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Latest Hauterivian (Early Cretaceous) ammonites from Umbria-Marche Apennines (Central Italy)

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KEY WORDS – Palaeontology, Systematics, Ammonoidea, Cretaceous, Hauterivian, Maiolica, Umbria-Marche Apennines, Italy.

ABSTRACT – This monograph presents the systematic description of a rich ammonite fauna of latest Hauterivian age, collected in the Maiolica formation of the Umbria-Marche Apennines. In terms of ammonite zones the fauna indicates the P. angulicostata *Auctt. zone,* P. catulloi *subzone. The whole fauna comes from a single bed, the so-called "Guide-bed" of the Faraoni Level. Twenty-nine species have been recognized and some new taxa are proposed:* Pseudovaldedorsella *nov. genus, whose type-species is* P. crassidorsata *(Karakash),* Phyllopachyceras laeviventris *n. sp.,* Barremites primitivus *n. sp.,* Plesiospitidiscus breskovskii *n. sp.,* Psilotissotia (P.) apenninica *n. sp.,* Discoidellia pseudobertrandi *n. sp.,* Discoidellia vermeuleni *n. sp. The intraspecific variability of the above mentioned species plus that of Pseudothurmannia sarasini* Sarkar and *P. mortilleti* (Pictet & De Loriol) has been thoroughly analysed. The absence of ammonites identifiable *as* Pseudothurmannia catulloi *(Parona)* sensu *Hoedemaeker does not imply an older age than the* P. catulloi *subzone. In fact the whole ammonite assemblage belong to the typical fauna which defines the* P. catulloi *subzone itself..*

PAROLE CHIAVE – Paleontologia, Sistematica, Ammonoidea, Cretaceo, Hauteriviano, Maiolica, Appennino umbro-marchigiano, Italia.

RIASSUNTO – La presente monografia tratta della descrizione sistematica di una ricca fauna ad ammoniti dell'Hauteriviano terminale raccolta nella formazione della Maiolica dell'Appennino umbro-marchigiano. In termini di zone ad ammoniti la fauna indica la zona a P. angulicostata *Auctt., ed in particolare al sottozona a* P. catulloi. *L'intera fauna proviene da un singolo strato, il "Guide-bed" del Livello Faraoni. Sono riconosciute ventinove specie e proposte le istituzioni dei seguenti nuovi taxa:* Pseudovaldedorsella *nov. genus., la cui specie tipo è* P. crassidorsata *(Karakash),* Phyllopachyceras laeviventris *n. sp.,* Barremites primitivus *n. sp.,* Plesiospitidiscus breskovskii *n. sp.,* Psilotissotia (P.) *apenninica n. sp., Discoidellia pseudobertrandi n. sp. and Discoidellia vermeuleni n. sp. E' stata dettagliatamente esaminata la variabilità intraspecifica di tutte le specie succitate ed anche di* Pseudothurmannia sarasini *Sarkar e* P. mortilleti *(Pictet & De Loriol). L'assenza di* Pseudothurmannia catulloi *(Parona)* sensu *Hoedemaeker non implica un'età più antica della sottozona a* P. catulloi. *Infatti l'intera associazione ad ammoniti appartiene alla tipica fauna che caratterizza la stessa sottozona a* P. catulloi.

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INTRODUCTION

The aim of this work is the systematic description of the rich ammonite fauna collected from several localities of the Umbria-Marche Apennines (fig.1), in the "Guide-bed" of the so-called Faraoni Level. The latter was originally defined by Cecca *et al.*, (1994a) as a regional lithostratigraphic marker level occurring in the upper part of the Maiolica formation of Umbria-Marche Apennines. Some specimens of this fauna have already been figured in articles devoted to the regional stratigraphy (Cecca *et al.*, 1994a, 1995; Cecca & Pallini, 1995; Faraoni *et al.*, 1996) but the whole fauna needed a systematic study.

The Faraoni Level consists of a 25 to 45 cm thick alternance of organic carbon-rich black shales and limestones. One of the limestone beds, the "Guide-bed", is characterized by a well preserved, rich and diverse ammonite fauna which is the object of the present work.

The occurrence of such abundant fauna in the Maiolica succession is exceptional. In fact, other ammonitiferous levels are known (Cecca, 1985, 1995a, b; Cecca *et al.*, 1994a, 1995; Cecca & Pallini, 1996; Faraoni *et al.*, 1996) but they are never as rich as the "Guide-bed" and the fossils do not display the same good state of preservation.

Recent researches proved the presence of the Faraoni Level in northern Italy, in the Biancone formation of the Trento Plateau area (Cecca *et al.*, 1996; Faraoni *et al.*, 1997). This level has therefore an extraregional extent and it could represent a useful tool for correlations in the Tethyan areas.

THE FARAONI LEVEL

A short summary of the litho and biostratigraphic characters of the Faraoni Level is given here. We refer the reader to the papers by Galeotti (1996), Cecca *et al.* (1996) and Coccioni *et al.* (1998)

