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The ammonoid genus *Gregoryceras* (Oxfordian, Late Jurassic) in the Monti Lessini, Province of Verona, Italy

By REINHART A. GYGI¹⁾

ABSTRACT

The genus *Gregoryceras*, a typical representant of the mediterranean faunal province, occurs in the Monti Lessini over all the vertical range of the genus. This means that the presence of the equivalents of the late Cordatum and the Densiplicatum Zone can be proven in Italy for the first time.

RIASSUNTO

Il genere *Gregoryceras*, tipico della provincia mediterranea, occorre nei Monti Lessini durante tutta l'età del genere. Cioè, la presenza delle zone corrispondenti alla Zona di Cordatum superiore ed a la Zona di Densiplicatum puo essere provato per la prima volta in Italia.

ZUSAMMENFASSUNG

Die Gattung *Gregoryceras*, ein typischer Vertreter der mediterranen Faunenprovinz, ist in den Monti Lessini während der ganzen Lebensdauer der Gattung vertreten. Dies bedeutet, dass in Italien die Äquivalente der späten Cordatum- und der Densiplicatum-Zone erstmals nachgewiesen werden können.

1. Introduction

This paper is based on a collection of 36 *Gregoryceras* made by A. Benetti and N. Pezzoni and another private collector. The material was found exclusively in the Monti Lessini north of Verona in the southern Alps. The ammonites are from the Rosso ammonitico Veronese. PAVIA, BENETTI & MINETTI (1987, Fig. 3) have published a general section of this unit. MASSARI et al. (1988) gave a detailed section from Piccola Mantova near Boscochiesanuova. Among the ammonites are specimens that occur in Switzerland and elsewhere in Europe in the Cordatum Subzone and in the Densiplicatum Zone. Ammonites of this age were not described from Italy so far.

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2. Taxonomy

Family **Aspidoceratidae** ZITTEL 1895
 Subfamily Peltoceratinae SPATH 1924
 Genus *Gregoryceras* SPATH 1924
 Subgenus *Pseudogregoryceras* JEANNET 1951

Type species. Gregoryceras (Pseudogregoryceras) iteni JEANNET

Designation of the type species. JEANNET 1951, p. 200.

Diagnosis. Small to medium-size *Gregoryceras* with whorls that are smooth to a diameter of at least 25 mm. The cross-section of the adult body-chamber is oval to rounded. The ribbing is weak to moderately strong.

Occurrence. Early Oxfordian, Cordatum Zone, Cordatum Subzone, in Switzerland, France, and Italy.

Gregoryceras (Pseudogregoryceras) iteni JEANNET

Fig. 1

Synonyms. (not given in GYGI 1977):

v 1977 *Pseudogregoryceras iteni* BOURSEAU, Pl. 10, Fig. 10.

Holotype. Zü ETHZ 595, figured by JEANNET 1951, Pl. 30, Fig. 6. Designated by JEANNET (1951, p. 200).

Type locality. Iron mine of Herznach, canton Aargau, Switzerland, old part of the mine below the hill of Hübstel.

