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Revision of Silurian cephalopods from the Carnic Alps: The Gortani and Vinassa de Regny collection, 1909

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ABSTRACT – *The type specimens of Gortani & Vinassa de Regny described and partially figured in 1909 have been revised according to an up to date taxonomy. A synthetic systematic table of the whole collection is also given. The aim is to clarify the paleobiogeographical distribution of the described species within the North Gondwana area during the Silurian.*

RIASSUNTO – [Revisione dei cefalopodi siluriani delle Alpi Carniche: la collezione di Gortani e Vinassa de Regny, 1909] – *Vengono rivisti gli esemplari originali della collezione Gortani descritti e in parte figurati nel 1909 da Gortani & Vinassa de Regny nel lavoro «Fossili neosilurici del Pizzo di Timau e dei Pal nell'Alta Carnia» e alcuni esemplari, non figurati nel lavoro, sono stati studiati e illustrati. Viene inoltre fornita una tabella sistematica riassuntiva di tutti i fossili della suddetta collezione. Lo scopo di questa revisione è quello di evidenziare la distribuzione paleobiogeografica delle specie descritte nella fascia settentrionale del Gondwana durante il Siluriano.*

INTRODUCTION

In 1909 Gortani & Vinassa de Regny published «Fossili Neosilurici del Pizzo di Timau e dei Pal nell'Alta Carnia» in the Memorie della Reale Accademia della Scienze dell'Istituto di Bologna. Michele Gortani (Text-fig. 1) and Paolo Vinassa De Regny (Text-fig. 2) published many papers on the stratigraphy of the Lower Paleozoic strata of the Italian Carnic Alps (1908, 1909, 1910, 1913). However, their paper of 1909 is one of the few where they systematically described and figured the fossil fauna and try to correlate it with that from Bohemia, where precise stratigraphic levels had been identified for the species. The studied fossils were probably collected in the Kok Limestones of Mt. Cocco, Pal Grande and Pal Piccolo (Text-fig. 3). Unfortunately, precise locality data are not included with the specimens, therefore their stratigraphic placement is not possible. At present this fossil collection is deposited in the Museum of Paleontology, Department of Geology and Environmental Sciences (Bologna University, curator Dr. C. Sarti). Gortani & Vinassa de Regny illustrated also bivalves, trilobites, favositids, ostracodes and gastropods. As far as concerns bivalves, mainly cardioids, Kríž (1996) published a recent and accurate revision recognizing in the fauna several *Cardiola* Community Groups.

It must be specified that not all the nautiloid specimens collected were illustrated by Gortani & Vinassa de Regny (1909), so that in the present paper, where appropriate the remnant material of this collection is illustrated and described. The aim of the present revision

is to establish whether the species cited by Gortani & Vinassa de Regny are actually present in the Carnic Alps and may be used for correlation with the nautiloid faunas of Sardinia and Bohemia. Furthermore, this will allow a clarification of the paleobiogeographical distribution of the Silurian nautiloid species described so far.

DESCRIPTION AND TAXONOMICAL REMARKS ON THE GORTANI & VINASSA DE REGNY CEPHALOPOD COLLECTION

A short taxonomic description is given of the material of the examined "collection" of Gortani & Vinassa de Regny (1909) with the present revised determinations. Most of the specimens however, are only fragmentary and do not allow a precise taxonomic classification. These are listed as "Other Material" and are ordered under the original specific classification used by the authors. In Table 1 the species described (Gortani & Vinassa de Regny 1909) are listed in alphabetical order with their revised classification for easy reference. Additional specimens apart from the figured material have been included in this study and in some cases they are described separately. It must be specified that under the locality data "Casera" means farmhouse.

