

Carinoconus iraqiensis (Foraminifera), a new orbitolinid from the Cenomanian Mishrif Formation of the oil fields of southeastern Iraq

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ABSTRACT: A detailed micropalaeontological study of the Mishrif Formation in the Buzurgan, Fauqui and Abu Guirab oil fields in Iraq has provided a new species of the genus *Carinoconus* Cherchi and Schroeder 1982. *Carinoconus iraqiensis* n. sp. is formally described from on-shore cored sediments of south-east Iraq, where it occurs in Middle to Late Cenomanian platform deposits. This new species is roughly half the size of *C. casterasi* (Bilotte et al. 1973), the only representative of genus *Carinoconus* described to date. *Carinoconus iraqiensis* n. sp. is the first representative of the genus *Carinoconus* ever found in the Middle East region.

INTRODUCTION

The genus *Carinoconus* was originally described by Cherchi and Schroeder in 1982 as a subgenus of the genus *Dictyoconus*, and was later upgraded to genus level by Loeblich and Tappan in 1988. The type-species (*Carinoconus casterasi* (Bilotte et al.), 1973) was initially attributed to the genus *Paracoskinolina*, but it was later re-assigned to *Dictyoconus*, based on the alternated position of the central zone pillars in successive chambers (in contrast to *Paracoskinolina*, which has the pillars aligned).

A biostratigraphical study of the Mishrif Formation in several Iraqi wells was commissioned by Elf-EP (now Total) to expand the already extensive in-house catalogue of foraminifera found in the sub-surface of the Middle East. For this study thousands of thin sections were analyzed from the Buzurgan, Fauqui and Abu Ghirab oil fields, which are located in SE Iraq, close to the Iran border (text-fig. 1).

The first detailed published micropalaeontological account of the Cretaceous in the Middle East is the work of Henson (1948) on foraminifera. Subsequent studies include: El-Naggar and Al-Rifaiy (1973), Simmons and Hart (1987), Smith et al. (1990), Kennedy and Simmons (1991), Philip et al. (1995) and Simmons et al. (2000), but none of these relate specifically to the Mishrif Formation of Iraq.

The purpose of this paper is to describe a new species of foraminifera found within the Mishrif Formation of south-eastern Iraq.

STRATIGRAPHIC FRAMEWORK

All of the studied specimens occur in core samples from the Abu Ghirab, Fauqui and Buzurgan oil fields, from wells drilled during the early 1970s. These well sections were first documented by Brun (1970, 1971a, 1971b, 1972) in internal company reports. General descriptions of the Mishrif Formation sediments of Iraq can be found within Van Bellen et al. (1959),

Gaddo (1971), Aqrabi et al. (1998), Sadooni and Aqrabi (2000) and Sadooni (2005), among others.

Within the studied sediments, three faunal assemblages were observed: a) benthic foraminifera platform assemblage, b) rudist (radiolite) platform margin assemblage and, c) benthic and small planktonic foraminifera open platform assemblage. Specimens of *Carinoconus iraqiensis* n. sp. were recorded from all of these faunal assemblages, which can be reworked (i.e. when associated with planktonic forams or rudists).

Based on the distribution of the foraminifera (text-fig. 2), two stratigraphic intervals were differentiated (from top down):

- (i) *Cisalveolina* sp. upper interval
- (ii) *Praealveolina cretacea* lower interval

The *Cisalveolina* sp. upper interval yields the following assemblage: *Cisalveolina* sp., *Biplanata peneropliformis* Hamaoui and Saint-Marc 1970, *Carinoconus iraqiensis* n. sp., *Chrysalidina gradata* d'Orbigny 1839, *Coxites zubairensis* Smout 1956, *Cycledomia iranica* (Henson) 1948, *Dicyclina schlumbergeri* Munier-Chalmas 1887, *Merlingina cretacea* Hamaoui and Saint-Marc 1970, *Multispirina iranensis* Reichel 1947, *Nezzazata concava* (Smout) 1956, *Nezzazata gyra* (Smout) 1956, *Nezzazata simplex* Omara 1956, *Nummofallotia apula* Luperto Sinni 1968, *Pseudolituonella reicheli* Marie 1954, *Qataria dukhani* Henson 1948, *Taberina bingistani* Henson 1948, *Andersenolina arabica* (Henson) 1949, *Trochospira avnimelechi* Hamaoui and Saint-Marc 1970 and *Nezzazatinella picardi* (Henson) 1948. This assemblage is probably of Late Cenomanian age based on the presence of Middle?-Late Cenomanian foraminifera (i.e. *Cisalveolina* sp., *Merlingina cretacea* Hamaoui and Saint-Marc, *Chrysalidina gradata* D'Orbigny) and the absence of representatives of the genus *Orbitolina*, which ranges no younger than Middle Cenomanian.

