Early Late Permian (Wordian) non-ammonoid cephalopods from the Hamrat Duru Group, central Oman Mountains

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Abstract. The Wordian Rustaq Formation is a unit of the Hawasina Nappes in the central Oman Mountains, and contains a diverse pelagic fauna. Four species of non-ammonoid cephalopods are described herein: orthocerids Brachycycliloceras rustaqense sp. nov. and Bitaunoceras cf. zonatum (Gemmellaro), nautilid Liroceras sp. and bactritid Bactrites? sp. One of these, Brachycycliloceras rustaqense, represents the youngest record of the genus, previously known unquestionably only from the Carboniferous. The fauna indicates affinity to the Timor and Sicily faunas.

Key words: Orthocerids, nautilid, bactritid, central Oman Mountains, Wordian

Introduction

During the Late Cretaceous obduction of the Semail Ophiolite, Tethyan margin sediments were thrust onto the Arabian continental margin in the Oman Region (e.g. Glennie et al., 1973; Robertson and Searle, 1990). The allochthonous units of sedimentary origin are called the Hawasina Nappes and subdivided into the following six groups: Ramaq, Al Buda'ah, Hamrat Duru, Al Ardih, Kawr and Umar (Béchennec et al., 1988; Pillevuit, 1993). This report, preceded by a preliminary report in the account of Pillevuit (1993), deals with non-ammonoid cephalopods obtained from reddish cephalopod limestone of the Rustaq Formation of the Hamrat Duru Group. The Permian ammonoid fauna of the formation indicates a close resemblance to those from the west Mediterranean (Sosio fauna, Gemmellaro, 1887-1888) and Timor (Haniel, 1915), suggesting the Hawasina Basin corresponds to a seaway along the northern margin of Gondwana (Blendinger et al., 1992). This faunal exchange between the Hawasina Basin and Timor is also supported by the investigation of the trilobite fauna by Pillevuit (1993).

The Rustaq Formation, defined by Pillevuit (1993), crops out in the vicinity of Rustaq village in the central Oman Mountains (Figure 1). This stratum represents the lowest part of the Hamrat Duru Group, and consists of pillow lavas and carbonate rocks indicating a pelagic environment. The cephalopod limestone containing a thin barren dolomite is 2.6 m thick (Figure 2). Besides cephalopods, the Rustaq fauna includes conodonts, ostracodes, crinoids, trilobites and serpulids. Blendinger et al. (1992) assigned a Wordian (early Guadalupian, early Late Permian) age to the fauna, based on ammonoids, including Sicanites schopeni (Gemmellaro), Agathiceras suassi Gemmellaro and Sociocrinites insignis (Gemmellaro), and conodonts.

The specimens studied are deposited in the paleontological collections of the Geological Museum of Lausanne (MGL), Switzerland.

Systematic paleontology

Class Cephalopoda Cuvier, 1797
Subclass Nautilioidea Agassiz, 1847
Order Orthocerida Kuhn, 1940
Superfamily Orthocerataceae M'Coy, 1844
Family Brachycycliloceratidae Furnish, Glenister and Hantsman, 1962
Genus Brachycycliloceras Miller, Dunbar and Condra, 1933

Type species: Brachycycliloceras normale Miller, Dunbar and Condra, 1933.

Brachycycliloceras rustaqense sp. nov.

Figures 3–1–5

Diagnosis.—Species of strongly annulated Brachycycloceras with depressed cross section; annulations form adanal lateral sinus; siphuncular position between center and venter.

Description.—Single deciduous phragmocone, 40.8 mm in length, of strongly annulated exogastric shell with depressed cross section, shell diameter of slightly deformed adoral end approximately 28 mm in lateral diameter (breadth) and 21 mm in dorsoventral diameter (height); annulations form deep adanal sinus on lateral side, 2-3 annuli bear in length equal to corresponding dorsoventral diameter; sutures with shallow but broad ventral lobes; septa thin with weak curvature; camerae short, width (max.)/length ratio of camerae approximately 6:8 in dorsoventral section of adoral shell; siphuncle narrow, between center and venter in position with suborthochoanitic short septal necks, length of septal necks ranges from 0.5 to 0.9 mm; connecting rings not preserved; no cameral and/or siphuncular deposits detected.

Discussion.—Although examined specimen is a fragmentary deciduous phragmocone abraded on the apical dorsal side, the distinctive shell shape and siphuncular structure and position confirm generic identification. The known stratigraphic distribution of Brachycycloceras was previously restricted to sediments ranging from the Namurian (Phillips, 1985) to the Upper Pennsylvanian (Furnish et al., 1962). Only a questionable record of a Lower Permian species of the genus has been reported from western Australia (Teichert, 1951). This Wordian specimen thus represents the youngest record of this genus, so this discovery from the Oman Mountains is noteworthy.