SYSTEMATICS

The systematic classification adopted in the «Treatise (1964)» is mainly followed in this paper. The employed terminology is that adopted by Flower

Nautiloid taxa identified by Gortani & Vinassa de Regny in 1909	Figures Pl. 1 of G. & V.	Present revision	Remarks and additional material
" <i>Orthoceras</i> " <i>alticola</i> Barrande 1870		Coll. No. 20695A indeterminable specimen Coll. No. 20907A <i>Plagiostomoceras</i> cf. <i>gruenewaldti</i>	(Coll. No. 20907B) Fragment of living chamber and phragmocone showing cyrtchoanitic septal necks of indeterminable specimen
" <i>Orthoceras</i> " <i>amoenum</i> Barrande 1866	Pl. 1, fig. 19	Coll. No. 20710A indeterminable specimen Coll. No. 20908A <i>Plagiostomoceras</i> cf. <i>gruenewaldti</i>	In the same block there is a specimen (Coll. No. 20710B) of <i>Hemicosmorthoceras semimbricatum</i> Gnoli 1983 (1982) Coll. No. 20908B, C are also <i>Plagiostomoceras</i> cf. <i>gruenewaldti</i>
" <i>Orthoceras</i> " <i>dulce</i> Barrande 1868	Pl. 1, figs. 22, 23	Coll. No. 20898A <i>Pseudocycloceras</i> sp. ind. Coll. No. 20898B indeterminable specimen	Oblique annulations about 80° from the vertical line (Coll. No. 20898A)
" <i>Orthoceras</i> " <i>firum</i> Barrande 1870	Pl. 1, figs. 20, 21	Coll. No. 20702A indeterminable specimen Coll. No. 20652A indeterminable specimen	Coll. No. 20702A Orthochoanitic septal necks (figured by G. & V., fig. 20) Coll. No. 20652A Expansion angle close to 14° in the adult part
" <i>Orthoceras</i> " <i>littorale</i>	Pl. 1, fig. 24	Coll. No. 20901 indeterminable specimen	Ornamentation-type= imbrication towards the apex
" <i>Orthoceras</i> " <i>melchioni</i> Barrande 1866	not figured	See note (1) below	See note (1) below
" <i>Orthoceras</i> " <i>pelagium</i> Barrande 1870		Coll. No. 20910 indeterminable specimen	Fragment of living chamber
" <i>Orthoceras</i> " cf. <i>pleurotomum</i> Barrande 1866		Coll. No. 20675 indeterminable specimen	
" <i>Orthoceras</i> " <i>potens</i> Barrande 1866		Coll. No. 20673 <i>Geisonoceras</i> ? sp.	Fragment of living chamber and phragmocone showing cyrtchoanitic septal necks
" <i>Orthoceras</i> " <i>pulchrum</i> Barrande 1868	Pl. 1, fig. 25 and text-fig. 2	Coll. No. 20902 indeterminable specimen	
" <i>Orthoceras</i> " <i>subannulare</i> Münster 1840		Coll. No. 20692 indeterminable specimen	The specimen may be compared with <i>O. pulchrum</i> Barrande
(1) In the Paleontological Collection of Bologna University the specimen of <i>M. melchioni</i> (Barrande) described by Gortani & Vinassa de Regny (1909, p. 205) seems to be missing.			

