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Alternacanthoceras subgen. nov. (Ammonoidea) and some remarks on other Cenomanian representatives of the genus *Acanthoceras* Neumayr, 1875

ABSTRACT: A new subgenus *Alternacanthoceras* subgen. nov. is recognized within the ammonoid genus *Acanthoceras* Neumayr, 1875, to include large acanthoceratids with long and short ribs alternating at all the ontogenetic stages. A comparative analysis is given of the nominative subgenus *Acanthoceras* and the subgenus *Guerangericeras* Thomel, 1972. The species *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath, 1926) recognized for the type species of *Alternacanthoceras* subgen. nov. is here described from the Middle Cenomanian of the Subherzynian basin.

INTRODUCTION

The present paper gives some results of the investigations on the Cenomanian ammonoids derived from various geological sections from the German Democratic Republic (Subherzynian basin, Saxony), southern Poland, and the Soviet Union (Podolia, Crimea, Caucasus, and Mangyshlak).

The species *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath) occurs in the Cenomanian section at Hoppenstedt, Subherzynian basin, in the "beds with *Acanthoceras*" of Tröger (1969, pp. 35 and 38); it is associated with the following species documenting Middle Cenomanian age: *Calycoceras (Newboldiceras) spinosum nodosum* (Thomel), *Acanthoceras (Acanthoceras) rhotomagense rhotomagense* (Brongniart), *A. (A.) rhotomagense sussexiense* (Mantell) and *A. (A.) rhotomagense subflexuosum* Spath.

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SYSTEMATIC DESCRIPTION

Superfamily **Acanthoceratacеae** Hyatt, 1900
Family **Acanthoceratidae** Hyatt, 1900
Subfamily **Acanthoceratinae** Hyatt, 1900
Genus *ACANTHOCERAS* Neumayr, 1875
(Type species: *Ammonites rhotomagensis* Brongniart *in* Cuvier & Brongniart, 1822)

General remarks. — The genus *Acanthoceras* Neumayr, 1875, comprises a few groups of ammonites which Kennedy (1971, p. 85) suggested to represent distinct subgenera. The present author's collection includes some Middle Cenomanian specimens attributed to the subgenera *Acanthoceras* Neumayr, 1875, *Guerangericeras* Thomel, 1972, and *Alternacanthoceras* subgen. nov. The aim of the present paper is mainly to describe the latter subgenus and its type species. However, some remarks are also given on the other subgenera in order to permit a more comprehensive analysis of the investigated taxa.

The subgenus *Pseudacanthoceras* Thomel, 1972, has also been distinguished within the genus *Acanthoceras;* and the species *Acanthoceras tapara* Wright, 1963, has been recognized for its type species. The latter species shows a dense ribbing (more and more prominent with the increase of a shell), lower and upper ventro-lateral tubercles persisting up to the late ontogenetic stages, and more or less rounded section of the outer whorls. However, this very characteristics demonstrate that *A. tapara* Wright is actually transitional between *Acanthoceras* and the *"newboldi"* group of *Calycoceras* (cf. Wright 1963, p. 605) and hence, is to be assigned to the subgenus *Newboldiceras* Thomel, 1972[1]. One may then claim that *Pseudacanthoceras* Thomel, 1972 (diagnosed by Thomel 1972 on p. 153), is actually a junior synonym of *Newboldiceras* Thomel, 1972 (diagnosed by Thomel 1972 on p. 105). By the way, some specimens attributed by Thomel (1972) to *Pseudacanthoceras* represent the *"rhotomagense"* group (*cf.* Juignet & Kennedy 1976, pp. 116—117) and hence, are to be assigned to the nominative subgenus *Acanthoceras* (see below).