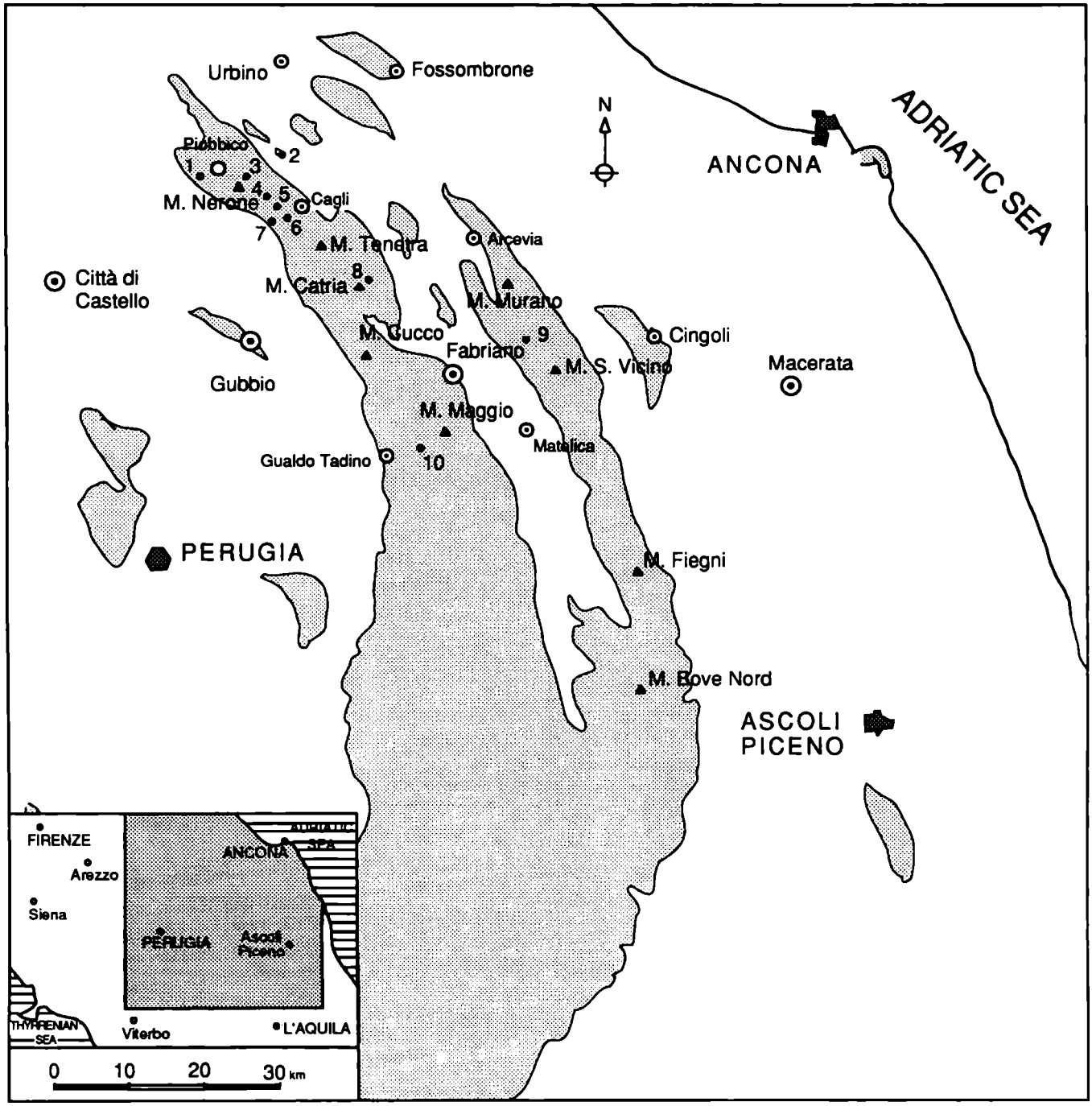

Fig. 1 - Location of the localities where the material has been collected: 1) Sette Vene, along the road from Piobbico to Apecchio, km 33.7; 2) Gorgo a Cerbara, near Piobbico; 3) Ranchi, northern flank of Monte Nerone, on the road from Piobbico to the top of the mountain; 4) Stirpeto, on the southern slope of Monte Nerone, above the Bosso valley; 5) northern slope of Monte Petrano, above the valley of the Bosso River; 6) road from Cagli to the top of Monte Petrano; 7) valley of the Bosso River, along the road from Cagli to Pianello; 8) north-east slope of Monte Catria; 9) Poggio San Romualdo; 10) Val Sorda, near Gualdo Tadino. Grey area: Jurassic to Oligocene folded formations.

as far as regards the micropalaeontological content, and to Baudin *et al.* (1995) for the geochemistry of the organic matter contained in the black shale layers.

Cecca *et al.* (1994a) described the Faraoni Level as composed by (from top to bottom):

"Upper Interval", consisting of three layers
layer G, black shale 1.5 to 3.5 cm;
layer F, limestone, 1 to 5 cm;
layer E, black shale, 1 to 2.5 cm;

"Guide-bed", a 18-20 cm thick ammonite-rich limestone (layer D);

"Lower Interval", also consisting of three layers
layer C, black shale, 0.5 ;
layer B, limestone, 1 to 6 cm;
layer A, black shale, 2 to 6.

This succession is schematically summarized in fig. 2, which corresponds to the log of the type-section selected by Cecca *et al.* (1994a) along the road from Cagli to Pianello in the valley of the Bosso river.