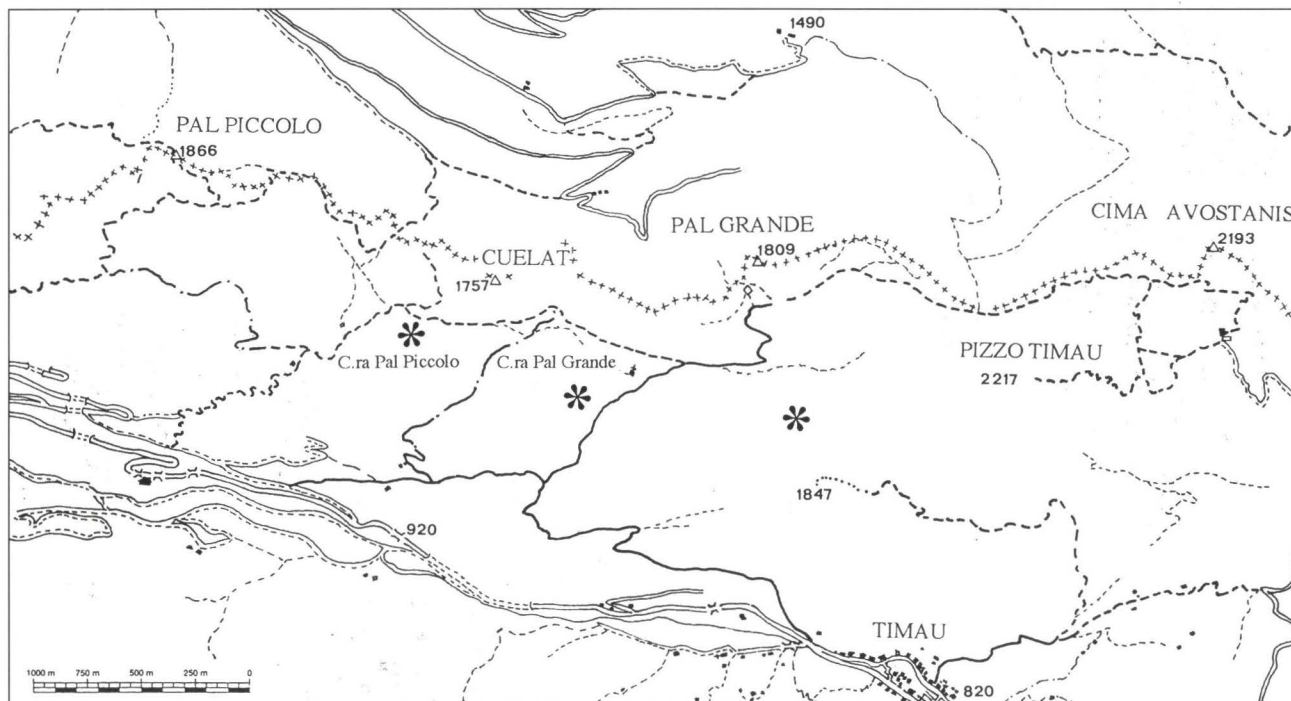
Tab. I - A synthetic systematic table summarizing the present revision of the examined specimen of the Gortani & Vinassa de Regny (G. & V.) collection in alphabetical order of their specific classification.



Text-fig. 1 - Michele Gortani (1883-1966). Portrait reproduced from "Michele Gortani" by Ermes Dorigo (1993, p. 27), Edizioni Studio Tesi, Pordenone



Text-fig. 2 - Paolo Vinassa De Regny (1871-1957). Portrait reproduced from Alfredo Boni, "Ricordo di Paolo Vinassa De Regny", Boll. Soc. Geol. Ital., vol. 77, pt. 1, p. 237.



Text-fig. 3 - Simplified map of the Carnic Alps. Fossil localities marked by *.

(1964) including the terms apicad (towards the apex) and orad (towards the aperture). The maximum conch diameter is (D) and the minimum (d), the diameter of the siphuncle (d.).

The publication date of the species here reported refers to their first publication independently either by their description or illustration.

Class CEPHALOPODA Cuvier, 1797
Subclass NAUTILOIDEA Agassiz, 1847
Order ORTHOCERIDA Kuhn, 1940
Family ORTHOCERATIDAE M'Coy, 1844
Subfamily MICHELINOCERATINAE Flower, 1945

Genus PLAGIOSTOMOCERAS Teichert & Glenister, 1952

Type species – By original designation *Orthoceras pleurotomum* Barrande, 1860, pl. 224.