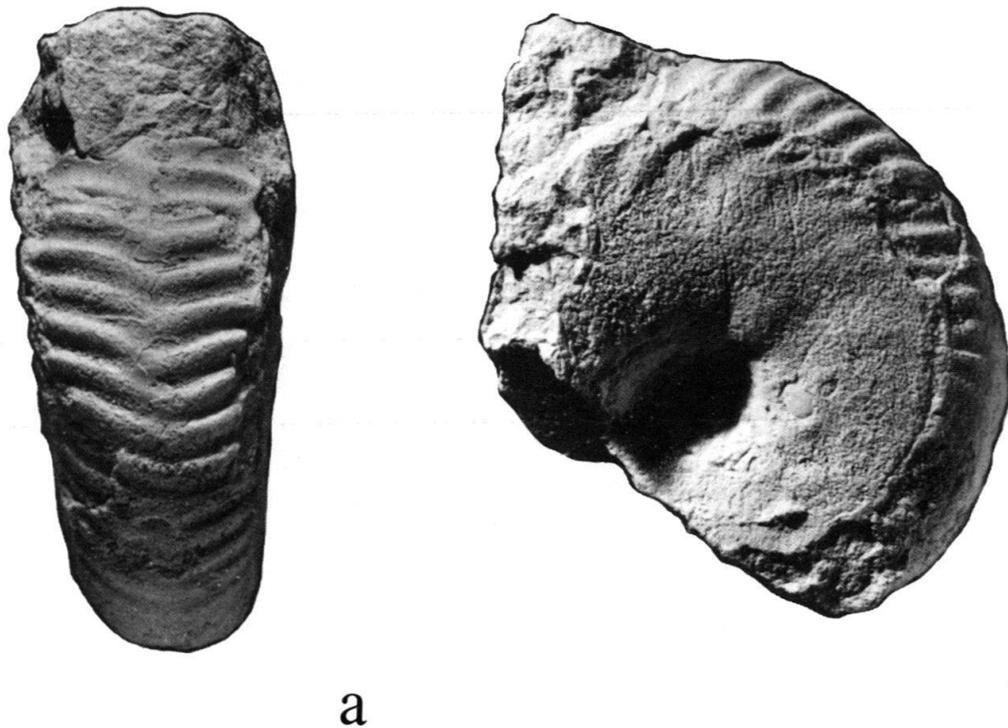


Fig. 1. *Gregoryceras (Pseudogregoryceras) iteni* JEANNET Q 1 CC, Rosso ammonitico superiore, Covolo di Camposilvano, Velo Veronese, Province of Verona, × 1. Coll A. Benetti & N. Pezzoni.

Horizon of the type. After JEANNET (1951, p. 201) bed F 1, marl directly below the Schellenbrücke Bed, Cordatum Subzone.

Material. 1 specimen, Q 1 CC, Rosso ammonitico superiore, Covolo di Camposilvano, Velo Veronese, Province of Verona.

Diagnosis. Medium-size species of the subgenus *Pseudogregoryceras* with a rounded siphonal side. A marked marginal edge appears at a diameter of about 25 mm and disappears at a diameter of about 45 mm.

Description. The specimen Q 1 CC is a fragmentary nucleus and a detached quarter whorl of the body-chamber. The nucleus has a diameter of about 33 mm and is wholly septate. The whorl sides of the nucleus are slightly convex and the siphonal side is rounded. A sharp siphonal edge develops just before the end of the last whorl of the nucleus at a diameter of about 30 mm. The siphonal edge is at three quarters the whorl height. Umbilical ribs appear at a diameter of 30 mm. They begin on the middle of the whorl side and bend back strongly. They split up into two secondary ribs on the siphonal edge. The secondary ribs bend back to the siphonal line where they meet in a distinct, wide-open angle (Fig. 1a).

Discussion. The sharp siphonal edge is a feature that appears only in *Gregoryceras iteni*. The distinct angle of the secondary ribs on the siphonal line is also restricted to this taxon. Such an angle develops also in *Gregoryceras tenuisculptum*, but there it is less distinct. The specimen Q 1 CC can be attributed unambiguously to *Gregoryceras iteni*.

Age. *Gregoryceras (Pseudogregoryceras) iteni* JEANNET occurs in Switzerland in the Cordatum Subzone of the Cordatum Zone.

Subgenus *Gregoryceras* SPATH 1924

Type species. *Ammonites transversarius* QUENSTEDT 1847.

Designation of the type species. – JEANNET 1951, p. 200.

Diagnosis. Middle-to large-size *Gregoryceras* with umbilical ribs that appear at the latest at a diameter of 25 mm. The umbilical ribs originate on the umbilical edge. They swing first forward, then turn on the middle of the whorl side and from there on bend back. The turning point of the umbilical ribs shifts in the course of ontogeny towards the umbilical edge. From there on the umbilical ribs bend back either in the form of an S, in a simple arch, or as a straight line or they are near-radial. Umbilical ribs splitting into secondary ribs are always dichotomous. The cross-section of the body-chamber is rounded to trapezoidal. The ribbing is strong.

Occurrence. Middle Oxfordian, Densiplicatum Zone to Bifurcatus Zone in central and southern Europe, North Africa, Madagascar, and South America (Chile).

Gregoryceras (Gregoryceras) tenuisculptum GYGI

Fig. 2

Synonyms. (not given in GYGI 1977):

v 1983 *Gregoryceras (Gregoryceras) tenuisculptum* TARKOWSKI, Pl. 22, Fig. 3a–b.

Holotype. Ba J 23064, figured by GYGI 1977, Pl. 1, Fig. 5a–b. Designated by GYGI 1977, p. 471.