Brachycycloceras rustaqense sp. nov. differs from all other described Brachycycloceras species in having a depressed shell cross section and the lateral sinus of the annulations.

Etymology.—The specific name is derived from the Rustaq Formation, where the species occurs.

Material.—The holotype, MGL 72026.

Superfamily Pseudorthocerataceae Flower and Caster, 1935
Family Pseudorthoceratidae Flower and Caster, 1935
Subfamily Spyroceratinae Shimizu and Obata, 1935
Genus Bitaunioceras Shimizu and Obata, 1936

Type species.—Orthoceras bitauniense Haniel, 1915.

Bitaunioceras cf. zonatum (Gemmellaro, 1890)

Figures 3-6-11

cf. Orthoceras zonatum Gemmellaro, 1890, pl. 11, figs. 9-11, pl. 12, figs. 19, 20.

Description.—Orthocones with gradual shell expansion, angle of expansion approximately 3-4 degrees; cross section circular; largest specimen (MGL 72027) of phragmocone attains 20.0 mm in diameter; surface ornamentation of relatively coarse transverse lirae forming salients;
length of fragmentary body chamber of immature specimen (MGL 72028) 30.8 mm and adoral shell diameter 15.9 mm; sutures not observed, but obvious obliquity not recognized in dorsoventral section; camerae long, width (max.)/length ratio of camerae ranges from 1.1 to 1.3, septa exhibit considerably strong curvature; siphuncular position subcentral, minimum distance of central axis of siphuncle from shell surface per shell diameter in dorsoventral section ranges from 0.48 to 0.46, septal necks suborthocoonichic to orthocoonichic, short, 1.1 mm long in well-preserved neck; connecting rings not preserved; internal molds of phragmocone and body chamber bear transverse, shallow constrictions caused by periodic thickenings of shell wall, and transverse, straight to partly zigzag wrinkled layer; no cameral and/or siphuncular deposits detected.

**Discussion.**—The specimens of *Bitauicoceras cf. zonatum* from the central Oman Mountains closely resemble *B. zonatum* (Gemmerlir) from the Middle Permain of Sicily in its general shell shape, nature of surface ornamentation and well-developed wrinkled layer. The unknown adoral siphuncular structure of the type specimens leads to the tentative specific assignment of the specimens.

Prior to the present description, *Bitauicoceras* had been recorded from Sicily, southern Uralis, Timor, Japan, northern Mexico, and Texas (Niko and Nishida, 1987). The genus was widespread in the Tethyan region and the southern margin of the Boreal region during Sakmarian to Guadalupian times.

**Material.**—Two specimens, MGL 72027, an incomplete phragmocone, 65.7 mm long, and MGL 72028, a fragment of immature body chamber, 30.8 mm long.

Order Nautilida Agassiz, 1847
Superfamily Clydonautiaceae Hyatt in Zittel, 1900
Family Lioceratidae Miller and Youngquist, 1949
Genus *Lioceras* Teichert, 1940

**Type species.**—*Coloceras litatum* Girty, 1911.

**Lioceras** sp.

Figures 3-12, 13

**Description.**—Single subglobose nautilicone with 21.5 mm in shell diameter, whorl breadth/height ratio 1.88; coiling extremely involute with umbilicus comprising less than 10 percent of diameter; whorl section reniform, rounded ventrally and laterally; shell surface smooth, lacking in conspicuous ornament without growth lines; suture simple, nearly straight.

**Discussion.**—The specimen probably represents an immature portion of the shell. The lack of those diagnostic features which appear in the adult shell precludes specific determination.

**Material.**—A specimen, MGL 72029.
Subclass Bactritioidea Shimanskij, 1951
Order Bactritida Shimanskij, 1951
Family Bactritidae Hyatt, 1884
Genus Bactrites Sandberger, 1843

Type species: — Bactrites subconicus Sandberger, 1843.

Bactrites ? sp.

Figures 3-14, 15

Description: — Single incomplete body chamber of orthoconic shell, 39.8 mm in length, with circular cross-section, weak dorsal carina; angle of shell expansion approximately 9 degrees; surface ornamentation with weak transverse lirae.

Discussion: — The combination of carina and transverse ornamentation of the shell surface, which is characteristic of some bactritids such as the body chamber of Bactrites peytonensis Mapes (1979, pl. 8, figs. 4-14, pl. 9, figs. 2, 3, 6-8, 12, 13, 15, 17-19, pl. 14, figs. 7, 8, 10) and Ctenobactrites minus Shimansky (1954, pl. 9, figs. 1, 2), indicates that the specimen can be assigned to the Family Bactritidae. In addition, the lacking of the coarse costae and/or lirae suggests the Oman species belongs to Bactrites rather than Ctenobactrites.

Material: — A specimen, MGL 72030.

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