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CONIACIAN AMMONITES FROM THE NEGEV (SOUTHERN ISRAEL)

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AND THE HEBREW UNIVERSITY, DEPARTMENT OF GEOLOGY

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

Page

Text figures

Plates 1—4, photographs of species described.

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CONIACIAN AMMONITES FROM THE NEGEV (SOUTHERN ISRAEL)*

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ABSTRACT

Ammonites of Coniacian age occur in the area between Har Zenifim and the southern slopes of Makhtesh Ramon in the Negev, Southern Israel. The forms described are:
Proplacenticeras sp., Coilopoceras zihoricum n. sp., Coilopoceras sp. indet., Hemitissotia morreni (Coquand), Allotissotia galeppei (Pervinquière), Barroisiceras neqarotense n. sp., Barroisiceras onilahyense Basse, Harleites bentori n. sp., Forresteria cf. allaudi(BLT), Buchiceras bilobatum Hyatt, Roemeroceras tunisiense (Hyatt) and its subspecies laevis Perv., constricta n. subsp. and arrondata n. subsp.

The relationship of Hemitissotia galeppei Perv. is discussed; its separation as a distinct genus, Allotissotia, and the inclusion of the latter together with Hemitissotia, Plesiotissotia and Heterotissotia in the new subfamily Hemitissotiinae is proposed.

The taxonomic position of Harleites is revised.

The reinstatement of the genus Roemeroceras Hyatt, suppressed by previous authors, and of the subfamily Buchiceratinae (ex Buchiceratidae) Hyatt is proposed. The close relationship of the Buchiceratinae to Barroisiceras suggests that they may be regarded as a subfamily of the Collignoniceratidae.

INTRODUCTION

The ammonites recorded in this paper occur in the Israel Negev, between the anticline of Zenifim and the southern slopes of the Ramon anticline (see text fig. 1). Coniacian fauna, other than ammonites, occurs further to the south, but only some worn and undeterminable ammonites were found. No definite Coniacian fauna is hitherto known north of Makhtesh Ramon.

In the area mentioned, Coniacian ammonites are locally frequent, but their state of preservation is mostly not favourable to detailed study. All are internal moulds; one side, on which they lie on the ground or adhere to the rock, is generally worn and often other parts are damaged. The interior of the fossils is filled with crystals of calcite or amorphous calcitic matter and the innermost volutions are completely destroyed. Thus, only the preserved outer volutions can be examined and the earlier ontogenetic stages cannot be recognized. Ornamentation and suture lines — although mostly affected by corrosion — are, however, in most cases sufficiently preserved.

The associated fauna of echinoids, bivalves and gastropods is very rich. A preliminary account of these faunas was given by the author in a previous paper (1958). Coniacian faunas have been described from Palestine and adjacent areas (Egypt-Sinai, Transjordan, Lebanon), but were mostly attributed to the Santonian or Turonian.

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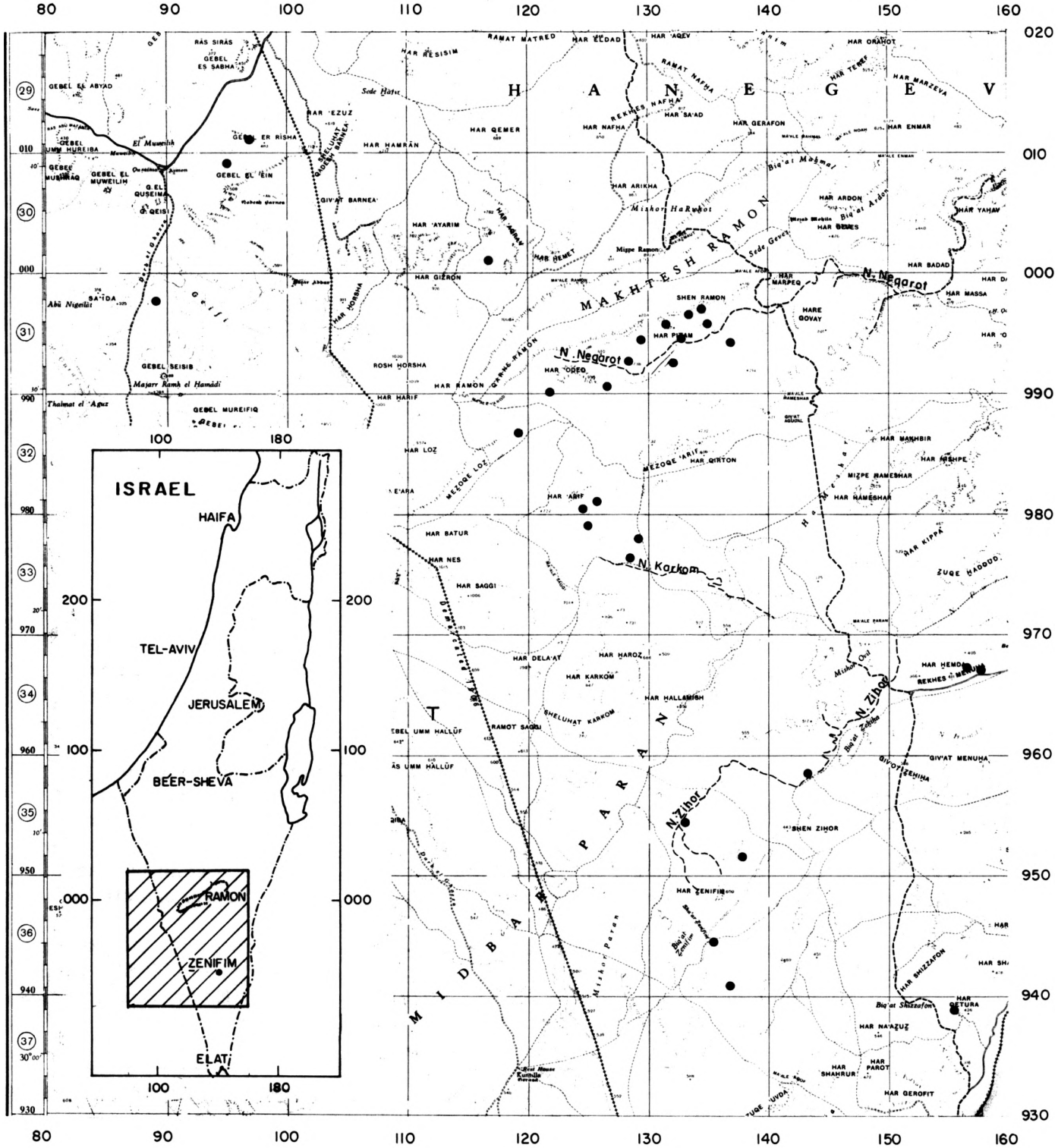
MAP OF OCCURRENCE OF CONIACIAN AMMONITES IN THE NEGEV

TEXT FIG. I



Diener (1887) described from chalks in the vicinity of Jerusalem Placenticeras sp. similar to P. memoria schloenbachi Laube and Bruder and Schloenbachia cf. tricarinata d'Orb. and believed that they point to a Late Turonian or Senonian age.

Blanckenhorn (1890, p. 22; 1905; 1914; p. 26) attributed the ammonites from the lower part of the chalks east of Jerusalem and of Safad, as well as Hemitissotia morreni (Coq.) from Transjordan to the "Santonian at the limit of Turonian and Senonian". Faunas from Egypt-Sinai are listed by Blanckenhorn (1900, table to p. 32 and p. 38; 1921, p. 55) as belonging to the "Santonian or Lower Senonian (incl. Coniacian = Emscherian sensu lato)" or to the Santonian stage (incl. Emscherian or Coniacian)". In his study of echinoids from the Cretaceous chalk of Palestine, Blanckenhorn (1925, p. 88 and 96) has distinguished an "upper horizon of sea urchins from the uppermost Turonian or lowermost Santonian at the limit of the Senonian" or "Turonian-Santonian (Emscherian)" (ibid. p. 110-111).

Fourtau at first (1900, 1901, 1904) attributed the fauna from the base of the Senonian of Egypt (species of Tissotia, echinoids, lamellibranchs etc.) to the Santonian. Later (1914, 1917) he determined various echinoids and mollusks from Egypt-Sinai as "Emscherian (Santonian)" or "limit of the Santonian and Turonian". Dacqué (1903) includes the Lower Senonian fauna of Abu Roach which comprises Tissotia in the Santonian.

Taubenhaus (1920) has attributed several ammonites from Palestine and Transjordan to the Emscherian, but his determinations are in some cases doubtful. To the critical objections of Blanckenhorn (1927, p. 185) several comments on the specimens in the Blanckenhorn collection (deposited at the Geol. Dept., Hebrew University Jerusalem) may be added:

Placenticeras subplanum (Taubenhaus 1920, p. 40, pl. VII, fig. 2 and pl. VIII, fig. 4, Hebr. Univ. coll. HU 2206 and HU 2158*); the two specimens from Transjordan have a high median keel, clearly seen on the sections of the calcitic inner whorls and are by their suture lines true Coilopoceras. Their oval-lanceolate whorl sections, with maximum width near the middle of the flank agrees with Coilopoceras zihoricum n. sp.

Engonoceras sauli Taubenhaus (ib. p. 39, pl. VIII, fig. 3, HU 2153) is, as labeled by Blanckenhorn, a Hoplitoides or perhaps a Coilopoceras.

Schloenbachia (Peroniceras) sandrezkii Blanckenhorn (Taubenhaus 1920, p. 37, pl. IX, figs. 1-2; HU 2150 and HU 2151); two specimens from the Upper Cretaceous chalk near Jerusalem, have three crenulate keels on the narrow ventral area and were correctly labeled and determined by Blanckenhorn (1905, p. 105) as "Schloenbachia (Mortoniceras) sandreczkii". They bear umbilical and ventrolateral nodes and should be included in Protexanites. Their age may be Upper Coniacian or lowermost Santonian.