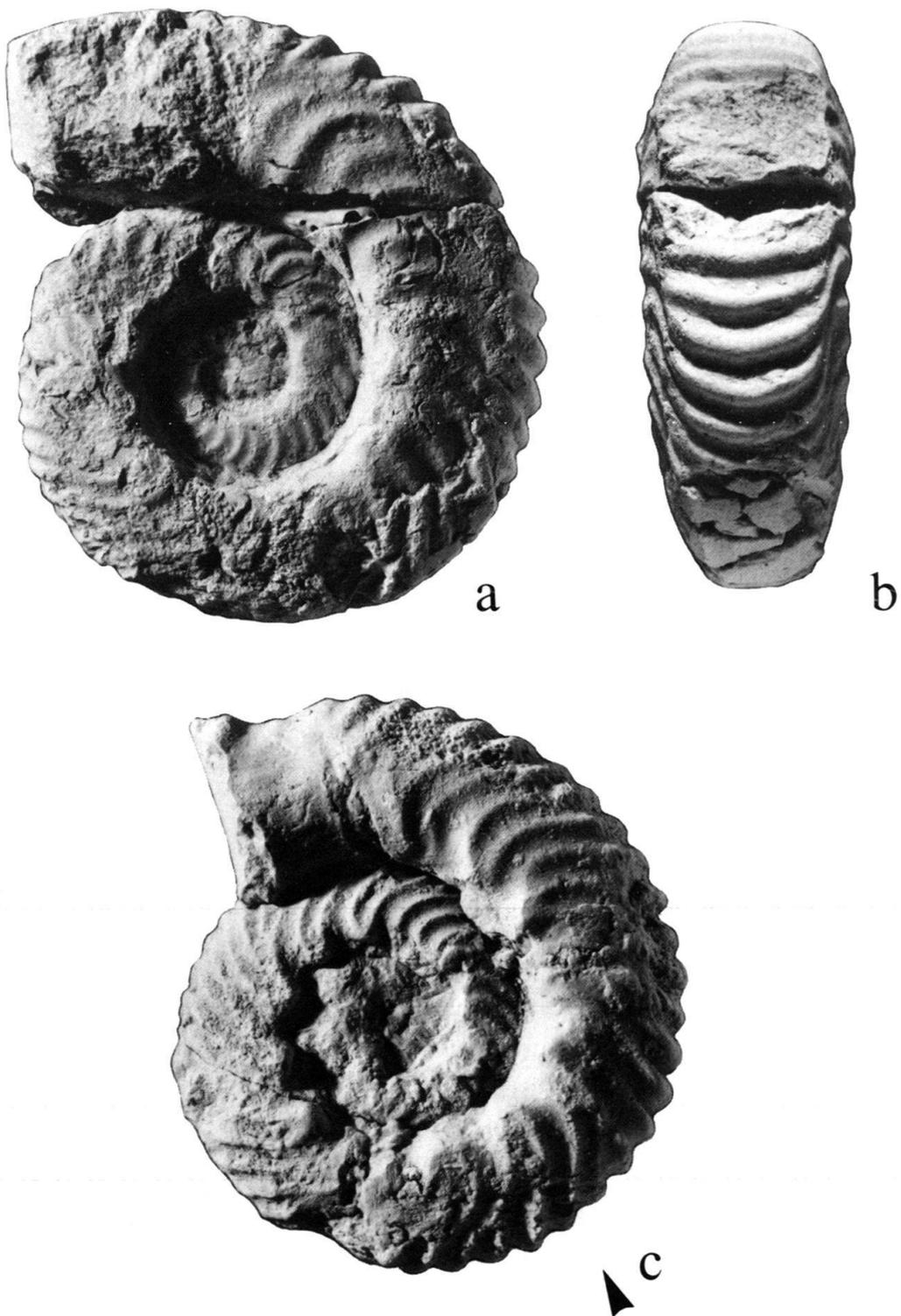


Fig. 2 a–b. *Gregoryceras (Gregoryceras) tenuisculptum* Gysi 911 R, Rosso ammonitico superiore, Roverè, locality Snel, Province of Verona, $\times 1$. Coll. A. Benetti. 2c: *Gregoryceras (Gregoryceras) tenuisculptum* Gysi 1016 OX CC, Rosso ammonitico superiore, Covolo di Camposilvano, Velo Veronese, Province of Verona, $\times 1$. Coll. A. Benetti & N. Pezzoni. An arrow indicates the end of the phragmocone.

Type locality. Excavation RG 212 at Siblingen near the shooting range in Churz Tal, canton Schaffhausen, Switzerland.

Horizon of the type. Bed no. 7 of the excavation RG 212, see GYGI 1977, Pl. 11, section 7, Densiplicatum Zone.

