure 79A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-C2 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 129 specimens, conch diameter up to 92 mm.

Diagnosis. *Rotopericyclus* with thickly pachyconic conch up to 15 mm in dm, thereafter continuous transformation into a thinly discoidal conch of about 90 mm in dm; conch usually subinvolute, but with wider umbilicus above 8 mm dm; umbilical margin rounded, umbilical wall convex; aperture low or moderately high throughout ontogeny. Ornament with coarse growth lines, course biconvex with low lateral sinus and deep ventral sinus, direction slightly rursiradiate in the adult stage; deep shell and steinkern constrictions parallel to the growth lines. Suture line with very narrow parallel-sided external lobe, median saddle very low; ventrolateral saddle broadly rounded and almost symmetric; adventive lobe V-shaped, very narrow and symmetric.

Table 115. Conch ontogeny (Figs 80A–C, E–G) of *Rotopericyclus wendti* n. sp.

dm	conch shape	whorl cross section shape	aperture
4 mm	thickly pachyconic; subinvolute (ww/dm = 0.75–0.80; uw/dm = 0.15–0.20)	moderately depressed; very strongly embracing (ww/wh = 1.60–1.75; IZR = 0.45–0.55)	low to moderate (WER = 1.65–1.85)
10 mm	thickly pachyconic; subinvolute (ww/dm = 0.75–0.85; uw/dm = 0.20–0.30)	moderately to strongly depressed; very strongly embracing (ww/wh = 1.80–2.25; IZR = 0.45–0.50)	low (WER = 1.50–1.75)
30 mm	thinly pachyconic; subinvolute (ww/dm = 0.60–0.70; uw/dm = 0.20–0.30)	weakly to moderately depressed; strongly embracing (ww/wh = 1.20–1.60; IZR = 0.40–0.45)	low to moderate (WER = 1.70–1.90)
60 mm	thinly to thickly discoidal; subinvolute or subevolute (ww/dm = 0.45–0.55; uw/dm = 0.25–0.33)	weakly depressed; strongly embracing (ww/wh = 1.00–1.30; IZR = 0.40–0.45)	low (WER = 1.60–1.75)
90 mm	thinly discoidal; subinvolute or subevolute (ww/dm ~ 0.38; uw/dm ~ 0.30)	weakly depressed; strongly embracing (ww/wh ~ 1.00; IZR = 0.40–0.45)	moderate (WER ~ 1.80)

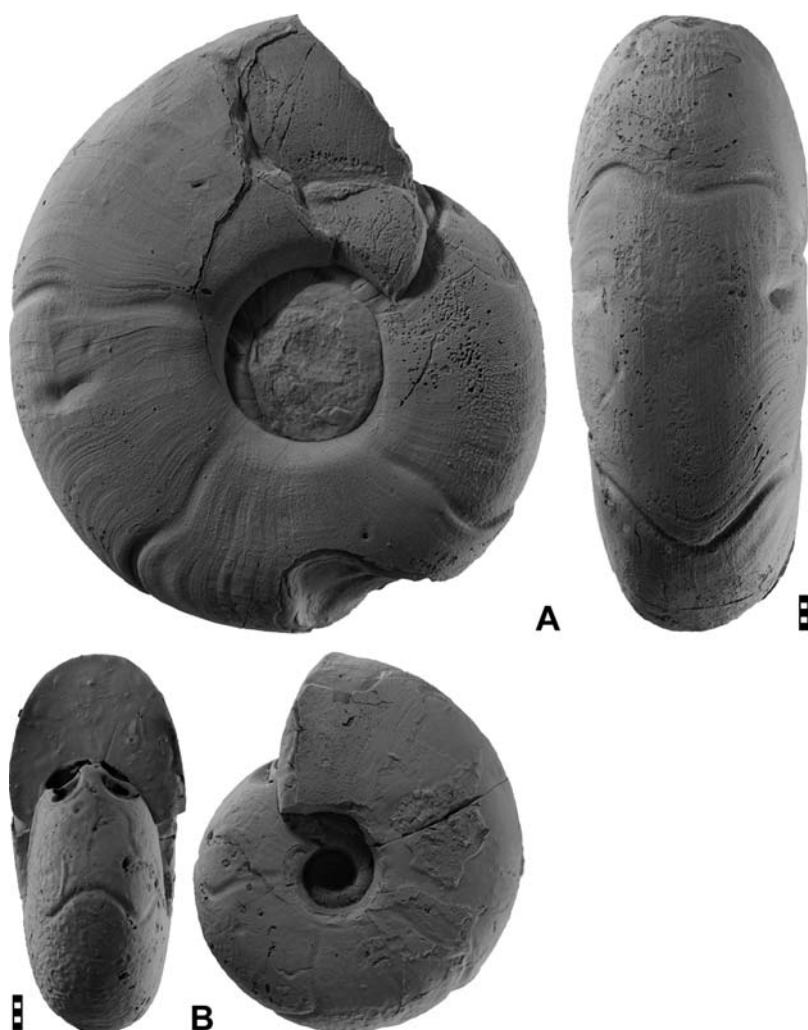
Table 116. Conch dimensions (in mm) and proportions for reference specimens of *Rotopericyclus wendti* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18808.1	86.2	33.2	33.8	23.0	20.4	0.39	0.98	0.27	1.72	0.40
paratype MB.C.18808.3	83.3	34.8	35.0	22.3	19.1	0.42	0.99	0.27	1.68	0.46
paratype MB.C.18808.4	66.6	30.9	27.2	17.5	14.9	0.46	1.13	0.26	1.66	0.45
paratype MB.C.18808.2	54.8	25.4	25.6	12.1	13.4	0.46	0.99	0.22	1.75	0.48
paratype MB.C.18808.5	41.9	21.8	18.6	8.2	11.1	0.52	1.17	0.19	1.85	0.40

Table 117. Suture line proportions (Fig. 80D) for *Rotopericyclus wendti* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18808.5	40.7 mm	0.32	0.53	0.87	0.19	0.61	A lobe very deep and narrow

Discussion. The strong constrictions of *Rotopericyclus wendti* differentiate it from *R. subplicatilis* and *R. foordi*.



◀ **Figure 79.** *Rotopericyclus wendti* n. sp. from locality MOU-C1; all $\times 1$. **A.** Holotype MB.C.18808.1. **B.** Paratype MB.C.18808.2.

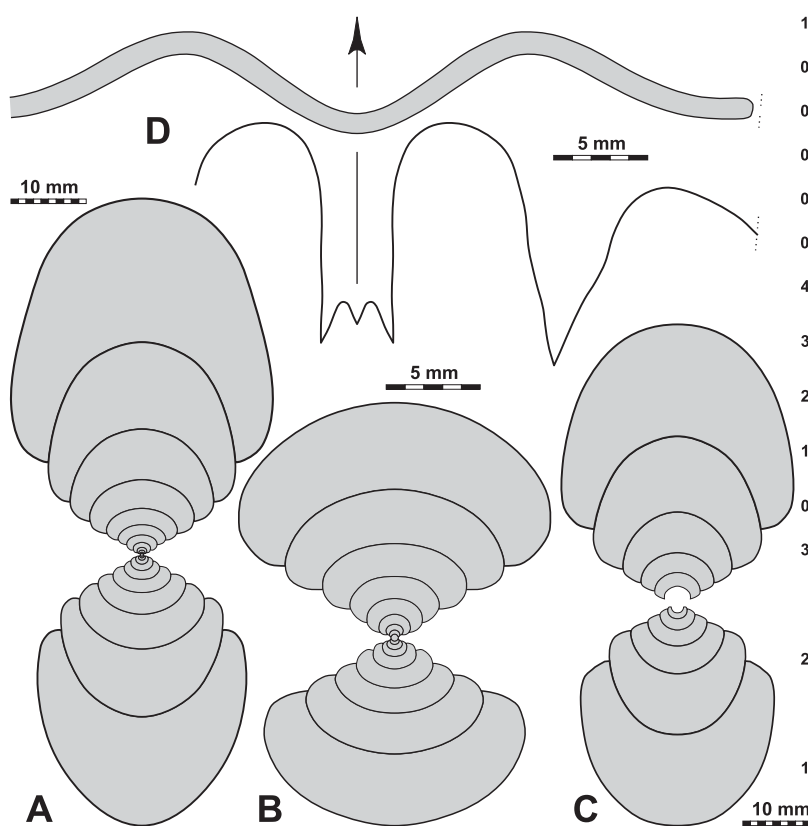
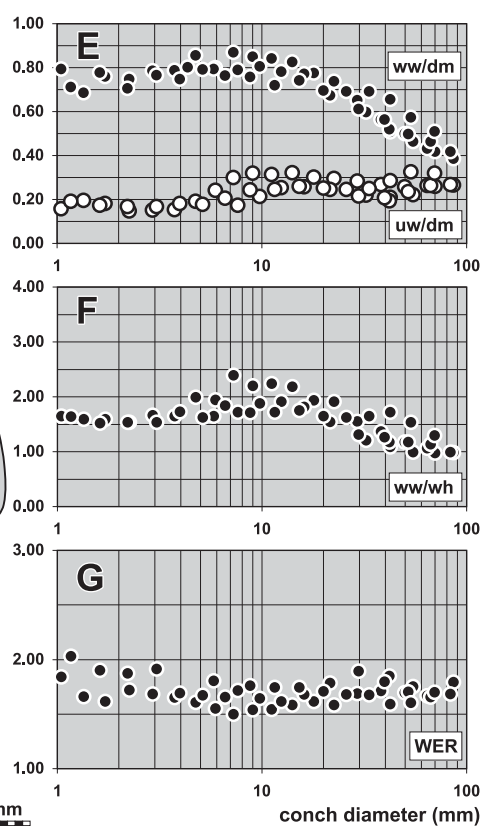


Figure 80. *Rotopericyclus wendti* n. sp. from locality MOU-C1. **A.** Cross section of paratype MB.C.18808.3; $\times 1.0$. **B.** Cross section of the inner whorls of the same specimen; $\times 2.5$. **C.** Cross section of paratype MB.C.18808.4; $\times 1.0$. **D.** Suture line and constriction of paratype MB.C.18808.5, at 40.7 mm dm, 22.0 mm ww, 20.2 mm wh; $\times 2.5$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.



***Rotopericyclus lubesederi* n. sp.**

Figures 81, 82

Derivation of name. After Stefan Lubeseder, who collected some of the material.*Holotype.* Specimen MB.C.18809.1, illustrated in Figure 81A.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-C2 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.*Material.* 47 specimens, conch diameter up to 90 mm.*Diagnosis.* *Rotopericyclus* with thickly pachyconic conch up to 10 mm in dm, thereafter continuous transformation into a thinly discoidal conch above 60 mm dm; conch involute up to 6 mm dm and thereafter subinvolute; umbilical margin rounded, umbilical wall convex; aperture moderately high throughout ontogeny. Ornament with coarse growth lines, coarse biconvex with low lateral sinus and deep ventral sinus, direction slightly rursiradial in the adult stage; adult stage without shell or steinkern constrictions. Suture line with very narrow subparallel-sided external lobe, median saddle low; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe V-shaped, symmetric.**Table 118.** Conch ontogeny (Figs 82A–C, E–G) of *Rotopericyclus lubesederi* n. sp.

dm	conch shape	whorl cross section shape	aperture
4 mm	thickly pachyconic; involute (ww/dm ~ 0.80; uw/dm ~ 0.12)	moderately depressed; very strongly embracing (ww/wh ~ 1.60; IZR ~ 0.47)	moderate (WER ~ 1.85)
10 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.74; uw/dm ~ 0.20)	moderately depressed; strongly embracing (ww/wh ~ 1.55; IZR ~ 0.40)	moderate (WER = 1.80–2.00)
30 mm	thickly discoidal; subinvolute (ww/dm = 0.48–0.55; uw/dm = 0.15–0.20)	weakly depressed; strongly embracing (ww/wh ~ 1.05; IZR ~ 0.42)	moderate (WER = 1.85–1.95)
60 mm	thinly discoidal; subinvolute (ww/dm ~ 0.46; uw/dm ~ 0.22)	weakly depressed; strongly embracing (ww/wh ~ 1.05; IZR ~ 0.45)	moderate (WER = 1.75–1.85)
90 mm	thinly discoidal; subinvolute (ww/dm ~ 0.41; uw/dm ~ 0.25)	weakly compressed; strongly embracing (ww/wh ~ 1.00; IZR ~ 0.42)	moderate (WER ~ 1.75)

Table 119. Conch dimensions (in mm) and proportions for reference specimens of *Rotopericyclus lubesederi* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18809.3	86.9	35.7	38.6	18.5	21.7	0.41	0.92	0.21	1.78	0.44
holotype MB.C.18809.1	51.8	24.9	23.2	10.7	14.0	0.48	1.07	0.21	1.88	0.40
paratype MB.C.18809.2	47.2	21.0	23.0	8.9	13.2	0.45	0.91	0.19	1.93	0.43
paratype MB.C.18809.4	46.6	23.0	20.8	9.5	12.7	0.49	1.10	0.20	1.89	0.39

Table 120. Suture line proportions (Fig. 82D) for *Rotopericyclus lubesederi* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18809.2	c. 30.0 mm	0.42	0.67	0.81	0.25	0.63	flanks of A lobe almost straight

**Figure 81.** *Rotopericyclus lubesederi* n. sp. from locality MOU-C1; all $\times 1$. **A.** Holotype MB.C.18809.1. **B.** Paratype MB.C.18809.2.

Discussion. *Rotopericyclus lubesederi* is the species of the genus that shows the closest similarities to *Muensteroceras*. However, the conch ontogeny shows changes such as the adult opening of the umbilicus, which is not present in *Muensteroceras*. Similarities can be seen in the suture line with an almost parallel-sided external lobe and the ornament that consists of slightly biconvex growth lines and constrictions.

Rotopericyclus lubesederi is similar to *R. subplicatilis* and *R. foordi*, but differs in the narrower umbilicus (at about 90 mm dm: $uw/dm \sim 0.26$ in *R. subplicatilis*, 0.30 in *R. foordi*, but 0.20 in *R. lubesederi*). Both species have a stouter conch than *R. lubesederi* (at about 90 mm dm: $ww/dm \sim 0.45$ in *R. subplicatilis*, 0.45 in *R. foordi*, but 0.40 in *R. lubesederi*).

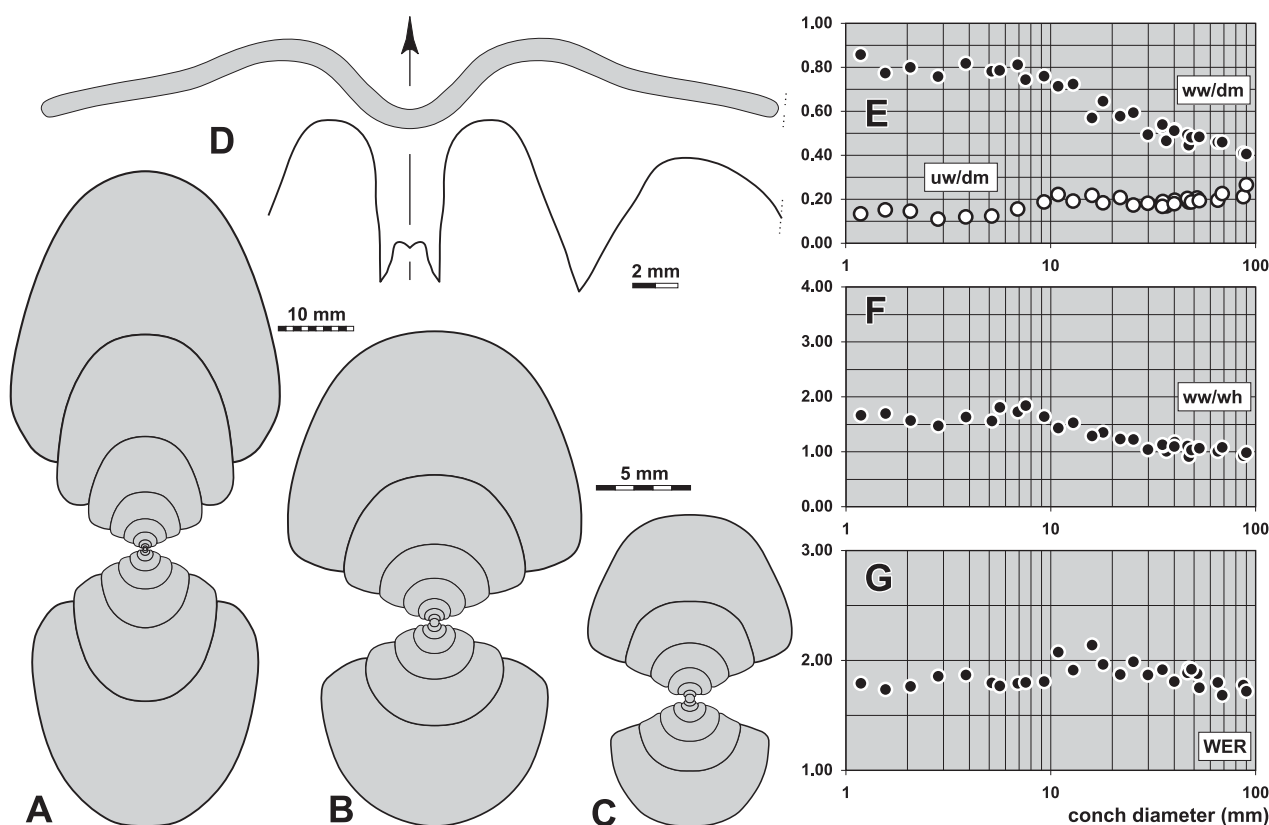


Figure 82. *Rotopericyclus lubesederi* n. sp. **A.** Cross section of paratype MB.C.18809.3 from locality MOU-C1; $\times 1.0$. **B.** Cross section of the inner whorls or the same specimen; $\times 2.5$. **C.** Cross section of paratype MB.C.18816 from locality MOU-C2; $\times 2.5$. **D.** Suture line and constriction of paratype MB.C.18809.2 from locality MOU-C1, at 14.8 mm ww, 14.7 mm wh; $\times 3.0$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Rotopericyclus? sp.

Figures 83, 84

Material. 9 specimens, conch diameter up to 50 mm. The present material does not allow the description of a distinct species. All specimens are almost smooth without constrictions; which separates it from the co-occurring species. The umbilical margin is subangular (Fig. 84A) and the umbilical wall flat. The conch ontogeny resembles that of species of *Rotopericyclus* or *Eurites* (Figs 84B, C).

Family Maxigoniatiidae Korn, Klug & Mapes, 1999

Subfamily Dzhaprakoceratinae n. subfam.

Subfamily definition. Maxigoniatiidae with a narrowly to moderately umbilicate juvenile stage and involute or subinvolute adult stage with compressed or moderately depressed whorl cross section. Ornament usually with biconvex, fine growth lines. Suture line with parallel-sided, slightly pouched external lobe, flanks of the external lobe usually strongly sinuous.

Included genera.

Dzhaprakoceras Popov, 1965

Muensteroceratoides Popov, 1965 (synonym of *Dzhaprakoceras* Popov, 1965)

Discussion. The morphological evolution within the family Maxigoniatiidae includes the widening of the external lobe, which is still parallel-sided in the first representatives of the family. This plesiomorphic condition is maintained in the conservative lineage (Dzhaprakoceratinae n. subfam.) until the Late Viséan (genera *Eoglyphioceras* Brünig, 1923 and *Beyrichoceratoides* Bisat, 1924, from which the synonymy conditions still have to be solved).