Schloenbachia (Peroniceras) cf. tricarinata d'Orb. (Taubenhaus, 1920, p. 38, HU 2152) from the white chalk of Safad is rather an undeterminable fragment. It shows three superposed ridges and below them tubercles on what appears to be the flank; no ribs are recognizable. It is labeled by Blanckenhorn, "Schloenbachia cf. tricarinata"; this interpretation may be correct, but the evidence is very poor.

Schloenbachia (Barroisiceras) sequens de Grossouvre (Taubenhaus, 1920, p. 35, pl. IX, fig. 3) from the Stuttgart collection, is a plastercast from an imprint and appears superficially similar to B. sequens, but there is no evidence that it is a Barroisiceras at all.

Schloenbachia (Barroisiceras) haberfellneri v. Hauer var. desmoilinsi de Grossouvre (Taubenhaus, 1920, p. 36; HU 2148), collected by Blankenhorn from the Campanian of Jeb. Shihan-Wadi Modjib, is a fragment of Libycoceras.

* Registration numbers preceded by the letter "M" indicate specimens deposited in the collections of the Paleontology Division, Geological Survey of Israel; those preceded by "HU" are deposited in the paleontological collection of the Department of Geology, Hebrew University, Jerusalem.

Douvillé (1928) describes species of Hemitissotia and Tissotia from Egypt.

The occurrence of Coniacian fauna in Egypt (Sinai) and in the Negev was recognized (1945, 1947) by L. Picard and his collaborators M. Avnimelech and A. Vroman, who have examined faunas collected by the geologists of the Standard Oil Company of Egypt and of the Petroleum Development (Palestine) Company. The Coniacian strata, however, could not be clearly separated from the underlying Turonian and the overlying Santonian ones and were, therefore, referred to as "Coniacian-Santonian" or as "passage beds Senonian-Turonian". The find of Coniacian ammonites during the geological mapping of the Negev by Y. K. Bentor and A. Vroman has enabled a more definite recognition of the Coniacian Substage and its faunal assemblage in the southern and central Negev. A preliminary examination of the faunal assemblage by A. Vroman and the present author has served for the delineation of the Coniacian on the geological maps of the Negev (Bentor-Vroman 1954, 1964).

In the opinion of this author Coniacian strata are present in the northern Negev also but, in the absence of ammonites, their determination is difficult. It is hoped that further study of the fauna, especially of echinoids and rudistids, will lead to the differenciation of the Coniacian north of Makhtesh Ramon.

ACKNOWLEDGEMENTS

Most of the material described in this paper was collected by the author in collaboration with Y. K. Bentor and A. Vroman. In collecting the fauna of Zenifim, the author has been aided by the geologists Ph. Biro and M. Sommer, (Zurich) and supported by H. J. Tschopp and J. Barnea (formerly of Lapidoth Oil Co.). Various specimens were contributed by A. Nevo (Kibbutz Sa'ar) and by R. Freund and R. Rahmout (excursions of geological class of the Hebrew University). The specimens from Sinai were collected by Y. K. Bentor, A. Issar, and A. Shilo (G. S. I.).

The photographs were taken by M. Raab (G. S. I.). Thanks are due to C. Hershkowitz, R. Behrend and Y. Levy (G. S. I.) for drafting and photo-laboratory work.

SYSTEMATIC PALEONTOLOGY

Family PLACENTICERATIDAE Hyatt, 1900

Genus Proplacenticeras Spath, 1926

Type species: Placenticeras fritschi de Grossouvre, 1894

Proplacenticeras sp.

Pl. 2, fig. 9, text-fig. 2, k-1.

A septate fragment of about 1/4 volution (HU 20937), 38 mm long, height of whorl 21 mm, its width 9 mm, the impressed area 7 mm high. The fragment belongs to an involute shell, with small umbilicus, rounded umbilical margin and umbilical wall. Its maximum width is near the umbilical margin, the flanks above the periumbilical inflation are flat, convergent externally. The venter is narrow, tabulate in the outer volution, grooved and bicarinate in the inner volution. Ventrolateral margins are angular. The ornamentation consists of minute ventrolateral nodes, corresponding on both margins

and faint riblets on the middle part of the flank. The preserved part of the umbilicus is small, and therefore the presence or absence of umbilical nodes cannot be ascertained.

The suture line has three auxiliary lobes on the flank, a fourth auxiliary lobe begins on the umbilical margin. The external saddle is tripartite, the other saddles bifid. The indentation of the sutural elements is simple.

The specimen differs from Proplacenticeras fritschi (de Grossouvre) (1894, p. 124, pl. V. figs. 1-2) by its small umbilicus with rounded umbilical walls, by the presence of ventrolateral tubercles and simpler suture line. The suture line is similar to the suture of Placenticeras hyatti Diener (= P. syrtale Gross., 1894, p. 134, text-fig. 54, pl. V. fig. 3), from which our specimen differs by its riblets and finer, corresponding ventromarginal nodes.

Occurrence and age: The specimen was collected by R. Freund from the base of a yellowish chalk, north of Har Hemda, half-way between Be'er Menuha and Newe Midbar (coord. 1565/9675), regarded by its stratigraphic position as of Early Coniacian age.

Family COILOPOCERATIDAE Hyatt, 1903
Genus Coilopoceras Hyatt, 1903
Type species: Coilopoceras colleti Hyatt, 1903

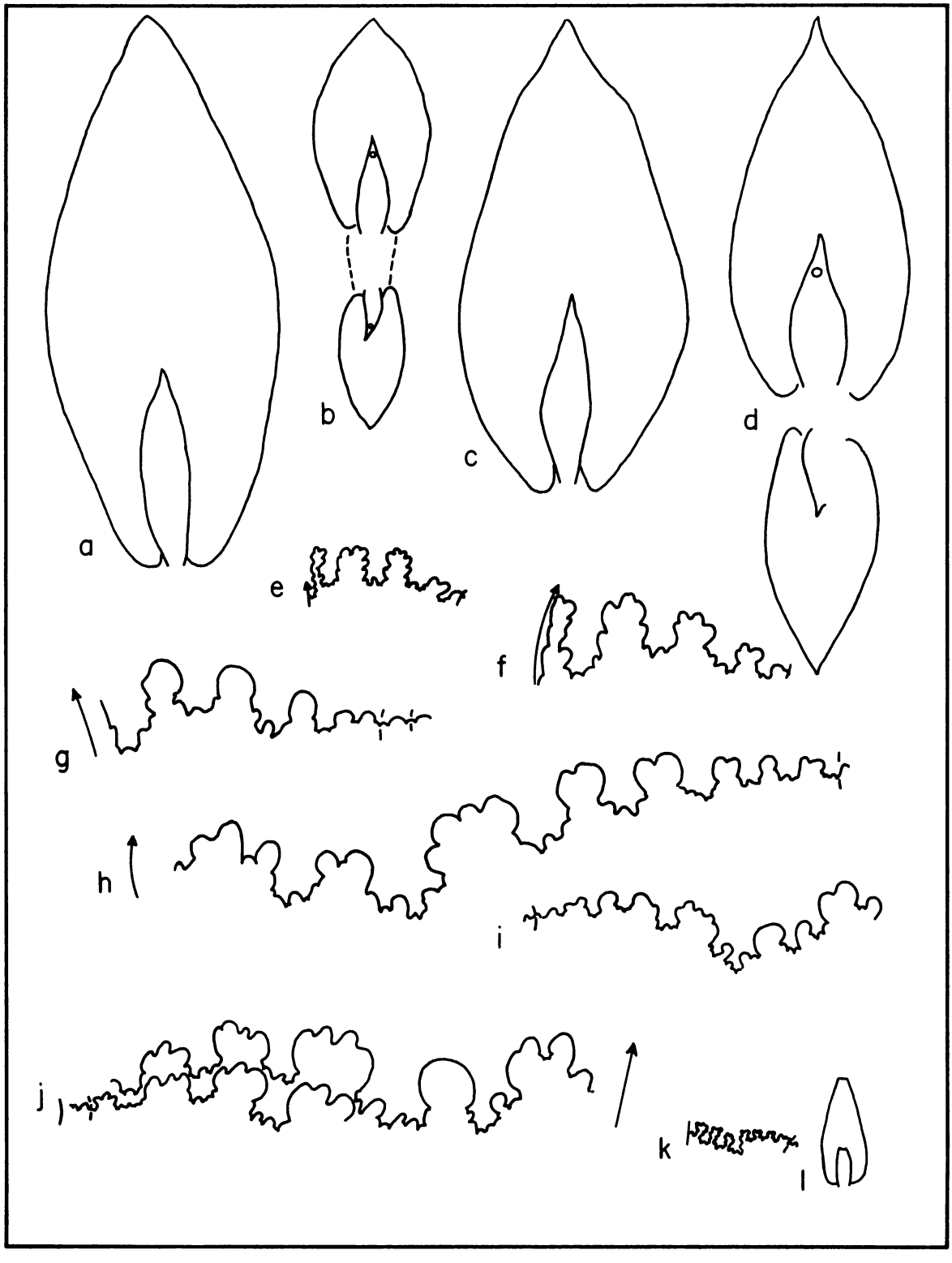
Various species of Coilopoceras have been based on whorl shape, ornamentation and suture line. As stated by various authors the suture line of this group is highly variable (Solger, 1904, p. 130; Pervinquière, 1907, p. 220); thus, no great importance can be attributed to it and only the general pattern should be retained.

Ornamentation is a more stable feature. Unfortunately, it is easily obscured or entirely obliterated by corrosion, and often it is difficult to decide if apparently smooth specimens should be separated from ornamented forms.

The most stable feature for distinction between species seems to be the pattern of the whorl section. This shows in most species the maximum inflation near the umbilicus (C. requienianum d'Orb., C. colleti Hyatt, C. lesseli Brueggen, C. austinense Adkins). Other species have the maximum width at or near the middle of the flank (C. eaglefordense Adkins, C. jenksi Benavides-Càceres, C. newelli B.-Càceres, C. zihoricum n. sp.). Some species (C. chispaense Adkins, C. lesseli Basse 1937, non Brueggen) have the maximum inflation nearer to the external region.