Material. 4 specimens: 911 R, Roverè Veronese, locality Snel; 1016 Ox CC, 1 RB CC, 803 CC, all Covolo di Camposilvano, Velo Veronese.

Diagnosis. Middle-size species of the subgenus *Gregoryceras* with umbilical ribs that appear at a diameter of between 20 and 25 mm. The cross-section of the inner whorls is subrectangular, then becomes trapezoidal in the outer whorls.

Description. The specimen 911 R is septate to a diameter of at least 50 mm. The sides of the inner whorls are almost flat and subparallel. On the last whorl the sides are convergent and the siphonal side is rounded. The umbilical ribs appear at a diameter of 20 mm. They bend very strongly back (Fig. 2a). Most of the umbilical ribs split into two secondaries that form an indistinct angle on the siphonal line (Fig. 2b). The specimen 1016 Ox CC has a broad constriction at the end of the last whorl (Fig. 2c) and seems to be a complete adult.

Discussion. The subparallel sides of the inner whorls, the strong backward bending of the umbilical ribs, and the indistinct angle of the secondary ribs on the siphonal line are characteristic of *Gregoryceras tenuisculptum*.

Age. *Gregoryceras (Gregoryceras) tenuisculptum* GYGI occurs in Switzerland and in Poland in the Densiplicatum Zone s. str.

Gregoryceras (Gregoryceras) riasi (DE GROSSOUVRE)

Fig. 3

Synonyms. (not given in GYGI 1977):

non 1976 *Gregoryceras riasi* SAPUNOV, Pl. 5, Fig. 1a-b.

v 1977 *Gregoryceras* aff. *romani* BOURSEAU, Pl. 10, Fig. 8.

? 1982 *Gregoryceras riasi* DEBRAND-PASSARD, Pl. 12, Fig. 3.

Lectotype. Ly FSL 12847, figured by DE GROSSOUVRE 1917, Pl. 9, Fig. 10–12, designated by GYGI 1977, p. 474.

Type locality. Trept, Dépt. Isère, France.

Horizon of the type. Argovien, from a bed below the Couches de Birmensdorf with siliceous sponges.

Material. 6 specimens: 583 R, Roverè, locality Snel; 229 P, 274 P, 304 P, 456 P, all Piccola Mantova, Boscochiesanuova; Ox CC, Covolo di Camposilvano, Velo Veronese.

Diagnosis. Large-size species of the subgenus *Gregoryceras* with trapezoidal whorl-section. On middle growth stages the inner half of the whorl sides is convex and the outer half is concave. On the last whorl the sides are concave over all the whorl height as measured above the ribs.

Description. The sides of the inner whorls of the specimen Ox CC (not figured) are almost parallel and flat, and the siphonal side forms a high arch. The whorl sides begin to converge from a diameter of 30 mm. The first umbilical ribs of this specimen appear at a diameter of 23 mm. The umbilical ribs originate on the umbilical edge

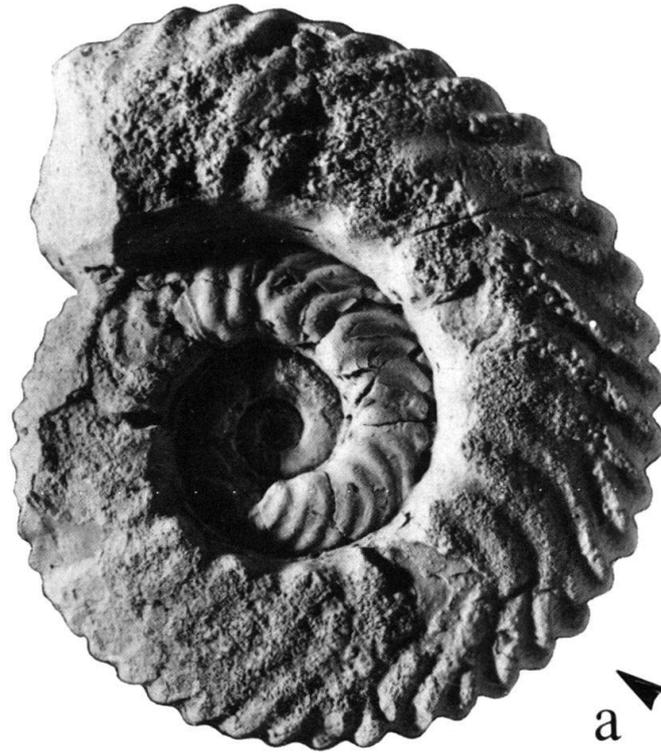


Fig. 3a. *Gregoryceras (Gregoryceras) riazi* (DE GROSSOURE) 229 P, Rosso ammonitico superiore, Piccola Mantova, Boscohiesanuova, Province of Verona, $\times 1$. Coll. A. Benetti & N. Pezzoni. 3b: *Gregoryceras (Gregoryceras) riazi* (DE GROSSOURE) 583 R, Rosso ammonitico superiore, Roverè Veronese, locality Snel, Province of Verona, $\times 1$. Coll. A. Benetti & N. Pezzoni. An arrow indicates the end of the phragmocone.