Figure 83. *Rotopericyclus?* sp., specimen MB.C.18741.1 from locality MOU-C1; $\times 1$.

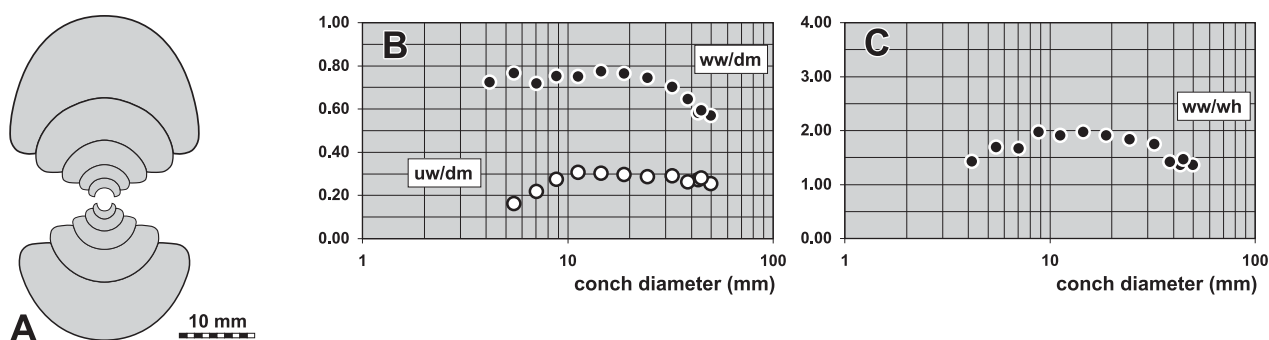


Figure 84. *Rotopericyclus?* sp. from locality MOU-C1. **A.** Cross section of specimen MB.C.18741.2; $\times 1.0$. **B, C.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), and whorl width index (ww/wh), of the available specimens.

Dzhaprakoceras Popov, 1965

Type species. *Muensteroceras tianshanicum* Librovitch, 1927 (OD).

Genus definition. Maxigoniatiidae with insignificant ontogenetic changes in the conch; shape pachyconic or discoidal, involute or subinvolute with an ontogenetic tendency for lateral compression of the conch and closure of the umbilicus; flanks moderately strong converging towards the rounded venter; umbilical wall and umbilical margin rounded; aperture high in the adult stage. Ornament with very fine, biconvex rectiradial growth lines with moderately high ventrolateral projection and rather deep ventral sinus; sometimes with shell constrictions parallel to the growth lines. Suture line with very narrow, slightly pouched external lobe and very low or low median saddle; ventrolateral saddle broadly rounded and usually strikingly asymmetric; adventive lobe V-shaped, usually asymmetric with almost straight or concave ventral side and convex dorsal side.

Included species.

aksuense: *Muensteroceras aksuense* Popov, 1965, p. 37; Tien Shan.

amplum: *Dzhaprakoceras amplum* n. sp.; Mouydir, Algeria.

angustum: *Dzhaprakoceras angustum* Kusina & Konovalova, 2004, p. 15; North Urals.

arkansanum: *Muensteroceras arkansanum* Gordon, 1965, p. 177; Arkansas.

belcourtense: *Dzhaprakoceras belcourtense* Work & Nassichuk, 2000, p. 44; British Columbia.

biconvexum: *Dzhaprakoceras biconvexum* n. sp.; Mouydir, Algeria.

catena: *Dzhaprakoceras catena* Riley, 1996, p. 53; Lancashire.

chermnykhi: *Dzhaprakoceras chermnykhi* Kusina, 1980, p. 51; North Urals.

crassum: *Dzhaprakoceras crassum* Work & Nassichuk, 2000, p. 45; British Columbia.

deflexum: *Dzhaprakoceras deflexum* Kusina, 1980, p. 58; North Urals.

djaprakense: *Muensteroceras djaprakense* Librovitch, 1927, p. 37; Tien Shan.

duponti: *Munsteroceras duponti* Delépine, 1940, p. 58; Belgium.

dzhazairense: *Dzhaprakoceras dzhazairense* Ebbighausen, Korn & Bockwinkel, 2010; Gourara, Algeria.

- flexiforme*: *Dzhaprakoceras flexiforme* Kusina & Konovalova, 2004, p. 15; North Urals.
flexum: *Dzhaprakoceras flexum* Riley, 1996, p. 58; Lancashire.
flexuosum: *Nautellipsites pseudoparallelus* forma *flexuosa* Pareyn, 1961, p. 106; Saoura Valley. [synonym of *D. hispanicum*]
glabrum: *Dzhaprakoceras glabrum* Kusina & Konovalova, 2004, p. 13; North Urals.
gordoni: *Dzhaprakoceras gordoni* Petersen, Korn & Kullmann, 2000, p. 885; Utah.
gracile: *Dzhaprakoceras gracile* Kusina in Shimansky & Kusina, 1977, p. 87; North Urals.
hibernicum: *Nautellipsites hibernicus* Delépine, 1940, p. 164; Ireland.
hispanicum: *Glyphioceras hispanicum* Foord & Crick, 1903, p. 190; Cantabrian Mountains.
humile: *Münsteroceras humile* Schindewolf, 1951, p. 62; Harz.
improcerum: *Dzhaprakoceras improcerum* Kusina, 1980, p. 50; North Urals.
latilobatum: *Dzhaprakoceras latilobatum* Kusina, 1983, p. 93; North Urals.
levis: *Dzhaprakoceras levis* Riley, 1996, p. 61; Lancashire.
narynense: *Bollandites narynensis* Popov, 1965, p. 39; Tien Shan.
paracatena: *Dzhaprakoceras paracatena* Riley, 1996, p. 63; Lancashire.
planum: *Dzhaprakoceras planum* Kusina & Yatskov, MB.C.18884.1, p. 103; Novaya Zemlya.
procerum: *Münsteroceras procerum* Schindewolf, 1951, p. 57; Harz.
pseudoparallelum: *Nautellipsites pseudoparallelus* Delépine, 1940, p. 54; Anti-Atlas.
punctum: *Dzhaprakoceras punctum* n. sp.; Mouydir, Algeria.
quantulum: *Dzhaprakoceras quantulum* Kusina & Yatskov, MB.C.18884.1, p. 104; Novaya Zemlya.
shabyrense: *Bollandites shabyrensis* Popov, 1968, p. 93; Tien Shan.
sonkulicum: *Muensteroceras kazakhstanicum* var. *sonkulica* Librovitch, 1940, p. 32; Karaganda.
subglobosum: *Muensteroceras subglobosum* Librovitch, 1927, p. 35; Tien Shan.
subquadratum: *Glyphioceras* (*Beyrichoceras*) *subquadratum* Foord, 1903, p. 172; Ireland. [synonym of *D. koninckianum*]
subtile: *Dzhaprakoceras subtile* Kusina, 1980, p. 54; North Urals.
subtruncatum: *Glyphioceras* (*Beyrichoceras*) *subtruncatum* Foord, 1903, p. 168; Ireland. [synonym of *D. koninckianum*]
tianshanicum: *Muensteroceras tianshanicum* Librovitch, 1927, p. 33; Tien Shan.
vergum: *Dzhaprakoceras vergum* n. sp.; Mouydir, Algeria.
? difficile: *Glyphioceras* (*Beyrichoceras*) *difficile* Foord, 1903, p. 171; Ireland.
? kokdzharensis: *?Bollandites kokdzharensis* Popov, 1965, p. 41; Tien Shan.

Separation of the new species. The four species of *Dzhaprakoceras* from Oued Temertasset can be separated by their conch morphology, steinkern surface, and suture line. In the conch shape and its ontogenetic development, they are characterised as follows:

- *D. punctum* – ww/dm stable at 0.80–0.90 from 1 mm to 8 mm, thereafter decrease to ~ 0.65 at 15 mm dm; uw/dm ~ 0.20 in the initial stage, continuous decrease to 0.05 at 15 mm dm; umbilical margin rounded;
- *D. amplum* – ww/dm decreasing from ~ 0.80 at 2 mm dm to ~ 0.40 at 35 mm dm; uw/dm decreasing from ~ 0.30 at 2 mm dm to ~ 0.10 at 7 mm dm; umbilical margin rounded;
- *D. vergum* – ww/dm continuously decreasing from ~ 0.80 at 1 mm dm to 0.40 at 25 mm; uw/dm decreasing from ~ 0.25 at 2 mm dm to = 0.10–0.20 at 8 mm dm and then remaining in these limits; umbilical margin subangular;
- *D. biconvexum* – ww/dm continuously decreasing from ~ 0.90 at 1 mm dm to 0.40 at 40 mm; uw/dm continuously decreasing from ~ 0.20 at 2 mm dm to = 0.05–0.15 at 40 mm dm; umbilical margin rounded or subangular.

The steinkern surface differs in the four specimens:

- *D. punctum* – without constrictions;
- *D. amplum* – numerous concavo-convex constrictions;
- *D. vergum* – numerous biconvex constrictions;
- *D. biconvexum* – deep biconvex constrictions.

The suture line offers more distinguishing characters:

- *D. punctum* – external lobe very narrow (EL w/d less than 0.40), flanks slightly curved, ventrolateral saddle slightly asymmetric, adventive lobe with convex flanks;
- *D. amplum* – external lobe narrow (EL w/d about 0.50), flanks almost straight, ventrolateral saddle narrowly rounded and strongly asymmetric, adventive lobe V-shaped with concave ventral and convex dorsal flank;
- *D. vergum* – external lobe very narrow (EL w/d less than 0.40), flanks moderately curved, ventrolateral saddle broadly rounded and strongly asymmetric, adventive lobe V-shaped with concave ventral and convex dorsal flank;
- *D. biconvexum* – external lobe very narrow (EL w/d less than 0.40 in the adult stage but 0.50 in juveniles), flanks moderately curved, ventrolateral saddle slightly asymmetric and broadly rounded, adventive lobe with convex flanks.

Discussion. The species list shows that *Dzhaprakoceras* had an almost global distribution. The numerous species are very similar in their conch shape (usually thickly discoidal and involute or subinvolute) and they share a similar suture line.

Dzhaprakoceras was probably the first Carboniferous ammonoid that possessed a subparallel-sided, slightly pouched external lobe. It was thus, by Korn et al. (1999), placed in the new family Maxigoniatiidae, which is characterised by sinuous flanks of the external lobe and hook-shaped secondary prongs. However, it is not certain that this character emerged only once in the evolution of the Early Carboniferous ammonoids.

It appears to be clear that *Muensteroceras* is a close relative to *Dzhaprakoceras*, but it is not clear which genus is the plesiomorphic one. Generally it was accepted that *Dzhaprakoceras* is the derived genus, but this opinion may be wrong.

***Dzhaprakoceras vergum* n. sp.**

Figures 85, 86

Derivation of name. From Latin *vergum* = inclined, because of the shape of the ventrolateral saddle.*Holotype.* Specimen MB.C.19028.1, illustrated in Figure 85A.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-V (Mouydir, South Algeria); lower part of the *Pericyclus-Progoniatites* Assemblage.*Material.* 874 specimens, conch diameter up to 29 mm.

Diagnosis. *Dzhaprakoceras* with thickly pachyconic conch in early juveniles, thereafter continuous transformation into a thinly discoidal conch at 20 mm dm; conch subinvolute in the early juvenile stage and involute at 8 mm dm, slight re-opening of the umbilicus in the adult stage (conch involute or subinvolute); umbilicus funnel-shaped, umbilical margin subangular, umbilical wall flattened and oblique; aperture low in juveniles and moderately high to high above 6 mm dm. Steinkern with sharp constrictions, course slightly concavo-convex with very shallow lateral sinus and deep ventral sinus; weak riblets occur occasionally between the constrictions. Suture line with very narrow, slightly pouched external lobe and very low median saddle; ventrolateral saddle rounded and strongly asymmetric; adventive lobe V-shaped, strikingly asymmetric with concave ventral side and convex dorsal side.

Table 121. Conch ontogeny (Figs 86A–F, I–K) of *Dzhaprakoceras vergum* n. sp.

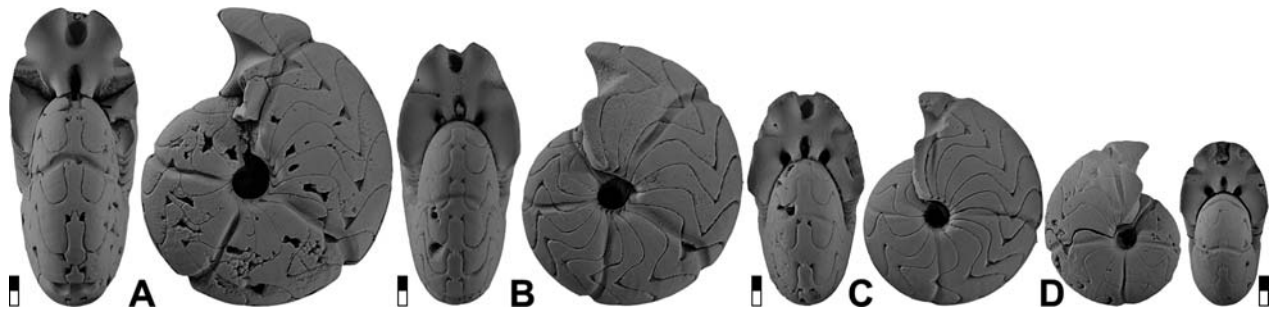
dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm = 0.75–0.85; uw/dm = 0.22–0.30)	moderately depressed; very strongly embracing (ww/wh = 1.75–2.00; IZR = 0.45–0.50)	low (WER = 1.65–1.75)
8 mm	thickly discoidal to thinly pachyconic; involute (ww/dm = 0.50–0.65; uw/dm 0.08–0.15)	weakly compressed to weakly depressed; strongly embracing (ww/wh = 0.90–1.25; IZR = 0.40–0.45)	moderate to high (WER = 1.90–2.10)
20 mm	thinly discoidal; involute or subinvolute (ww/dm = 0.40–0.50; uw/dm = 0.10–0.20)	weakly compressed; strongly embracing (ww/wh = 0.80–1.00; IZR = 0.35–0.45)	moderate to high (WER = 1.85–2.15)

Table 122. Conch dimensions (in mm) and proportions for reference specimens of *Dzhaprakoceras vergum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19028.1	19.5	8.3	9.8	2.9	5.9	0.43	0.85	0.15	2.04	0.40
paratype MB.C.19028.2	17.8	8.6	8.3	2.6	5.2	0.48	1.04	0.14	2.00	0.37
paratype MB.C.19028.3	13.9	7.2	7.6	1.2	4.2	0.52	0.95	0.09	2.04	0.45
paratype MB.C.19028.4	11.1	5.8	5.6	1.1	3.3	0.52	1.04	0.10	2.02	0.41

Table 123. Suture line proportions (Figs 86G, H) for *Dzhaprakoceras vergum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19028.1	19.4 mm	0.40	0.51	0.80	0.20	0.78	A lobe strikingly asymmetric
paratype MB.C.19028.3	12.3 mm	0.37	0.54	0.66	0.19	0.69	A lobe slightly asymmetric

**Figure 85.** *Dzhaprakoceras vergum* n. sp. from locality MOU-V; all $\times 2$. **A.** Holotype MB.C.19028.1. **B.** Paratype MB.C.19028.2. **C.** Paratype MB.C.19028.3. **D.** Paratype MB.C.19028.4.

Discussion. *Dzhaprakoceras vergum* shows only slightly curved flanks of the E lobe and can thus be regarded as a rather basal member of the genus. Apart from the slightly pouched external lobe, it resembles *Muensteroceras quadriconstrictum* from the Anti-Atlas.

The strong steinkern constrictions of *D. vergum* help to separate the new species from other species with a similar conch morphology, such as *D. tianshanicum* and *D. dzhazairense*. Another separating criterion is the umbilicus, which is narrower in *D. tianshanicum*, *D. chermnykhi*, *D. gracile*, *D. hispanicum*, *D. pseudoparallelum*, *D. belcourtense*, and *D. dzhazairense* (uw/dm is in the adult stage less than 0.10).

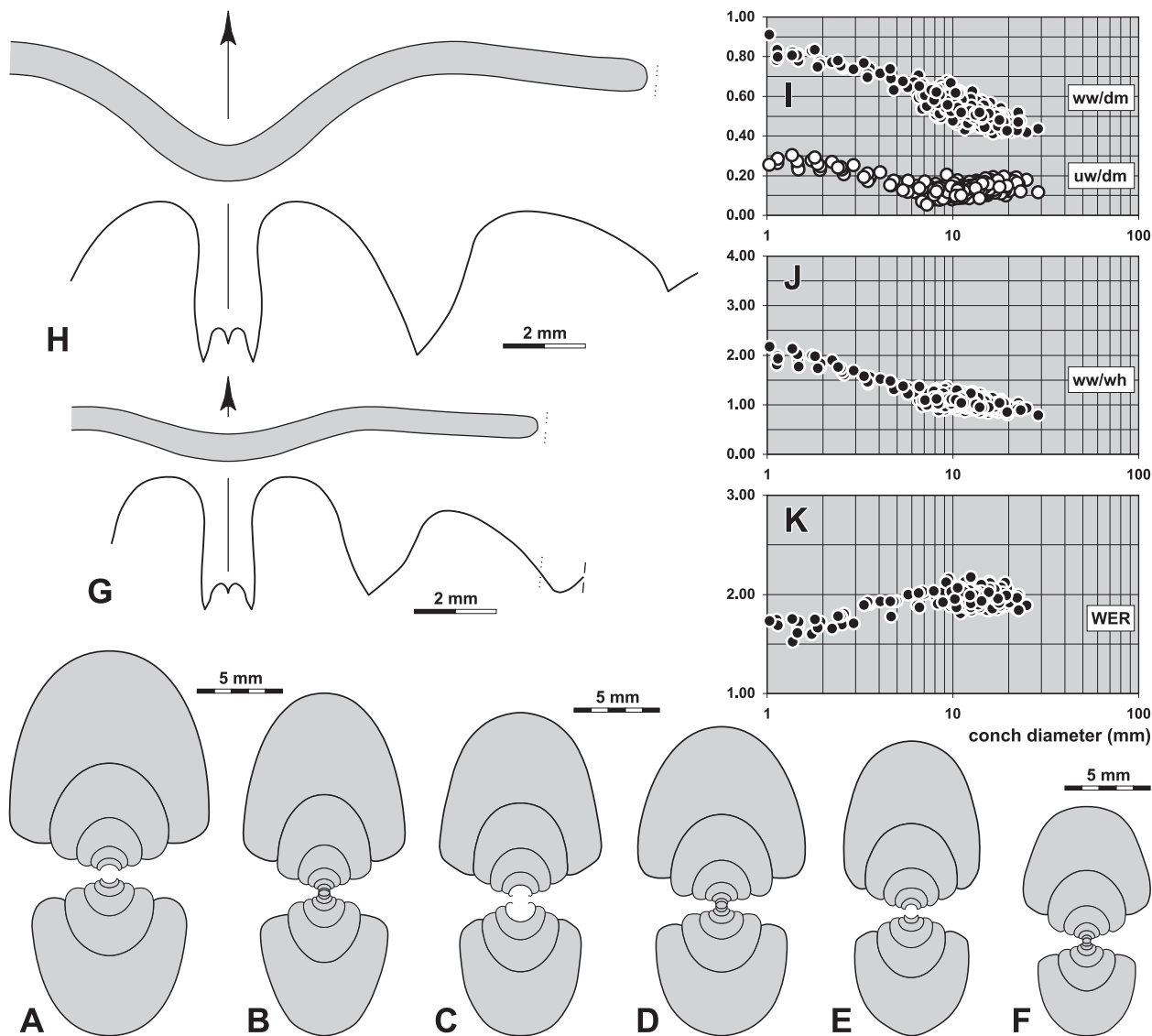


Figure 86. *Dzhaprakoceras vergum* n. sp. **A.** Cross section of paratype MB.C.19028.5 from locality MOU-V; $\times 2.5$. **B.** Cross section of paratype MB.C.19028.6 from locality MOU-V; $\times 2.5$. **C.** Cross section of paratype MB.C.18875.1 from locality MOU-D1; $\times 2.5$. **D.** Cross section of paratype MB.C.19028.7 from locality MOU-V; $\times 2.5$. **E.** Cross section of paratype MB.C.18875.2 from locality MOU-D1; $\times 2.5$. **F.** Cross section of paratype MB.C.18922.1 from locality MOU-E03; $\times 2.5$. **G.** Suture line and constriction of paratype MB.C.19028.3 from locality MOU-V, at 12.3 mm dm, 7.2 mm ww, 6.7 mm wh; $\times 6.0$. **H.** Suture line and constriction of holotype MB.C.19028.1 from locality MOU-V, at 19.4 mm dm, 8.4 mm ww, 10.1 mm wh; $\times 6.0$. **I–K.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Dzhaprakoceras amplum* n. sp.**