Coilopoceras zihoricum n. sp.
Pl. 1, figs. 8-11, text-fig. 2 a-b, d, e-i and text-fig. 3

Holotype: Pl. 1 figs. 10-11, text-fig. 3, HU 20925 a.
Derivation of name: From the type locality.
Type locality: Nahal Zihor, coord. 1433/9586.
Occurrence and age: Yellow marly chalk; Early Coniacian.
Diagnosis: A Coilopoceras attaining giant size; shell moderately inflated, maximum width of whorl at or slightly below the middle of the flank; median keel high, lamelliform; whorl section lenticular; ornamentation of 10 folds and intercalated short secondaries; suture line variable, consists of 5-7, generally bifid and marginally incised saddles on flank.



Text fig 2

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EXPLANATION OF TEXT-FIGURE 2

(Unless otherwise indicated all figures natural size)

a-b. Coilopoceras zihoricum n. sp., whorl sections;
  a. from Nahal Zihor, M 3767a;
  b. Holotype, from N. Zihor, HU 20925a.

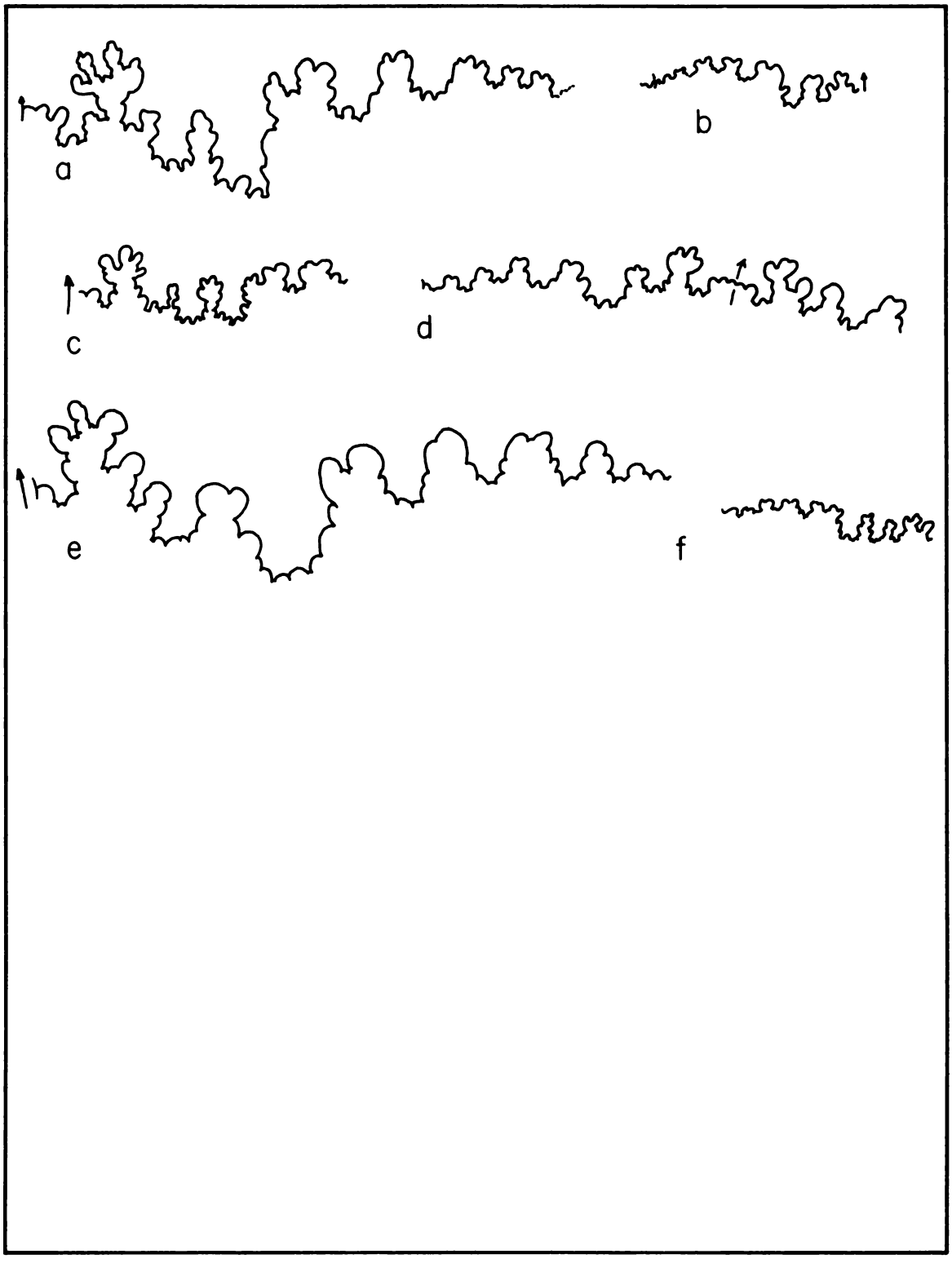
c. Coilopoceras sp. from Nahal Aqrav, M 3766b.

d. C. zihoricum n. sp. from N. Zihor, HU 20925b.

e-i. C. zihoricum n. sp., suture lines;
  e-g. from N. Zihor, dorsal series;
  e. HU 20929;
  f. HU 20925c;
  g. HU 20928;
  h-i. lateral sutures;
  h. from Zenifim, HU 20926a;
  i. from Ain Qudeirat (Sinai; Egypt), M 3798.

j. Coilopoceras sp., from N. Aqrav, M 3766.

k-l. Proplacenticeras sp., from Har Hemed, HU 20937; suture line and whorl section enlarged × 2.



Text fig 3

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EXPLANATION OF TEXT-FIGURE 3

(All figures natural size)

Coilopoceras zihoricum n. sp., suture lines.

a-b. Holotype from N. Zihor, M 3767a, HU 20925a.

c. From Zenifim (South), HU 20927.

d-e. From N. Zihor, HU 20925. b-c.

f. From NE Zenifim, HU 20926b.

Material examined: 6 specimens and several fragments (M-3601, HU 20925) from Nahal Zihor, coord. 1433/9586; 5 specimens and many fragments (HU 20928, HU 209 from the upper reaches of N. Zihor, coord. 1317/9535; several fragments of large s: specimens (HU 20927) from Zenifim, coord. 137/941; 2 specimens (M 2806, HU 2092 from the northeastern plunge of Zenifim, coord. 1381/9513; 2 specimens (HU 20930, HU'20931) from the southern part of Zenifim, coord. 1355/9465 and 1355/9460; 4 spe imens from Sinai, Egypt (M 3798 from Ain Qudeirat, coord. 095/009; M 3799 a-c fro Jeb. el Rishe, coord. 097/011).

Measurements:
(Figures in mm and percentages of given shell diameter).
Ch - measured with stated part of body chamber.
Phr - measured at maximum diameter of septate shell.
At - measured at a suitable diameter behind end of phragmocone.
D - shell diameter measured; H - maximum height of whorl at given shell diameter H_1 - smallest height of whorl at given diameter; W - maximum width of whorl; O - m imum diameter of umbilicus at given shell diameter.

No.	Measured	D	H	H_1	W	O
M 2806	At.	350	208(0,59)	-	90(0,26)	24(0,07)
M 3601c	Ch 1/5 vol.	215	119(0,54)	-	50(0,23)	12(0,05)
M 3767a	At.	190	106(0,56)	38	44(0,23)	10(0,05)
M 3798	At.	128	73(0,57)		31(0,24)	5,5(0,04)
M 3799b	Phr.	125	74(0,59)		31(0,25)	10(0,08)
HU 20925a	Ch 1/4 vol.	104	58(0,56)	19	27(0,26)	8(0,08)
	Phr.	80	43(0,54)		23(0,28)	6(0,07)
HU 20929a	Phr.	114	63(0,55)		32(0,28)	10(0,09)

Description: The size of the shell is variable, from moderate to giant. In the north eastern part of Zenifim specimens embedded in the rock attain diameters of 700-800 mr

The whorl is moderately inflated at the middle of the flank (pl. 1 figs. 9-10, text-fig. 2 a-b). The maximum width is slightly below the middle of the flank. The flanks converg from the region of maximum inflation externally and curve gently dorsally, but at about the inner fourth of the flank they curve rapidly towards the umbilicus. This change in curvature is often marked on the side by a spiral line, along which the shell is sometimes fractured. The whorl section is lenticular, its variability being illustrated on pl. figs. 9-10 and text-fig. 2 a, b, d.

The growth of the shell is rapid in the adult, in which the impressed area of the outer volutions is 1/3 of their height. The middle volutions are mostly deformed and asymmetrical, or totally compressed, so that only a narrow slit remains. Such disappearance of the inner volutions in C. newelli from Peru is described by Benavides-Càceres (1956, p. 474, pl. 62, fig. 6).

The median keel is high, lamelliform, attaining at a diameter of 40 mm, 3 mm heigh A nearly completely preserved part of the keel in the holotype is 7 mm high. It is delimited from the narrow ventral region by a spiral depression, below which a kind of ventral shoulder is formed.

The ornamentation consists of about 10 folds, sharply narrow in the periumbilical region, thickening rapidly towards the middle of the flank, and becoming wide and flat ventrally. The intervals are deep dorsally and shallow to superficial ventrally. Short intercalated secondaries on the outer part of the flank reach to the region of maximum inflation at the middle of the flank.

The suture line consists of 5-7 inequally bipartite saddles on the flank, the inner part usually larger than the outer. Subdivision of the inner part makes the saddles often tripartite. The external saddle is mostly tripartite, but greatly variable in form and dissection (text-figs. 2 h-i and text-fig. 3). The first lateral lobe is also very variable in width, in form and number of the accessory elements, and in depth. It may be wide and shallow, or deep and angular.