where two of these ribs at a time may be linked in a U-shaped node. Some of the umbilical ribs swing backward in the form of an S in specimen 229 P (Fig. 3a). Part of the umbilical ribs splits into two secondaries that pass in an arch over the siphonal side. The umbilical ribs are attenuated on the middle of the whorl sides. The specimen 583 R is septate to a diameter of 67 mm. The last septa are approximated. This seems to be a near-complete adult (Fig. 3b). The ribs on the siphonal side of specimen 229 P are attenuated and somewhat approximated from the diameter of 86 mm. There is a broad, shallow constriction at the end of the last whorl, on the opposite side of the one visible on Figure 3a. The specimen is septate to the diameter of 73 mm. The body-chamber of this complete adult is somewhat less than one-half whorl long.

Discussion. The subparallel whorl sides of specimen Ox CC resemble *Gregoryceras tenuisculptum*, but it may be seen from the highly arching siphonal side that the specimen belongs to *Gregoryceras riazii*. The attenuation of the umbilical ribs in the middle of the whorl sides of specimen 583 R (Fig. 3b) and the S-form shape of some of the umbilical ribs on the body-chamber are characteristic of *Gregoryceras riazii*.

Age. *Gregoryceras (Gregoryceras) riazii* (DE GROSSOUVRE) occurs in central Europe in the Antecedens Subzone and in the Parandieri Subzone of the Transversarium Zone.

Gregoryceras (Gregoryceras) romani (DE GROSSOUVRE)

Synonyms. See GYGI (1977).

Lectotype. Ly FSL 12849, figured by DE RIAZ 1898, Pl. 19, Fig. 1–2, and again by DE GROSSOUVRE, 1917, Pl. 10, Fig. 18–19. Designated by ARKELL 1946, p. 133.

Type locality. Optevoz, Dépt. Isère, France.

Horizon of the type. Glauconitic bed below the Couches de Birmensdorf proper, after ENAY 1966, p. 267.

Material. 1 specimen: 1366 P, Piccola Mantova, Boscochiesanuova.

Diagnosis. Middle-to large-size species of the subgenus *Gregoryceras* with whorl sides that are convex at all stages of growth.

Description. The ill-preserved specimen is septate to the diameter of about 60 mm. Somewhat less than one-half whorl of body-chamber is preserved. The last whorl has a well rounded cross-section on the phragmocone as well as on the body-chamber. This is characteristic of *Gregoryceras (Gregoryceras) romani* (DE GROSSOUVRE).

Age. *Gregoryceras (Gregoryceras) romani* (DE GROSSOUVRE) occurs in Switzerland in the Antecedens Subzone and in the Parandieri Subzone of the Transversarium Zone.

Gregoryceras (Gregoryceras) cf. toucasianum (D'ORBIGNY)

Fig. 4

Material. 2 specimens: 351 P, Piccola Mantova, Boscochiesanuova; Ox 28 c. S., Boscochiesanuova, collection U. Sauro.

Description. The inner whorls of specimen 351 P have slightly convex sides. An umbilical edge develops from the diameter of 25 mm. The whorl sides are flat from there to the diameter of about 70 mm. From the diameter of 70 mm to 90 mm the whorl sides are concave, then become convex again. The umbilical ribs of middle



Fig. 4. *Gregoryceras (Gregoryceras) cf. toucasianum* (D'ORBIGNY) 351 P, Rosso ammonitico superiore, Piccola Mantova, Boscochiesanuova, Province of Verona, $\times 1$. Coll. A. Benetti & N. Pezzoni. An arrow indicates the end of the phragmocone.

growth stages bend back directly from the umbilical edge. On the last whorl the umbilical ribs are first radial and bend back only from the middle of the whorl sides. On the last whorl the umbilical ribs issue from nodes on the umbilical edge. Two ribs issue from one node where they form an acute angle. The siphonal side is rounded on the body-chamber, but on the phragmocone it is relatively flat. The specimen is septate to the diameter of 80 mm. There is one-half whorl of body-chamber.