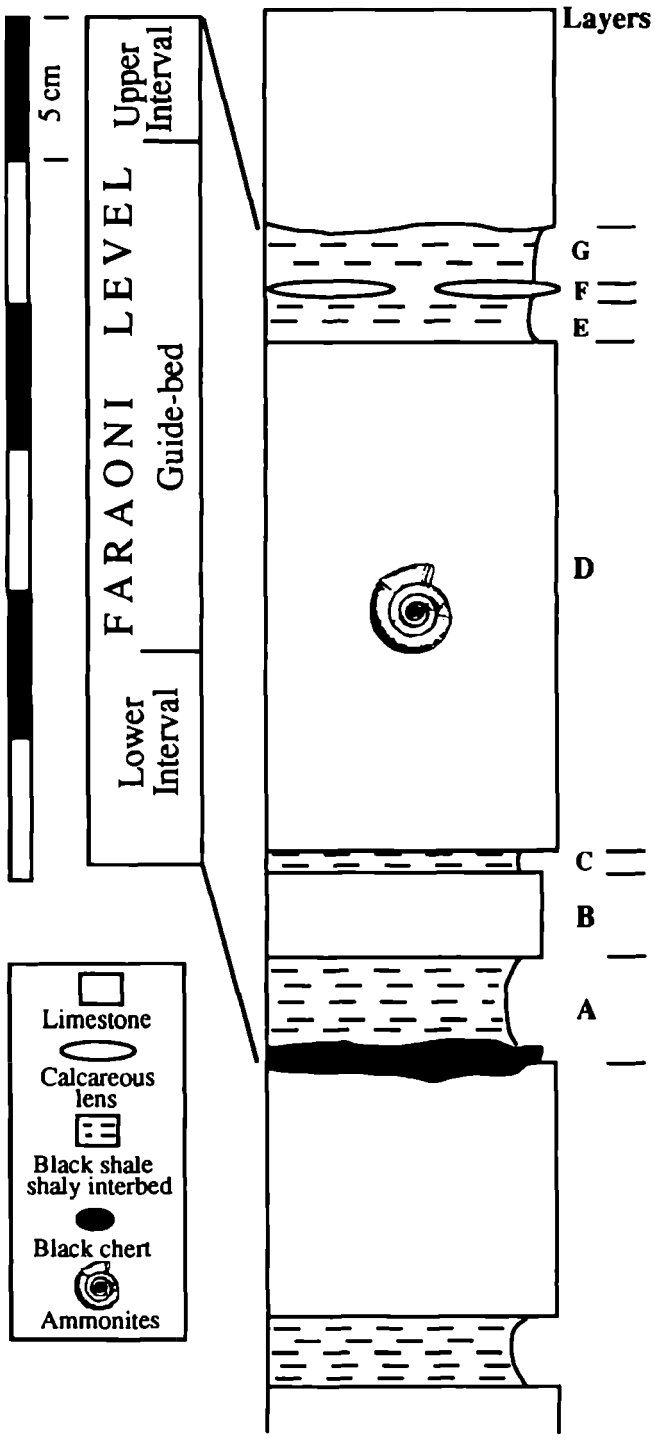

Fig. 2 - Stratigraphic log of the type-section of the Faraoni Level, located in the valley of the Bosso River, along the road from Cagli to Pianello at km 9.8.

It is important to recall here that the Faraoni Level usually occurs 65-70 metres below the top of the Maiolica, although in the southern outcrops of the Marche region this distance can reach 85 metres.

Within the "Guide-bed", which also contains abundant planktonic foraminifers (Cecca *et al.*, 1996; Coccioni *et al.*, 1998), the ammonites are well preserved, bear a neomorphic test and are filled by micrite and calcite arranged in geopetal structure. This structure shows normal polarity, being petrographically continuous with the fabric of the enclosing rock, thus indicating the absence of both re-elaboration and taphonomic condensation (*sensu* Fernández-López, 1991).

AGE OF THE FAUNA

The following species have been recognized in the "Guide-bed": *Phyllopachyceras infundibulum* (d'Orbigny), *P. laeviventris* n. sp., *Holcophylloceras ponticuli* (Rousseau), *Lytoceras subfimbriatum* (d'Orbigny), *Eulytoceras anisoptychum* (Uhlig), *E.* aff. *lepidum* (d'Orbigny), *Haploceras (Neolissoceras) grasi subgrasi* Druschits, *Plesiospitidiscus breskovskii* n. sp., *P. subdifficilis* (Karakash), *Pseudovaldedorsella crassidorsata* (Karakash), *P. compsensis* (Kilian), *Barremites primitivus* n. sp., *Psilotissotia (P.) apenninica* n. sp., *P. (P.)* aff. *apenninica* n. sp., *P.* aff. *reigi* (Nicklès), *P. (Buergliceras) favrei* (Ooster), *Discoidellia pseudobertrandi* n. sp., *D. vermeuleni* n. sp., *Crioceratites (C.)* sp. A, *C. (Emericiceras)* cf. *thiollierei* (Astier), *C. (E.) imlayi* Sarkar, *Pseudothurmannia sarasini* Sarkar, *P. mortilleti* (Pictet & De Loriol), *P.* sp. cf. *catulloi* ? (Parona) *sensu* Hoedemaeker, *Hamulinites munieri* (Nicklès), *Acrioceras tabarelli* (Astier), *A.* cf. *meriani* (Ooster), *Anahamulina* sp., *Paraspiticeras laeve* (Fallot & Termier).

The ammonites of the "Guide-bed" indicate the uppermost Hauterivian *P. angulicostata* zone, *P. catulloi* subzone (Hoedemaeker & Company, 1993). The Faraoni Level was also correlated to the middle part of chron CM4 in two sections of the Umbria-Marche Apennines (Cecca *et al.*, 1994b; Channell *et al.*, 1995).

As far as regards the *P. catulloi* subzone, it must be stressed that it was originally proposed by Hoedemaeker (Hoedemaeker & Company, 1993; Hoedemaeker, 1995) as a zone, whose base is defined by an important turnover of the ammonite fauna. Hoedemaeker considered the base of his *P. catulloi* zone to coincide with the base of the Barremian stage, in contrast with the recommendations of the 1st Symposium on Cretaceous stage boundaries (Birkelund *et al.*, 1985) to draw the Hauterivian - Barremian boundary either below or above the *Pseudothurmannia* beds. However, both 2nd (Hoedemaeker & Company, 1993) and 3rd (Hoedemaeker & Cecca, 1995) Workshops of the Lower Cretaceous Working Group as well as the 2nd Symposium on Cretaceous stage boundaries (Rawson, 1996), decided to draw the Hauterivian-Barremian boundary above the *Pseudothurmannia* beds. We follow the decisions taken in the occasions of these meetings. Accordingly, the *P. angulicostata* Auctt. is divided in two subzones, the *P. ohmi* subzone at the base and the *P. catulloi* subzone at the top. In terms of ammonite biostratigraphy, the latter is the last biostratigraphic unit of the Hauterivian.

TAPHONOMIC CONSIDERATIONS

Each geologist having worked in Tethyan successions, particularly in Central Apennines, would

judge as exceptional the preservation and the abundance of such a fauna in the Maiolica formation. This deserves some short considerations.