Figures 87, 88

Derivation of name. From Latin *amplum* = wide, because of the comparatively wide external lobe.*Holotype.* Specimen MB.C.18912.1, illustrated in Figure 87.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-D3 (Mouydir, South Algeria); *Helicocychus-Ouaoufilalites* Assemblage.*Material.* 20 specimens, conch diameter up to 36 mm.*Diagnosis.* *Dzhaprakoceras* with thickly pachyconic and subinvolute conch in the early juvenile stage, thereafter almost continuous transformation into a thinly discoidal and involute conch at 30 mm dm; umbilical margin rounded, umbilical wall convex; aperture moderate in juveniles and high above 8 mm dm. Steinkern usually without constrictions. Suture line with narrow, slightly pouched external lobe and low median saddle; ventrolateral saddle narrowly rounded and asymmetric; adventive lobe V-shaped, asymmetric with steep ventral flank.**Table 124.** Conch ontogeny (Figs 88A, D–F) of *Dzhaprakoceras amplum* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.80; uw/dm ~ 0.20)	moderately depressed; strongly embracing (ww/wh ~ 1.70; IZR ~ 0.44)	moderate (WER ~ 1.85)
8 mm	thinly pachyconic; involute (ww/dm ~ 0.65; uw/dm ~ 0.08)	weakly depressed; strongly embracing (ww/wh ~ 1.10; IZR ~ 0.44)	high (WER ~ 2.10)
20 mm	thickly discoidal; involute (ww/dm = 0.50–0.55; uw/dm ~ 0.10)	weakly compressed; strongly embracing (ww/wh ~ 0.95; IZR ~ 0.40)	high (WER ~ 2.10)
30 mm	thinly discoidal; involute (ww/dm = 0.40–0.48; uw/dm ~ 0.10)	weakly compressed; strongly embracing (ww/wh ~ 0.85; IZR ~ 0.40)	high (WER ~ 2.10)

Table 125. Conch dimensions (in mm) and proportions for reference specimens of *Dzhaprakoceras amplum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
paratype MB.C.18900.1	32.1	14.0	17.8	2.8	10.0	0.43	0.78	0.09	2.12	0.44
holotype MB.C.18912.1	29.7	13.6	16.3	2.8	9.1	0.46	0.83	0.10	2.08	0.44
paratype MB.C.18912.4	23.7	11.6	12.5	3.0	7.6	0.49	0.93	0.12	2.15	0.40

Table 126. Suture line proportions (Figs 88B, C) for *Dzhaprakoceras amplum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18912.1	29.0 mm	0.50	0.88	1.21	0.32	0.57	flanks of E lobe barely diverging
paratype MB.C.18912.3	c. 22.0 mm	0.52	0.94	1.23	0.30	0.56	VL saddle narrowly rounded

Discussion. *Dzhaprakoceras amplum* is one of the few species within the genus that possesses a rather wide external lobe (EL w/d ~ 0.50 in contrast to a value of less than 0.40 of many of the other species). The slender, very narrow umbilicate conch is characteristic for a number of species of *Dzhaprakoceras*, but the steinkern constrictions are much stronger in *D. amplum* than those of other members of the genus.

**Figure 87.** *Dzhaprakoceras amplum* n. sp., holotype MB.C.18912.1 from locality MOU-D3; $\times 2$.

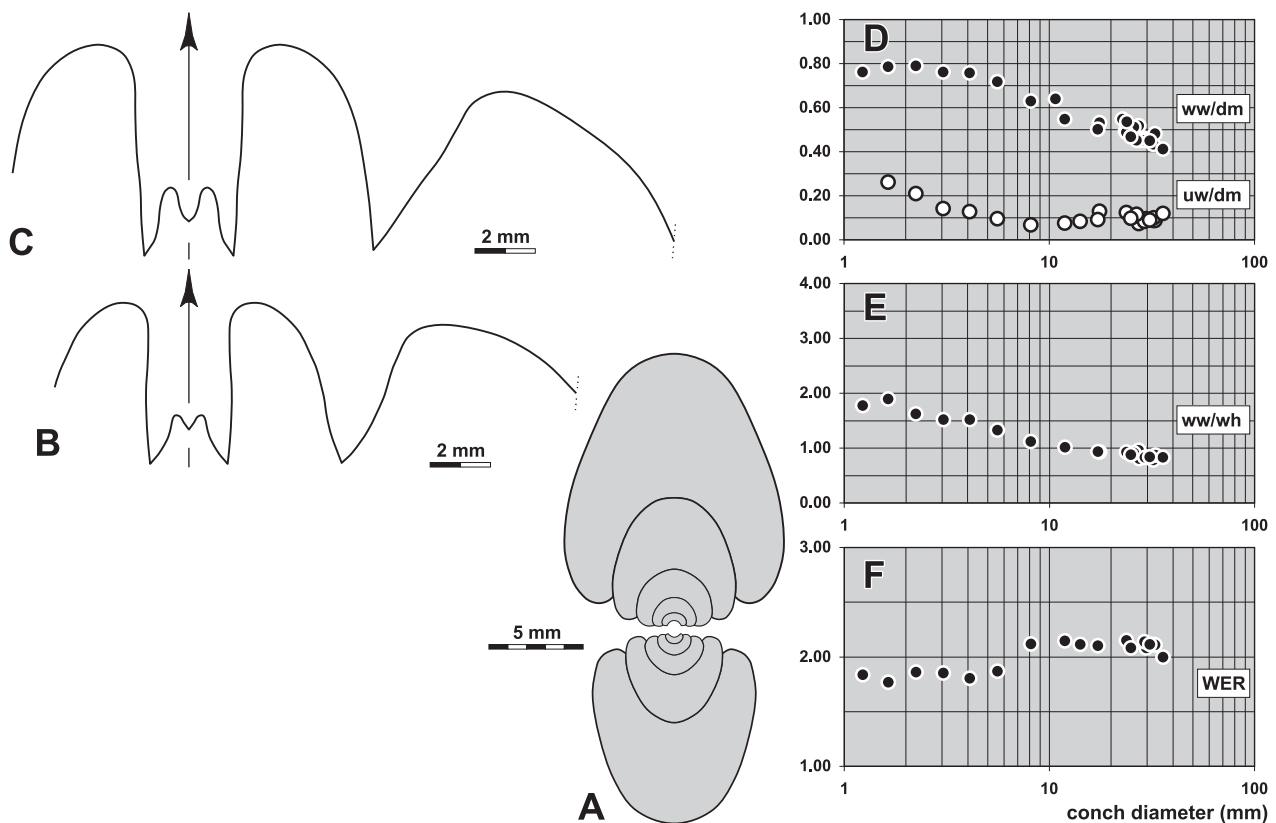


Figure 88. *Dzhaprakoceras amplum* n. sp. from locality MOU-D3. **A.** Cross section of paratype MB.C.18912.2; $\times 2.5$. **B.** Suture line of paratype MB.C.18912.3, at 10.5 mm ww, 11.8 mm wh; $\times 4.0$. **C.** Suture line of holotype MB.C.18912.1, at 29.0 mm dm, 13.6 mm ww, 15.2 mm wh; $\times 4.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Dzhaprakoceras punctum n. sp.

Figures 89, 90

Derivation of name. From Latin punctum, because of the punctiform umbilicus.

Holotype. Specimen MB.C.19050.1, illustrated in Figure 89A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-Y (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 29 specimens, conch diameter up to 16 mm.

Diagnosis. *Dzhaprakoceras* with thickly pachyconic or globular conch up to 8 mm dm, thereafter transformation into a thinly pachyconic conch at 16 mm dm; conch subinvolute in the early juvenile stage and involute above 2.5 mm dm; umbilical margin rounded, umbilical wall convex; aperture low in juveniles and high in the adult stage. Steinkern without constrictions. Suture line with very narrow, slightly pouched external lobe and low median saddle; ventrolateral saddle moderately narrowly rounded and slightly asymmetric; adventive lobe V-shaped, asymmetric.

Discussion. *Dzhaprakoceras punctum* differs, in its smooth steinkern without constrictions, from many of the other species of the genus. The rather stout conch and the very narrow umbilicus are further criteria for separation.

Table 127. Conch ontogeny (Figs 90A, B, F–H) of *Dzhaprakoceras punctum* n. sp.

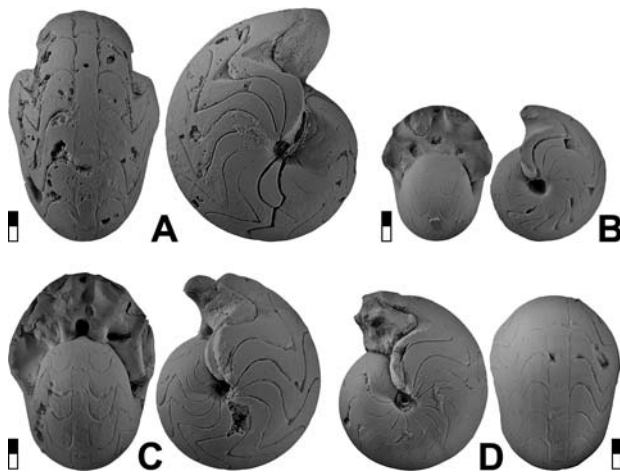
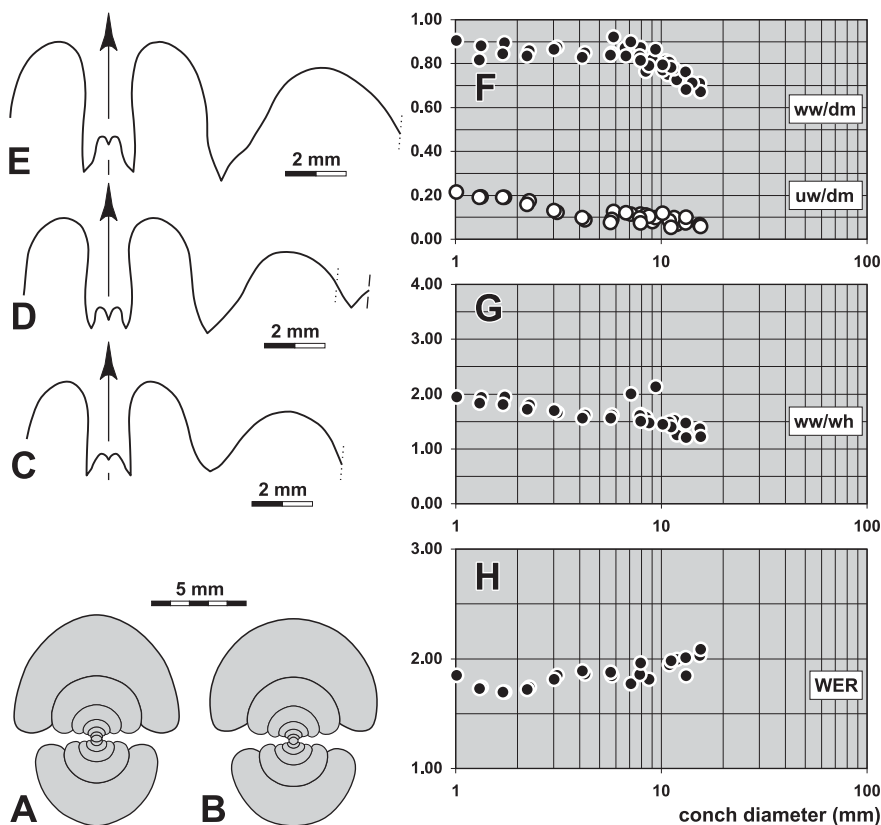
dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm ~ 0.85 ; uw/dm ~ 0.18)	moderately depressed; very strongly embracing (ww/wh ~ 1.75 ; IZR ~ 0.50)	low (WER ~ 1.70)
8 mm	thickly pachyconic; involute (ww/dm = 0.75–0.85; uw/dm 0.07–0.12)	moderately depressed; very strongly embracing (ww/wh ~ 1.50 ; IZR ~ 0.50)	moderate (WER = 1.80–1.95)
16 mm	thinly pachyconic; involute (ww/dm = 0.65–0.72; uw/dm ~ 0.06)	weakly depressed; strongly embracing (ww/wh = 1.25–1.40; IZR ~ 0.44)	high (WER ~ 2.05)

Table 128. Conch dimensions (in mm) and proportions for reference specimens of *Dzhaprakoceras punctum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19050.1	15.5	10.4	8.5	0.9	4.8	0.67	1.23	0.06	2.09	0.44
paratype MB.C.19050.3	13.1	9.4	7.4	0.8	4.0	0.71	1.27	0.06	2.05	0.46
paratype MB.C.19050.4	11.9	8.6	6.9	0.8	3.5	0.73	1.26	0.07	1.99	0.49
paratype MB.C.19050.2	8.7	6.9	4.7	0.9	2.2	0.79	1.47	0.10	1.81	0.52

Table 129. Suture line proportions (Figs 90C–E) for *Dzhaprakoceras punctum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19050.1	14.6 mm	0.37	0.65	0.77	0.27	0.57	A lobe strikingly asymmetric
paratype MB.C.19050.3	12.5 mm	0.39	0.71	0.73	0.20	0.55	M saddle comparatively low
paratype MB.C.19050.4	11.1 mm	0.44	0.70	0.66	0.24	0.62	

**Figure 89.** *Dzhaprakoceras punctum* n. sp. from locality MOU-Y; all $\times 2$. **A.** Holotype MB.C.19050.1. **B.** Paratype MB.C.19050.2. **C.** Paratype MB.C.19050.3. **D.** Paratype MB.C.19050.4.**Figure 90.** *Dzhaprakoceras punctum* n. sp. from locality MOU-Y. **A.** Cross section of paratype MB.C.19050.5; $\times 2.5$. **B.** Cross section of paratype MB.C.19050.6; $\times 2.5$. **C.** Suture line of paratype MB.C.19050.4, at 11.1 mm dm, 8.6 mm ww, 6.0 mm wh; $\times 4.0$. **D.** Suture line of paratype MB.C.19050.3, at 12.3 mm dm, 9.4 mm ww, 7.0 mm wh; $\times 4.0$. **E.** Suture line of holotype MB.C.19050.1, at 14.6 mm dm, 10.3 mm ww, 8.5 mm wh; $\times 4.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Dzhaprakoceras biconvexum* n. sp.**

Figures 91, 92

Derivation of name. From Latin *biconvexum*, = because of the biconvex constrictions.*Holotype.* Specimen MB.C.18737.1, illustrated in Figure 91A.*Type locality and horizon.* Oued Temertasset, locality and sample A320–5 (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.*Material.* 122 specimens, conch diameter up to 38 mm.*Diagnosis.* *Dzhaprakoceras* with thickly pachyconic conch in early juveniles, thereafter continuous transformation into a thinly discoidal conch at 40 mm dm; conch subinvolute in the early juvenile stage and involute in stages above 8 mm dm; umbilical margin and umbilical wall rounded; aperture moderate in juveniles and moderately high or high above 6 mm dm. Steinkern with moderately sharp constrictions, course biconvex with shallow lateral sinus and moderately deep ventral sinus. Suture line with very narrow, weakly pouched external lobe and low median saddle; ventrolateral saddle broadly rounded and slightly asymmetric; adventive lobe V-shaped, almost symmetric with slightly curved flanks.**Table 130.** Conch ontogeny (Figs 92A–C, G–I) of *Dzhaprakoceras biconvexum* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly pachyconic; subinvolute (ww/dm = 0.80–0.85; uw/dm = 0.18–0.24)	moderately depressed; strongly embracing (ww/wh = 1.70–1.80; IZR = 0.40–0.45)	moderate (WER = 1.75–1.85)
8 mm	thickly pachyconic; involute or subinvolute (ww/dm = 0.65–0.70; uw/dm 0.12–0.20)	weakly to moderately depressed; strongly embracing (ww/wh = 1.30–1.65; IZR = 0.40–0.45)	moderate to high (WER = 1.90–2.10)
20 mm	thickly discoidal; involute (ww/dm = 0.50–0.60; uw/dm = 0.10–0.15)	weakly depressed; strongly embracing (ww/wh = 1.00–1.25; IZR = 0.35–0.45)	moderate to high (WER = 1.90–2.15)
30 mm	thinly to thickly discoidal; involute (ww/dm = 0.44–0.52; uw/dm = 0.10–0.15)	weakly compressed to weakly depressed; strongly embracing (ww/wh = 0.90–1.10; IZR = 0.40–0.45)	moderate to high (WER = 1.90–2.10)

Table 131. Conch dimensions (in mm) and proportions for reference specimens of *Dzhaprakoceras biconvexum* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18737.1	33.0	17.5	15.8	3.5	9.8	0.53	1.11	0.11	2.02	0.38
paratype MB.C.19014.1	21.3	11.2	10.3	2.5	6.0	0.52	1.08	0.12	1.94	0.42
paratype MB.C.18737.2	19.4	11.5	9.9	2.8	5.7	0.59	1.15	0.15	2.00	0.43
paratype MB.C.18737.6	10.7	6.8	5.5	1.2	3.3	0.63	1.24	0.11	2.10	0.39

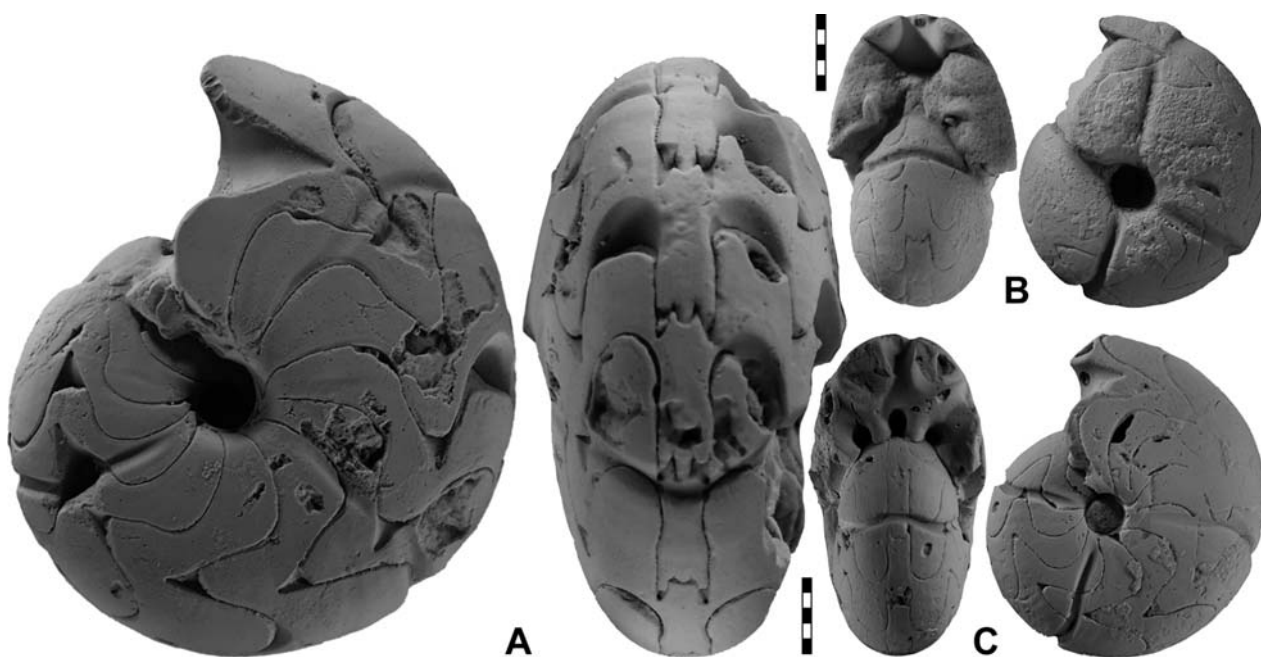
**Figure 91.** *Dzhaprakoceras biconvexum* n. sp.; all $\times 2$. **A.** Holotype MB.C.18737.1 from locality A320–5. **B.** Paratype MB.C.18737.2 from locality A320–5. **C.** Paratype MB.C.19014.1 from locality MOU-F.