Praealveolina cretacea lower interval contains *Praealveolina cretacea* (D'Archiac) 1937, *Biplanata peneropliformis* Hamaoui



TEXT-FIGURE 1
Geographic setting of Buzurgan, Fauqui and Abu Ghirab oil fields in Iraq.

and Saint-Marc, *Carinoconus iraqiensis* n. sp., *Chrysalidina gradata* D'Orbigny, *Coxites zubairensis* Smout, *Cycledomia iranica* (Henson), *Dicyclina schlumbergeri* Munier-Chalmas, *Merlingina cretacea* Hamaoui and Saint-Marc, *Multispirina iranensis* Reichel, *Nezzazata concava* (Smout), *Nezzazata gyra* (Smout), *Nezzazata simplex* Omara, *Nummofallotia apula* Luperto Sinni, *Orbitolina (Conicorbitolina) conica* (D'Archiac) 1837, *Ovalveolina ovum* (D'Orbigny) 1850, *Pseudolituonella reicheli* Marie, *Taberina bingistani* Henson, *Andersenolina arabica* Henson, *Trochospira avnimelechi* Hamaoui and Saint-Marc and *Nezzazatinella picardi* (Henson) among others. This assemblage is of Middle Cenomanian age based on to the coexistence of *Orbitolina (Conicorbitolina) conica* (d'Archiac), which ranges from the Early to Middle Cenomanian (Schroeder and Neumann, 1985) and *Praealveolina cretacea* (d'Archiac), of Middle-Late Cenomanian age (Schroeder and Neumann 1985).

MATERIAL AND METHODS

The studied specimens occur in cored fully lithified limestones and thus observed in random sections. Thousands of thin sections from the Buzurgan, Fauqui and Abu Ghirab oil fields were studied for their fossil content with the main objective of building a distribution chart for the Mishrif Formation in this area.

Representative specimens (holotypes and paratypes) of *Carinoconus iraqiensis* n. sp. are deposited in the Centre Scientific and Technique Jean Feger, Total (France).