Subgenus *ACANTHOCERAS* Neumayr, 1875

Remarks. — This subgenus comprises most species assigned to the *"rhotomagense"* group or *Acanthoceras* sensu stricto. However, the species *Acanthoceras tapara* Wright, the systematic position of which is discussed above, it to be excluded of the *"rhotomagnese"* group *sensu* Kennedy & Hancock (1970, p. 487)

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[1] When having erected the genus *Newboldiceras*, Thomel (1972, p. 105) assigned to it those forms related both to *Acanthoceras* Neumayr, 1875, and to the *"newboldi"* group of *Calycoceras* Hyatt, 1900. Matsumoto (1975, p. 102) and Cooper (1978, p. 85), are however, of the opinion that morphological differences making this taxonomical distinction are of lower than generic significance; if there is indeed a need of such a distinction, then *Newboldiceras* Thomel, 1972, is to be regarded as a subgenus of *Calycoceras* Hyatt, 1900. The same is also the opinion of the present author.

and Juignet & Kennedy (1976, p. 114); the same is also the case with *A. rhotomagense confusum* (Guéranger) which is the type species of the subgenus *Guerangericeras* Thomel, 1972. As it is discussed below on *Alternacanthoceras* subgen. nov., at least the species *Acanthoceras procostatum* Thomel, *A. withei* Matsumoto, and *A. hippocastanum* (J. de C. Sowerby) are to be excluded of the subgenus *Acanthoceras* Neumayr *sensu* Thomel (1972, pp. 123 and 170—171).

The subgenus *Acanthoceras* Neumayr displays a world-wide distribution in the Middle Cenomanian of Europe, Asia (Kopet-Dag in Turkmenia), South Africa and Madagascar, Australia, Peru, and Texas; it appears characteristic of the lower Middle Cenomanian in Europe (*vide* Kennedy & Hancock 1970, pp. 487—488). In the present author's collection, the subgenus is represented by several specimens from the Subherzynian basin and from the Caucasus.

Subgenus *GUERANGERICERAS* Thomel, 1972

Remarks. — Thomel (1972, p. 119) recognized *Ammonites confusum* Guéranger, 1867, for the type species of the newly erected subgenus. The subgenus *Guerangericeras* Thomel comprises acanthoceratids showing a wide umbilicus, fairly narrow whorls, and massive singular ribs at the last whorl; at the ventral side, the ribs are very high and a few last ones do commonly not display tubercles (*cf.* Pervinquière 1907, Pl. 13, Fig. 4; Moreman 1942, Pl. 32, Fig. 1; Kennedy & Hancock 1970, Pl. 94, Fig. 1; Thomel 1972, Pls 49—50). The inner whorls show usually less dense ribbing but more conspicuous tubercles than in the subgenus *Acanthoceras* Neumayr. All these features are convincingly demonstrated by the specimens described and illustrated by Thomel (1972, pp. 119—121, Pls 49—51 and Pl. 52, Figs 10—11). However, Thomel (1972) claimed the morphological uniqueness of *Guerangericeras* to justify its recognition for a distinct genus, whereas the present author is of the opinion that the distinction is at the subgeneric level.

Due to the courtesy of Dr. A. A. Atabekyan, the present author was able to study perfectly preserved, large-sized, complete and almost complete specimens assigned to the subgenus *Guerangericeras* Thomel, collected in the Cenomanian strata in Kopet-Dag, Turkmenia. They display the above presented morphological characteristics and appear easily recognizeable among other acanthoceratids of similar shell size.

The form *Acanthoceras rhotomagense confusum* (Guéranger) described by Kennedy & Hancock (1970, Pl. 95, Fig. 1) and Juignet & Kennedy (1976, Pl. 30, Fig. 1) shows fairly large whorl-width (Wb:Wh close to 1.3) and low ribs at the ventral side at a rather large shell diameter (D=124 mm). It may not belong to the subspecies "*confusum*" but instead, it may represent a form transitional between *Guerangericeras* Thomel and *Acanthoceras* Neumayr; one might even suppose that it is to be assigned to the latter subgenus.

The subgenus *Guerangericeras* Thomel displays a world-wide distribution in the Middle Cenomanian of England, France, India, Texas, Mozambique (*cf.* Thomel 1972, Förster 1975), and Kopet-Dag in Turkmenia. In the present author's collection, the subgenus is represented by a single specimen from the Middle Cenomanian of Crimea.