Table 132. Suture line proportions (Figs 92D–F) for *Dzhaprakoceras biconvexum* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18737.1	30.5 mm	0.38	0.65	0.83	0.20	0.58	VL saddle and A lobe asymmetric
paratype MB.C.18737.2	15.4 mm	0.49	0.86	0.91	0.23	0.57	A lobe almost symmetric
paratype MB.C.18737.6	10.1 mm	0.51	0.71	0.78	0.23	0.73	

Discussion. *Dzhaprakoceras biconvexum* is mainly characterised by its biconvex steinkern constrictions.

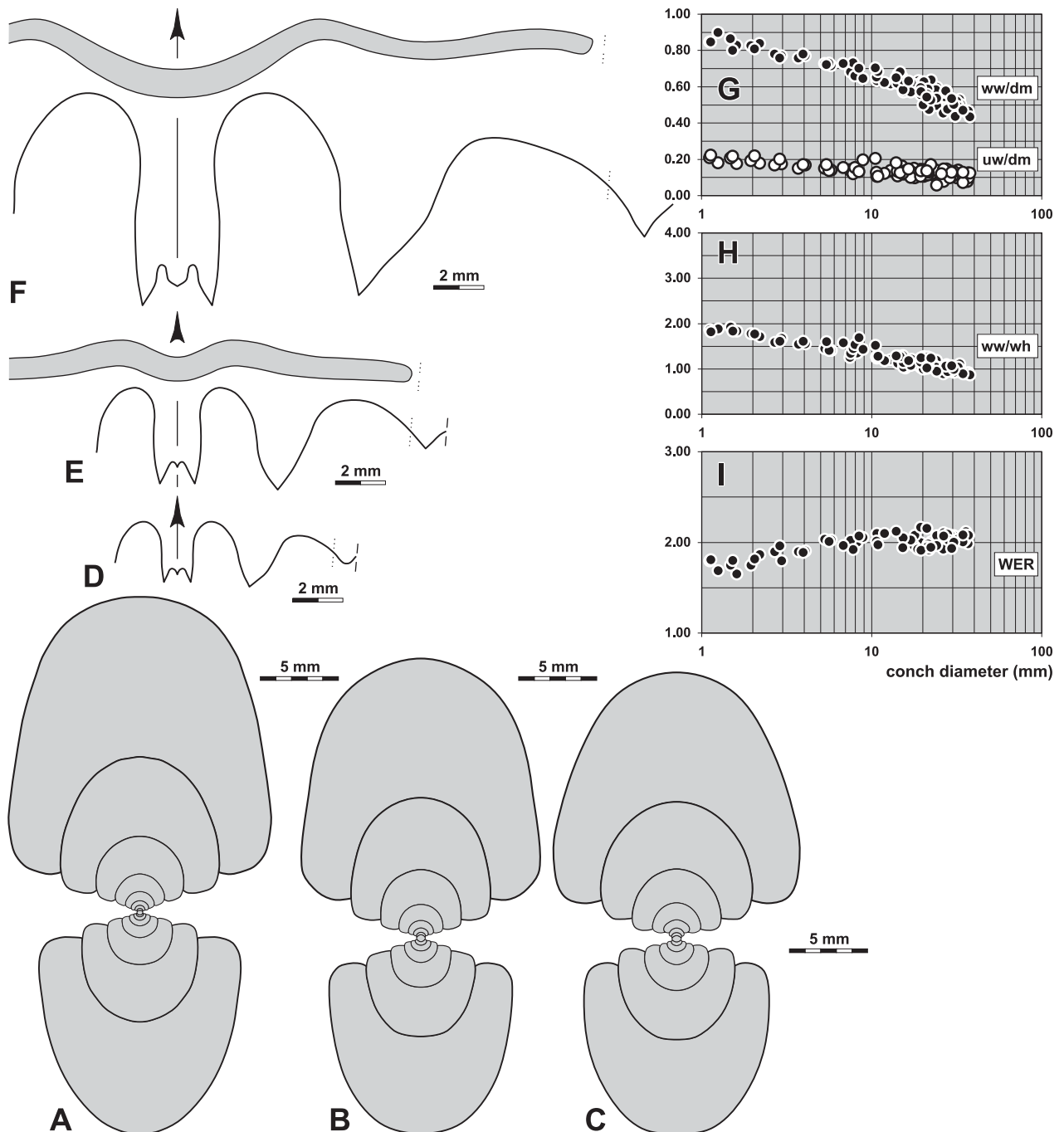


Figure 92. *Dzhaprakoceras biconvexum* n. sp. from locality A320–5. **A.** Cross section of paratype MB.C.18737.3; $\times 2.5$. **B.** Cross section of paratype MB.C.18737.4; $\times 2.5$. **C.** Cross section of paratype MB.C.18737.5; $\times 2.5$. **D.** Suture line of paratype MB.C.18737.6, at 10.1 mm dm, 6.5 mm ww, 5.4 mm wh; $\times 4.0$. **E.** Suture line and constriction of paratype MB.C.18737.2, at 15.4 mm dm, 10.7 mm ww, 8.3 mm wh; $\times 4.0$. **F.** Suture line and constriction of holotype MB.C.18737.1, at 30.5 mm dm, 16.6 mm ww, 15.2 mm wh; $\times 4.0$. **G–I.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Superfamily **Goniaticaceae** de Haan, 1825Family **Goniaticidae** de Haan, 1825*Included subfamilies.*

Goniaticinae de Haan, 1825

Arnsbergitinae Korn & Ebbighausen, 2008

Sygambrinae Korn, 1988

Sudeticeratinae Korn & Ebbighausen, 2006

Progoniaticinae n. subfam.

Habadratinae n. subfam.

Antegoniaticinae n. subfam.

Subfamily **Progoniaticinae** n. subfam.

Subfamily definition. Goniaticidae with a simple conch ontogeny. Early ontogeny up to 4–5 mm conch diameter pachyconic or globular with almost constant ww/dm ratio, the conch becomes continuously more slender in later ontogeny. Early juvenile stage subinvolute or involute. Suture line with strongly diverging external lobe ($EL\ w/d > 0.75$; $EL/AL > 1.50$) and usually with asymmetric, acute or subacute ventrolateral saddle.

*Included genus.**Progoniatices* Korn, Bockwinkel, Ebbighausen & Klug, 2003

Discussion. The members of the subfamily differ from the subfamilies Goniaticinae and Arnsbergitinae in the simple juvenile conch ontogeny (Korn 1988; Klug et al. 2006; Korn & Ebbighausen 2008). While the other two subfamilies show a narrowing of the conch at 2–3 mm dm followed by an intermediate thickening and a subsequent narrowing, the ww/dm ratio is stable in the Progoniaticinae.

***Progoniatices* Korn, Bockwinkel, Ebbighausen & Klug, 2003**

Type species. *Progoniatices maghribensis* Korn, Bockwinkel, Ebbighausen & Klug, 2003 (original designation).

Genus definition. Goniaticidae with moderately large conch, reaching approximately 50 mm in diameter; conch ontogeny two-phased, juvenile stage usually globular and subinvolute, closure of the umbilicus is accompanied by transformation into a pachyconic or discoidal conch. Suture line with V-shaped, mostly narrow or moderately narrow external lobe ($EL\ w/d = 0.50–0.80$; $EL/AL = 0.90–1.40$) and moderately low median saddle ($MS\ h = 0.35–0.40$); ventrolateral saddle narrowly rounded or subacute, asymmetric with a dorsally vergent top.

*Included species.**angustilobatus*: *Glyptoceras angustilobatum* Schindewolf, 1926, p. 89: Thuringia.*divisus*: *Goniatices divisus* de Koninck, 1880, p. 117; Belgium.*globulus*: *Progoniatices globulus* n. sp.; Mouydir, Algeria.*karensis*: *Zhifangoceras karensis* Kusina, 2000, p. 22; North Urals.*maghribensis*: *Progoniatices maghribensis* Korn, Bockwinkel, Ebbighausen & Klug, 2003, p. 89; Anti-Atlas, Morocco.*paenacutus*: *Progoniatices paenacutus* n. sp.; Mouydir, Algeria.*pilus*: *Progoniatices pilus* n. sp.; Mouydir, Algeria.*uncus*: *Progoniatices uncus* n. sp.; Mouydir, Algeria.

Discussion. *Progoniatices* is a strange component in the Tournaisian ammonoid assemblages, the first well-preserved specimens were collected in the North Urals (Kusina 2000; there listed under the genus name *Zhifangoceras*) and the Anti-Atlas (Korn et al. 2003). The far-reaching morphological relationship to *Goniatices* (sensu Korn 1988, 1997a, 1997b), which can hardly be explained by convergence, makes *Progoniatices* a Lazarus taxon (Korn et al. 2005). Despite their close resemblance, *Progoniatices* and *Goniatices* do possess some separating characters. The conch ontogeny of *Progoniatices* is simpler without a distinct widely umbilicate early juvenile stage, as known from *Goniatices* and the external lobe is wider in *Progoniatices*.

The most important difference to the co-occurring *Antegoniatices* n. gen. is the narrower external lobe, the lower median saddle, and the strikingly asymmetric ventrolateral saddle. *Habadrates* n. gen. differs from *Progoniatices* in the rounded ventrolateral saddle and the conch ontogeny that shows an increasing aperture height.

Separation of the new species. The four species of *Progoniatices* from Oued Temertasset can be separated in terms of their conch morphology and their ornament that is, in some cases, visible on the steinkern surface. The bivariate plots for morphometric properties of the four new species display some common features, but also distinguishing characters. A first common feature is the ontogenetic trend in the two-phased ontogeny of the relative conch thickness. In this character, *Progoniatices* differs from the other representatives of the order Goniaticida (such as the genus *Goniatices*), which have a three-phased ontogeny. The ontogenetic development of the conch width index differs between the species:

- *P. uncus* – the CWI is rather constant at 0.80–0.90 until 6 mm dm, and then continuously decreasing to 0.60 at 30 mm conch diameter;
- *P. pilus* – a rather stable CWI is maintained at 0.80–0.90 up to 9 mm dm, followed by a decrease to 0.65 at 30 mm conch diameter;
- *P. paenacutus* – a more or less continuous decrease of the CWI can be observed, from 0.90 at 2 mm dm to 0.50 at 20 mm conch diameter; and
- *P. globulus* – the conch is thickest at 8 mm (CWI almost 1.10), and then continuously decreasing to 0.80 at 20 mm conch diameter.

A common character of the four species is the early ontogenetic closure of the umbilicus. They possess an opened umbilicus ($uw/dm = 0.20–0.40$) in the initial stage, and the reduction of the umbilical width index to a value of 0.10 happens at conch diameters between 3 and 5 mm.

In the ontogenetic modification of the aperture height, there are two different modes to be recognised:

- *P. globulus* has an almost stable low whorl expansion rate (WER around 1.50) throughout ontogeny, but
- *P. uncus*, *P. pilus*, and *P. paenacutus* show ontogenetic variations. These include an increase of the WER in juvenile stages between 4 and 8 mm conch diameter, where a maximum value of 2.00 can be reached. In the adult stage, a decrease to a value of 1.50–1.60 (*P. uncus* and *P. pilus*) or 1.80 (*P. paenacutus*) can be observed.

The ornament, partly visible on the internal mould, reveals further criteria to separate between the species:

- *P. pilus* and *P. paenacutus* possess an ornament with weak transverse ribs on the venter, but
- *P. uncus* lacks ribs; a fine spiral ornament is particularly developed on the flanks near the umbilicus.

The suture lines of the four Algerian species of *Progoniatites* display differences, which help to separate them. A major specific character is the width of the external lobe, i.e., the ratio of width and depth.

Discussion. *P. maghribensis* Korn et al., 2003 has a thickly pachyconic, involute conch at 15 mm dm ($ww/dm = 0.84$; $uw/dm = 0.13$) and thus resembles *P. pilus*. *P. maghribensis* lacks the riblets present in *P. pilus* and has a narrower external lobe.

P. karensis (Kusina, 2000) has a conch shape ($ww/dm = 0.56$, $uw/dm = 0.11$ at 34 mm dm) similar to *P. uncus*, but possesses weak riblets that are absent in *P. uncus*.

P. divisus (de Koninck, 1880) is based on poorly preserved specimens, which only allow for the recognition of a thickly pachyconic, involute conch that is ornamented with weak riblets extending across the venter. *P. angustilobatus* (Schindewolf, 1926) is based on distorted specimens, which do not allow for the description of all conch characters. The adventive lobe is shown to be deeper than the external lobe, but this may be caused by deformation.

Remarks. *Progoniatites* was proposed by Korn et al. (2003, 2005) for early Late Tournaisian ammonoids with a suture line that closely resembles the Late Viséan genus *Goniatites*. At that time, *Progoniatites* was only represented by a few species of which only the type species was well known. The discovery of four additional species in the Mouydir of Algeria allows now for a revision of the genus based on this new rich material.

Stratigraphic occurrence. Those species of the genus that were found in stratigraphically well-dated successions, i.e., the records from North Africa come from horizons with early Late Tournaisian ammonoid assemblages with *Pericyclus*, *Temertassetia*, *Imitoceras*, *Muensteroceras*, *Eurites*, *Jerania*, etc. The other occurrences, for instance in the Rußschiefer of Zedelsdorf, are not dated as accurately, but they do not contradict the assignment to an early Late Tournaisian age.

***Progoniatites uncus* n. sp.**

Figures 93, 94

Derivation of name. From Latin uncus = hook, because of the top of the ventrolateral saddle.

Holotype. Specimen MB.C.18902.1, illustrated in Figure 93A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D2 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 143 specimens, conch diameter up to 35 mm.

Diagnosis. *Progoniatites* with a globular conch in the juvenile stage (up to 7 mm dm), thereafter becoming more slender and being thinly pachyconic at 30 mm dm; conch subinvolute in early juveniles and involute above 3 mm dm; umbilical margin rounded; aperture high at 8 mm dm and moderate in smaller and larger stages. Steinkern with delicate spiral lines around the umbilicus, without riblets; convex constrictions with wide and moderately deep ventral sinus. Suture line with narrow external lobe that varies in the degree of divergence; median saddle moderately low; ventrolateral saddle subacute; adventive lobe deep, asymmetric with strongly curved ventral flank.

Table 133. Conch ontogeny (Figs 94A, F–H) of *Progoniatites uncus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute ($ww/dm \sim 0.86$; $uw/dm \sim 0.25$)	moderately depressed; very strongly embracing ($ww/wh \sim 2.00$; $IZR \sim 0.48$)	moderate ($WER \sim 1.75$)
8 mm	thickly pachyconic; involute ($ww/dm = 0.74–0.82$; $uw/dm = 0.05–0.10$)	weakly to moderately depressed; very strongly embracing ($ww/wh = 1.35–1.60$; $IZR = 0.45–0.50$)	high ($WER \sim 2.05$)
20 mm	thinly pachyconic; involute ($ww/dm = 0.63–0.72$; $uw/dm = 0.05–0.12$)	weakly depressed; very strongly embracing ($ww/wh = 1.15–1.50$; $IZR = 0.45–0.50$)	low to moderate ($WER = 1.65–1.85$)
30 mm	thinly pachyconic; involute ($ww/dm = 0.60–0.68$; $uw/dm = 0.08–0.12$)	weakly depressed; very strongly embracing ($ww/wh = 1.20–1.45$; $IZR = 0.45–0.50$)	low ($WER \sim 1.65$)