SYSTEMATIC PALEONTOLOGY

Family ORBITOLINIDAE Martin 1890

Genus CARINOCONUS Cherchi and Schroeder 1982

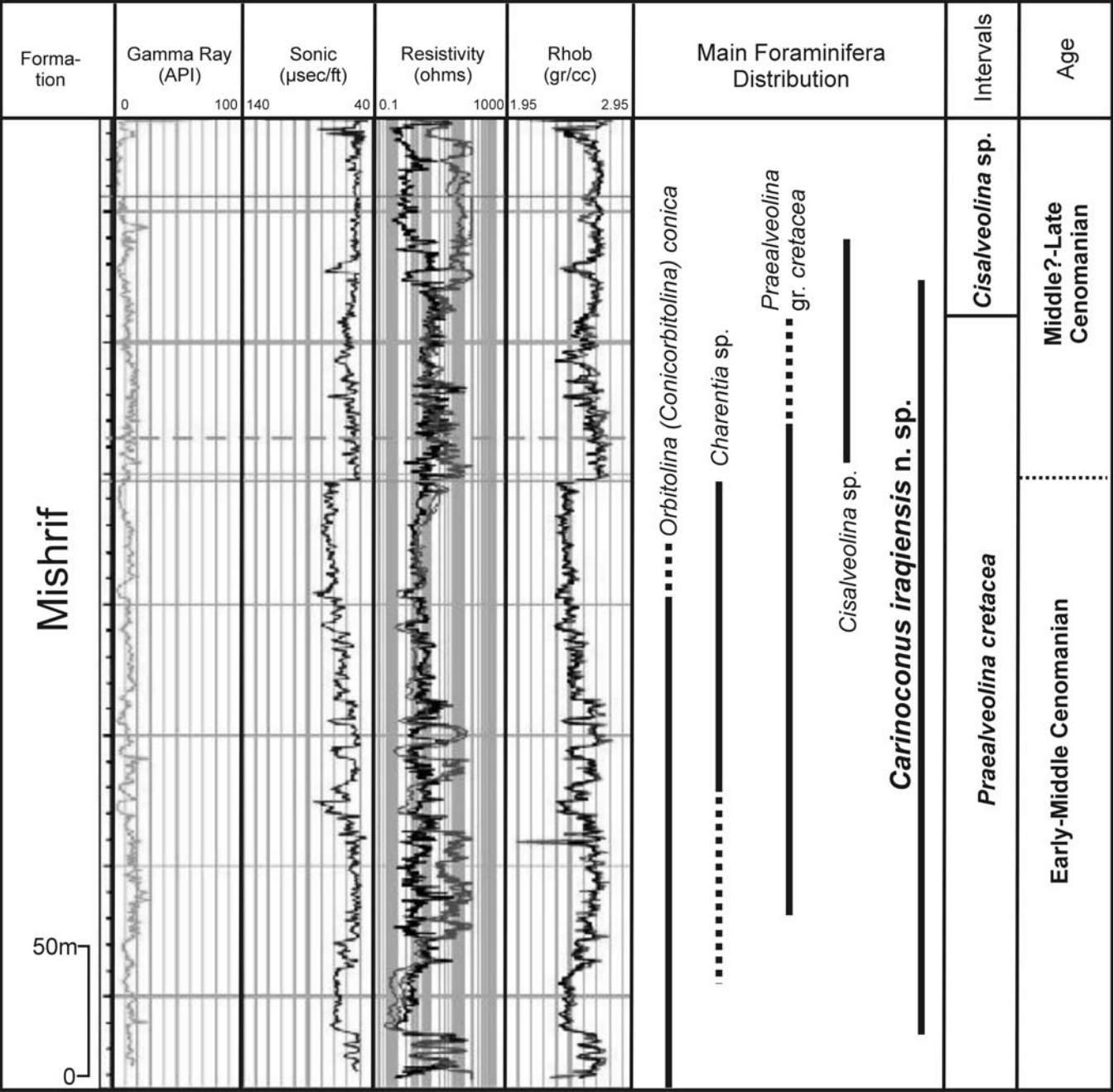
***Carinoconus iraqiensis* Bernaus and Masse n. sp.**

Plate 1, figures 1-11

New genus (aff. *Pseudotextulariella*) - AL-SIDDIKI 1978, pl. IX, figs. 4-5.

Diagnosis: A representative of the genus *Carinoconus* with a relatively large initial spire, which represents almost half of the specimen height, with sharp angular carina and few chambers in the rectilinear stage.

External morphology: The dimorphism observed in many other orbitolinid species was not observed in the studied specimens. The description of this species corresponds to the megalo-spheric form (A form), which is externally conical to cylindro-conical. The wall is finely microgranular. The early stage consists of a large non-centred spire (?trochospiral/ planispiral) (pl. 1, fig. 1). The spire is compressed and elliptical in some sec-



TEXT-FIGURE 2
A typical Mishrif log section of the studied area. The stratigraphic distribution of selected foraminifera is also given for reference.

tions (pl. 1, figs. 2-3, 8-9). It shows a sharp angular carina, which is followed by a rectilinear stage. The rectilinear stage comprises between 4 and 8 discoidal chambers, comprising a flat or slightly concave base (pl. 1, figs. 1, 6-7). The maximum height of the rectilinear stage is 0.33mm (maximum dimension of the test 0.79mm) and the basal diameter is up to 0.48mm.

Internal structures: The *embryonic apparatus* is located at the beginning of the spire. The embryo is only poorly visible in pl. 1, fig. 1. It seems globular and probably comprises a proloculus and deuteroeculus.

The initial spire is very big and comprises 25 to 30 chambers. Only beams (exoskeleton external perpendicular partitions to the septum) where observed as internal structures (pl. 1, fig. 2-3, 8-9). The chambers of the spire are compressed, showing a sharp angular carina (pl. 1, fig. 2-3, 8-9).

The rectilinear stage follows the spiral stage. It consists of 2 to 8 discoidal slightly concave chambers (pl. 1, figs. 1, 6-7). It is not possible to establish a number of chambers for the last mm or half mm due to the reduced size of the shell (rectilinear stage

only up to 0.33mm), though it is possible to differentiate a marginal zone and a central zone in transverse section (pl. 1, fig. 5).