Subgenus *ALTERNACANTHOCERAS* subgen. nov.
(Type species: *Protacanthoceras jukesbrownei* Spath, 1926)

Derivatio nominis: **Lat. *alterno* — to alternate; after the regular alternation of long and short ribs.**

Diagnosis: **Large *Acanthoceras* with alternation of long and short ribs persisting up to the late developmental stages. The phragmocone is moderately evolute, with variable whorl**

section ranging from a depressed to more or less compressed one. The intercostal cross-section shows flat sides. The ribs are slightly prorsiradiate at the inner whorls, whereas they become rectiradiate at the outer whorl. There are 1—2 short ribs intercalated between every two long ribs at the inner whorls. The long ribs bear distinct umbilical tubercles, conspicuous lower and upper ventro-lateral tubercles, and rather indistinct siphonal ones. The latter tubercles disappear at the early developmental stages. The short ribs display only the lower and upper ventro-lateral tubercles and the siphonal ones; most commonly, the tubercles resemble closely those of the primary ribs but sometimes the lower ventro-lateral tubercles appear smaller-sized and sporadically disappear at all.

The ribs become more and more prominent and thick at the last whorl. The long and short rib alternation appears much more regular here (*cf.* Pl. 1, Fig. 1*a*). The lower ventro-lateral tubercles disappear from the long ribs; there are only the prominent umbilical tubercles and very strong (sometimes hypernodose) upper ventro-lateral ones. At the body chamber, the short ribs bear exclusively the upper ventro-lateral tubercles approximating in size those at the primaries. The venter of the body chamber is wide and almost flat; all the ribs are here more or less equal in size, lower than at the whorl sides (*cf.* Pl. 1, Fig. 1*b-c*).

Remarks. — The subgenus *Alternacanthoceras* subgen. nov. comprises both sparsely and coarsely, as well as densely and delicately ribbed species. The former show approximate 17 ribs at the last whorl; this group is represented by such species as *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath, 1926) and *A. (Alternacanthoceras) hudai* (Frič, 1911). The other group shows 20 or more ribs at the last whorl and it is represented by *A. (Alternacanthoceras) withei* Matsumoto, 1959, and *A. (Alternacanthoceras) procostatum* Thomel, 1972.

The species *Acanthoceras hippocastanum* (J. de C. Sowerby, 1826) shows more inflated whorls, more prominent and pointed tubercles, and coarser ribbing than *A. (Alternacanthoceras) jukesbrownei* (Spath) but nevertheless, it resembles in ornamentation very closely the inner whorls of the latter species. The difference consists mostly in much smaller mature size of *A. hippocastanum* (J. de C. Sowerby) and in its stratigraphic range restricted thus far to the Upper Cenomanian (Kennedy & Hancock 1970, pp. 479 and 488; Kennedy 1971, p. 88). If future investigations will extend the stratigraphic range of *A. hippocastanum* (J. de C. Sowerby) down to the Middle Cenomanian, this species might be regarded as a microconch of *A. (Alternacanthoceras) jukesbrownei* (Spath)[2].

The subgenus *Alternacanthoceras* subgen. nov. is characteristic of the upper Middle Cenomanian in southern England, France (*cf.* Kennedy & Hancock 1970, p. 488; Kennedy 1971, p. 89; Thomel 1972; Juignet & Kennedy 1976, p. 120), Czechoslovakia, and Subherzynian basin. It has also been reported from the Middle Cenomanian of Kopet-Dag (Turkmenia), India, and the United States (*cf.* Matsumoto 1959, p. 84; Atabekyan 1961, p. 63).

Acanthoceras (Alternacanthoceras) jukesbrownei (Spath, 1926)
(Pl. 1, Fig. 1*a-c*)

1857. *Ammonites hippocastanum*, Sowerby; Sharpe *(partim)*, pp. 37—38, Pl. 17, Fig. 2 *(only)*.
1926. *Protacanthoceras jukes-brownei* nom. nov.; Spath, p. 82.
1951. *Acanthoceras jukes-brownei* (Spath); Wright & Wright, p. 28.
1969. *Acanthoceras jukes-brownei*; Kennedy, Pl. 18, Fig. 1, and Pl. 20.
1971. *Acanthoceras jukes-brownei* (Spath); Kennedy, pp. 88—89, Pl. 52, Figs 1—3, Pl. 53, Fig. 1, and Pl. 55, Figs 1—2.