PLAGIOSTOMOCERAS cf. GRUENEWALDTI
(Barrande, 1866)
Pl. 2, figs. 5a, 5b

- cf. 1857 *Orthoceras* sp. MENEGHINI, pp. 209-210, pl. C, figs. 12a-d.
cf. 1866 *Orthoceras gruenewaldti* BARRANDE, pl. 217, figs. 18, 19.
cf. 1868 *Orthoceras gruenewaldti* BARRANDE, pl. 315, figs. 1-19.
cf. 1874 *Orthoceras gruenewaldti* BARRANDE, pp. 373-374.
cf. 1877 *Orthoceras gruenewaldti* BARRANDE, pl. 476, fig. vii.
cf. 1909 *Orthoceras amoenum* Barrande - GORTANI & VINASSA DE REGNY, pp. 200-201, pl. 1, fig. 19.
cf. 1909 *Orthoceras alticola* Barrande - GORTANI & VINASSA DE REGNY, pp. 201-202 (*pars*).
cf. 1913 *Orthoceras gruenewaldti* Barrande - GORTANI, 310, 312.
cf. 1977 *Plagiostomoceras gruenewaldti* (Barrande) - SERPAGLI & GNOLI, p. 168, pl. 3, figs. 3-4.
cf. 1998 *Plagiostomoceras gruenewaldti* (Barrande) - GNOLI & HISTON, p. 317, pl. 1, figs. 5-6.

Description – Max. length = 38.3 mm, D=12.7 mm; d = 8.5 mm. Expansion angle = about 7-8 degrees. Outer ornamentation consists of transversal adorally imbricate costae, sinuous in shape, numbering one per mm and increasing towards the aperture to 1.5 per mm. Central siphuncle. Circular cross section even if there is some tectonic compression present.

Remarks – Comparison with the specimens figured by Barrande (Pl. 395, figs. 26-31 and pl. 405, fig. 8) permits their taxonomic determination as the above reported taxon. In addition the writers report another specimen already described by Gortani and Vinassa de Regny as *O. alticola* Barrande (Coll. No. 20907A) formally revised here, despite the lack of siphuncular structure, as *Plagiostomoceras* cf. *gruenewaldti* (Barrande). It must be pointed out that nautiloids of the studied block show a clear structure of telescoping revealing the presence of wave motion in the depositional environment. Also specimens (20908 B and C) belong to this species.

Occurrence – Casera Pal Grande (Timau, UD).

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Three specimens coll. No. 20908A, (figured specimen), 20908B (unfigured specimen), 20908C (? figured specimen by Gortani & Vinassa de Regny), plus the specimen (Coll. No. 20907A, see remarks above reported).

Subfamily SPYROCERATINAE Shimizu & Obata, 1935
Genus PSEUDOCYCLOCERAS Barskov, 1959

Type species – By original designation *Pseudocycloceras karagandense* Barskov, 1959