Although the biostratigraphic resolution indicates that the "Guide-bed" is not condensed, the fossil richness could be explained by a slower rate of sedimentation. This would result in a sort of condensation undetectable by biostratigraphic means.

This hypothesis can be excluded. Although a complete taphonomic study, which is not the aim of this work, has not yet realized, the preliminary taphonomic observations suggest the opposite: the rate of sedimentation was probably high during the deposition of the "Guide-bed" because:

a - long-time unburied shells could be destroyed corroded or damaged;

b - some almost smooth shells show fine traces of echinoid grasps which should be destroyed if the shells remained unburied for long periods of time;

c - normal geopetal structures (calcite in the upper part of the internal mold) have been observed even in specimens lying vertically or oblique to the bedding plane; the micrite around these specimens shows traces of bioturbation, indicating that burrowers displaced the empty shells in the still soft sediment, prior to their sedimentary infilling.

Compared to that of the other ammonites found in other levels of the Maiolica, this exceptional preservation cannot be explained without the action of differential diagenetic factors. A relation between the circulation of interstitial waters and the occurrence of black shales below and above the "Guide-bed" must be investigated.

SYSTEMATIC DESCRIPTIONS

We generally follow the classification of the revised version of the "Treatise on Invertebrate Palaeontology", Cretaceous Ammonoidea, by Wright *et al.* (1996). Deviations from this classification will be discussed in the text.

The standard dimensions are given in millimetres and as percentages of the diameter. The following abbreviations, all explained in fig. 3, have been used:

D = maximum diameter;

d = diameter at which measurements were taken when less than D;

Uw = umbilical width;

Wh = whorl-height;

Wb = whorl-breadth; the ratio Wb/Wh expresses the degree of compression of the whorl;

Ph = diameter of the end of the phragmocone ("n" means that the specimen is entirely septate);

N/2 = number of main ribs per half-whorl;

K/2 = number of intermediate ribs per half-whorl (*Pseudothurmannia*);

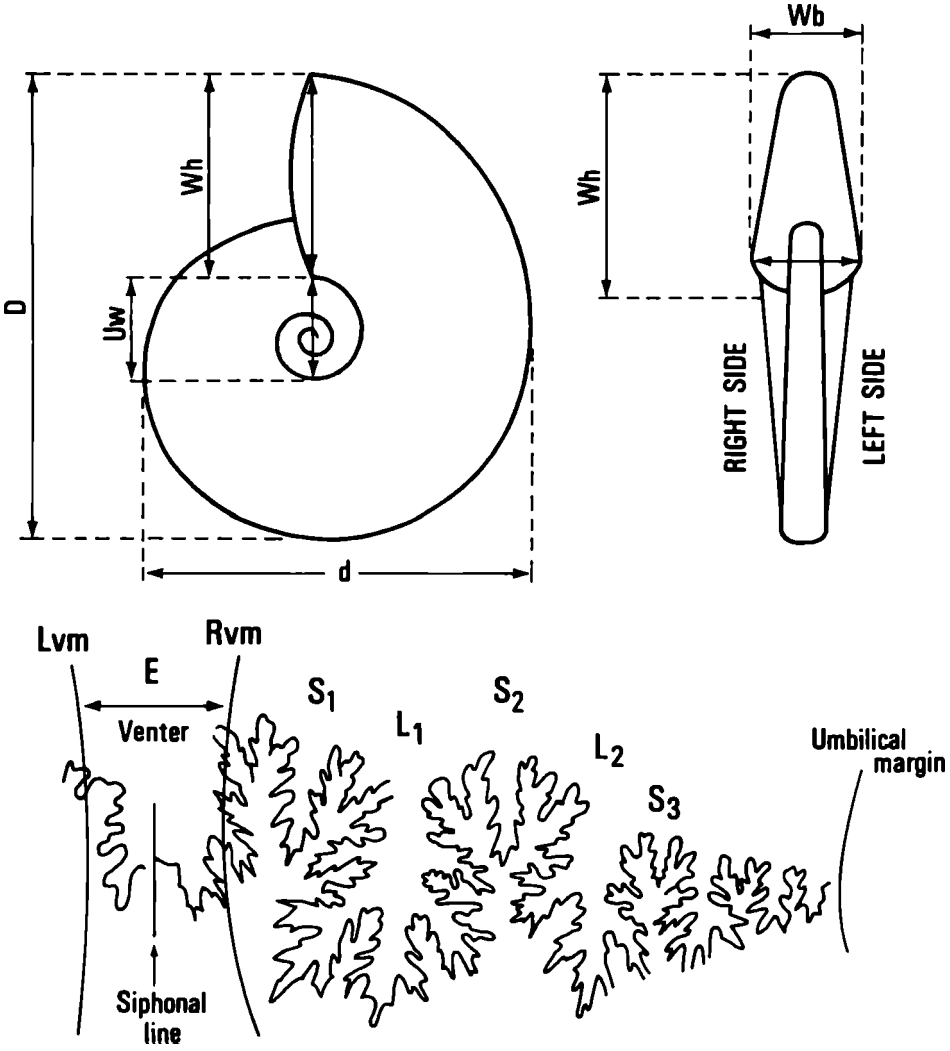

Fig. 3 - Abbreviations of the dimensional parameters used in the systematic descriptions, nomenclature of some shell characters and sutural elements. D = maximum diameter; d = lower diameter; Uw = umbilical width; Wh = whorl height; Wb = whorl breadth; Lvm = left ventrolateral margin; Rvm = right ventrolateral margin; E = external saddle and lobe; S1, S2, Sn.= first, second, etc. lateral saddles; L1, L2, Ln = first, second, etc. lateral lobes.