[2] The species *A. hippocastanum* (J. de C. Sowerby) may indeed be expected to occur in the Middle Cenomanian, as it has already been recorded in strata referred to the Middle Cenomanian in Kopet-Dag, Turkmenia (*cf.* Atabekyan 1960, p. 192; 1961, p. 63). The species is, however, divergently interpreted by various authors (*vide* Kennedy & Hancock 1970, p. 479; synonymy *in* Kennedy 1971, pp. 86—87) and hence, its true stratigraphic range cannot be reliably given as yet.

1971. *Acanthoceras* aff. *jukes-brownei* (Spath); Kennedy, p. 89, Pl. 54, Fig. 1, and Pl. 55, Fig. 2.

1972. *Acanthoceras (Acanthoceras) rotomagense rotomagense* (Brongniart); Thomel *(partim)*, pp. 131—132, Pl. 55, Fig. 1, Pl. 59, and Pl. 60, Figs 1—3.

1972. *Acanthoceras (Acanthoceras)* cf. *rotomagense rotomagense* (Brongniart) (forme 1); Thomel, p. 133, Pl. 58, Figs 4—6.

1972. *Acanthoceras (Acanthoceras)* cf. *rotomagense rotomagense* (Brongniart) (forme 2); Thomel, pp. 133—134, Pl. 58, Figs 1—3.

?1972. *Acanthoceras (Acanthoceras) rotomagense porthaulti* nov. subsp.; Thomel, p. 135, Pl. 61, Figs 1—2.

1972. *Acanthoceras (Acanthoceras) rotomagense latecostatum* nov. subsp.; Thomel, pp. 136—137, Pl. 54, Figs 3—4, Pl. 55, Figs 2, 5—6, Pl. 57, Figs 1—2, 8—9, and Pl. 67, Figs 3—4, 7—9.

1972. *Acanthoceras (Acanthoceras) rotomagense crassum* nov. subsp.; Thomel, pp. 138—139, Pl. 55, Figs 3—4, Pl. 56, Figs 1—2, Pl. 57, Figs 3—7, and Pl. 67, Figs 5—6.

1972. *Acanthoceras (Acanthoceras) rotomagense armatum* nov. subsp.; Thomel *(partim)*, pp. 139—140, Pl. 62, Figs 4—6, Pl. 63, Pl. 64, Figs 1—2, and Pl. 67, Figs 1—2, *non* Pl. 65 [close to *Acanthoceras (Alternacanthoceras) hudai* (Frič, 1911)].

1972. *Acanthoceras jukes-brownei* Spath; Thomel, pp. 156—157.

1976. *Acanthoceras jukesbrownei* (Spath); Juignet & Kennedy, pp. 119—120, Pl. 32, Fig. 1.

Material: A single well preserved specimen (No. *Tr64*).

Biometry (all linear measurements in *mm*):

	D	Wh	Wb	U	Ribs per whorl
Specimen No. *Tr64* (Pl. 1, Fig. 1)	226	85	85	86	17
Ratio to *D*		0.38	0.38	0.38	

Remarks. — The investigated specimen shows 9 long ribs with intercalated 8 short ones. The long ribs onset with a low but wide swelling at the umbilicus wall and form very strong umbilical tubercles at the umbilical edge. The massive ribs make them connected with prominent, transversally elongate ventro-lateral tubercles. The ribs become wider but at the same time lower at the ventral side of the whorl, just as it occurs commonly in other specimens of *A. (Alternacanthoceras) jukesbrownei* (Spath); one may thus claim that this feature is typical of the species, irrespective to the preservation state (*cf.* description of the specimen No. *17224* by Thomel 1972, p. 140). The short ribs onset close to the mid-flank of the whorl and bear only the ventro-lateral tubercles. Both the tubercles and the rib characteristics at the ventral side appear identical to those of the primaries. At the inner part of the whorl, the short ribs onset a little below the mid-flank.