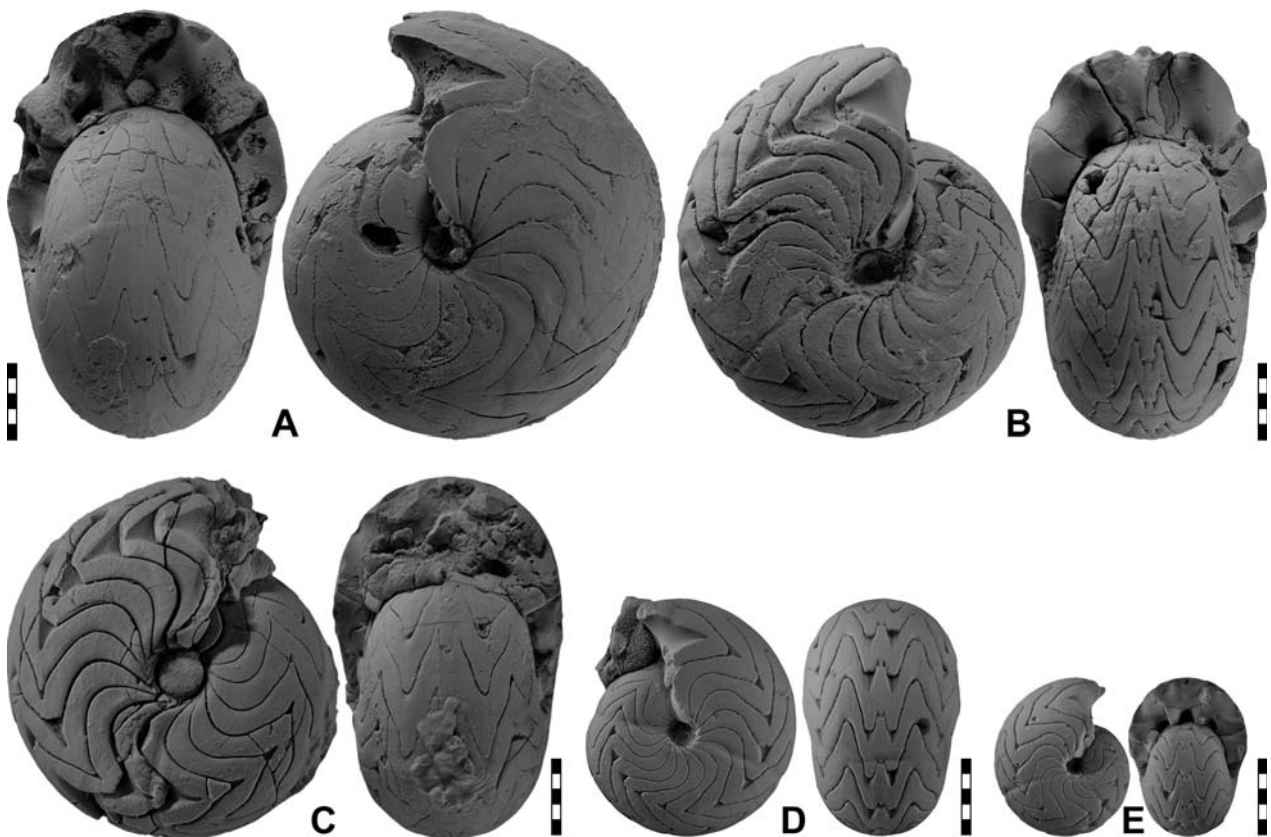
Table 134. Conch dimensions (in mm) and proportions for reference specimens of *Progoniatites uncus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18902.1	28.5	18.2	14.8	2.4	6.3	0.64	1.23	0.09	1.64	0.58
paratype MB.C.18902.2	26.7	16.8	13.3	2.8	6.2	0.63	1.26	0.10	1.70	0.53
paratype MB.C.18902.3	24.0	15.3	10.5	2.6	5.9	0.64	1.47	0.11	1.76	0.44
paratype MB.C.18876.1	19.7	13.4	9.6	2.2	4.9	0.68	1.39	0.11	1.76	0.50
paratype MB.C.18902.4	15.6	10.1	7.6	1.2	–	0.65	1.33	0.08	–	–
paratype MB.C.19059.1	14.4	10.8	7.9	1.5	3.7	0.75	1.36	0.10	1.81	0.54
paratype MB.C.18902.5	10.6	7.8	5.7	0.8	2.8	0.74	1.39	0.08	1.85	0.51

Table 135. Suture line proportions (Figs 94B–E) for *Progoniatites uncus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18902.1	22.9 mm	0.55	1.54	1.04	0.42	0.36	E lobe weakly diverging
paratype MB.C.18902.3	21.8 mm	0.60	1.25	1.13	0.39	0.48	E lobe strongly diverging
paratype MB.C.18902.4	15.5 mm	0.56	1.07	1.36	0.46	0.52	VL saddle narrowly rounded
paratype MB.C.18902.5	10.6 mm	0.65	1.66	0.86	0.35	0.39	VL saddle narrowly rounded

Remarks. *Progoniatites uncus* possesses some variability in the suture line, as shown in the comparison of holotype MB.C.18902.1 and paratype MB.C.18902.3 (Figs 94D, E). The external lobe particularly differs in its shape, being strongly divergent with a very narrow base in paratype MB.C.18902.3.

**Figure 93.** *Progoniatites uncus* n. sp. from locality MOU-D2; all $\times 2$. **A.** Holotype MB.C.18902.1. **B.** Paratype MB.C.18902.2. **C.** Paratype MB.C.18902.3. **D.** Paratype MB.C.18902.4. **E.** Paratype MB.C.18902.5.

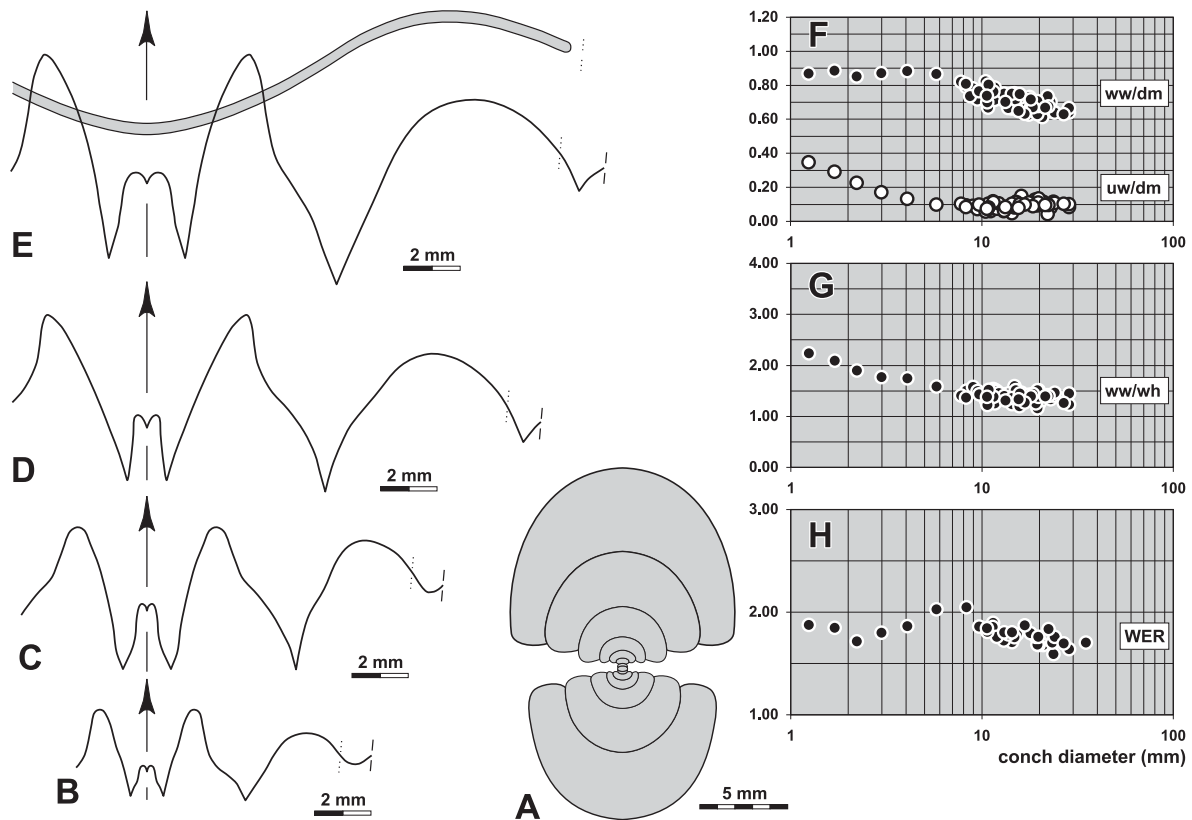


Figure 94. *Progoniatites uncus* n. sp. **A.** Cross section of paratype MB.C.18953.1 from locality MOU-E07; $\times 2.5$. **B.** Suture line of paratype MB.C.18902.5 from locality MOU-D2, at 10.8 mm dm, 7.8 mm ww, 5.6 mm wh; $\times 5.0$. **C.** Suture line of paratype MB.C.18902.4 from locality MOU-D2, at 15.5 mm dm, 10.1 mm ww, 7.5 mm wh; $\times 5.0$. **D.** Suture line of paratype MB.C.18902.3 from locality MOU-D2, at 21.8 mm dm, 14.3 mm ww, 10.0 mm wh; $\times 5.0$. **E.** Suture line and steinkern constriction of holotype MB.C.18902.1 from locality MOU-D2, at 22.9 mm dm, 16.1 mm ww, 12.1 mm wh; $\times 5.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Progoniatites pilus n. sp.

Figures 95, 96

Derivation of name. From Latin pilus = ball, because of the stout conch.

Holotype. Specimen MB.C.18954.1, illustrated in Figure 95A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-E07 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 47 specimens, conch diameter up to 31 mm.

Diagnosis. *Progoniatites* with thickly pachyconic or globular conch in the juvenile and preadult stage (up to 16 mm dm), thereafter becoming more slender and being thinly pachyconic at 30 mm dm; conch subinvolute in early juveniles and involute above 2 mm dm; umbilical margin subangular; aperture high at 5 mm dm and low to moderate in smaller and larger stages. Steinkern with gentle constrictions, which extend in convex course across the flank and form a wide and deep ventral sinus; venter with shallow, rounded riblets. Suture line with narrow to moderately narrow external lobe; median saddle low or moderately low; ventrolateral saddle very asymmetric and subacute; adventive lobe strongly asymmetric with strongly curved ventral flank.

Table 136. Conch ontogeny (Figs 96A, E–G) of *Progoniatites pilus* n. sp.

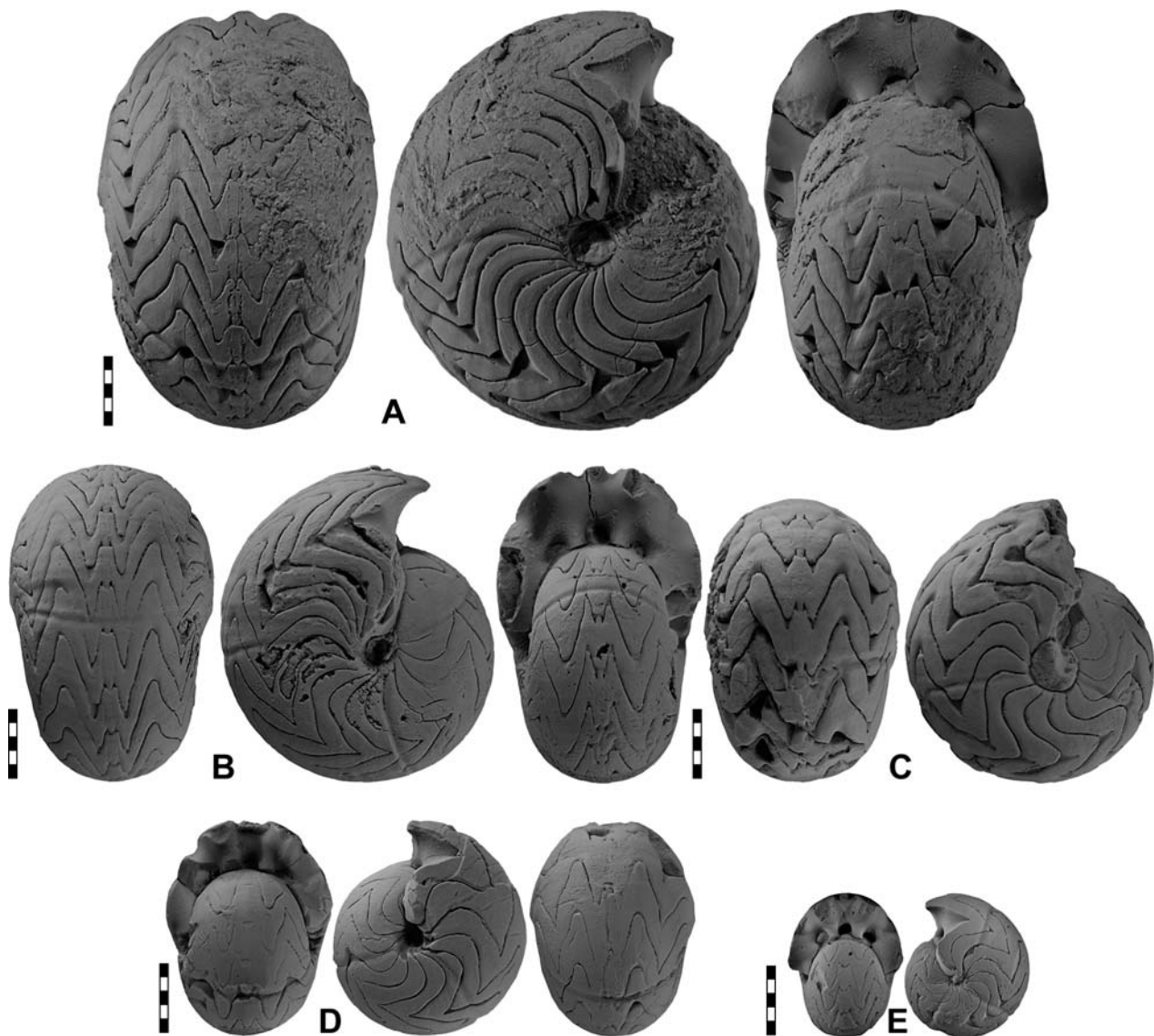
dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; involute (ww/dm \sim 0.86; uw/dm \sim 0.14)	moderately depressed; very strongly embracing (ww/wh \sim 1.75; IZR \sim 0.50)	moderate (WER \sim 1.75)
8 mm	thickly pachyconic to thinly globular; involute (ww/dm = 0.80–0.90; uw/dm = 0.07–0.10)	weakly to moderately depressed; very strongly embracing (ww/wh = 1.40–1.60; IZR = 0.52–0.58)	low to moderate (WER = 1.65–1.80)
20 mm	thinly to thickly pachyconic; involute (ww/dm = 0.68–0.80; uw/dm = 0.08–0.13)	weakly to moderately depressed; very strongly embracing (ww/wh = 1.40–1.70; IZR = 0.54–0.60)	low (WER = 1.55–1.70)
30 mm	thinly pachyconic; involute (ww/dm \sim 0.65; uw/dm \sim 0.10)	weakly depressed; very strongly embracing (ww/wh \sim 1.30; IZR \sim 0.62)	low (WER \sim 1.55)

Table 137. Conch dimensions (in mm) and proportions for reference specimens of *Progoniatites pilus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18954.1	30.7	20.3	15.4	2.6	6.0	0.66	1.32	0.09	1.55	0.61
paratype MB.C.18903.1	22.8	14.8	12.0	1.8	5.5	0.65	1.23	0.08	1.74	0.54
paratype MB.C.18964	20.6	14.1	9.7	2.2	4.4	0.69	1.45	0.11	1.63	0.54
paratype MB.C.18777	15.4	11.9	7.7	1.4	3.5	0.77	1.53	0.09	1.66	0.55
paratype MB.C.18903.3	11.9	9.1	6.3	1.2	2.7	0.77	1.44	0.10	1.67	0.58
paratype MB.C.18903.2	10.6	8.3	5.8	0.6	2.4	0.78	1.44	0.06	1.68	0.58

Table 138. Suture line proportions (Figs 96B–D) for *Progoniatites pilus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18954.1	27.5 mm	0.80	1.63	0.99	0.34	0.49	VL saddle subacute
paratype MB.C.18750.1	20.8 mm	0.67	1.94	1.13	0.38	0.35	E lobe with almost straight flanks
paratype MB.C.18903.2	10.2 mm	0.55	1.26	0.95	0.32	0.43	VL saddle narrowly rounded

**Figure 95.** *Progoniatites pilus* n. sp.; all $\times 2$. **A.** Holotype MB.C.18954.1 from locality MOU-E07. **B.** Paratype MB.C.18903.1 from locality MOU-D2. **C.** Paratype MB.C.18964 from locality MOU-E08. **D.** Paratype MB.C.18777 from locality MOU-D1. **E.** Paratype MB.C.18903.2 from locality MOU-D2.

Discussion. Suture lines of *Progoniatites pilus* show some variability; they differ in the shape of the external lobe and also in the width of the adventive lobe (Figs 96B–D). Common features, however are the rather wide and strikingly asymmetric adventive lobe and the shape of the narrowly rounded or subacute ventrolateral saddle.

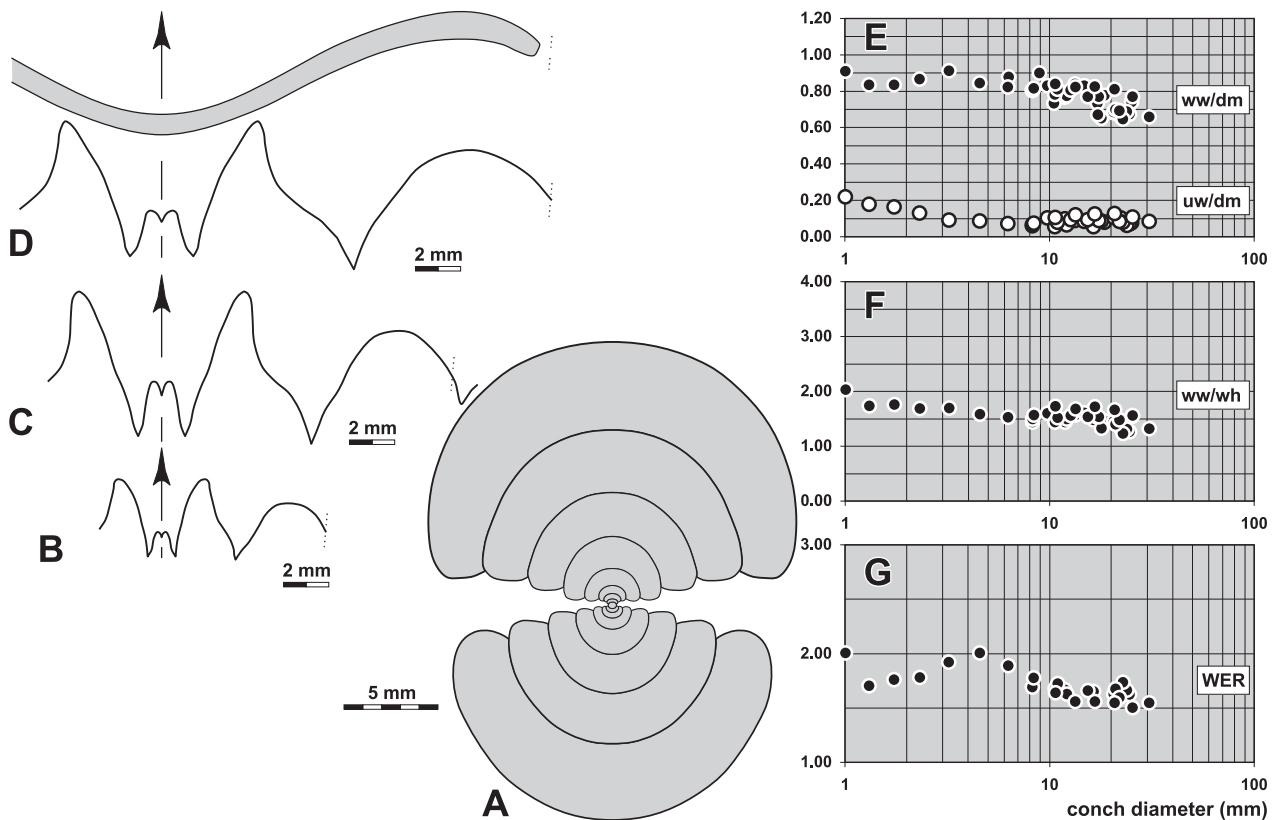


Figure 96. *Progoniatites pilus* n. sp. **A.** Cross section of paratype MB.C.18970 from locality MOU-E09; $\times 2.5$. **B.** Suture line of paratype MB.C.18903.2 from locality MOU-D2, at 10.2 mm dm, 7.4 mm ww, 5.9 mm wh; $\times 4.0$. **C.** Suture line of paratype MB.C.18750.1 from locality A321, at 20.8 mm dm, 14.5 mm ww, 10.9 mm wh; $\times 4.0$. **D.** Suture line and steinkern constriction of holotype MB.C.18954.1 from locality MOU-E07, at 27.5 mm dm, 20.5 mm ww, 14.2 mm wh; $\times 4.0$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Progoniatites paenacutus n. sp.