α = diameter of the beginning of grooves in *Plesiospitidiscus*;

β = diameter of the beginning of lateral tubercles (*Psilotissotia* and *Discoidellia*);

γ = number of tubercles (or bullae) per half-whorl (ventrolateral tubercles in *Psilotissotia apenninica* n. sp., lateral bullae in *Discoidellia vermeuleni* n. sp. and *D. pseudobertrandi* n. sp.);

Ω = diameter of the beginning of ventral collars in *Barremites primitivus* n. sp.

As far as regards the elements of the suture-line a purely descriptive nomenclature has been used in this paper. Except the external lobe and saddle, saddles and lobes have been increasingly numbered from the ventrolateral margin towards the dorsum (fig. 3). Lobes and saddles are usually oriented perpendicularly to the radial strike of the suture-line; deviations from this rule have been observed in some specimens of *Psilotissotia* (see fig. 12 a, d, e) which bear "derailed" sutures (Seilacher, 1988). In general the line of symmetry of a suture-line (middle-line of lobe E) coincides with the siphonal-line, hence with the intersection of the plane of symmetry of the shell on ventral area. However, in *Barremites primitivus* n. sp. the suture-lines of some specimens are "displaced" because the middle of the lobe E lies on the ventrolateral margin (see fig. 11 a, e) and does not coincide with the siphonal-line.

The specimens studied have been numbered progressively in three distinct series indicated by letters corresponding to localities: series A, series AP and a third series of progressive numbers where the letters change according to the locality (RS, P, etc.). The abbreviations used for the different localities are:

A, AP, P: correspond to a section exposed along the road from Cagli to the top of Monte Petrano;

PC, PE, PH, PL, PN, PW etc.: correspond to different hills of the northern slope of Monte Petrano (right side of the valley of the Bosso river);

RS: Stirpeto, on the southern slope of Monte Nerone (left side of the valley of the Bosso river);

B: Bosso valley, along the road from Cagli to Pianello;

SV: Sette Vene, along the road from Piobbico to Apecchio;

RA: Ranchi, northern slope of Monte Nerone, on the road from Piobbico to the top of the mountain;

F: Gorgo a Cerbara, near Piobbico;

RNE: north-east flank of Monte Catria;

VS: Val Sorda, near Gualdo Tadino;

PSR: Poggio San Romualdo;

The material studied is provisionally housed in authors' collections: it will be housed in the palaeontological branch of the Museum of the town of Cagli, which is currently under restructuration.

Class Cephalopoda Leach, 1817
Order Ammonoidea Zittel, 1884
Suborder Phylloceratina Arkell, 1950
Superfamily Phylloceratacea Zittel, 1884
Family Phylloceratidae Zittel, 1884
Subfamily Phylloceratinae Zittel, 1884

Genus *Phyllopachyceras* Spath, 1925
Type-species *Ammonites infundibulum* d'Orbigny, 1841

Phyllopachyceras infundibulum (d'Orbigny, 1841)
fig.4; tab. 1; pl. 1, fig. 1-7

1841 *Ammonites infundibulus* d'Orbigny, p. 131, pl. 39, fig. 4, 5.
1972 *Partschiceras infundibulum* - Vasicek, p. 27, pl. 1, fig. 2 (*cum syn.*)
1993 *Phyllopachyceras infundibulum* - Autran, pl. 13, fig. 11.
1994a *Phyllopachyceras infundibulum* - Cecca *et al.*, fig. 5b.
1995 *Phyllopachyceras infundibulum* - Cecca *et al.*, pl. 3, fig. 16.
1995 *Phyllopachyceras infundibulum* - Hoedemaeker, pl. 12, fig. 1.
1995 *Phyllopachyceras infundibulum* - Delanoy & Joly, p. 131, pl. 1, fig. 4.
1996 *Phyllopachyceras infundibulum* - Reboulet, p. 184, pl. 36, fig. 1-5.
1996 *Phyllopachyceras infundibulum* - Faraoni *et al.*, pl. 4, fig. 17.
1997 *Phyllopachyceras infundibulum* - Faraoni *et al.*, pl. 3, fig. 8.

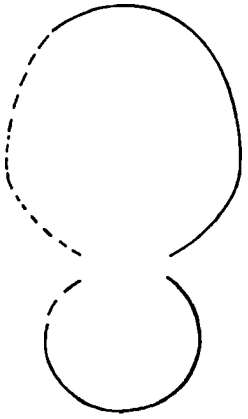

Fig. 4 - Whorl section of Phyllopachyceras infundibulum (d'Orbigny), spec. A 16, at d=53 mm, x1.

DESCRIPTION

Extremely involute shells, with whorls higher than wide, rounded flanks and maximum whorl-breadth above the umbilical edge. The ventral area is rounded in the phragmocone and flat in the body chamber of the adult specimens. In fact the whorl section changes with the growth, from ovate in the young stage to sub-trapezoidal in the mature stage. The umbilicus is deep, narrow, funnel-shaped with a smooth, steep, oblique, umbilical wall.

In the phragmocone the ornamentation is weak or even absent up to d≈20 mm. The primary ribs are prorsiradiate and weak to very weak on the umbilical wall, where they spring, then they strengthen and become rectiradiate from the umbilical edge. Fifty to sixty primary ribs per whorl have been counted in the large specimens. The primary ribs are adorally convex on the venter, where they can increase their relief. One or occasionally two intercalatory ribs between two primaries, springing at different heights of the flank. In some specimens primary and intercalatory ribs are alternately strengthened on the venter.

TABLE 1 - Measurements of Phyllopachyceras infundibulum (d'Orbigny).