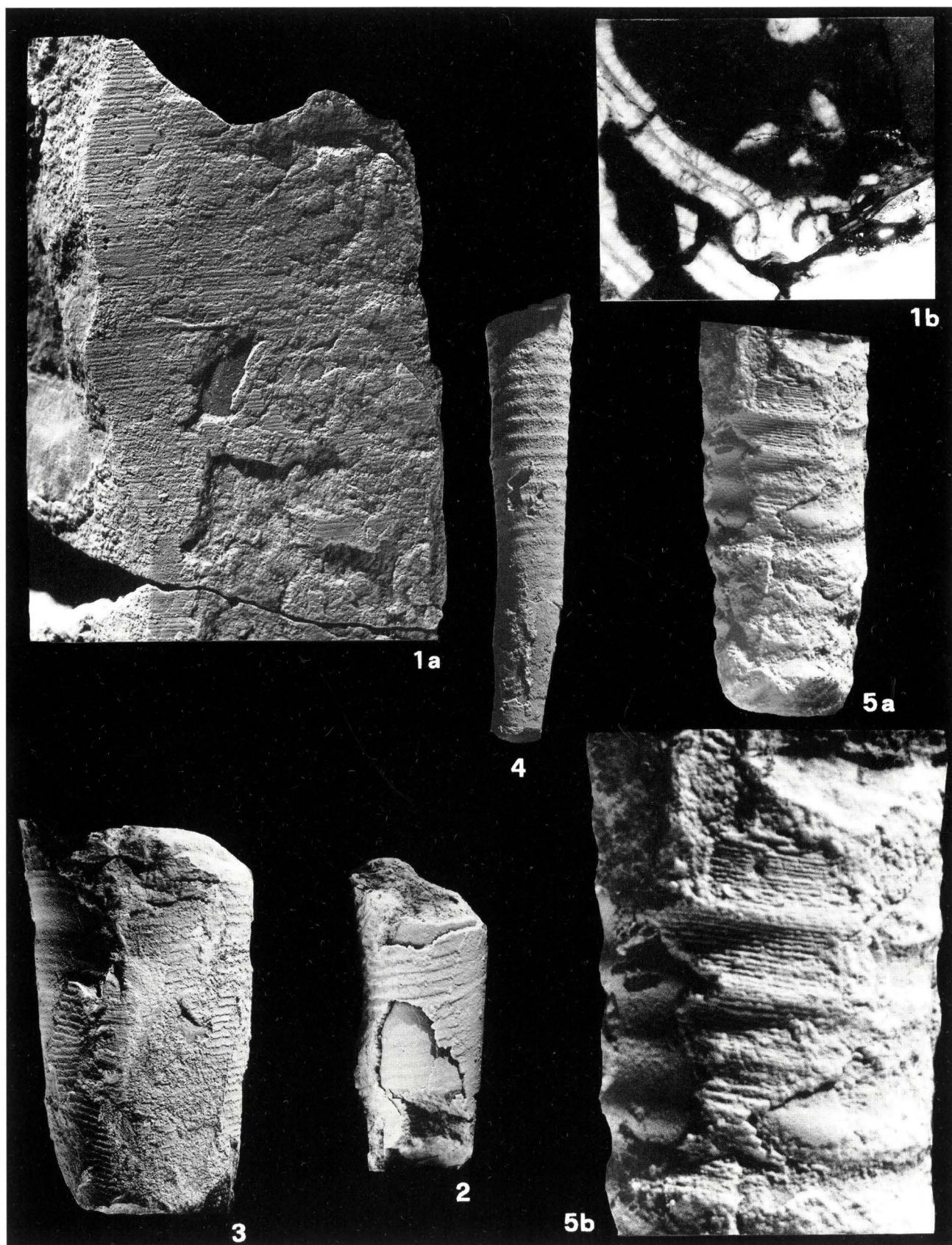
PSEUDOCYCLOCERAS sp. ind.
Pl. 1, figs. 5a, b

1909 *Orthoceras dulce* Barrande, 1874 - GORTANI & VINASSA DE REGNY, pp. 205-206, pl. 1, figs. 22-23.

Description – Max. length 14 mm. D= 6.4 mm; d = 5.5. Angle of expansion = about 4°. Annuli number about 3 in 2.5 mm; there are approximately 15 striae per each annulus. Annuli ventrally oblique by ten degrees from the horizontal line. Subcircular cross section. No evidence of the siphuncle.

EXPLANATION OF PLATE 1

- Figs. 1a, b - *Geisonoceras* ? sp. (corresponding to "*O. potens*" of Gortani & Vinassa de Regny, 1909) - 1a) Outer view of the specimen n. 20673 showing fine, slightly oblique, striations, x 3. 1b) Polished longitudinally medial section of the last septum of the same specimen showing detail of the cyrtocochanitic septal neck, x 2.
Fig. 2 - *Hemicosmorthis semimbricatum* Gnoli, 1983. Lateral view of the specimen Coll. No. 20710B showing the outer ornamentation only on the half (ventral) part of the shell by imbricate orad costae, x 4.
Fig. 3 - Indeterminable specimen corresponding to "*Orthoceras*" *littorale* of Gortani & Vinassa de Regny, 1909) - Ventral outer view of the specimen Coll. No. 20901, (note the ventral lobe corresponding to the hyponomic sinus), x 2.
Fig. 4 - Indeterminable specimen corresponding to "*Orthoceras*" cf. *pleurotomum* of Gortani & Vinassa de Regny, 1909) - External lateral view of the specimen Coll. No. 20675 showing sharp annulation, bearing between them poorly detectable thin striae, x 3.
Figs. 5a, b - *Pseudocycloceras* sp. ind. (corresponding to "*Orthoceras*" *dulce* of Gortani & Vinassa de Regny, 1909) - 5a) Lateral view of the specimen Coll. No. 20898A showing slightly oblique sharp annulation, between which fine striation is visible (see the enlarged view, fig. 5b), x 5 and x10 respectively.