The *marginal zone* is quite large and is divided by exoskeletal elements (beams). Two orders of beams have been observed. These have the inner end inflated (pl. 1, fig. 5). Tangential sections show the beams dividing the marginal zone into squares or rectangles (pl. 1, fig. 4, 11), which are aligned in successive chambers (pl. 1, fig. 4, 11). No rafters (exoskeleton external horizontal partitions) were observed within the studied specimens, but they can be present as in *Carinoconus casterasi* (Bilotte et al.).

The elements of the *central zone* (endoskeleton) are sometimes very difficult to recognize, but pillars were observed in some specimens (pl. 1, figs. 5, 10). Pillars are probably wider at the base of the chamber than at the top as interpreted from the illustrated section at pl.1, fig. 10. From the studied specimens it is very difficult to recognise any pillar arrangement. In transverse section, pillars are disposed in concentric circles, alternating with the apertures (pl. 1, figs. 5).

The *apertures* are located between pillars. They are also disposed in concentric circles in transverse section (pl. 1, fig. 5).

Remarks: *C. iraqiensis* is the second species attributed to this genus. The first species was described originally as *Paracoskinolina casterasi* by Bilotte et al. (1973), and reattributed to the genus *Carinoconus* (described at that time as subgenus) by Cherchi and Schroeder (1982). *Carinoconus iraqiensis* n. sp. is roughly half the size of *C. casterasi* (Bilotte et al.) (the maximum height and basal diameter of *C. iraqiensis* n. sp. are 0.79 mm and 0.48 mm respectively, as compared with 1.5mm and 1.0mm in *C. casterasi* (Bilotte et al.)). The rectilinear stage is very poorly represented in *C. iraqiensis* n. sp., with only a maximum of 8 chambers in the studied specimens compared with up to 30 in *C. casterasi* (Bilotte et al.). That is the reason why the spire of *C. iraqiensis* n. sp. is about half the height of the test. Its small size also results in a central zone that is less well developed in *C. iraqiensis* n. sp. than in *C. casterasi* (Bilotte et al.). The presence of an initial stage with a sharply angular carina was the only criteria used by Cherchi and Schroeder (1982) for the creation of the new sub-genus, now genus, *Carinoconus*. Based on this characteristic, and as no other genus of the family *Orbitolinidae* has such a distinctive feature, we also assign this new species to the genus *Carinoconus*.

The two species of *Carinoconus* differ in their geographical distribution as well as their age range. *C. casterasi* (Bilotte et al.) was found in the Late Albian-?Early Cenomanian of France and Spain, whereas *Carinoconus iraqiensis* n. sp. occurs in Middle-Late Cenomanian sediments of Iraq.

Material: Holotype, axial section illustrated in plate 1, figure 1; macrospheric form from well Fauqui-6, sample 4075m. Paratypes, the rest of specimens illustrated in plate 1. Studied material deposited in the Total Centre Scientifique et Technique Jean Feger, Pau (France).

Etymology: From its geographic first occurrence (Iraq).

Type locality: Buzurgan, Fauqui and Abu Ghirab oil fields, Iraq.

Occurrence: *Carinoconus iraqiensis* n. sp. occurs throughout the whole studied cored interval, and is coeval with species that indicate a Middle-Late Cenomanian age. This represents a minimum age range for this new species, although the total range maybe greater because the overlying and underlying sediments were not studied.

CONCLUSIONS

Biostratigraphical analysis of the Mishrif Formation in the Buzurgan, Fauqui and Abu Ghirab oil fields has provided a new representative of the genus *Carinoconus* for the Middle East. A new species of the genus *Carinoconus*, *C. iraqiensis* n. sp. is characterised by (i) a relatively large initial spire, (ii) a distinctive sharp angular carina and (iii) relatively few chambers in the rectilinear stage. *Carinoconus iraqiensis* n. sp. occurs in the Mishrif Formation in the southeastern part of Iraq and it has a minimum range of Middle to Late Cenomanian, although its total range could be greater.

This is the first time that a representative of this genus has been documented from the Middle East, and it is evidently younger than the species *Carinoconus casterasi* (Bilotte et al.) found in Western Europe.