Discussion. The specimen 351 P differs from *Gregoryceras toucasianum* D'ORBIGNY in that the umbilical ribs of the last whorl are first radial and bend back only from the middle of the whorl sides.

Gregoryceras (Gregoryceras) transversarium (QUENSTEDT)

Fig. 5

Synonyms. (not given in GYGI 1977):

1985 *Gregoryceras transversarium* SARTI, Pl. 2, Fig. 1a–b.

Holotype. Tü Qu. 91/26, figured by QUENSTEDT 1847, Pl. 15, Fig. 12 a–b. Designated by ARKELL 1957, p. 336.

Type locality. Birmenstorf, canton Aargau (see map in Fig. 2 in GYGI 1977).

Horizon of the type. Lowermost White Jura α or Birmenstorf Member, respectively.

Material. 5 specimens: Ox 29 c. S., Ox 30 c. S., Boscochiesanuova, collection U. Sauro; 1661 P 11, 401 P, Piccola Mantova, Boscochiesanuova; SA 1, Valpolicella.

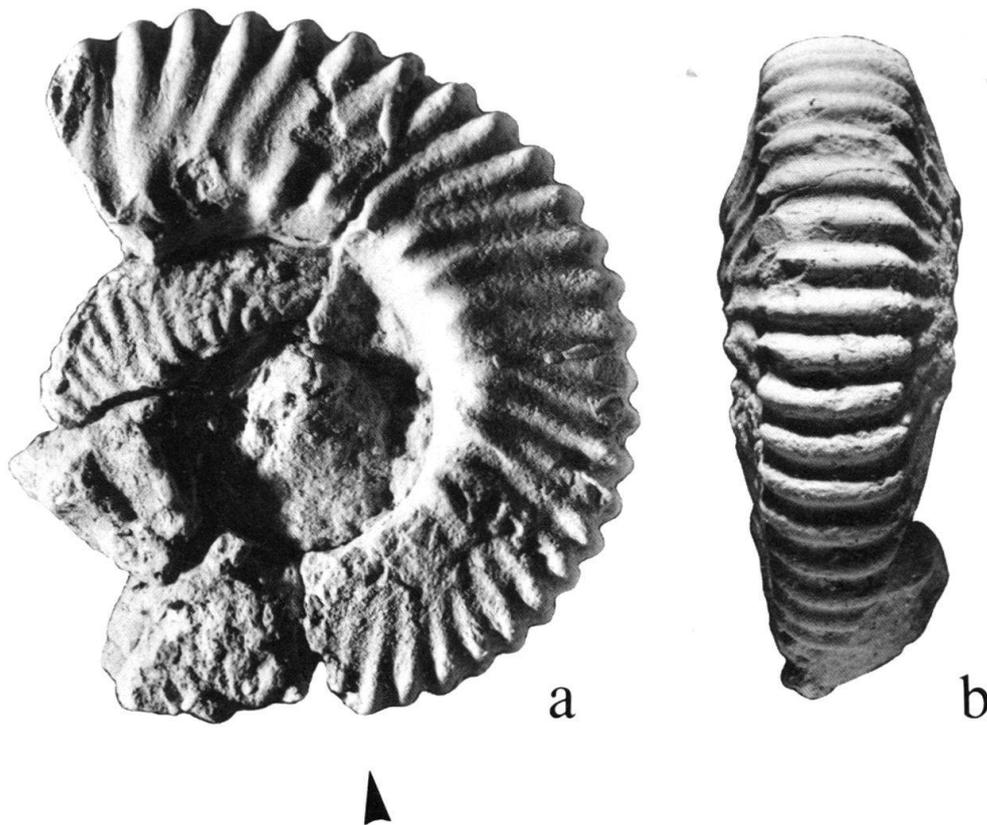


Fig. 5 a–b. *Gregoryceras (Gregoryceras) transversarium* (QUENSTEDT) Ox 29 c. S., Rosso ammonitico superiore, Boscochiesanuova, Province of Verona, $\times 1$. Coll. U. SAURO. An arrow indicates the end of the phragmocone.

Diagnosis. Medium- to large-size species of the subgenus *Gregoryceras* with trapezoidal whorl section. The whorl sides are concave from a diameter of 35 mm as measured over and between the ribs. The majority of the umbilical ribs is straight from a diameter of 55 mm at the latest.