The suture line is variable, sometimes even in the same specimen. There are differences in the opposite sides of the specimen (text-fig. 3 d), or between the suture line of the inner and outer volution. Thus the suture line in the inner whorl of HU 20925e has, as the Sinai specimen M 3798, shallow lobes and rounded low saddles (text-fig. 2 i), whereas the outer whorl has deep lobes and high bifid saddles (text-fig. 3 e). These two types of suture line would perhaps suggest two different species if the two whorls would be found apart.

The internal (dorsal) series of the suture line agrees with the dorsal series of Coilopoceras colleti described and figured by Hyatt (1903, pl. X, fig. 8). Its variability is illustrated in text-fig. 2 e-g.

In aged specimens the external region is mostly modified by loss of keel. In corroded specimens the venter may be sharp, blunt or rounded. Where the keel is broken away the venter appears to be flat or excavated, bordered by two ridges (pl. 1, fig. 8) and simullating a Hoplitoides, but the sections of the preceding volutions with high lamelliform carina show that they are true Coilopoceras.

The body chamber (pl. 1, fig. 11) is preserved to 1/2 volution.

Remarks: Some specimens, as e. g. M 3798 from Sinai and HU 20931 from the south of Zenifim in the Negev (both from the hard limestone underlying immediately the marly chalk with Coilopoceras zihoricum), are smooth with no trace of ornamentation. They could be separated together with others as an uncostate or feebly costate variety of Coilopoceras zihoricum. But it seems most probable that the absence or weakness of ornamentation in most other specimens is secondary and due to the state of preservation. Thus, the Sinai specimens from the yellow marly chalk bed (M 3799) have partly the same ornamentation as the holotype, whereas others are smooth; but one specimen (M 3799 b) has the keel, as well as the ornamentation preserved on the less corroded beginning of the volution, whereas the more corroded rest of the specimen is smooth. On the other hand, from two specimens from the underlying hard limestone of N. Zihor (M 3767 a-b) one is smooth, while the other (M 3767 b) has one side smooth, but the other side showing the same folds as the holotype. This makes the assumption of an original absence or weakness of ornamentation and the distinction by ornamentation doubtful.

Other variations affect the width of the umbilicus and the rate of inflation. Some specimens are flat and thin. By these variations, however, the general pattern of the whorl is not changed. They occur in all beds and seem to be of no significance.

Relationship: Coilopoceras zihoricum n. sp. is very similar to Coilopoceras colleti Hyatt from the Colorado-Group of Peru and differs from it by the whorl shape, with maximum inflation at the middle of the flank. Coilopoceras lesseli Brueggen from the Coniacian of Peru has the maximum width of whorl nearer the umbilicus and is smooth. A Coilopoceras from the top Turonian or base Coniacian of Chekka in the Lebanon is

identified by Basse (1937) with Coilopoceras lesseli Brueggen. It seems near to C. zihoricum, but the maximum width of whorl is nearer the venter and the form is much more inflated. Coilopoceras requienianum d'Orbigny from the Turonian of France is faintly ornamented and its maximum inflation is nearer the umbilical region. The pattern of its suture line seems to be more regular than of C. zihoricum n. sp. (Pervinquière, 1907, p. 222, text-fig. 90). C. grossouvrei Hyatt (Grossouvre, 1894, p. 141, fig. 59) is distinguished from C. requienianum only by variation of suture, which may be individual, as in C. zihoricum n. sp. C. springeri Hyatt from the Colorado-Group of Peru has a greatly widening umbilicus and shows no ornamentation on shell or cast; its suture is much more developed than in C. zihoricum. C. novimexicanum Hyatt differs greatly by its whorl section, faint ornamentation and peculiar dissection of suture line.

Reeside (in Wasson and Sinclair, 1927) figures two giant specimens from Ecuador; sp. A aff. C. lesseli Brueg. and C. springeri Hyatt (pl. 9, figs. 1-2) has a whorl section like C. lesseli, but a much more dissected suture line and a very wide umbilicus; sp. B (pl. 9, figs. 3-5) has a whorl section like C. zihoricum with maximum width rather slightly above the middle of the flank, but differs by fine ornamentation and finely dissected suture line.

C. austinense Adkins (1931) from the lowermost Austin Chalk of Travis County is inflated in the dorsal half of the whorl. C. eaglefordense Adkins has the maximum inflation like C. zihoricum at the middle of the flank, but is completely smooth. C. chispaense Adkins has the maximum thickness of whorl nearer the ventral region and differs also by coarser ornamentation.

C. jenksi Benavides-Càceres (1956) from the Lower Turonian of Peru differs by its smaller, almost closed umbilicus and is completely smooth; its suture has only 4 saddles on the flank. C. newelli Benavides differs by its sparse, unconstant radial swellings on the middle of the flank and its much larger umbilicus. C. vandersluisi Reyment (1957) is different by its inflated whorl section.

Occurrence and age: Rare Coilopoceras zihoricum n. sp. occur at the top of a hard limestone, at the base of the Coniacian sequence, but they are common or frequent in the immediately overlying chalk bed. In the southern part of Zenifim (coord. 1355/9460), the hard bed contains also Leiocidaris subvenulosa (Peron and Gauth.), Alectryonia dichotoma (Bayle), Cucullaea maresi (Coq.). The overlying chalk with Coilopoceras bears Leiocidaris subvenulosa, Hemiaster fourneli Desh. and Clypeopygus spp. In the yellow chalk of the upper N. Zihor (coord. 1317/9535) Coilopoceras zihoricum is associated with Alectryonia dichotoma, Cucullaea maresi, Hemiaster fourneli. The overlying chalk-marl contains Pseudoholaster meslei Gauthier, Pseudoholaster moabiticus (Blanckenhorn), Bothriopygus aegyptiacus Fourtau. But the sequence seems here to be disturbed. In N. Zihor (coord. 1433/9586) the yellowish marl containing Pseudoholaster meslei is separated from the bed with Coilopoceras by chalk with Gastropoda. In the northeastern part of Zenifim (coord. 1381/9513) the beds with giant Coilopoceras and Alectryonia dichotoma are overlain by marly and hard chalks with Cucullaea maresi, Alectryonia dichotoma, Clypeopygus sp. sp. and Hemitissotia morreni Coq. In Sinai, the hard limestone with Coilopoceras of Ain Qudeirat (095/009) is followed by yellowish chalk with ammonites at Er-Rishe (coord. 097/011). All occurrences lead to the conclusion that the beds with Coilopoceras zihoricum shall be regarded as of Early Coniacian age.

Coilopoceras sp. indet.
Text-fig. 1 c and j

Description: Two strongly corroded specimens from Nahal Aqrav (Wadi Akbar), coord. 1170/0008, represent a Coilopoceras of large size. One specimen (M 3766 a) has the body chamber preserved to one half volution. Its diameter is about 210 mm. The umbilicus is very small (0,05-0,06 of d.), width of whorl about 0,28 of shell diameter. The other, somewhat better preserved, specimen (M 3766 b) is a septate fragment of 1/2 volution. Its diameter is 180 mm. The maximum inflation of the whorl is near the periumbilical region. Broad waves on the flank indicate the original presence of ornamentation. The suture line (text-fig. 2 j) has on the flank 6 or 7 saddles with tops broad, rounded, bipartite, each part subdivided by marginal incisions. It is very similar to the suture of M 3798 from Sinai (text-fig. 2 i). The accessory saddle is large, round, entire, but in an earlier septum and in the other specimen (M 3766 a) it is bifid and marginally serrated at its base.

The specimens are too badly preserved for specific determination. They recall by whorl shape Coilopoceras lesseli Brueggen. They differ from Coilopoceras zihoricum by whorl section (text-fig. 2 c).

Occurrence and age: At the top of white chalky limestone containing echinoids (Hemiaster spp., Clypeopygus spp., Caenholectypus sp. Rachiosoma sp., regarded (Raab, 1962) as of Turonian age. The age of these specimens of Coilopoceras may thus be Late Turonian or Earliest Coniacian.

Family TISSOTIIDAE Hyatt, 1900
Subfamily HEMITISSOTIINAE Parnes, n. subfam.

The subfamily HEMITISSOTIINAE is here proposed for direct descendents of Choffaticeras with modified and simplified suture lines, including the genera: Hemitissotia Peron, Plesiotissotia Peron, Heterotissotia Peron and Allotissotia Parnes (see discussion, pp. 32-34).

Most authors have emphasized that the direct connection of Hemitissotia with Tissotia, based on the simplification of the suture line only, is questionable and that such forms, more closely allied to Choffaticeras (Leoniceras), are not of the same lineage as Tissotia.

Genus Hemitissotia Peron, 1897
Type species: Hemitissotia cazini Peron, 1897

Hemitissotia morreni (Coquand)

Ammonites morreni Coq. 1862, p. 173, pl. I, figs. 3-4
Synonymy in Pervinquière, 1907, p. 360.
Material: One specimen (HU 20943) from the northern part of Zenifim, coord: 1381/9513.

Measurements:

		D	H	H_1	W	O
HU 20943	Ch 1/3 vol.	109	60(0,55)	48	60(0,55)	10(0,09)

Description: The shell is very involute, the whorl strongly inflated, depressed, the umbilicus is small, circular, the umbilical edge delimited by a short vertical umbilical wall. The ventral edge is blunt. The surface is worn, incrusted by oysters and shows no traces of ornamentation. From the suture line only a part of the external saddle could be detected; it is marginally incised. The whorl shape agrees exactly with the type of Hemitissotia morreni Coq. and with H. morreni var. tissotiaeformis Peron (1897, p. 78, pl. XV, fig. 3).

Occurrence and age: White chalk overlying marly chalk with Coilopoceras zihoricum. Lower Coniacian.