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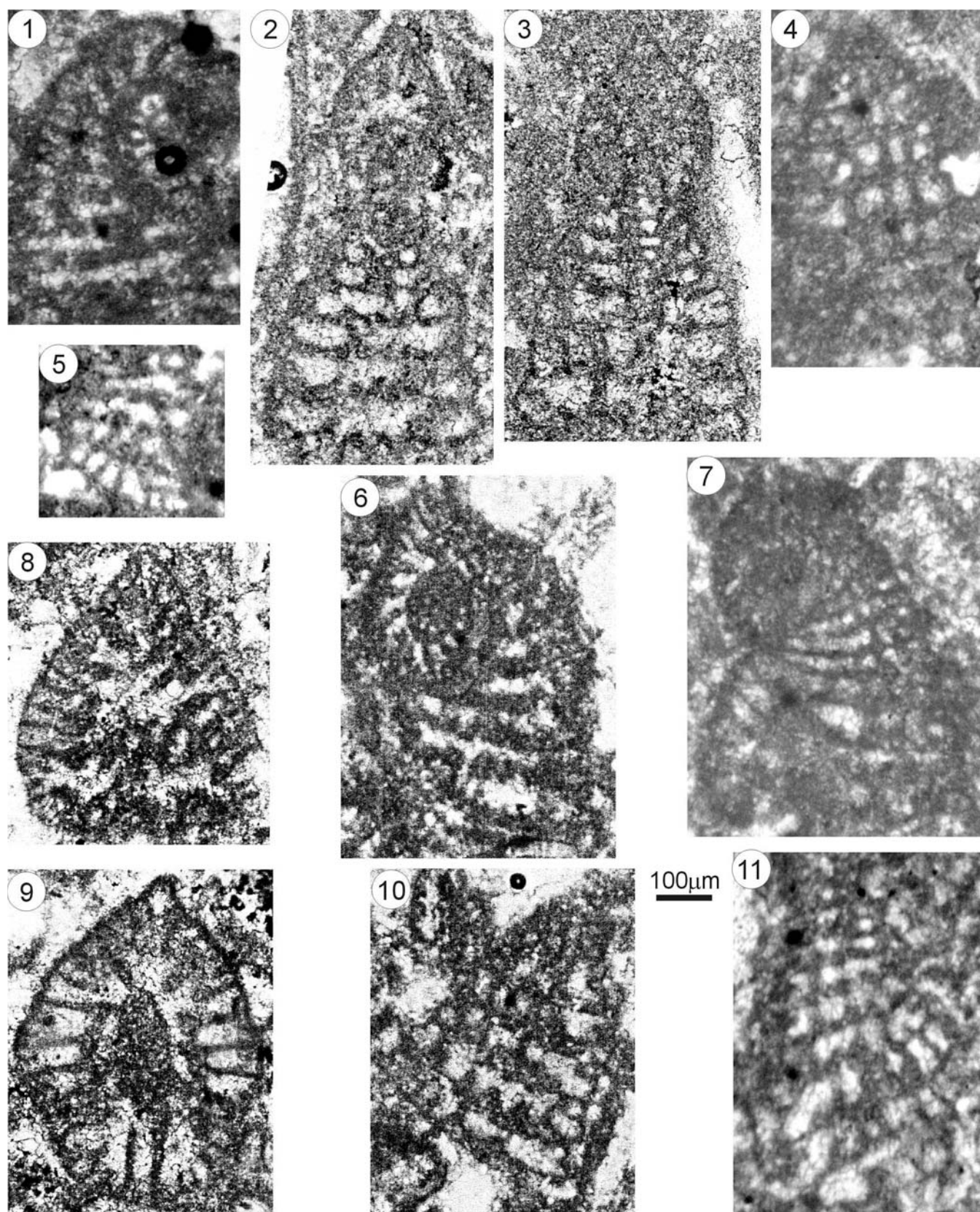
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PLATE 1

Carinoconus iraqiensis n. sp.

- 1,6,7 Axial sections. Samples Fauqui-6 4075m, Buzurgan-11 3056.5m, Fauqui-10 4004m, $\times 100$.
- 2,3 Subaxial sections. Samples Buzurgan-3 12649' and Buzurgan-3 12840', $\times 100$.
- 4,10,11 Oblique sections. Samples Fauqui-6 4037.5m, Buzurgan-11 3850.50m, Abu Guirab-3 3908m, $\times 100$.

- 5 Transverse-oblique section through the rectilinear stage. Sample Fauqui-1 4049m, $\times 100$.
- 8,9 Oblique sections through the initial spire. Samples Buzurgan-3 12401', Buzurgan-3 12672', $\times 100$.



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