Description. The figured specimen Ox 29 c. S. is septate to the diameter of 63 mm. Somewhat more than one-half of the last whorl is occupied by the body-chamber. The umbilical ribs issue from radially elongate umbilical nodes. One or two umbilical ribs originate from one node. The ribs are attenuated on the middle of the whorl sides. They are strongest where they cross the siphonal side. The umbilical ribs do not split into secondary ribs in the figured specimen. Secondary ribs are only visible in specimen Ox 30 c. S. The siphonal side of the figured specimen is relatively flat. The ribs cross the siphonal side in a straight line. The ribbing of specimen SA 1 is abnormal on the body-chamber because of an injury. The last three ribs are approximated. This specimen is septate to the diameter of 78 mm and the maximum diameter is 112 mm. SA 1 is probably a complete adult.

Discussion. The straight ribs leaning backward directly from the umbilical nodes are typical of *Gregoryceras (Gregoryceras) transversarium*. The concavity of the whorl sides is less pronounced than in material from central Europe. Mainly the concavity as measured between the ribs is slight to nil on the body-chamber.

Age. *Gregoryceras* (*Gregoryceras*) *transversarium* occurs in central Europe in the Antecedens Subzone and in the Parandieri Subzone of the Transversarium Zone. Representatives from the two subzones cannot be discerned morphologically.

Gregoryceras (*Gregoryceras*) *fouquei* (KILIAN)

Fig. 6–7

Synonyms. (not given in GYGI 1977):

1973 *Gregoryceras fouquei* SAPUNOV, Pl. 6, Fig. 1 a–c.

1975 *Gregoryceras fouquei* SEQUEIROS, Pl. 1, Fig. 3; Pl. 2, Fig. 4–10.

1976 *Gregoryceras riasi* SAPUNOV, Pl. 5, Fig. 1 a–c

1979 *Gregoryceras riasi* SAPUNOV, Pl. 48, Fig. 3; Pl. 49, Fig. 1 a–b.

1984 *Gregoryceras fouquei* ATROPS & BENEST, Pl. 1, Fig. 3.

Lectotype. Pa EM without number, figured by KILIAN 1889, Pl. 26, Fig. 2 a–b. Designated by SAPUNOV 1973, p. 114.

Type locality. Cabra 50 km southeast of Cordoba, Andalusia, Spain.

Horizon of the type. Malm.

Material. 7 specimens: 52 P, 121 P, 189 P, 373 P, 645 P, all Piccola Mantova, Boscochiesanuova; Ox 33 c. S., Ox 44 c. S., Boscochiesanuova, collection U. Sauro.



Fig. 6. *Gregoryceras* (*Gregoryceras*) *fouquei* (KILIAN) 645 P, Rosso ammonitico superiore, Piccola Mantova, Boscochiesanuova, Province of Verona, $\times 1$. Coll. A. Benetti & N. Pezzoni.



Fig. 7 *Gregoryceras (Gregoryceras) fouquei* (KILIAN) Ox 33 c. S., Rosso ammonitico superiore, Boscochiesanuova, Province of Verona, $\times 1$. Coll. U. Sauro.

Diagnosis. Large-size species of the subgenus *Gregoryceras* with a great morphological variability. The umbilical ribs do not split into secondary ribs. The backward inclination of the ribs is slight from small diameters.

Description. The figured specimen 645 P is very evolute. The ribs of the next to the last whorl originate on umbilical nodes. There are one to three ribs per node. The umbilical nodes vanish on the last whorl. Low marginal nodes appear at irregular intervals on the last half whorl. Most ribs cross the siphonal side in a straight line.

The figured specimen Ox 33 c. S. is septate to a diameter estimated at 80 mm. One to two ribs originate from one umbilical node. There are two intercalated ribs on the preserved part of the whorl. Ox 44 c. S. is wholly septate at the diameter of 63 mm. The state of preservation of the other specimens is insufficient for a description.

Discussion. Specimen 645 P has an umbilicus of 48% of the diameter. It is even more evolute than the holotype. It differs from the holotype by the presence of umbilical and marginal nodes.

Age. The vertical range of *Gregoryceras (Gregoryceras) fouquei* is from the upper Transversarium Chron (ATROPS & BENEST 1984, p. 210) to the Bifurcatus Chron (SEQUEIROS 1974).

Gregoryceras (Gregoryceras) n. sp.