Genus Allotissotia Parnes, n. gen.
Type species: Hemitissotia galeppei Pervinquière, 1907

Pervinquière has included his species in Hemitissotia with some hesitation. He remarks that judging from the suture line it is a Hemitissotia, nevertheless it is externally so similar to Pseudotissotia (Choffaticeras) luciae that one may ask if their generic separation is justified. The suture, however, is already not that of a Choffaticeras. The lobes are of Tissotia, whereas the saddles are still serrated as in Pseudotissotia. Altogether, the species is in his opinion intermediate between Pseudotissotia on one hand and Hemitissotia and Tissotia on the other (loc. cit. p. 359). Hemitissotia cf. galeppei Karrenberg (1935) from the Upper Coniacian of N. Spain shows pronounced inflation at the internal part of the flank, a deep umbilicus, and an overhanging umbilical wall and is identical with some more inflated specimens of our collection (as e. g. M 3755a and M 3751 a). The first lateral lobe of the Spanish form is in the earlier whorls symmetrically bifid and becomes in the later stage more asymmetrically bifid, similar to the first lateral lobe of Leoniceras. Karrenberg concludes that it is difficult to separate his form from Leoniceras because the indentation of the first lobe is not ceratitic as in the type of Hemitissotia galeppei. Thus, the only difference from Leoniceras remains the convex curvature of the flanks.

Basse (1947, p. 159) regards H. galeppei as a curious species which seems to continue the line of Leoniceras luciae; the form of the umbilicus is analogous and the first saddle is equally trifid, but the first lateral lobe does not show the accessory external saddle which is constantly present in Leoniceras and is frequently seen in Barroisiceras.

The type species of Hemitissotia, H. cazini Peron (1897, p. 74, pl. XIV, figs. 1-5; pl. XVIII, figs. 9-10) is a highly involute regularly coiled form with narrow, simple umbilicus clearly different from the excentrically widening umbilicus with overhanging umbilical wall of Allotissotia galeppei (Perv.), Furthermore, all saddles of A. galeppei are more incised than in Hemitissotia proper. Considering the unstable nature of the suture line (see also Arkell in Moore, 1957, p. 111) and its plasticity in this group of Upper Cretaceous ammonites, the inclusion of the species galeppei in Hemitissotia was regarded by Pervinquière as provisional. (see discussion, pp. 32-34)

Allotissotia geleppei (Pervinquière)

Pl. 1, figs. 1-6, text-fig. 5 a-d and 1-n.

Hemitissotia galeppei Perv., 1907, p. 359, pl. XXV, fig. 1 a-b, text-fig. 139.

Hemitissotia cf. galeppei Perv. — Karrenberg, 1935, p. 149, pl. XXXII, fig. 18, pl. XXXIII, figs. 18-19.

The specimens from the Negev and Sinai agree in form of shell and suture line with the species of Pervinquière and its variety described by Karrenberg. Some observations on the nature of keel, characteristics of the umbilicus and variability of the species are added to the detailed descriptions of the previous authors.

Material examined: 16 specimens and various fragments (M 3705, M 3751, M 3752, M 3753, M 3754, HU 20939, HU 20940) from the southern slopes of Har Oded, coord. 1262/9906, and 3 specimens (M 3755, Hu 21443) from 10 kms S. of Quseima (Sinai, Egypt).

Measurements:

		D	H	W	O
M 3751a	Ch 1/2 vol.	154	81(0,52)	45(0,29)	20(0,13)
	Ch 1/4 vol.	120	68(0,56)	41(0,34)	16(0,13)
M 3752c	Phr.	100	59(0,59)	34(0,34)	7(0,07)
M 3754	Ch 1/3 vol.	106	51(0,48)	33(0,32)	17(0,16)
M 3755a	Phr.	130	70(0,54)	40(0,30)	18(0,15)
M 3755b	Ch 1/4 vol.	120	63(0,52)	-	16(0,13)
HU 20940a	Ch 1/4 vol.	117	61(0,52)	40(0,34)	20(0,18)
	Phr.	97	53(0,54)	32(0,33)	15(0,15)
M 3752a	Ch 1/4 vol.	118	54(0,46)	30(0,25)	21(0,18)
M 3752b	Phr.	104	51(0,49)	28(0,27)	15(0,14)
M 3753b	Ch 1/2 vol.	150	69(0,46)	36(0,24)	27(0,18)
M 3705a	Ch 1/4 vol.	121	57(0,47)	26(0,21)	17(0,14)
	Phr.	103	50(0,49)	22(0,22)	9(0,09)
M 3705b	Ch 1/2 vol.	130	64(0,50)	27(0,21)	17(0,13)
	Phr.	95	54(0,56)	21(0,22)	10(0,10)
HU 20939b	Ch 1/4 vol.	100	53(0,53)	24(0,24)	11(0,11)

Description: Shell moderately large, attaining a size of about 200 mm with body chamber of 3/4 volution. Typical specimens are like that figured by Pervinquière (pl. XXV, fig. 1) moderately inflated with a moderately deep umbilicus, sharp umbilical margin, and reclined umbilical wall. The maximum width is on the inner part of the whorl, which has a bellied appearance; externally the flanks converge, curving towards the narrow ventral region. The whorl section is lanceolate to suboval-lanceolate. Strongly inflated whorls with keel preserved have a galeate appearance. The keel is thin, high, lamelliform, delimited from the venter by a slight spiral depression (p. 1., fig. 1 on the right). The keel is mostly corroded and the venter sharpened, blunt or rounded. Where the keel is broken away there appears instead a tabulate subtricarinate venter (pl. 1, figs. 2, 5; text-fig. 5 a-d). Some of these latter shells become strikingly similar to unornamented Heterotissotia.

The flanks are smooth except for flexuous growth lines.

The suture lines show some tissotiid tendencies described by Pervinquière (p. 359). Generally, all saddles are marginally incised, the lobes bifid, the suture line rather that of Pseudotissotiinae (see Karrenberg, 1935, p. 150) than of Tissotiinae.

Variability: The specimens show great variability in the rate of inflation, height of umbilical wall and its more or less strong reclination, depth of umbilicus, increase in width of umbilicus and its more or less pronounced eccentricity. In more inflated specimens (pl. 1, fig. 6) the umbilical wall is high, strongly reclined, the width of the umbilicus reduced by the sharp overhanging margin.

Douvillé has observed (1928, pp. 4-5) that thick forms have a larger umbilicus, whereas thin forms have narrower umbilici and are usually less ornamented. He concludes that these are only variations probably due to some differences in habitat of these animals. In Allotissotia galeppei the width of the umbilicus seems to be connected with eccentric growth, independent from the thickness of shell.

In the thin specimens (see: measurements M 3705a, M 3705b, HU 20939b and pl. 1, figs. 1-2, 4-5; text-fig. 5a, b, d) the inflation near the umbilical region is smaller, the umbilicus shallow, the umbilical wall extremely short, only slightly reclined and little overhanging, the umbilical margin remains sharp, only in the adoral part of the body chamber it becomes (in specimen M 3752) sharply rounded. In the late adult the flanks curve gently towards the umbilicus and converge with slight curvature towards the narrow venter. The shell is flat and well distinct from the associated more inflated forms with deep and strongly overhanging umbilical walls. Nevertheless, they cannot be separated even subspecifically, the differences being of degree only. The thin and flat specimens may be regarded as an attenuate variation.

A peculiar alteration of the late adult in the flat specimens is the rounding of the external part of whorl, similar to the old Hemitissotia ceadouroensis Choffat (1818, p. 74, pl. XX, figs. 7-12) from Portugal. This "curious old age transformation, the rounding of the venter and contraction of the outer volution", as well as "the probable senile scaphitoid deviation from the spiral" were noted by Hyatt (1903, p. 40). It seems that Hemitissotia ceadouroensis is eccentrically coiled and resembles some specimens of Allotissotia galeppei with small umbilicus.

Family COLLIGNONICERATIDAE Wright and Wright, 1951
Subfamily BARROISICERATINAE Basse, 1947
Genus Barroisiceras de Grossouvre, 1894
Type species: Ammonites haberfellneri v. Hauer, 1866

Barroisiceras neqarotense n. sp.
Pl. 2, figs. 1-6, pl. 4, fig. 3, text-fig. 4a-c, i, m.

Holotype: Pl. 2, figs. 5-6, text-fig. 4a, M 3735.
Derivation of name: From the type locality.
Type locality: Nahal Neqarot, coord. 1285/9922.
Occurrence and age: White chalky limestone, Coniacian.
Diagnosis: A Barroisiceras with very involute shell, umbilicus narrow and deep, maximum width near umbilical margin; flanks flat, converge from periumbilical region externally; venter broadens with age and becomes low and the whorl may become rounded to subtrapezoidal on later part of body chamber. Ornamentation unchanged on earlier part of body chamber.

Material examined: 8 specimens (M 3735, M 3740, M 3741, M 3745, M 3746, M 3749, HU 20946) from Nahal Neqarot (coord. 1285/9922 and 1288/9925) and one specimen (M 4794) from Nahal Qetura (coord. 1555/9389).