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph
P41 (pl. 1, fig. 4)	57	3	0.053	34	0.596	30	0.526	0.882	30
A33	66	5	0.075	37	0.560	≈ 30	0.454	0.811	30
A16 (pl. 1, fig. 3)	55	4	0.072	33	0.600	30	0.545	0.909	25
A32	59	4	0.067	34	0.576	≈ 23	0.389	0.676	25
A50	50	4	0.080	29	0.580	≈ 31	0.620	1.069	23
A34 (pl. 1, fig. 5)	54	4	0.074	32	0.592	≈ 30	0.555	0.938	30
P744	60	5	0.830	36	0.600	32	0.533	0.889	35
A15	35	3	0.085	23	0.657	20	0.571	0.870	27
P750	46	3	0.065	30	0.652	30	0.652	1.000	30
RS4 (pl. 1, fig. 1)	38	3	0.078	23	0.605	22	0.578	0.957	28
A49	37	2.7	0.072	22	0.594	22	0.594	1.000	30
A30	31	2.7	0.087	21	0.677	20	0.654	0.952	25
A31	40	2.8	0.070	25	0.625	23	0.575	0.920	25
A52	40	3	0.075	22	0.550	20	0.500	0.909	18
P 743 (pl. 1, fig. 2)	41	3	0.073	25	0.609	20	0.487	0.800	25
P 746	30	2.8	0.093	18	0.600	17	0.566	0.944	26
P23	27	2	0.074	18	0.666	18	0.666	1.000	25
A53	33	2.4	0.072	19	0.575	21	0.636	1.105	33
A51	32	2	0.062	19	0.593	-	-	-	22
P 749	35	2.6	0.074	20	0.571	20	0.571	1.000	32
P25	38	3	0.078	24	0.631	-	-	-	28
P24	32	3	0.093	20	0.625	21	0.656	1.050	18
A73	23	2	0.086	15	0.652	14	0.608	0,933	17
A75	25	2	0.080	15	0.600	14	0.560	0.933	16
A70	21	2	0.095	13	0.619	12	0.570	0.923	18
P 751	35	3	0.085	21	0.600	20	0.570	0.952	33
A72	25	2	0.080	15	0.600	15	0.600	1.000	15
P 257	23	2	0.086	15	0.450	14	0.600	0.933	18
P 747	45	4	0.088	26	0.570	-	-		27
P 753	40	3.3	0.082	24	0.600	-	-	-	20
A29	26	2.2	0.084	15.5	0.590	15	0.570	0.968	26
A69	28	2.7	0.096	18	0.640	18	0.640	1.000	12

DISCUSSION

About 30 complete specimens and 30 fragments assigned to this species have been studied. *P. infundibulum* displays a slight intraspecific variability of both whorl section and ornamentation.

This species can be easily distinguished from *P. bulgaricum* Dimitrova because the latter bears characteristic whorls wider than high.

P. ladinum (Uhlig) bears intercalatory ribs strengthened on the venter, whereas in *P. infundibulum* the primaries are strengthened. However, one of our specimens (pl. 1, fig. 6) shows primary and intercalatory ribs alternately strengthened on venter. Therefore *P. ladinum* and *P. infundibulum* could be conspecific as already considered by Sarasin & Schöndelmayer (1901, p. 11, 12).

SPECIMENS

Monte Petrano: A 15, A 16, A 17, A 29, A 30, A 31, A 32, A 33, A 34, A 49, A 50, A 51, A 52, A 53, A 69, A 70, A 71, A 72, A 73, A 74, A 75, A 76, P 22, P 23, P 24, P 25, P 26, P 34, P 41, P 76, P 78, P 81, P 87, P 89, P 244, P 245, P 246, P 247, P 250, P 251, P 252, P 253, P 257, P 258, P 259, P 743, P 744, P745, P 746, P 747, P 748, P 749, P 750, P 751, P 752, P 753.

Stirpeto: RS 4, RS 111.

Phyllopachyceras laeviventris n. sp.
fig. 5; tab. 2; pl. 1, fig. 8-11

DERIVATIO NOMINIS: the name refers to the aspect of the ribs, which weaken and fade on venter.

TABLE 2 - Measurements of Phyllopachyceras laeviventris n. sp.

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph	N/2
PH754 holotype (pl. 1, fig. 11)	23	2	0.086	13	0.560	≈ 13	0.560	1.000	15	25
A38 paratype (pl. 1, fig. 10)	24	2	0.083	13	0.540	≈ 11	0.450	0.846	15	25

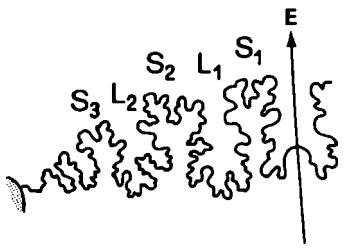

Fig. 5 - Suture-line of Phyllopachyceras laeviventris n. sp., spec. A 38, at Wh = , d=15 mm, x6.

HOLOTYPE: specimen, PH 754, figured in pl. 1, fig. 11 a, b.

PARATYPE: A 38.

TYPE-LOCALITY: northern slope of Monte Petrano, "hill H", Marche Apennines.

TYPE-LEVEL: uppermost Hauterivian, *P. angulicostata* zone , *P. catulloi* subzone.

DIAGNOSIS

Small phylloceratid with strong, radial ribs and smooth venter.

DESCRIPTION

Small, extremely involute shell with maximum diameter of 24 mm. The whorls are almost circular, with maximum whorl-breadth at mid-flank. Flanks and venter are rounded and the umbilicus is deep, funnel-shaped, with steep umbilical wall.

The ornamentation consists of strong, regularly spaced ribs, well developed on the entire last whorl. The ribs are weak and prorsiradiate close to the umbilicus, slightly prorsiradiate or slightly rursiradiate at mid flank; they do not cross the ventral area, where a smooth band occurs.

The suture-line is moderately frilled (fig. 5).

DISCUSSION

P. infundibulum shows some morphologic similarities. However *P. laeviventris* n. sp. is clearly distinguishable because of its smooth venter and its simpler suture.

SPECIMENS

Monte Petrano: A 38, P 72, PH 754, PH 755.