Remarks – Due to the poor preservation of the examined specimens specific characters are not distinguishable.

Occurrence – Studied specimens come from the “Red Limestones” of Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Two fragments Coll. No. 20898 A (figured specimen and Gortani & Vinassa de Regny at pl. 1, fig. 22,) and 20898 B (probably figured by Gortani & Vinassa de Regny at pl. 1, fig. 23).

Family GEISONOCERATIDAE Zhuravleva, 1959
Genus GEISONOCERAS Hyatt, 1884

Type species – By original designation *Orthoceras rivale* Barrande, 1866, pl. 209.

GEISONOCERAS? sp.
Pl. 1, figs. 1a, 1b

1909 *Orthoceras potens* Barrande – GORTANI & VINASSA DE REGNY, p. 203.

Description – A fragment of this form, approximately 9 cm in length shows an orthoconic shell, regularly expanding by about four degrees. Septa deep, 1/4 their diameter. Siphuncle subcentral in position. Septal necks suborthochoanitic to cyrtochoanitic with a septal foramen 2.5 mm in width. Outer ornamentation consists of thin irregularly spaced bands 5mm apart. Between these, there are slightly detectable striae that number 5 per mm. No other inner features are preserved.

Remarks – Due to tectonic compression and distortion of the examined specimens, the position of the siphuncle, its precise diameter and that of the shell remain unknown. Only towards the apex of the shell three septa are well enough preserved to show a cyrtochoanitic septal neck. The examined specimen is classified on this latter feature as belonging, even if dubiously, to the genus *Geisonoceras*.

The lack of well preserved features prevents any classification at the specific level.

Occurrence – Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – One fragmentary specimen Coll. No. 20673 (figured specimen).

OTHER MATERIAL

The remaining material of the collection described by Gortani & Vinassa de Regny (1909) consists of badly preserved fragmentary specimens which do not allow either a specific or generic determination. The indeterminable specimens are described below in alphabetical order under the specific identifications used by Gortani & Vinassa de Regny (see also tab. 1).

“ORTHOCERAS” ALTICOLA Barrande, 1870

1909 *Orthoceras alticola* Barrande – GORTANI & VINASSA DE REGNY, pp. 201-202 (*pars*).

Description – Max. length = 17.3 mm. Circular cross section and central siphuncle; $d_s = 0.8$ mm, $D = 9.2$ mm; $d = 7.3$ mm. Angle of expansion = about 9° . Outer ornamentation represented by slight costae, imbricate towards the aperture that number 2 per mm.

Remarks – The lack of any internal features in the examined material prevents, however, any reliable taxonomic classification.

Occurrence – Casera Pal Piccolo.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Inner mould Coll. No. 20695A. In addition to the above described specimen we must add another one, Coll. No. 20907B from Casera Pal Grande.

“ORTHOCERAS” AMOENUM Barrande, 1866

1909 *Orthoceras amoenum* Barrande – GORTANI & VINASSA DE REGNY, pp. 200-201.

Description – Max. length = 16 mm. The examined specimen (20710A) from the “black limestone” does not show any detectable features useful for its taxonomic determination.

Remarks – In the same block, however, there is another specimen (Coll. No. 20710B) easily identifiable as *Hemicosmorthoceras semimbricatum* Gnoli 1983 (Pl.1, fig. 2). However, as this specimen was not described by Gortani & Vinassa de Regny but forms part of the additional material of the collection, it is only mentioned here.

Occurrence – Casera Pal Piccolo.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Coll. No. 20710A.

“ORTHOCERAS” FIRMUM Barrande 1868
Pl. 2, fig. 2

1909 *Orthoceras firmum* Barrande – GORTANI & VINASSA DE REGNY, pp. 204-205, pl. 1, fig. 21.

Description – Max. length = 46.4 mm. Circular cross section and central siphuncle with $d_s = 0.5$ mm. $D = 11.5$ mm; $d = 5$ mm. Expansion angle = about 14° .