Measurements:

		D	H	H_1	W	O
M 3735	Ch 1/4 vol.	109	60(0,51)	26	38(0,35)	14(0,13)
	Phr.	88	50(0,55)		35(0,39)	12(0,14)
M 3740	Ch 1/4 vol.	115	67(0,58)		48(0,42)	16(0,14)
	Phr.	90	50(0,55)		41(0,45)	13(0,14)
M 3741	Ch 1/4 vol.	90	48(0,53)		37(0,41)	12(0,13)
M 3745	Phr.	87	48(0,56)		38(0,43)	14(0,16)
M 3746	Ch 1/2 vol.	107	61(0,57)	27	44(0,41)	14(0,13)
	Phr.	77	44(0,58)		36(0,47)	11(0,13)
M 3749a	Ch 1/2 vol.	95	54(0,57)		34(0,35)	11 (0,11)
M 3749b	Ch 1/2 vol.	140	73(0,52)		52(0,37)	20(0,15)
HU 20946	At.	58	30(0,52)	11	25(0,43)	9(0,15)
M 4794	Ch 1/4 vol.	70	38(0,54)	20	35(0,50)	8(0,11)
	At.	53	20(0,38)		21(0,39)	7(0,13)

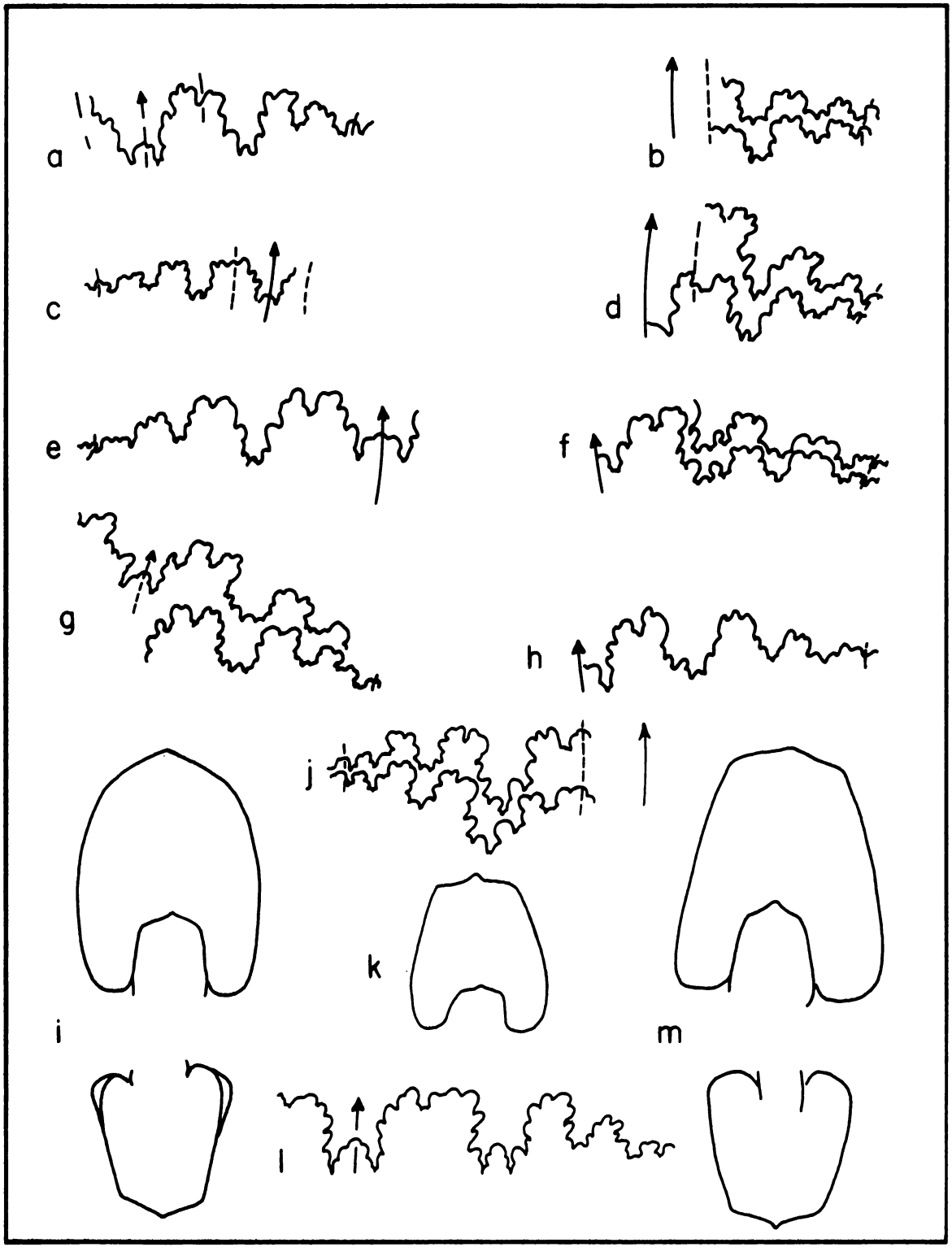
Description: The shell is of moderate size, but may attain more than 150 mm in diameter. It is very involute, the outer whorl embracing the preceding volution near the umbilical margin and concealing partly the elongated umbilical tubercles. The umbilicus is narrow and deep, the umbilical margin rounded, umbilical wall steep, slightly convex, becomes flat and abrupt in the late adult. The maximum width of the whorl is at the periumbilical region, the flanks are flat, or very slightly curved and converge from the umbilical region externally. External region fastigate, median keel moderately raised, crenulated.

Body chamber of half a volution increases rapidly in width. The increase is marked on the flank by a constriction, followed by a swollen umbilical tubercle and a raised rib. A similar acceleration of growth may occur also in the middle of the body chamber (M 3749a). The venter widens gradually and the keel loses its prominence and serration (pl. 2, fig. 6), the umbilical wall increases in height (in M 3749b it becomes 15 mm high) and delimits a deep and small umbilicus. In the adapertural part of the body chamber the width of the whorl remains nearly unchanged.

Ornamentation consists of 6-7 strong umbilical tubercles, elongated radially; radial ribs bifurcating, some are single or intercalated; ventrolateral tubercles about 20 per volution. Ornamentation persists unchanged on earlier part of body chamber, then umbilical tubercles disappear, ribs weaken and may disappear entirely adaperturally; ventrolateral tubercles persist longer.

Suture line with bifid and incised saddles, the second saddle at the middle of the flank, the fourth saddle on the umbilical margin. The lobes are narrower than the saddles.

The changes of the body chamber are variable. Lowering of the subfastigate venter and of the keel corresponds to increase in width of the ventral region. The maximum inflation of the whorl may move higher above the periumbilical region and the whorl section may become oval (M 3740, M 3741, text-fig. 4 i). In thickened body chamber with much widened and flattened venter together with high umbilical wall, the section becomes broadly trapezoidal (M 3749a, M 4794).



Text fig 4

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EXPLANATION OF TEXT-FIGURE 4

(All figures natural size)

a-c. Barroisiceras neqarotense n. sp., from N. Neqarot, suture lines;
- a. Holotype, M 3735;
- b. M 3746;
- c. compressed variety, M 3738b.

d. Barroisiceras onilahyense Basse, from N. Neqarot, suture line, M 3748.

e, f, h. Harleites bentori n. sp., from N. Neqarot, suture lines;
- e. M 3763b;
- f. HU 20935a;
- h. M 3705m.

g, j, k, l. Barroisiceras onilahyense Basse ;
- g. from N. Neqarot, suture line, HU 20938, note prionidian lobes;
- j. south of Shen-Ramon HU 20948;
- k. from Zenifim, whorl section, HU 20941;
- l. HU 20944, from Bir-Hassana (Sinai, Egypt). Note large accessory saddle of first lateral lobe.

i, m. Barroisiceras neqarotense n. sp., from Nahal Neqarot, whorl sections;
- i. M 3741, note oval whorl of body chamber;
- m. M 3740.

The specimen from N. Qetura (M 4794. pl. 4, fig. 3) shows on its last preserved volution (see measurements) no tendency of widening of its very small umbilicus. It develops a tabulate venter with lowered keel much earlier than the typical form and has a broadly trapezoidal whorl section already at the beginning of the last preserved volution. It should perhaps be separated as a trapezoidal variety.

Relationship: The author has first (1958, p. 170) regarded this species as related to Reesidoceras gallicum Basse. But the absence of mediolateral tubercles at any stage and the different development of the ventral region, as well as the characteristics of the umbilicus do not support this identification. The involute shell with narrow umbilical pit and evenly converging flanks suggests Subbarroisiceras mahafalense Basse (1946) from the lowermost Coniacian of Madagascar. This form has, however, a characteristically dissected suture line, the keel in the body chamber remains raised, and the ventrolateral tubercles disappear with the widening of the venter; whereas in our specimens the widened venter becomes adaperturally subcarinate and the ventrolateral tubercles persist until near the end of the body chamber. Subbarroisiceras is monotypical and the range of its variability is unknown. Thus, it is unsafe to assume a closer connection of our species with Subbarroisiceras. It seems, however, probable that Barroisiceras neqarotense has developed from Subbarroisiceras and may be regarded as intermediate between Subbarroisiceras mahafalense Basse and Barroisiceras onilahyense Basse.

Specimen M 3738b (pl. 2, figs. 3-4 and text-fig. 4 c) from N. Neqarot is distinct by its compressed shell and the body chamber is distinct by its narrow fastigate venter with keel subdued and entire, but remaining sharp throughout.

Measurements:

		D	H	H_1	W	O
M 3738b	Ch 1/2 vol.	95	52(0,54)	24	29(0,30)	11(0,11)
	Phr.	62	31(0,50)		23(0,37)	6(0,11)

Barroisiceras onilahyense Basse 1947

Pl. 1, figs. 7 and 12; Pl. 4, figs. 1-2, text-fig. 4 d, g and j-l.

Material examined: One specimen with body chamber (HU 20948) from chalky and nodular limestone collected by Z. Gorfinkel south of Shen Ramon (coord. 13460/99700); three septate specimens (M 3748, M 3736, HU 20938) from chalky limestone at Nahal Neqarot (coord. 1336/9961); one specimen of 1/2 volution (HU 20941) from Zenifim and one septate specimen with small part of body chamber (HU 20944) from the Standard Oil Company collection, from SE of Bir Hassana (Sinai, Egypt).

Measurements:

		D	H	W	O
HU 20948	Ch 1/2 vol.	145	72(0,50)	56(0,38)	25(0,17)
	Phr.	116	60(0,51)	46(0,39)	20(0,17)
HU 20944	Phr.	108	59(0,54)	44(0,40)	18(0,16)
	At.	80	43(0,53)	33(0,41)	11(0,14)
M 3748	At.	83	44(0,53)	32(0,38)	14(0,17)
M 3736	At.	89	45(0,50)	32(0,35)	17(0,19)

Description: The specimens examined are of moderate size, the septate shell attaining more than 100 mm diameter; the outer whorl embraces 2/3 of the preceding; the umbilicus is moderately narrow, the maximum width of the whorl at the inner third of the flank; the fastigate ventral region has a serrated median keel, but becomes subtabulate on the last septate whorl and flatly rounded on the body chamber; there are 8-9 umbilical nodes elongated radially on the last whorl.