Subfamily Calliphylloceratinae Spath, 1927

Genus *Holcophylloceras* Spath, 1927
Type-species *Phylloceras mediterraneum* Neumayr, 1871

SYNONYM: *Salfediella* Spath, 1927

Holcophylloceras ponticuli (Rousseau, 1842)
tab. 3; pl. 1, fig. 12-15

1842 *Ammonites ponticuli* Rousseau, p. 783, pl. 1, fig. 3.
1992 *Phylloceras (Hypophylloceras) ponticuli* - Delanoy, p. 20, pl. 3, fig.2, 3
1993 *Phylloceras (Hypophylloceras) ponticuli* - Joly, p. 28, pl. 5, fig. 2; pl. 6, fig. 2; pl. 18, fig. 7; pl. 19, fig. 2; pl. 25, fig. 4 (*cum syn.*).
1995 *Phylloceras (Hypophylloceras) ponticuli* - Delanoy & Joly, p. 122, text-fig. 3; pl. 1, fig. 1; pl. 3, fig. 3; pl. 4, fig. 1, 2, 4.
1995 *Holcophylloceras ponticuli* (Rousseau) n. ssp. - Avram, pl. 10, fig. 5-7.

DESCRIPTION

Compressed shell, whose diameter is often larger than 100 mm. The whorl is elliptic, with roun-

TABLE 3 - Measurements of Holcophylloceras ponticuli (Rousseau).

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph	N/2
RS12 (pl. 1, fig. 15)	44	3.4	0.077	24	0.540	-	-	-	25	≈ 83
A48 (pl. 1, fig. 12)	81	7	0.086	46	0.560	-	-	-	-	≈ 80
RS99 (pl. 1, fig. 13)	33	3	0.090	18	0.540	12	0.360	0.660	20	≈ 60
RS138	70	5	0.710	41	0.580	-	-	-	≈ 46	≈ 80
PH 757 (pl. 1, fig. 14)	24	2.4	0.100	13	0.550	≈ 7	0.290	0.526	15	≈ 60
P 761	35	3.4	0.970	21	0.600	-	-	-	-	≈ 50
P 759	26	3	0.110	14	0.530	-	-	-	-	-
P 760	24	3	0.127	13	0.550	7	0.290	0.530	14	≈ 50
P 758	15	2.5	0.160	7.3	0.480	-	-	-	8	≈ 60
P 756	14	2.4	0.170	7	0.500	-	-	-	7	-

ded venter, flat to gently convex flanks, maximum whorl-breadth just below the mid-flank. The umbilical width decreases with the growth. Therefore up to d≈20 mm the shell is moderately involute to become extremely involute in the adult stage.

Five to six sinuous, shallow constrictions per whorl occur in the young whorls up to d≈15 mm. The constrictions are deeper on the umbilical edge, their direction is slightly prorsiradiate up to mid-flank where they become rectiradiate.

The ornamentation consists of fine, dense, sinuous, almost prorsiradiate, ribs. These spring very weak and slightly prorsiradiate from the umbilicus, then they tend to disappear just above the umbilical edge, where they can be united in bundles. The ribs thicken at mid-flank, become rectiradiate at the upper third and finally cross the venter.

DISCUSSION

The numerous specimens available clearly show the occurrence of constrictions in the young whorls, thus leading us to include this species within the genus *Holcophylloceras* instead of *Hypophylloceras* as already observed by Avram (1995).

Hypophylloceras tethys (d'Orbigny) bears straight ribs and lacks constrictions.

SPECIMENS

Monte Petrano: A 48, PH 756, PH 757, PH 758, PH 759, PH 760, PH 761.
Stirpeto: RS 12, RS 99, RS 138.

Suborder Lytoceratina Hyatt, 1889
Superfamily Lytocerataceae Neumayr, 1875
Family Lytoceratidae Neumayr, 1875
Subfamily Lytoceratinae Neumayr, 1875

Genus *Lytoceras* Suess, 1865
Type-species *Ammonites fimbriatus* Sowerby, 1817

Lytoceras subfimbriatum (d'Orbigny, 1840)
tab. 4; pl. 1, fig. 16

1840 *Ammonites subfimbriatus* d'Orbigny, p. 121, pl. 35, fig. 1-4.
1901 *Lytoceras subfimbriatum* - Sarasin & Schöndelmayer, p. 16, pl. 2, fig. 3.
1967 *Eulytoceras subfimbriatum* - Dimitrova, p. 27, pl. 10, fig. 1.
1976 *Lytoceras subfimbriatum* - Mandov, p. 53, pl. 2, fig. 3.
1993 *Lytoceras subfimbriatum* - Autran, pl. 10, fig. 6
1995 *Lytoceras subfimbriatum* - Avram, pl. 3, fig. 4.
1995 *Lytoceras subfimbriatum* - Hoedemaeker, pl. 11, fig. 1.
1996 *Lytoceras subfimbriatum* - Reboulet, p. 193, pl. 37, fig. 6, 7; pl. 38, fig. 5-7.

DESCRIPTION

The specimen studied reaches the diameter of 100 mm and corresponds to an evolute shell with subcircular whorls with rounded venter.

The umbilicus is wide and rather deep.

Starting from the internal whorls the ornamentation is made of weak, dense, radial, irregularly spaced flares. On the body chamber five shallow constrictions are visible; they are adorally bounded by ribs. Thirty-five flares between two constrictions.

DISCUSSION

Our specimen is less evolute than d'Orbigny's type. It is similar to Avram's specimen (see synonymy).

SPECIMEN

Monte Petrano: A 35.

Genus *Eulytoceras* Spath, 1927
Type-species *Ammonites inaequalicostatus* d'Orbigny, 1840

Eulytoceras anisoptychum (Uhlig, 1883)
tab. 5; pl. 1, fig. 17-18

1883 *Lytoceras anisoptychum* Uhlig, p. 66, pl. 4, fig. 7; pl. 14, fig. 9a.
1972 *Eulytoceras anisoptychum* - Vasicek, p. 39, pl. 2, fig. 7 (*cum syn.*)
1994a *Eulytoceras anisoptychum* - Cecca *et al.*, fig. 5f.
1995 *Eulytoceras anisoptychum* - Avram, pl. 11, fig. 12.
1997 *Eulytoceras anisoptychum* - Faraoni *et al.*, pl. 3, fig. 5.