Figures 97, 98

Derivation of name. From Latin *paenus* = nearly and *acutus* = sharp, because of the shape of the ventrolateral saddle.

Holotype. Specimen MB.C.18904.1, illustrated in Figure 97A.

Type locality and horizon. Oued Temertasset, sample MOU-D2 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 18 specimens, conch diameter up to 22 mm.

Diagnosis. *Progoniatites* with thickly pachyconic or globular conch in the juvenile and preadult stage (up to 10 mm dm), thereafter becoming more slender and being thickly discoidal at 20 mm dm; conch subinvolute in early juveniles and involute above 3 mm dm; umbilical margin narrowly rounded; aperture high at 8 mm dm and moderate in smaller and larger stages. Steinkern with gentle constrictions, which extend in convex course, venter with shallow, rounded riblets. Suture line with narrow V-shaped external lobe; median saddle moderately low; ventrolateral saddle subacute, slightly asymmetric; adventive lobe asymmetric with curved flanks.

Table 139. Conch ontogeny (Figs 98A, D–F) of *Progoniatites paenacutus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm \sim 0.86; uw/dm \sim 0.25)	moderately depressed; very strongly embracing (ww/wh \sim 1.90; IZR \sim 0.45)	moderate (WER \sim 1.75)
8 mm	thickly pachyconic; involute (ww/dm \sim 0.75; uw/dm \sim 0.08)	weakly depressed; very strongly embracing (ww/wh \sim 1.40; IZR \sim 0.47)	high (WER \sim 2.00)
20 mm	thickly discoidal; involute (ww/dm \sim 0.55; uw/dm \sim 0.06)	weakly depressed; very strongly embracing (ww/wh = 1.00–1.10; IZR = 0.45–0.55)	moderate (WER = 1.75–1.85)

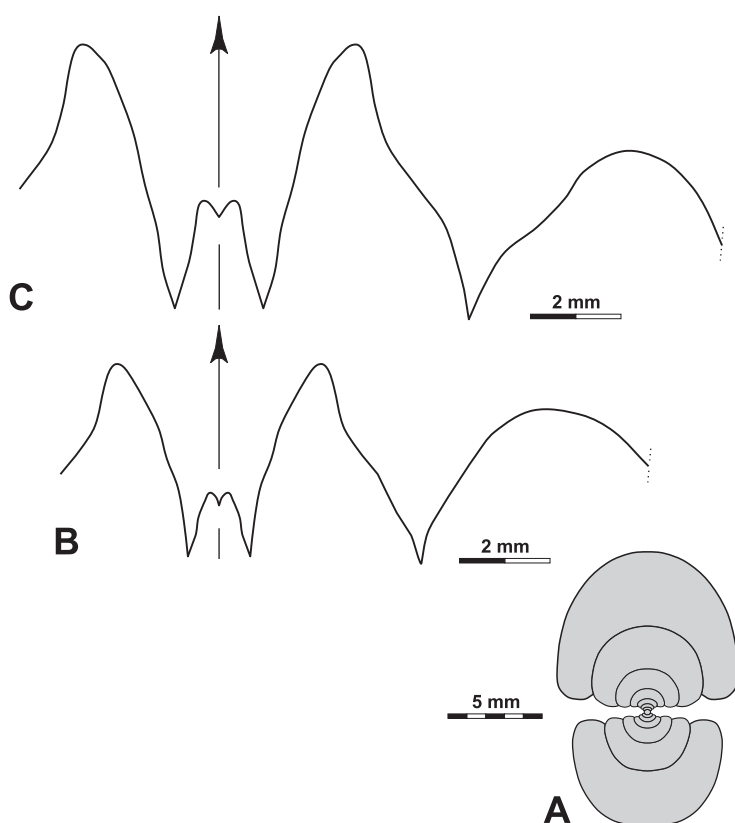
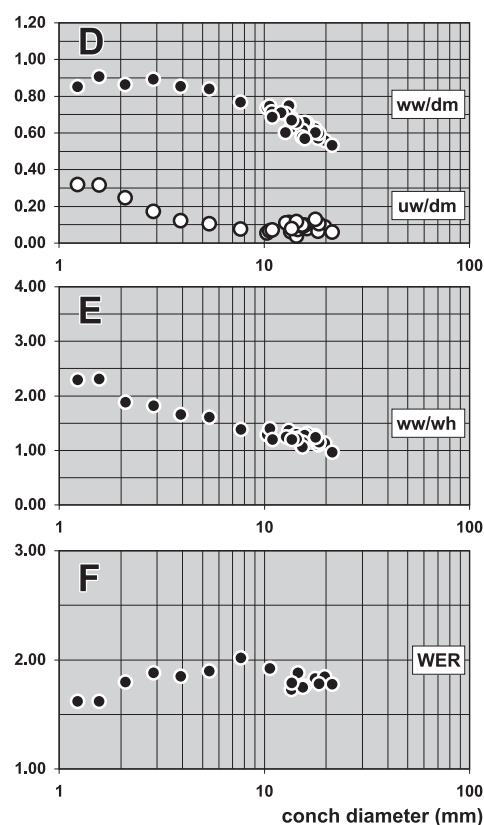
Table 140. Conch dimensions (in mm) and proportions for reference specimens of *Progoniatites paenacutus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18904.1	18.5	11.0	9.6	1.9	4.6	0.60	1.15	0.10	1.78	0.52
paratype MB.C.18965.1	17.6	11.0	8.7	1.8	4.6	0.62	1.27	0.10	1.83	0.47
paratype MB.C.18904.2	13.6	9.1	7.6	1.1	3.4	0.67	1.20	0.08	1.79	0.55

Table 141. Suture line proportions (Figs 98B, C) for *Progoniatites paenacutus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18904.1	18.4 mm	0.56	1.34	0.93	0.40	0.42	flanks of A lobe strongly curved
paratype MB.C.18904.2	13.9 mm	0.54	1.11	0.99	0.33	0.49	

Discussion. *P. paenacutus* is the most slender of the African species of *Progoniatites* and thus rather easy to separate from the others. Closest to it in conch shape is *P. uncus*, but that species shows spiral ornament on the steinkern and lacks riblets.

**Figure 97.** *Progoniatites paenacutus* n. sp.; all $\times 2$. **A.** Holotype MB.C.18904.1 from locality MOU-D2. **B.** Paratype MB.C.18965.1 from locality MOU-E08.**Figure 98.** *Progoniatites paenacutus* n. sp. **A.** Cross section of paratype MB.C.18955 from locality MOU-E07; $\times 2.5$. **B.** Suture line of paratype MB.C.18904.2 from locality MOU-D2, at 13.9 mm dm, 9.0 mm ww, 7.5 mm wh; $\times 6.0$. **C.** Suture line of holotype MB.C.18904.1 from locality MOU-D2, at 18.4 mm dm, 11.0 mm ww, 9.5 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

***Progoniatites globulus* n. sp.**

Figures 99, 100

Derivation of name. From Latin globulus = little globe, because of the conch shape.*Holotype.* Specimen MB.C.18879.1, illustrated in Figure 99A.*Type locality and horizon.* Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.*Material.* 12 specimens, conch diameter up to 20 mm.*Diagnosis.* *Progoniatites* with globular conch in the juvenile and preadult stage (up to 12 mm dm), thereafter becoming more slender and being thickly pachyconic at 20 mm dm; conch subinvolute in early juveniles and involute above 2 mm dm; umbilical margin rounded; aperture low throughout ontogeny. Steinkern with gentle constrictions, which extend in convex course, without riblets. Suture line possesses elements with almost linear flanks; external lobe narrow, median saddle moderately low; ventrolateral saddle asymmetric and subacute; adventive lobe V-shaped, deep.**Table 142.** Conch ontogeny (Figs 100A, D–F) of *Progoniatites globulus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thickly globular; subinvolute (ww/dm ~ 1.05; uw/dm ~ 0.16)	strongly depressed; very strongly embracing (ww/wh ~ 2.25; IZR ~ 0.60)	low (WER ~ 1.50)
8 mm	thinly to thickly globular; involute (ww/dm = 0.90–1.00; uw/dm = 0.08–0.12)	moderately depressed; very strongly embracing (ww/wh = 1.80–2.00; IZR ~ 0.60)	low (WER ~ 1.55)
20 mm	thickly pachyconic; involute (ww/dm ~ 0.78; uw/dm ~ 0.10)	moderately depressed; very strongly embracing (ww/wh ~ 1.60; IZR ~ 0.60)	low (WER ~ 1.60)

Table 143. Conch dimensions (in mm) and proportions for reference specimens of *Progoniatites globulus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18879.1	19.9	15.6	9.7	1.9	4.1	0.78	1.60	0.10	1.59	0.58
paratype MB.C.19029.2	15.0	12.4	7.8	2.1	3.0	0.83	1.59	0.14	1.57	0.61
paratype MB.C.18775.1	10.5	9.9	5.4	1.3	1.9	0.94	1.83	0.12	1.49	0.65
paratype MB.C.19029.1	10.4	9.2	5.0	1.2	2.0	0.89	1.87	0.11	1.54	0.59

Table 144. Suture line proportions (Figs 100B, C) for *Progoniatites globulus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18879.1	18.8 mm	0.53	1.53	1.26	0.37	0.34	VL saddle subacute, dorsally inclined
paratype MB.C.18775.1	10.3 mm	0.50	1.15	1.04	0.31	0.43	VL saddle narrowly rounded

**Figure 99.** *Progoniatites globulus* n. sp.; all $\times 2$. **A.** Holotype MB.C.18879.1 from locality MOU-D1. **B.** Paratype MB.C.18775.1 from locality MOU-A. **C.** Paratype MB.C.19029.1 from locality MOU-V.

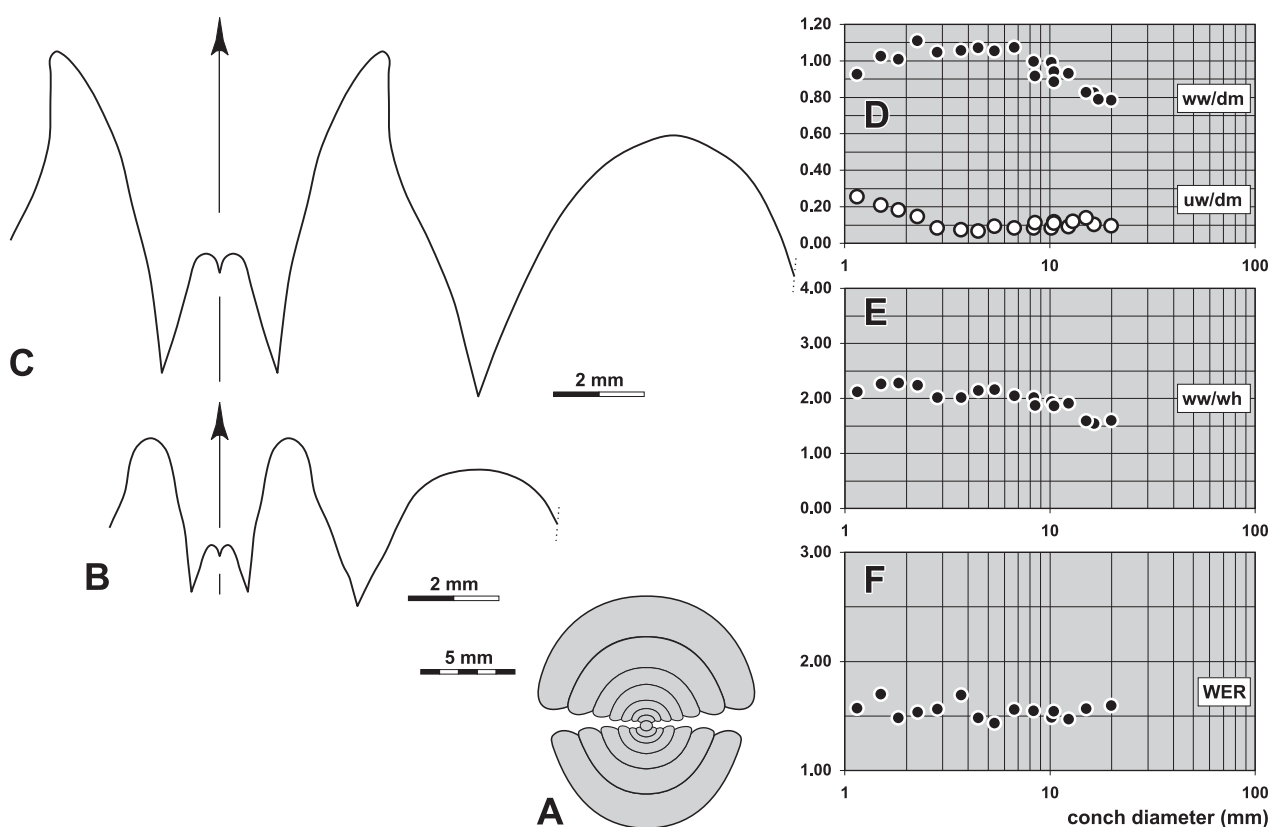


Figure 100. *Progoniatites globulus* n. sp. **A.** Cross section of paratype MB.C.18879.2 from locality MOU-D1; $\times 2.5$. **B.** Suture line of paratype MB.C.18775.1 from locality MOU-A, at 10.3 mm dm, 9.7 mm ww, 5.7 mm wh; $\times 6.0$. **C.** Suture line of holotype MB.C.18879.1 from locality MOU-D1, at 18.8 mm dm, 15.5 mm ww, 9.4 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Subfamily **Habadratitinae** n. subfam.

Subfamily definition. Goniatitidae with a simple conch ontogeny. Early ontogeny up to 2–3 mm conch diameter pachyconic or globular with almost constant ww/dm ratio, the conch becomes continuously more slender in later ontogeny. Early juvenile stage subinvolute; rapid narrowing of the umbilicus. Suture line with parallel-sided or diverging external lobe (EL w/d = 0.65–1.00; EL/AL = 1.20–1.60) with sinuous flanks and with asymmetric, rounded ventrolateral saddle.

Included genera.

Habadratites n. gen.

Primogoniatites n. gen.

Habadratites n. gen.

Derivation of name. After the waterhole Hassi Habadra near the fossil locality.

Type species. *Habadratites weyeri* n. sp.

Genus definition: Goniatitidae with rather small conch, reaching a conch diameter of up to 50 mm. Early whorls subinvolute, slight closure of the umbilicus in juvenile stages smaller than 4 mm conch diameter. Suture line with narrow or moderately narrow and trapezoidal external lobe (EL w/d = 0.65–1.00; EL/AL = 1.45–1.60) and moderately low median saddle (MS h = 0.38–0.50); ventrolateral saddle narrowly rounded, almost symmetric; adventive lobe V-shaped, asymmetric.

Included species.

weyeri: *Habadratites weyeri* n. sp.; Mouydir, Algeria.

supralatus: *Habadratites supralatus* n. sp.; Mouydir, Algeria.

Discussion. *Habadratites* resembles, in its conch shape and suture line, some species of *Progoniatites* and *Antegoniatites*. In these two genera, however, the ventrolateral saddle is subacute or even acute, which allows clear discrimination from *Habadratites* with a narrowly rounded ventrolateral saddle. Further sutural criteria to separate between these genera can be seen in the width of the external lobe: In this respect, *Habadratites* (where the external lobe amounts 1.40 of the adventive lobe) ranges between *Progoniatites* (1.00–1.20) and *Antegoniatites* (1.60).

The conch shape offers additional criteria to distinguish *Habadraites* from *Progoniatites* and *Antegoniatites*. The aperture in *Habadraites* (WER ~ 1.95 at 20 mm dm) is higher than in *Progoniatites* (1.50–1.70) and in *Antegoniatites* (1.70).

Separation of the new species. The two species of *Habadraites* can be separated by conch and suture characters:

- *H. weyeri* – subinvolute at 20 mm dm; EL w/d = nearly 0.75, flanks of external lobe nearly straight, adventive lobe V-shaped;
- *H. supralatus* – involute at 20 mm dm; EL w/d = nearly 1.00, flanks of external lobe sinuous, adventive lobe inflated.

Habadraites weyeri n. sp.

Figures 101, 102

Derivation of name. After Dieter Weyer (Berlin), for his cooperation in the field.

Holotype. Specimen MB.C.19030.1, illustrated in Figure 101A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-V (Mouydir, South Algeria); lower part of the *Pericyclus-Progoniatites* Assemblage.

Material. 24 specimens, conch diameter up to 20 mm.

Diagnosis. *Habadraites* with thickly pachyconic to thinly globular, subinvolute conch in the juvenile and preadult stage (up to 7 mm dm), thereafter becoming more slender and being thickly discoidal at 20 mm dm; umbilical margin subangular; aperture low in juveniles and becoming moderate during ontogeny. Steinkern with gentle constrictions, which extend concavo-convex with very shallow ventral sinus. Suture line with narrow or moderately narrow external lobe; median saddle moderately low; ventrolateral saddle narrowly rounded; adventive lobe V-shaped, slightly asymmetric.

Table 145. Conch ontogeny (Figs 102A, F–H) of *Habadraites weyeri* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm ~ 0.86 ; uw/dm ~ 0.24)	moderately depressed; very strongly embracing (ww/wh ~ 1.90 ; IZR ~ 0.50)	low (WER ~ 1.65)
8 mm	thinly to thickly pachyconic; subinvolute (ww/dm = 0.68–0.75; uw/dm = 0.15–0.20)	moderately depressed; strongly embracing (ww/wh ~ 1.55 ; IZR ~ 0.44)	moderate (WER ~ 1.90)
20 mm	thickly discoidal; subinvolute (ww/dm ~ 0.55 ; uw/dm ~ 0.16)	weakly depressed; strongly embracing (ww/wh = 1.10–1.30; IZR = 0.40–0.45)	moderate (WER = 1.85–1.95)

Table 146. Conch dimensions (in mm) and proportions for reference specimens of *Habadraites weyeri* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19030.1	20.5	11.6	10.3	3.1	5.8	0.56	1.13	0.15	1.94	0.44
paratype MB.C.18830	19.7	11.0	8.6	3.2	5.2	0.56	1.28	0.16	1.85	0.40
paratype MB.C.18925.1	18.8	11.3	9.0	2.7	5.3	0.60	1.26	0.14	1.94	0.41
paratype MB.C.18776.1	15.8	9.5	7.5	2.2	4.5	0.60	1.27	0.14	1.94	0.41
paratype MB.C.18776.2	10.5	7.4	4.9	1.3	2.9	0.70	1.52	0.12	1.90	0.41

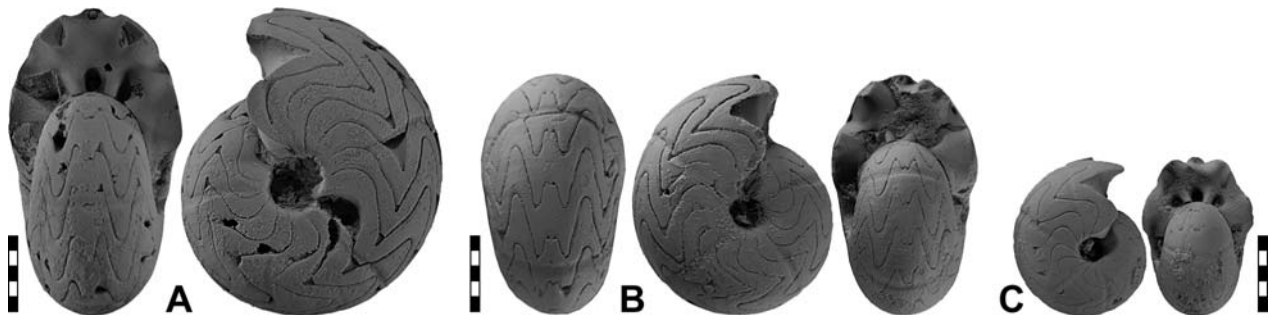


Figure 101. *Habadraites weyeri* n. sp.; all $\times 2$. **A.** Holotype MB.C.19030.1 from locality MOU-V. **B.** Paratype MB.C.18776.1 from locality MOU-A. **C.** Paratype MB.C.18776.2 from locality MOU-A.