Fig. 8

1975 *Gregoryceras fouquei* SEQUEIROS, Pl. 1, Fig. 1–2.*Locality.* Quebrada Sandon, Cordillera Domeyko, Chile.*Horizon.* Middle Oxfordian.*Material.* 3 specimens: Ox 2c S-P, Piccola Mantova, Boscochiesanuova, collection U. Sauro; Ox 47 c. S., Boscochiesanuova, collection U. Sauro; 854 P, Piccola Mantova, Boscochiesanuova.*Description.* Medium-to large-size representatives of the subgenus *Gregoryceras* with primary ribs that form nodes at the marginal edges. The ribs crossing the siphonal side between the marginal nodes form a trapezoid. The specimen Ox 47 c. S. is septate to the diameter of 66 mm. It is relatively involute. The umbilical ribs issue from low umbilical nodes. They do not split into secondary ribs. The backward inclination of the ribs is slight. The ribs form inconspicuous marginal nodes. The ribs crossing the siphonal side form a trapezoid.*Discussion.* The trapezoid formed by the ribs on the siphonal side is low, but nevertheless it is well visible (Fig. 8b). It is this trapezoid that makes the species distinct from the otherwise similar *Gregoryceras fouquei*.

The new species will be described and named by GYGI & VON HILLEBRANDT (in prep.).

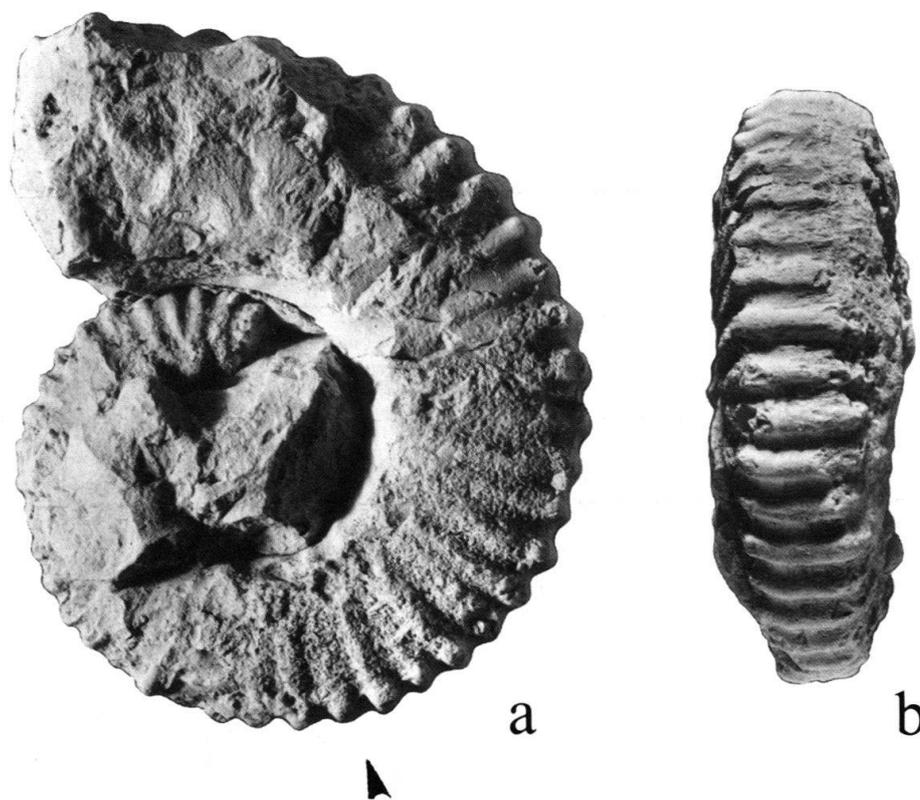


Fig. 8 a–b. *Gregoryceras (Gregoryceras) nov. sp.* Ox 47 c. S., Rosso ammonitico superiore, Boscochiesanuova, Province of Verona, $\times 1$. Coll. U. Sauro. An arrow indicates the end of the phragmocone.

Age. There is no direct evidence of the age of *Gregoryceras* n. sp. The resemblance with younger representants of *Gregoryceras fouquei* makes it probable that the age of *Gregoryceras* n. sp. is the Bifurcatus Chron.

3. Conclusions

1. *Gregoryceras* had a very wide, possibly world-wide geographical range in low paleolatitudes. The genus is relatively abundant in the mediterranean faunal province.

2. *Gregoryceras* occur in the Monti Lessini over the total vertical range of the genus.

3. *Gregoryceras (Pseudogregoryceras) iteni* proves for the first time the presence of a time equivalent of the Cordatum Subzone in northern Italy. *Gregoryceras (Gregoryceras) tenuisculptum* is proof that a time equivalent of the Densiplicatum Zone s. str. or the Vertebrale Subzone is present in the Monti Lessini of the southern Alps.

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