Remarks: The specimens are less involute than B. neqarotense n. sp., the umbilicus is shallower and wider, the maximum width of the whorl is at the inner third of the flank and not at the umbilical edge. The specimens from south of Shen Ramon (HU 20948) and Zenifim (HU 20941) agree with that figured by Basse (1947) on pl. I, fig. 1. The specimen from Bir Hassana (HU 20944) is similar to that figured by Basse (ibid.) on pl. I, fig. 2. The specimens from N. Neqarot agree with some other figures (ibid., pl. II, fig. 4 and pl. III, fig. 1) of this polymorphic species.

The specimen from Bir Hassana shows on the penultimate whorl a narrow umbilicus which widens rapidly on the last septate whorl and the flanks become subparallel. Its suture line shows marginally indented saddles and the first lateral lobe is subdivided by a high accessory saddle (text-fig. 4 l).

Very remarkable are the last suture lines of one specimen from N. Neqarot (HU 20938), which show a subprionidian simplification of the wide first lateral lobe (text-fig. 4 g).

Genus Harleites Reeside, 1932

Type species: Barroisiceras haberfellneri var. harlei de Grossouvre, 1894.

Reeside (1932) has included in this genus Harleites harlei (Gross.), which has a range of mediolateral tubercles disappearing on the last volution and Harleites castellense Reeside from the Coniacian of N. America, without mediolateral tubercles, but with pronounced and more persisting ornamentation.

Basse (1947), considers the presence or absence of a row of mediolateral tubercles to be of practical taxonomic importance for the distinction of various forms of the Barroisiceratinae (loc. cit. p. 119) and attaches to it a "primordial" significance for their distribution in various groups (ibid. p. 154). In this respect, the Barroisiceratinae would be exceptional, because in other groups of ammonites, as stated by Basse (ibid. p. 154), the presence of a mediolateral tubercle corresponds at most to a geographical race. On the other hand, within the Barroisiceratinae, the row of mediolateral tubercles is not homologous in various forms, as e. g. in Reesidoceras and Forresteria (ibid. p. 151). The grouping together of distinct forms on the basis of such a subordinate character must be, therefore, superficial.

Wright (1957, p. L432) and Reyment (1955, p. 67) treat Harleites as a subgenus of Forresteria. In the framework of this classification, Harleites castellense Reeside and Harleites bentori n. sp. should be excluded from the genus Harleites. It seems, however, that such obviously close forms should not be separated and that the distinction by mediolateral tubercles is only of specific importance.

It appears, therefore, warranted to separate Harleites as a distinct genus, characterized by a compressed, strongly involute shell, small umbilicus with short, steep umbilical wall, flattened flanks, narrow and high venter with prominent keel persisting

throughout growth, feeble ornamentation of flexuous ribs tending to disappear on the last volution; a row of mediolateral tubercles may be present in earlier whorls.

Harleites bentori n. sp.
Pl. 2, figs. 10-12, text-fig. 4 e, f, h.

Holotype: Pl. 2, fig. 10, M 3761a.
Derivation of name: In honour of Y. K. Bentor, who has collected the holotype.
Type locality: Nahal Neqarot, coord. 1288/9922.
Occurrence and age: White chalky limestone, Coniacian.
Diagnosis: A Harleites without umbilical and mediolateral nodes, numerous, low, flexuous ribs becoming feeble and tending to disappear on body chamber, ventrolateral nodes persisting to the end of body chamber.
Material examined: 20 specimens (M 3705 m-n, M 3761 a-c, M 3763 a-g, M 3764 a-d, HU 20934, HU 20935 a-c) and various fragments, from Nahal Neqarot, coord.: 1288/9922 and 1336/9961.
Measurements:

		D	H	H_1	W	O
M 3761a	Ch 2/5 vol.	108	62(0,57)	27	28(0,26)	10(0,09)
	Phr.	80	46(0,57)		22(0,27)	7(0,08)
M 3761b	Ch 1/2 vol.	148	80(0,55)		40(0,27)	14(0,10)
	Phr.	112	64(0,57)		34(0,30)	9(0,08)
M 3761c	Ch 1/4 vol.	120	64(0,53)		30(0,25)	12(0,10)
M 3763a	At.	101	57(0,57)	20	30(0,30)	9(0,09)
M 3763b	Ch 1/4 vol.	123	72(0,58)		36(0,29)	8,5(0,07)
M 3764a	Phr.	113	66(0,58)	28	28(0,25)	8(0,07)
M 3763g	Phr.	100	56(0,56)		23(0,23)	7(0,07)
M 3705m	Ch 1/4 vol.	134	76(0,57)		31(0,23)	11(0,08)
HU 20934	At.	88	51(0,58)	21	25(0,28)	7(0,08)
HU 20935b	Ch 1/4 vol.	138	75(0,54)		35(0,28)	10(0,07)
HU 20935c	Ch 1/2 vol.	186	96(0,52)	47	40(0,21)	15(0,08)
	Phr.	121	70(0,58)		33(0,27)	9(0,07)

Description: Shell of moderate to large size, attaining in some specimens about 200 mm diameter; compressed, strongly involute, the outer whorl embracing nearly the entire preceding volution. Umbilicus small (0,07-0,10 of d.) umbilical wall short, steep. Flanks flat, slightly curved. External region narrow, with high serrated keel; maximum width of whorl at the middle of the flank. Body chamber preserved to 1/2 volution.
Ornamentation: About 10 main radial ribs extending from umbilical margin. They are low, flexuous, narrow near umbilicus, and widen gradually externally. Two or three secondary ribs between the main ribs, some attain the main ribs at or near the umbilical margin, others near the middle of the flank. Ribs on body chamber mostly single, faint, tend to wane out and disappear generally on the adapertural part of body chamber. Ventrolateral tubercles about 30 per volution, persisting on body chamber.
Suture line with three lobes on flank, a fourth lobe begins on the umbilical margin. Four saddles on flank, bifid; the third saddle is often broad, tripartite.

Relationship: Harleites bentori n. sp. is distinct by its large size and by its ornamentation. It differs from H. harlei (Grossouvre) by the absence of umbilical and mediolateral tubercles and by more persistent ornamentation. It differs from H. castellense Reeside by the absence of umbilical nodes and by coarser ribbing.

? Harleites sp.
Pl. 3, figs. 1-2

Material examined: One specimen (M 3761 d) from Nahal Neqarot, coord. 1285/9922.

Measurements:

		D	H	W	O
M 3761d	Ch 1/4 vol.	112	60(0,54)	33(0,25)	16(0,14)
	Phr.	89	47(0,52)	27(0,30)	12(0,13)

Description: Shell of moderate size, involute, the outer whorl embracing about 2/3 of preceding volution. Umbilicus small, umbilical margin rounded, umbilical wall short, vertical. Flanks flat, subparallel; external region fastigate with prominent serrated keel, loosing serration, but persisting on body chamber; body chamber preserved more than 1/2 volution.

The septate shell has 8 umbilical and about 24 ventrolateral nodes. Slightly flexuous ribs bifurcate from the umbilical nodes or near the middle of the flank; the ornamentation persists on the earlier part of the body chamber; the umbilical nodes disappear at first and later the ribs; the ventrolateral nodes, however, persist nearly to the end. Suture line worn.

The specimen is distinct by its large body chamber, by the flat whorl, flexuous ribs, short and vertical umbilical wall, attenuation of ornamentation and by its proportions. It recalls Harleites, and seems also similar to Barroisiceras haberfellneri var. byzacenica Pervinquière. Reeside (1932) has included this latter form in the genus Harleites; but the umbilicus of var. byzacenica (and of our specimen) is much wider than in representatives of the genus Harleites and the ornamentation is much stronger. Basse (1947, p. 116) believes that var. byzacenica is near to "Tissotia" tunisiensis, but has dissected saddles and the lobes do not have prionidian character. The large body chamber of our specimen is indeed unusual in Barroisiceratinae.

Genus Forresteria Reeside, 1932.
Type species: Barroisiceras (Forresteria) forresteri Reeside, 1932

Forresteria cf. allaudi (B. L. T.)
Pl. 2, figs. 7-8

Acanthoceras (Prionotropis) allaudi Boule, Lemoine, Thevenin, 1907.
Synonymy: Basse, 1947, p. 128-9.

Material examined: One badly preserved specimen (HU 20947) found non in situ south of N. Neqarot.

Measurements:

		D	H	W	O
HU 20947	At.	56	24(0,48)	20(0,36)	16(0,28)

Description: Specimen of small size, flat flanks, flattened external region. Umbilical nodes feeble, about 12 per volution, mediolateral spines prominent, as numerous as the umbilical nodes, ventromarginal nodes twice as much, prominent. With age the mediolateral spines are coarsely inflated and approach the external margin. Weak ribs bifurcate from mediolateral spines.

The specimen is very near to, and possibly identical with, Forresteria allaudi (B. L. T.). It is most similar to the specimen from Cajamarca, Peru, described by Lisson (1908, p. 78, pl. 17).

Subfamily BUCHICERATINAE Hyatt, 1903
nom. transl. herein ex Buchiceratidae Hyatt, 1903.

Hyatt has included in the family Buchiceratidae the genera Buchiceras Hyatt, 1875 and Roemeroceras Hyatt, 1903. These ammonites from the Coniacian of Peru are characterized by a massive shell with flattened sides, tabulate venter with serrated keel at mature stage, but disappearing on body chamber; the umbilicus is moderately wide or widens with age; the whorl section is trapezoidal or squarish; ornamentation consists of umbilical and ventrolateral tubercles with branching ribs, directed anteriorly on the venter; the suture line is feebly denticulated, the saddles are bifid, serrated marginally, the ventral lobe deep, divided by a low, median saddle; the other lobes are usually narrow, the first lateral lobe irregularly bifid.