DESCRIPTION

Evolute shell with subcircular whorls, wide and shallow umbilicus.

The ornamentation is made of numerous irregularly spaced sharp, fine, rectiradiate, distant ribs. Weak striae are intercalated between two ribs.

DISCUSSION

E. anisoptychum differs from *L. subfimbriatum* because of its distant and strong ribs. It differs from *E.* aff. *lepidum* because of its rounded, instead of subelliptical, whorls and also because of a generally stronger ornamentation.

TABLE 4 - Measurements of Lytoceras subfimbriatum (d'Orbigny).

Specimen	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph
A35 (pl. 1, fig. 16)	100	40	0.400	38	0.380	≈ 30	0.300	0.789	50

TABLE 5 - Measurements of Eulytoceras anisoptychum (Uhlig).

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph
P46 (pl. 1, fig. 18)	32	15	0.468	10	0.312	10	0.312	1.000	22
A13 (pl. 1, fig. 17)	35	15	0.428	12	0.342	11	0.314	0.917	20

TABLE 6 - Measurements of Eulytoceras aff. lepidum (d'Orbigny).

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph
B 762	37	15	0.405	14	0.378	12	0.324	0.857	n
P 764	32	15	0.468	12	0.375	-	-	-	22
P 766	42	19	0.452	16	0.380	-	-	-	20
P 765	42	18	0.428	16	0.380	-	-	-	22

SPECIMENS
Monte Petrano: A 13, P 46, P 47, P 767, P768, P 769, P 770.

Eulytoceras aff. *lepidum* (d'Orbigny, 1840)
tab. 6

DESCRIPTION

Evolute shell with higher than wide, subelliptical whorls and maximum whorl-breadth at mid-flank. The ventral area and the flanks are rounded, the umbilicus is wide and relatively deep.

The ornamentation consists of fine, dense, rectiradiate, irregularly spaced striae Four to five ribs per whorl are associated with shallow constrictions. About fifteen weak intercalatory striae occur between two ribs.

DISCUSSION

The holotype of *E. lepidum* (d'Orbigny, 1840, pl. 58, fig. 3, 4) bears whorls wider than high, stronger ribs and only 8 to 10 intercalatory striae between two main ribs; furthermore its whorl-flanks are strongly rounded.

SPECIMENS
Monte Petrano: P 763, P 764, P 765, P 766.
Stirpeto: RS 582.
Bosso: B 762.

Suborder Ammonitina Hyatt, 1889
Superfamily Haploceratacea Zittel, 1884
Family Haploceratidae Zittel, 1884

Genus *Haploceras* Zittel, 1870
Type-species *Ammonites elimatus* Oppel, 1865

Subgenus *Neolissoceras* Spath, 1923
Type-species *Ammonites grasianus* d'Orbigny, 1841

Haploceras (Neolissoceras) grasi subgrasi
Druschits, 1960
tab. 7; pl. 1, fig. 19-20

1960 *Haploceras subgrasianum* Druschits, p. 268, pl. 13, fig. 4, 5; text-fig. 74.
1990 *Haploceras (Neolissoceras) subgrasianum* - Duraj *et al.*, p. 61, pl. 1, fig. 6.
1995 *Haploceras (Neolissoceras) grasianum* - Avram, pl. 5, fig. 3.
1995 *Neolissoceras grasianum subgrasianum* - Hoedemaeker, p. 245, pl. 11, fig. 5.
1997 *Neolissoceras grasi* - Faraoni *et al.*, pl. 2, fig. 3; pl. 3, fig. 4.

DESCRIPTION

Moderately evolute shell with subrectangular whorls; maximum whorl-breadth at ventrolateral margin. The flanks are flat, slightly inclined towards the umbilicus. The ventrolateral margin and the venter are rounded.

The shell is smooth and only some weak, growing striae occur on the ventral area, close to the aperture.

DISCUSSION

Compared to d'Orbigny's holotype (1841, p. 141, pl. 44, fig. 1-2; Uw/D = 0.25) and geologically older specimens (see Reboulet, 1996, p. 164), our forms show a narrower umbilicus (Uw/D = 0.16-0.18). For this reason, they could be grouped in the subspecies *H. (N.) grasi subgrasi* Druschits (in Druschits & Kudriavtsev, 1960) which are characterized by Uw/D ≈ 0.14-0.15. This would be consistent with Hoedemaeker's (1995) interpretation of the specimens occurring at the very base of the *P. catulloi* subzone in Southern Spain. However, it must be stressed that Druschits' type-specimens correspond to phragmocones and therefore the validity of *subgrasi* could be questioned.

In any case, the occurrence of this narrow-umbilicated morphotype seems to be limited at the

TABLE 7 - Measurements of Haploceras (Neolissoceras) grasi subgrasi (d'Orbigny).

Specimens	D	Uw	Uw/D	Wh	Wh/D	Wb	Wb/D	Wb/Wh	Ph
RS 6 (pl. 1, fig. 19)	51	9	0.18	26	0.51	≈ 13	0.254	0.50	≈ 25
A 14 (pl. 1, fig. 20)	33	≈ 6	0.18	17	0.515	9	0.21	0.53	≈ 22
A 57	31	5	0.16	17	0.55	10	0.32	0.59	≈ 20
RNE 771	25	4.5	0.18	13	0.52	7	0.28	0.54	≈ 20
P 772	26	-	-	13	0.50	-	-	-	≈ 26
P 773	45	8	0.18	23	0.51	-	-	-	≈ 25
P 776	23	4	0.17	12	0.52	7	0.30	0.58	≈ 23