Remarks – Comparison with Barrande's specimens (Pl. 397, fig. 10 and 426, figs. 11, 12) concerning the small size, the central siphuncle, the angle of expansion and the quite smooth outer surface of the shell, could permit the attribution of the examined specimen to the above reported species; however, the lack of any inner features prevents any taxonomic determination.

Occurrence – Pradesarchia outcrop (Timau).

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Inner mould Coll. No. 20652A.

“ORTHOCERAS” FIRMUM Barrande, 1868
Pl. 2, fig. 3

1909 *Orthoceras firmum* Barrande – GORTANI & VINASSA DE REGNY, pp. 204-205.

Description – Max. length = 14.9 mm. Sub-circular cross section. $D = 5$ mm; $d = 4.4$ mm. Angle of expansion = about 8° . Orthochoanitic septal neck, septal foramen corresponding to 1/14 the shell diameter. The eccentricity of the siphuncle corresponds to about half of its own diameter.

Remarks – The lack of outer ornamentation and the eccentricity of the siphuncle prevent a classification of the examined specimen as belonging to the above reported Barrande's species *O. firmum*. Furthermore, the poor preservation of this specimen, prevents any specific classification.

Occurrence – Casera Pal Piccolo.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Inner mould Coll. No. 20702A. (Figured specimens of Gortani & Vinassa de Regny, pl. 1, fig. 21). The specimen figured by Gortani & Vinassa (Pl. 1, fig. 20) has not been located.

“ORTHOCERAS” LITTORALE Barrande, 1868
Pl. 1, fig. 3

1909 *Orthoceras littorale* Barrande – GORTANI & VINASSA DE REGNY, p. 206, pl. 1, fig. 24.

Description – Max. length = 23.6 mm, $D = 19.5$, $d = 16.5$ mm. Angle of expansion = $7^\circ 30'$. Siphuncular features not distinguishable. Transversal bands, regularly spaced and apical imbricate, numbering two per mm, represent the outer ornamentation of the examined material. Fine transversal lineations remain on the surface of the inner mould wherever the external surface bearing ornamentation is removed.

Remarks – Differences by comparison with the specimens of this species figured by Barrande (Pl. 265) do not help in classifying examined material which, thus, remains uncertain.

Occurrence – Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – One fragmentary specimen Coll. No. 20901 (Figured specimen and by Gortani & Vinassa de Regny, pl. 1, fig. 24).

“ORTHOCERAS” PELAGIUM Barrande, 1870
Pl. 2, fig. 1

1909 *Orthoceras pelagium* Barrande – GORTANI & VINASSA DE REGNY, pp. 204.

Description – Max. length = 13 cm. Fragment of orthoconic shell of large dimension, longitudinally broken; external or internal features are not distinguishable. The ornamentation is present only on a small external part consisting of thin transversal, slightly oblique striae, numbering 5 per mm. The latter suggest a vague similarity with the specimen of this species figured by Barrande (Pl. 371, fig. 1).

Remarks – Poor preservation of the examined material suggests, however, to consider it as taxonomically indeterminable.

Occurrence – Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – One fragmentary specimen Coll. No. 20910.

"ORTHOCERAS" cf. *PLEUROTOMUM* Barrande, 1866
Pl. 1, fig. 4

1909 *Orthoceras* cf. *pleurotomum* Barrande – GORTANI & VINASSA DE REGNY, p. 205.

Description – Max. length = 31 mm, D = 6.4 mm, d = 2.3 mm. Angle of expansion = 7-8 degrees. Sharply annulated, orthoconic shell of small dimension, with circular cross-section and subcentral siphuncle (d_s = 0.3 mm). Transversal slightly oblique annulations, numbering 2 per mm with thin striae numbering of 4-5 in between the annulations represent its outer ornamentation. No inner features are distinguishable in the examined material.

Remarks – It seems to us impossible to compare the specimen with those species illustrated by Barrande mainly due to the circular cross section and the subcentral siphuncle. Again the Gortani & Vinassa de Regny taxonomic attribution results as a misinterpretation. The specimen is indeterminable.

Occurrence – Red limestones of Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – One fragmentary specimen Coll. No. 20675.