The large diameter, 17 ribs per whorl, and regular alternation of the long and short ribs make the specimen entirely consistent with the diagnosis of the species *„jukesbrownei"* (cf. also Kennedy 1971, pp. 88—89; Juignet & Kennedy 1976, p. 120). The type specimen of *Acanthoceras (Acanthoceras) rotomagense armatum* Thomel (*cf.* Thomel 1972, p. 140, Pl. 63) does also appear consistent with the diagnosis of the species *„jukesbrownei"* and hence, most specimens assigned to this subspecies are here attributed to *A. (Alternacanthoceras) jukesbrownei* (Spath). A single specimen with less regular alternation of the long and short ribs (*cf.* Thomel 1972, p. 140, Pl. 65) makes, however, an exception and appears close to *A. (Alternacanthoceras) hudai* (Frič) (*cf.* Frič 1911, p. 10, Text-fig. 33). In fact, the specimen reported by Frič seems to be very closely related to the species *"jukesbrownei"* (cf. Kennedy 1971, p. 89).

The present author agrees with Juignet & Kennedy (1976, pp. 115 and 120) that most forms showing fairly conspicuously ornamented inner whorls and alternating long and short ribs, assigned by Thomel (1972) to the species *"rhotomagense"* or its newly established subspecies (*vide* synonymy), belong actually to *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath). However, *A. (Alterna-*

canthoceras) procostatum Thomel included by Juignet & Kennedy (1976, p. 120) in the synonymy of the species *"jukesbrownei"* makes indeed a distinct species. In fact, it shows some 24 ribs at a large diameter (the body chamber is partly preserved) and thus, represents more densely ribbed species group of the subgenus *Alternacanthoceras* subgen. nov. (*vide* remarks on the subgenus).

Occurrence. — Northern limb of the Subherzynian basin, beds with *Acanthoceras*, Hoppenstedt quarry (*cf.* Tröger 1969, pp. 35 and 38).

The species *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath) has insofar been reported from the upper Middle Cenomanian of southern England and France (Kennedy & Hancock 1970, Kennedy 1971, Thomel 1972, Juignet & Kennedy 1976). It may also occur in a similar stratigraphic position in Kopet-Dag, Turkmenia (*cf.* Atabekyan 1961, p. 63).

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ALTERNACANTHOCERAS SUBGEN. NOV. ZE ŚRODKOWEGO CENOMANU NIECKI SUBHERCYŃSKIEJ ORAZ UWAGI O INNYCH PRZEDSTAWICIELACH RODZAJU *ACANTHOCERAS* NEUMAYR, 1875

(Streszczenie)

Przedmiotem pracy jest ustanowienie nowego podrodzaju *Alternacanthoceras* w obrębie amonitów z rodzaju *Acanthoceras* Neumayr, 1875. Wydzielenia tego dokonano w oparciu o analizę gatunku typowego dla nowego podrodzaju, a mianowicie *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath, 1926), reprezentowanego przez dobrze zachowany okaz (*patrz* Pl. 1, Fig. 1*a-c*) z osadów środkowego cenomanu profilu Hoppenstedt w niecce subhercyńskiej (Niemiecka Republika Demokratyczna). Podrodzaj *Alternacanthoceras* subgen. nov. obejmuje duże akantocerasy, u których przemienność w rozmieszczeniu długich i krótkich żeber zaznacza się we wszystkich stadiach rozwojowych. Dla pełniejszej charakterystyki nowego taksonu przedstawiono również uwagi dotyczące podrodzaju nominatywnego *Acanthoceras* Neumayr, 1875, oraz podrodzaju *Guerangericeras* Thomel, 1972.

1a-c *Acanthoceras (Alternacanthoceras) jukesbrownei* (Spath, 1926); specimen No. *Tr64*; Middle Cenomanian; Hoppenstedt, beds with *Acanthoceras*. Photos taken by K. Boruta; ×0.75