Table 147. Suture line proportions (Figs 102B–E) for *Habadrantes weyeri* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19030.1	20.4 mm	0.72	1.62	1.55	0.48	0.44	prongs of E lobe subacute
paratype MB.C.18925.1	16.5 mm	0.79	1.83	1.45	0.39	0.43	M saddle comparatively low
paratype MB.C.18776.1	15.1 mm	0.67	1.57	1.58	0.42	0.42	
paratype MB.C.18776.2	10.5 mm	0.79	2.03	1.45	0.35	0.39	

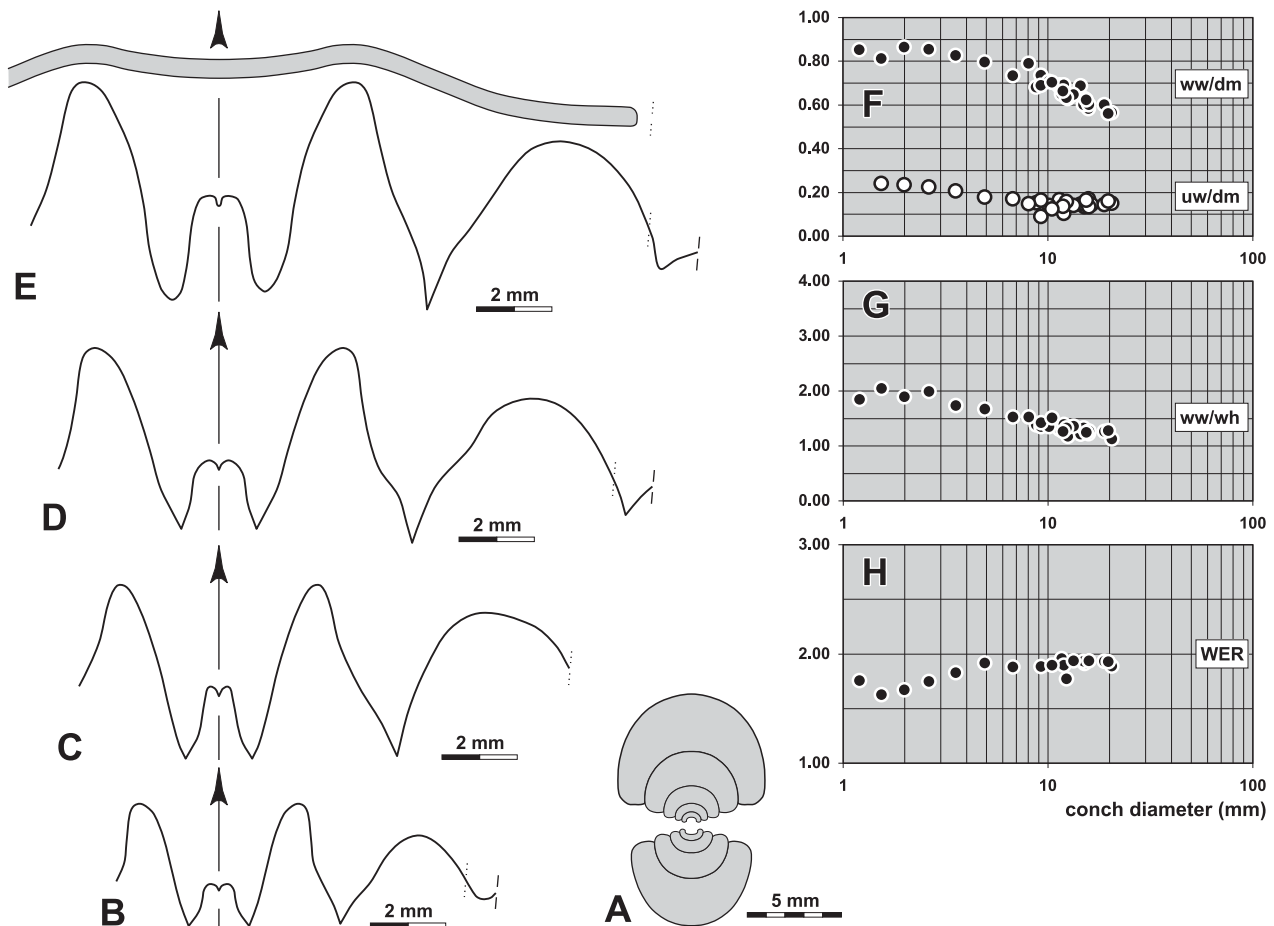


Figure 102. *Habadrantes weyeri* n. sp. **A.** Cross section of paratype MB.C.19030.2 from locality MOU-V; $\times 2.5$. **B.** Suture line of paratype MB.C.18776.2 from locality MOU-A, at 10.7 mm dm, 7.0 mm ww, 5.6 mm wh; $\times 5.0$. **C.** Suture line of paratype MB.C.18776.1 from locality MOU-A, at 15.1 mm dm, 9.5 mm ww, 7.5 mm wh; $\times 5.0$. **D.** Suture line of paratype MB.C.18925.1 from locality MOU-E03, at 16.5 mm dm, 10.0 mm ww, 8.3 mm wh; $\times 5.0$. **E.** Suture line and steinkern constriction of holotype MB.C.19030.1 from locality MOU-V, at 20.4 mm dm, 11.5 mm ww, 10.2 mm wh; $\times 5.0$. **F–H.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Habadrantes supralatus n. sp.

Figures 103, 104

Derivation of name. After the wide external lobe.

Holotype. Specimen MB.C.18881.1, illustrated in Figure 103A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-D1 (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 14 specimens, conch diameter up to 29 mm.

Diagnosis. *Habadrantes* with thickly pachyconic to thinly globular, subinvolute conch in the juvenile and preadult stage (up to 7 mm dm), thereafter becoming more slender and being thickly discoidal and involute at 30 mm dm; umbilicus funnel-shaped with subangular margin; aperture moderate throughout ontogeny. Steinkern with gentle constrictions, which extend concavo-convex with shallow ventral sinus. Suture line with moderately narrow external lobe; median saddle low; ventrolateral saddle rounded; adventive lobe asymmetric with convex flanks.

Table 148. Conch ontogeny (Figs 104A, D–F) of *Habadrantes supralatus* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm \sim 0.90; uw/dm \sim 0.20)	moderately depressed; very strongly embracing (ww/wh \sim 1.90; IZR \sim 0.50)	moderate (WER \sim 1.75)
8 mm	thickly pachyconic; involute to subinvolute (ww/dm = 0.75–0.80; uw/dm = 0.10–0.18)	weakly depressed; very strongly embracing (ww/wh = 1.40–1.50; IZR \sim 0.45)	moderate (WER \sim 1.90)
20 mm	thickly discoidal; involute (ww/dm = 0.55–0.60; uw/dm \sim 0.10)	weakly depressed; very strongly embracing (ww/wh \sim 1.10; IZR \sim 0.48)	moderate (WER \sim 1.90)
30 mm	thickly discoidal; involute (ww/dm = 0.55–0.60; uw/dm \sim 0.10)	weakly depressed; very strongly embracing (ww/wh \sim 1.10; IZR \sim 0.48)	moderate (WER \sim 1.90)

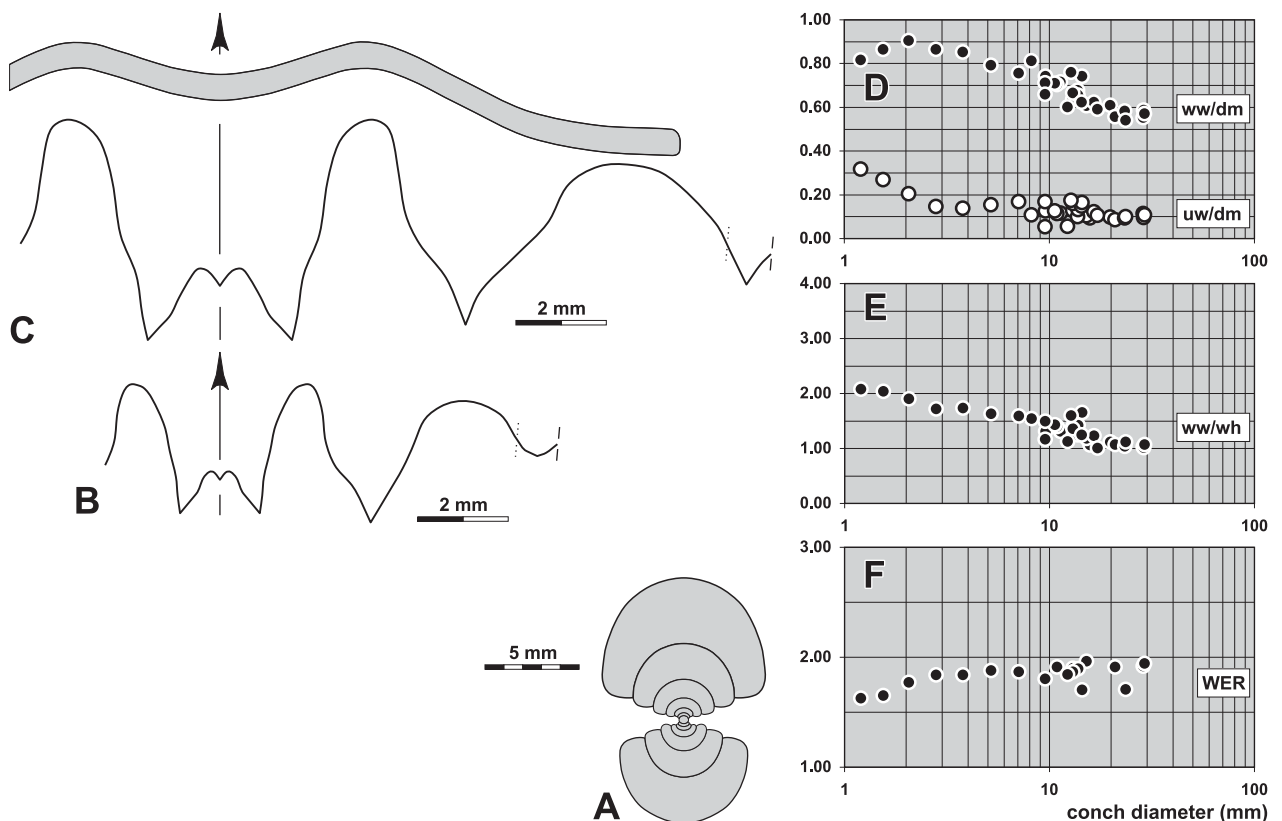
**Figure 103.** *Habadrantes supralatus* n. sp.; all $\times 2$. **A.** Holotype MB.C.18881.1 from locality MOU-D1. **B.** Paratype MB.C.19031.1 from locality MOU-V.**Figure 104.** *Habadrantes supralatus* n. sp. **A.** Cross section of paratype MB.C.19031.2 from locality MOU-V; $\times 2.5$. **B.** Suture line of paratype MB.C.19031.1 from locality MOU-A, at 13.7 mm dm, 9.0 mm ww, 6.3 mm wh; $\times 6.0$. **C.** Suture line and steinkern constriction of holotype MB.C.18881.1 from locality MOU-D1, at 20.8 mm dm, 11.6 mm ww, 10.8 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Table 149. Conch dimensions (in mm) and proportions for reference specimens of *Habadraites supralatus* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18881.1	20.9	11.7	10.9	1.8	5.8	0.56	1.07	0.09	1.91	0.47
paratype MB.C.18881.2	15.1	9.2	7.8	1.6	4.3	0.61	1.18	0.10	1.97	0.44
paratype MB.C.19031.1	13.8	9.1	6.4	1.8	3.8	0.66	1.42	0.13	1.90	0.41

Table 150. Suture line proportions (Figs 104B, C) for *Habadraites supralatus* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.18881.1	20.8 mm	0.98	2.40	1.55	0.32	0.41	
paratype MB.C.19031.1	13.7 mm	0.79	1.79	1.27	0.32	0.44	

***Primogoniatites* n. gen.**

Derivation of name. Combination of the Latin prefix *primo* and *Goniatites*, to point out the course of the suture line, which is considered plesiomorphic.

Type species. *Primogoniatites fundator* n. sp.

Genus definition. Goniatitidae with rather small conch, reaching 50 mm in conch diameter. Early whorls subinvolute, slight closure of the umbilicus in juvenile stages smaller than 5 mm conch diameter. Suture line parallel-sided, in the lower half pouched narrow external lobe (EL w/d ~ 0.70 ; EL/AL ~ 1.20) and moderately low median saddle (MS h ~ 0.45); ventrolateral saddle rounded, slightly asymmetric; adventive lobe V-shaped, asymmetric.

Included species.

fundator: *Primogoniatites fundator* n. sp.; Mouydir, Algeria.

Discussion. *Primogoniatites* resembles *Habadraites* in conch shape and suture line, but *Habadraites* has a subtrapezoidal external lobe with diverging flanks, unlike the pouched external lobe with subparallel flanks in *Primogoniatites*.

***Primogoniatites fundator* n. sp.**

Figures 105, 106

Derivation of name. From Latin *fundator* = founder, because the species might be close to the origin of the Goniatitidae.

Holotype. Specimen MB.C.18777.1, illustrated in Figure 105A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-A (Mouydir, South Algeria); upper *Pericyclus-Progoniatites* Assemblage.

Material. 37 specimens, conch diameter up to 30 mm.

Diagnosis. *Primogoniatites* with thinly globular, subinvolute early juvenile conch, thereafter becoming continuously more slender and being thickly discoidal and involute at 30 mm dm; conch is thickest near the narrowly rounded umbilical margin, from where the flanks converge to the widely rounded venter; aperture moderate in juveniles and high in the adult stage. Steinkern with constrictions, course convex with moderately deep ventral sinus; faint spiral lines are on the venter of the steinkern. Suture line with narrow external lobe; median saddle low; ventrolateral saddle asymmetric and rounded; adventive lobe V-shaped, slightly inflated.

Table 151. Conch ontogeny (Figs 106A, B, D–F) of *Primogoniatites fundator* n. sp.

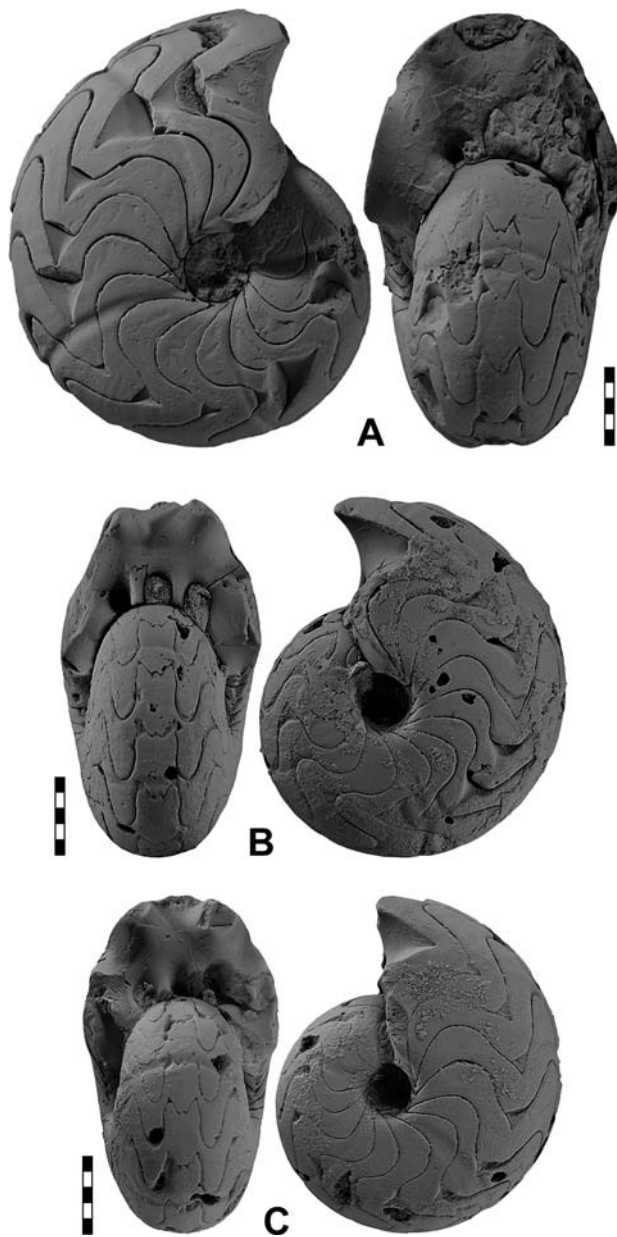
dm	conch shape	whorl cross section shape	aperture
2 mm	thinly globular; subinvolute (ww/dm ~ 0.90 ; uw/dm ~ 0.29)	strongly depressed; strongly embracing (ww/wh ~ 2.20 ; IZR ~ 0.38)	moderate (WER ~ 1.80)
8 mm	thinly pachyconic; involute to subinvolute (ww/dm = 0.68–0.72; uw/dm = 0.12–0.18)	weakly depressed; strongly embracing (ww/wh = 1.40–1.50; IZR ~ 0.40)	moderate (WER ~ 1.95)
20 mm	thickly discoidal to thinly pachyconic; involute (ww/dm = 0.55–0.70; uw/dm = 0.10–0.15)	weakly depressed; strongly embracing (ww/wh = 1.10–1.25; IZR = 0.35–0.45)	high (WER = 2.00–2.15)
30 mm	thickly discoidal; involute (ww/dm = 0.52–0.60; uw/dm = 0.10–0.15)	weakly depressed; strongly embracing (ww/wh = 1.10–1.25; IZR = 0.35–0.40)	high (WER = 2.00–2.15)

Table 152. Conch dimensions (in mm) and proportions for reference specimens of *Primogoniatites fundator* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.18777.1	27.7	16.6	14.4	4.2	8.8	0.60	1.16	0.15	2.15	0.39
paratype MB.C.18804.4	24.1	14.4	12.9	3.0	7.6	0.60	1.12	0.12	2.14	0.41
paratype MB.C.18804.1	22.4	12.6	11.0	2.8	6.9	0.56	1.14	0.12	2.09	0.37
paratype MB.C.18804.2	21.6	12.8	11.2	2.8	6.5	0.59	1.14	0.13	2.04	0.42
paratype MB.C.18804.5	21.3	13.8	10.9	2.7	6.1	0.65	1.26	0.13	1.97	0.44

Table 153. Suture line proportions (Fig. 106C) for *Primogoniatites fundator* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
paratype MB.C.18804.2	18.9 mm	0.69	1.55	1.20	0.28	0.44	A lobe slightly inflated

**Figure 105.** *Primogoniatites fundator* n. sp.; all $\times 2$. **A.** Holotype MB.C.18777.1 from locality MOU-A. **B.** Paratype MB.C.18804.1 from locality MOU-B0. **C.** Paratype MB.C.18804.2 from locality MOU-B0.