"ORTHOCERAS" *PULCHRUM* Barrande, 1866
Pl. 2, fig. 4

1909 *Orthoceras pulchrum* Barrande – GORTANI & VINASSA DE REGNY, pp. 206-207, text-fig. 2, pl. 1, fig. 25.

Description – Max. length = 35 mm. Longitudinal costae numbering 2 per mm, between which poorly recognizable transversal striae represent its outer ornamentation. It is also difficult to state the number and dimension of the latter. On the contrary, the annulation of the shell (about one in 4 mm) is easily distinguishable.

Remarks – Due to the bad preservation of the examined material neither external diameters of the shell nor siphuncular features are detectable. The lack of inner features and the badly preserved outer ornamentation prevent any taxonomic determination.

Occurrence – Casera Pal Grande.

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – An inner mould Coll. No. 20902 (Figured specimen and by Gortani & Vinassa de Regny, pl. 1, fig. 25).

ORTHOCERAS SUBANNULARE Münster, 1840

1909 *Orthoceras subannulare* Münster – GORTANI & VINASSA DE REGNY, pp. 202-203.

Description – Max. length = 37.5 mm. External shell diameters not distinguishable. A small fragment of the test with longitudinal and transversal ornamentation is visible which however, is too badly preserved for determination. Annulation of the shell is regularly spaced at 2 mm apart.

Remarks – The poorly preserved ornamentation can suggest that this fragment is more closely similar to the specimen Coll. No. 20902 classified by Gortani & Vinassa de Regny as *O. pulchrum* Barrande which, however, is indeterminable (see above).

As a last remark on the species *O. subannulare* Münster 1840, originally described and figured as *Orthoceratites* (Münster 1840, pl. 19, fig. 3) is that the holotype has been probably been lost during the Second World War (pers. comm. Dr. G. Schairer, Curator of the Bayrische Staatssammlung für Paläontologische und Historische Geologie in Munich, Germany).

EXPLANATION OF PLATE 2

- Fig. 1 – Indeterminable specimen corresponding to "*Orthoceras*" *pelagium* of Gortani & Vinassa de Regny, 1909) - Outer lateral view of the specimen Coll. No. 20910 showing outer ornamentation of thin transversal slightly oblique striae, x 3.
- Fig. 2 – Indeterminable specimen corresponding to "*Orthoceras*" *firmum* of Gortani & Vinassa de Regny, 1909) - Outer view of the specimen Coll. No. 20652A showing a quite smooth shell, x 2.
- Fig. 3 – Indeterminable specimen corresponding to "*Orthoceras*" *firmum* of Gortani & Vinassa de Regny, 1909) - Longitudinal natural unpolished section of another fragment Coll. No. 20702A showing a poorly detectable orthochoanitic septal neck, eccentric about half of its own diameter, x 5.
- Fig. 4 – Indeterminable specimen corresponding to "*Orthoceras*" *pulchrum* of Gortani & Vinassa de Regny, 1909 - Lateral outer view of the specimen Coll. No. 20902 showing annulation of the shell and the fine poorly distinguishable outer ornamentation which in addition to the lack of detectable inner features prevents any taxonomic placement, x 5.
- Figs. 5a, b - *Plagiostomoceras* cf. *gruenewaldti* corresponding to "*Orthoceras*" *amoenum* of Gortani & Vinassa de Regny, 1909.
- 5a) External ventral view of the specimen Coll. No. 20908A showing sinuous, orad imbricating transversal bands forming an easily detectable ventral sinus in correspondence to the presumably hyponomic sinus, x 3. 5b) Septal view of the same specimen showing its sub-central siphuncle, x 4.



Occurrence – Pradersachia (Timau).

Repository – Paleontological Museum, Dept. of Geology and Environmental Sciences (Bologna University, Italy).

Material studied – Fragment of an internal mould showing an orthoconic annulated shell consisting of dark grey limestone. Coll. No. 20692.

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North Gondwanan Mid-Palaeozoic
bioevent / biogeography patterns
in relation to crustal dynamics