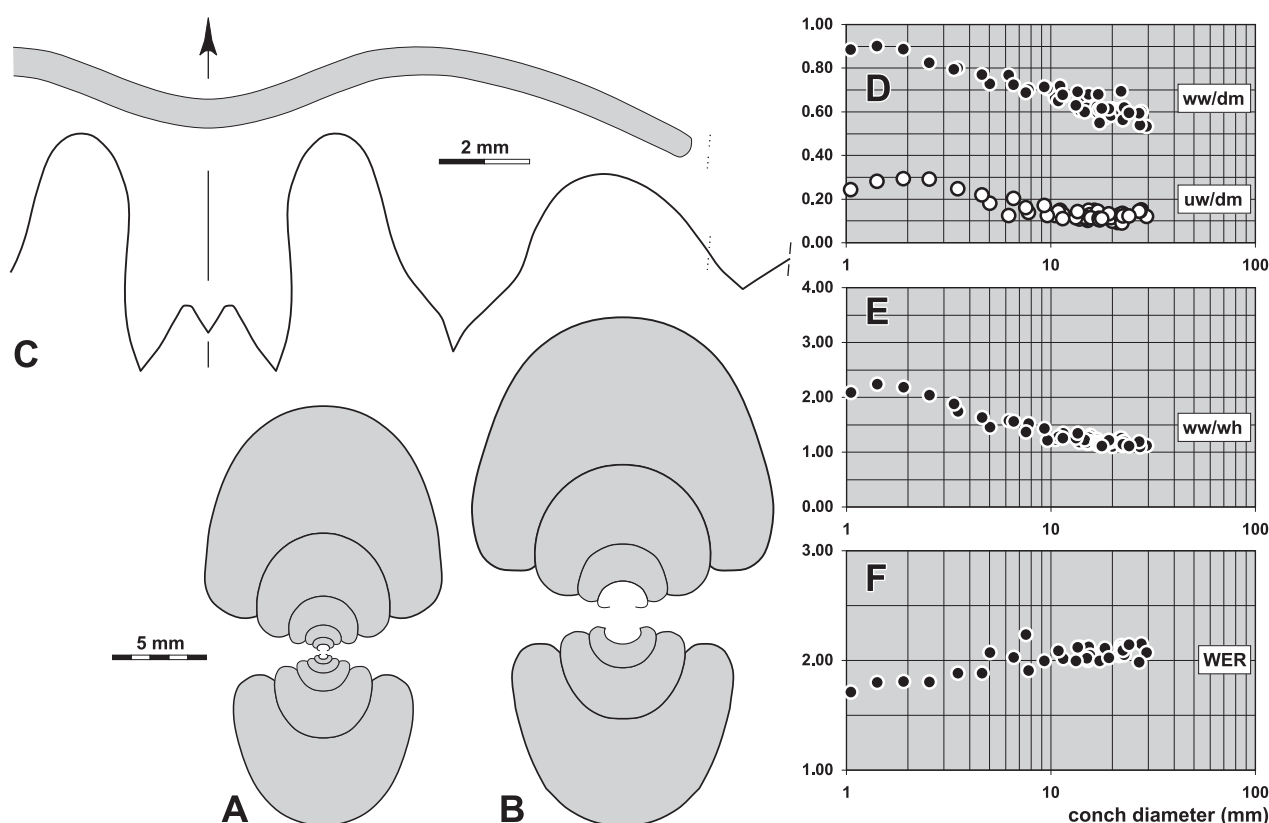


Figure 106. *Primogoniaticites fundator* n. sp. **A.** Cross section of paratype MB.C.18777.2 from locality MOU-A; $\times 2.5$. **B.** Cross section of paratype MB.C.18804.3 from locality MOU-B0; $\times 2.5$. **C.** Suture line and steinkern constriction of paratype MB.C.18804.2 from locality MOU-B0, at 18.9 mm dm, 11.5 mm ww, 10.6 mm wh; $\times 6.0$. **D–F.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Subfamily *Antegoniaticitinae* n. subfam.

Subfamily definition. Goniaticitidae with a rather complex conch ontogeny. Early ontogeny up to 4–5 mm conch diameter thickly discoidal with almost constant ww/dm ratio, the conch becomes continuously stouter in later ontogeny. Early juvenile stage evolute. Suture line with strongly diverging external lobe (EL w/d > 0.75 ; EL/AL > 1.50) and with symmetric, acute ventrolateral saddle.

Included genus.

Antegoniaticites n. gen.

Antegoniaticites n. gen.

Derivation of name. Combination of the Latin prefix ante and *Goniaticites*, to point out the suture line with very wide elements, which is only known from other much younger species.

Type species. *Antegoniaticites anticiparis* n. sp.

Genus definition. Goniaticitidae with small conch, reaching 30 mm in diameter. Juvenile whorls evolute, closure of the umbilicus already in the juvenile stage. Suture line with moderately narrow V-shaped external lobe (EL w/d > 0.75 ; EL/AL > 1.50) and moderately high median saddle (MS h = 0.55–0.60); ventrolateral saddle acute, almost symmetric with nearly straight flanks.

Included species.

anticiparis: *Antegoniaticites anticiparis* n. sp.; Mouydir, Algeria.

Discussion. *Antegoniaticites* is a very strange component in the early Late Tournaisian ammonoid fauna of the Mouydir. Goniaticites with such a suture line were so far only known from *Neogoniaticites*, a genus that occurs in Viséan-Serpukhovian boundary beds (Ruzhencev & Bogoslovskaya 1971). The sutures of the two genera display astonishing similarities in the width ratios of their elements and their shapes, with the exception that the flanks of the adventive lobe are a little bit more sinuous in *Neogoniaticites*. The main character to separate the two genera is the ontogenetic development of the conch shape. *Antegoniaticites* has a relatively long widely umbilicate ontogenetic stage, which in *Neogoniaticites* is extremely short and restricted to the initial stage.

Progoniatites has an almost time-equivalent occurrence; it is separated from *Antegoniatites* by the suture line, which has a much narrower external lobe ($EL/AL = 0.90\text{--}1.40$ in contrast to a value of more than 1.50 in *Antegoniatites*) and a much lower median saddle ($MS\ h = 0.35\text{--}0.40$ in *Progoniatites* but $0.55\text{--}0.60$ in *Antegoniatites*). The ventrolateral saddle is subtriangular and nearly symmetric in *Antegoniatites* but strikingly asymmetric in *Progoniatites*. The early widely umbilicate stage of *Progoniatites* is much shorter.

***Antegoniatites anticiparis* n. sp.**

Figures 107, 108

Derivation of name. From Latin *anticiparis* = anticipating, because of the very progressive suture line.

Holotype. Specimen MB.C.19052.1, illustrated in Figure 107A.

Type locality and horizon. Oued Temertasset, locality and sample MOU-Y (Mouydir, South Algeria); *Helicocyclus-Ouaoufilalites* Assemblage.

Material. 20 specimens, conch diameter up to 21 mm.

Diagnosis. *Antegoniatites* with thinly pachyconic, evolute conch in the early juvenile stage (at 2 mm dm), thereafter rapidly becoming subinvolute; umbilical margin rounded; aperture low or moderately high throughout ontogeny. Steinkern with gentle constrictions, which extend in a convex course. Suture line with moderately narrow external lobe; median saddle moderately high; ventrolateral saddle subtriangular, almost symmetric and acute; adventive lobe V-shaped and slightly asymmetric with gently curved ventral flank.

Table 154. Conch ontogeny (Figs 108A, B, E–G) of *Antegoniatites anticiparis* n. sp.

dm	conch shape	whorl cross section shape	aperture
2 mm	thinly pachyconic; evolute ($ww/dm \sim 0.60$; $uw/dm = 0.50$)	strongly depressed; very strongly embracing ($ww/wh \sim 2.10$; $IZR \sim 0.48$)	low ($WER \sim 1.55$)
8 mm	thinly pachyconic; subinvolute ($ww/dm = 0.63\text{--}0.68$; $uw/dm = 0.15\text{--}0.20$)	weakly depressed; very strongly embracing ($ww/wh = 1.25\text{--}1.40$; $IZR \sim 0.50$)	low to moderate ($WER \sim 1.75$)
16 mm	thickly discoidal to thinly pachyconic; subinvolute ($ww/dm = 0.55\text{--}0.65$; $uw/dm = 0.15\text{--}0.20$)	weakly depressed; very strongly embracing ($ww/wh = 1.25\text{--}1.40$; $IZR \sim 0.55$)	low ($WER \sim 1.65$)

Table 155. Conch dimensions (in mm) and proportions for reference specimens of *Antegoniatites anticiparis* n. sp.

	dm	ww	wh	uw	ah	ww/dm	ww/wh	uw/dm	WER	IZR
holotype MB.C.19052.1	17.2	10.9	8.3	2.6	3.8	0.63	1.32	0.15	1.63	0.55
paratype MB.C.19052.6	12.9	7.7	6.4	1.3	3.1	0.59	1.19	0.10	1.75	0.51
paratype MB.C.19052.2	12.6	8.0	6.6	1.2	3.1	0.64	1.21	0.10	1.76	0.53
paratype MB.C.19052.7	11.6	7.2	5.8	1.0	2.8	0.62	1.24	0.09	1.75	0.51
paratype MB.C.19052.5	11.3	7.2	5.5	1.5	2.8	0.64	1.30	0.14	1.78	0.49
paratype MB.C.19052.3	6.0	3.7	2.4	1.6	1.4	0.61	1.51	0.26	1.70	0.42

Table 156. Suture line proportions (Figs 108C, D) for *Antegoniatites anticiparis* n. sp.

specimen	at dm	EL w/d	EL/VLS	EL/AL	MS h	VLS w/h	remarks
holotype MB.C.19052.1	18.4 mm	0.83	1.78	1.64	0.60	0.47	flanks of E lobe nearly straight
paratype MB.C.19052.4	13.9 mm	0.75	1.87	1.52	0.55	0.39	flanks of E lobe slightly sinuous

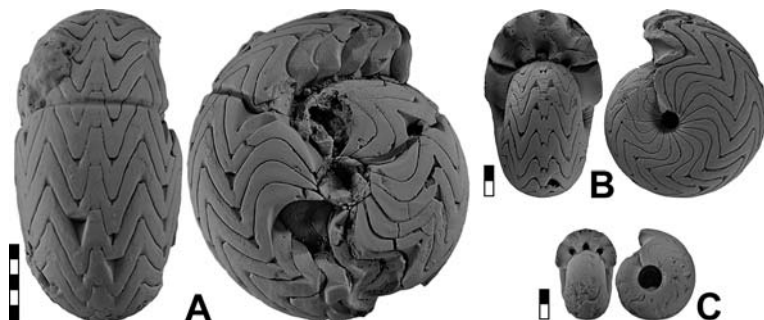


Figure 107. *Antegoniatites anticiparis* n. sp. from locality MOU-Y; all $\times 2$. **A.** Holotype MB.C.19052.1. **B.** Paratype MB.C.19052.2. **C.** Paratype MB.C.19052.3.

Discussion. *Antegoniatites anticiparis* is easily separated from all other Tournaisian ammonoids, due to its sutural outline with a rather wide external lobe. It shows striking similarities to some end-Viséan species of *Neogoniatites*, but this resemblance is most probably a homoplasy.

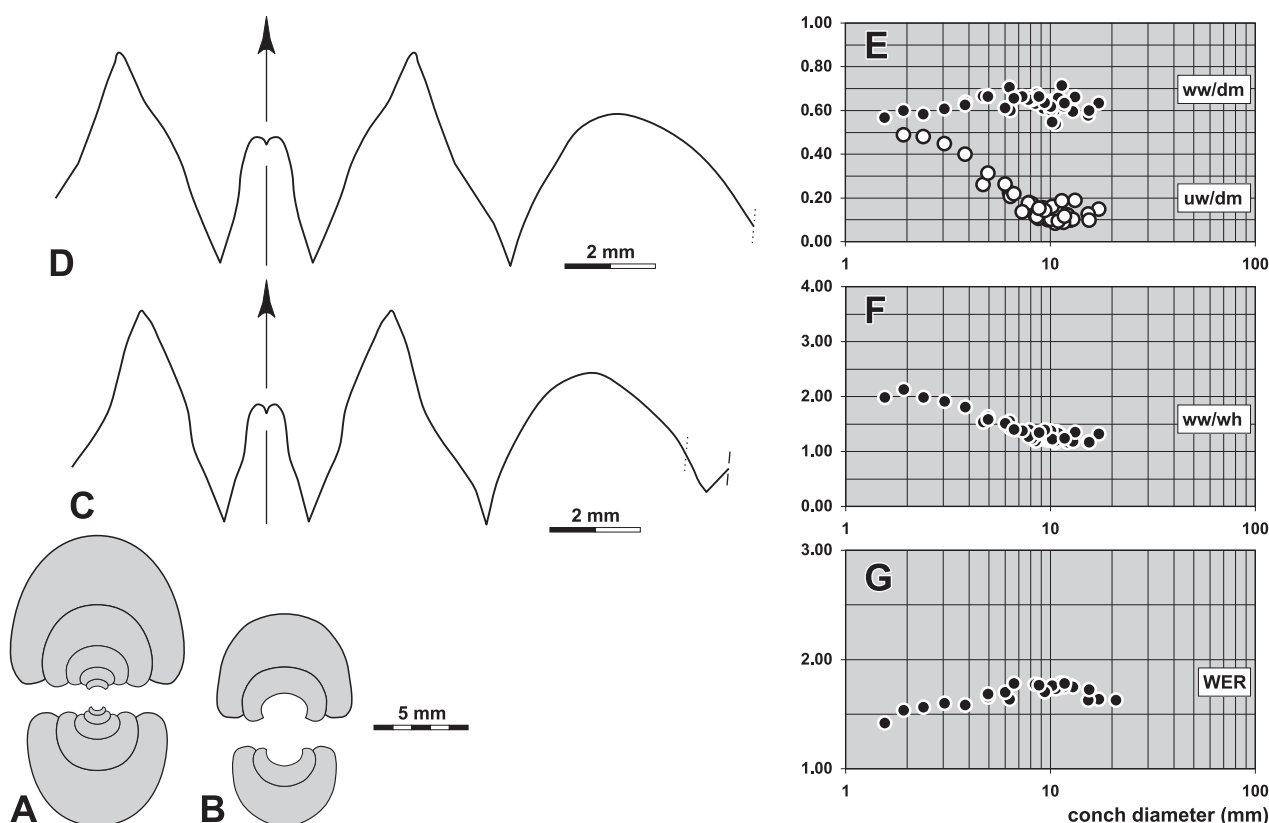


Figure 108. *Antegoniatites anticiparis* n. sp. from locality MOU-Y. **A.** Cross section of paratype MB.C.19052.4; $\times 2.5$. **B.** Cross section of paratype MB.C.19052.5; $\times 2.5$. **C.** Suture line of paratype MB.C.19052.4, at 13.9 mm dm, 9.0 mm ww, 7.5 mm wh; $\times 6.0$. **D.** Suture line of holotype MB.C.19052.1, at 18.4 mm dm, 11.0 mm ww, 9.5 mm wh; $\times 6.0$. **E–G.** Ontogenetic development of the conch width index (ww/dm), umbilical width index (uw/dm), whorl width index (ww/wh), and whorl expansion rate (WER) of all available specimens.

Order **Prolecanitida** Miller & Furnish, 1954
 Suborder **Prolecanitina** Miller & Furnish, 1954
 Superfamily **Prolecanitaceae** Hyatt, 1884
 Family **Prolecanitidae** Hyatt, 1884
 Subfamily **Prolecanitinae** Hyatt, 1884

***Becanites* Korn, 1997**

For a detailed discussion of the genus, see Korn et al. (2010a).

***Becanites inflatalis* Korn, Ebbighausen & Bockwinkel, 2010**

Figures 109, 110

1984 *Protocanites lyoni*. – Conrad, pl. 5, fig. 6.

Material. Nine specimens, mostly fragments, conch diameter up to approximately 40 mm.

Diagnosis. *Becanites* with extremely discoidal, subevolute conch at 20 mm dm; whorl cross section subquadrate; flanks flattened and parallel; venter slightly flattened; aperture high. Steinkern smooth. Suture line with pouched external lobe, broad and asymmetric adventive lobe with subparallel flanks, and pouched lateral lobe.

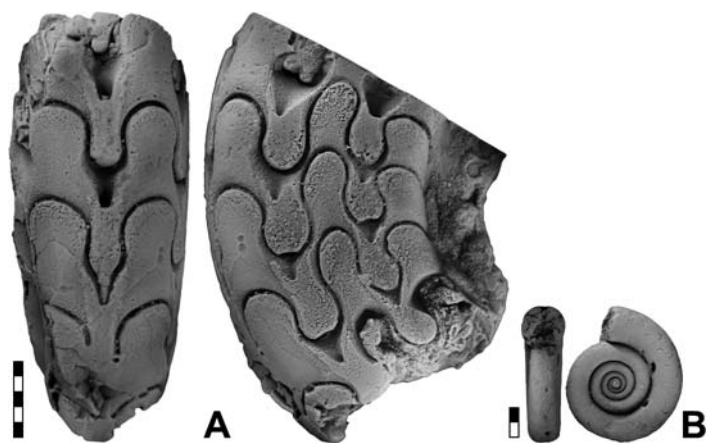


Figure 109. *Becanites inflateralis* n. sp.; all $\times 2$. **A.** Specimen MB.C.18883 from locality MOU-D1 **B.** Specimen MB.C.18778.1 from locality MOU-A.

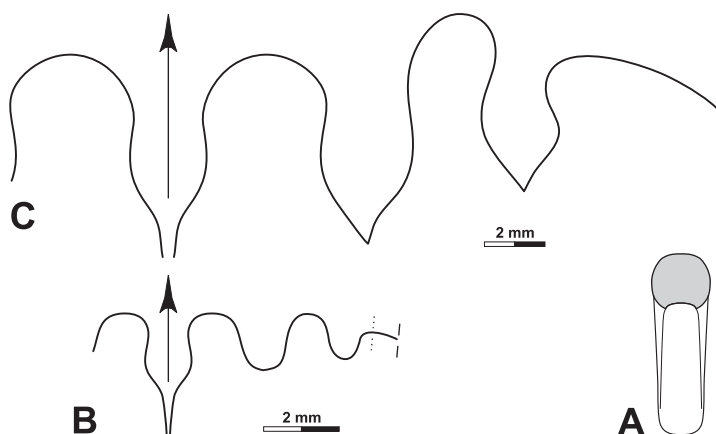


Figure 110. *Becanites inflateralis* n. sp. **A.** Dorsal view of specimen MB.C.18778.1 from locality MOU-A; $\times 2.5$. **B.** Suture line of specimen MB.C.18778.1 from locality MOU-A, at 8.4 mm dm, 2.6 mm ww, 2.2 mm wh; $\times 5.0$. **C.** Suture line of specimen MB.C.18883 from locality MOU-D1, at 11.5 mm ww, 13.2 mm wh; $\times 4.0$.

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