Relationship: By shape of whorl, ornamentation and keel, which is serrated at some stages, the Buchiceratinae are close to Barroisiceras. They differ from it by their squarish whorl, tabulate venter, rather flat sides, and smooth keel on early stages; the suture line is more simplified, less incised, the external lobe deeper. The Buchiceratinae differ from Tissotia by the deep external lobe, bifid and serrated saddles, and by the serrated keel. The Tissotiinae are highly involute forms, whereas the Buchiceratinae are less involute, having a much wider, open umbilicus and lower whorls. They differ from Pseudotissotia by the less incised suture line, narrow first lateral lobe and serrated keel. It is obvious that Buchiceratinae are nearest to Barrosiceras and are best classed in the vicinity of the Barroisiceratinae. The Buchiceratinae differ from the Barroisiceratinae by the less dissected suture, less vigorous ornamentation, and by the serration of the keel which appears later and disappears earlier.

Discussion: Hyatt (1903, p. 26), erecting the family Buchiceratidae, states that they are separable from the Tissotiidae by the first lateral saddles and their ventral lobes. The ventral lobes are entirely distinct from the broad ventrals of the Tissotiidae (ibid., p. 30). He believes (p. 27) that the development of Buchiceras is similar to that of the Peroniceratidae, but the keel tends to disappear; the faint serration on keel and other ornamentation suggests Barroisiceras, but the suture line and the absence of a third line of lateral tubercules, " are not favourable to this solution of affinities. " The suture

line of Buchiceras bilobatum, however, has (ibid., p. 29) the first lateral lobe funnel shaped, broad at the base, narrowing to a bifid termination and all saddles of Buchiceras and Roemeroceras are completely denticulated.

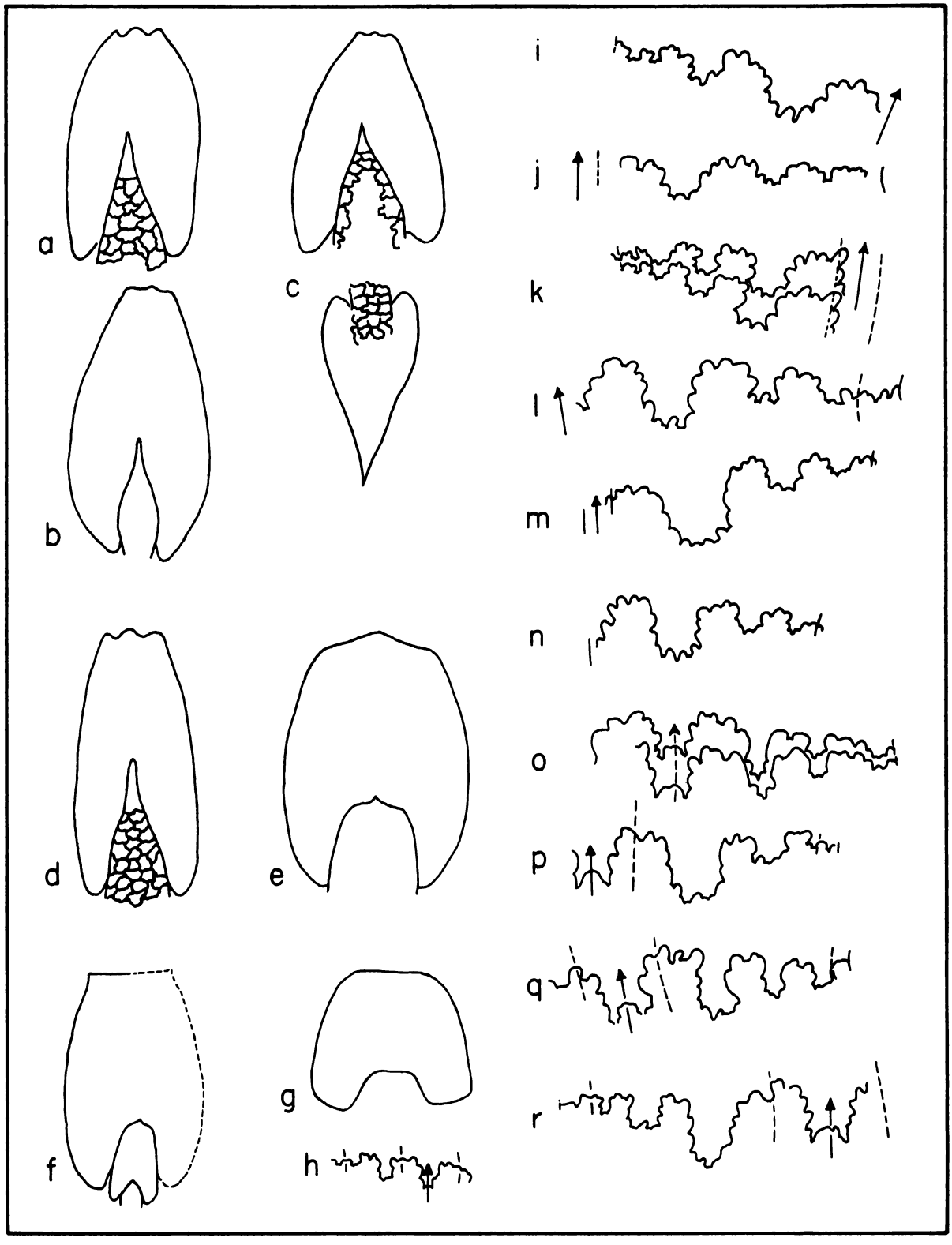
H. Douvillé (1890, p. 284) has pointed out that there is no analogy between the suture line of Buchiceras and Tissotia, all saddles being denticulated, the first saddle not bifurcate and — a most important characteristic — the lobes are angular, instead of rounded. He concludes that the comparison of the genus Buchiceras with the group ewaldi-tissoti appears to be unjustified. Douvillé maintains his opinion (1928, p. 18) that Buchiceras Hyatt was unwarrantedly regarded as Tissotia.

Lisson (1908, p. 59) states that the main difference between Buchiceras bilobatum and Roemeroceras consists in the suture line, which is more developed in Roemeroceras; nevertheless he proposes to unite both forms in one genus, Roemeroceras. The description of Roemeroceras subplanum (ibid. p. 59-61, pl. 7a) shows that in adult stages the section becomes subquadrate to elliptical, as distinguished from B. bilobatum, which develops a thick trapezoidal whorl in the adult stage.

Brueggen (1910, p. 728, fig. 9) figures suture lines of Buchiceras bilobatum with some saddles entire. However, serrated saddles seem to be the rule, the entire ones may perhaps be accidental or at least partly due to the state of preservation. This is supported by Pervinquière's description of "Tissotia" tunisiensis (Hyatt) (1907, p. 371) in which the median indentation of the saddles is sometimes obliterated by the slightest corrosion. This may be true also of the other marginal indentations. Brueggen states that the shape of the whorl of Buchiceras bilobatum is variable and all forms are connected by transitions. He believes, therefore, that all forms described by Hyatt as species of Buchiceras and Roemeroceras should be comprised in Buchiceras bilobatum.

Luethy (1918), following Brueggen, states that the greater or lesser inflation of the umbilical region or compression of the whorl cannot serve for the distinction of species of Buchiceras because there are many transitions. The separation of species by Hyatt is therefore, in his opinion, of no use and all species of Roemeroceras should be regarded as synonyms of Buchiceras bilobatum. This opinion is shared by Benavides-Càceres (1956, p. 482). But judging from the specimens of Buchiceras bilobatum figured by Brueggen, Luethy and Benavides-Càceres and from the measurements given by Luethy (ibid., p. 81) and Benavides-Càceres (loc. cit., pp. 481-2) they are readily distinguished from such forms as Roemeroceras syriaciforme Hyatt, Roemeroceras subplanum Hyatt or Roemeroceras tunisiense (Hyatt), as well as from Buchiceras bilobatum var. laeve Brueggen.

Hyatt (1903, p. 30) has first supposed that the type species of Roemeroceras represents an aged stage of Buchiceras bilobatum but "more acquaintance with these forms showed that they are not in the same generic group" (ibid and Roman 1938, p. 500). However, the distinction of Roemeroceras is based not only on the compression of the shell and subparallel whorl sides, but also on the different style of coiling and different characters of the umbilicus. The umbilicus in Buchiceras bilobatum is wider in the earlier stages and maintains a constantly regular increase in width throughout growth. With age (Hyatt, 1903, p. 28) the periumbilical region increases in width which makes the umbilicus very deep (Hyatt, 1903, p. 28; Douvillé, 1890, text-fig. 11). In Roemeroceras on the contrary, the earlier whorls are distinct from Buchiceras by narrower umbilicus, eccentrically widening with the age, the increase in width of the periumbilical region is less than in the middle of the whorl, the umbilical wall remains low and becomes oblique in the adult, the whorl section being, therefore, not trapezoidal, but much compressed with subparallel or rounded flanks. Hyatt attributes also much importance to the differences of the suture lines.



Text fig 5

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EXPLANATION OF TEXT-FIGURE 5

(All figures natural size)

a-d. Allotissotia galeppei (Pervinquière), from S. Har Arod, whorl sections;
- a. compressed form with rounded external region and subparallel sides. M 3752a;
- b. flat form with narrow external region and moderately inflated internal region, HU 20939b;
- c. strongly inflated galeate form, M 3754;
- d. compressed form, M 3752b.

e. Roemeroceras tunisiense tunisiense (Hyatt), typical form with rounded body chamber from south of Har Arod, coord. 1269/9907, M 3757.

f. Roemeroceras tunisiense laevis Perv. with flat ventral area, from Har Loz, M 3756h.

g-h. Buchiceras bilobatum Hyatt, section of outer whorl and suture line of inner whorl, from Nahal Karkom, M 3768b.

i-k. Allotissotia galeppei (Pervinqière), from S. of Har Arod, suture lines;
- i. HU 20940b;
- j. M 3751b;
- k. M 3752b.

l-n. Allotissotia galeppei (Perv.), from 10 kms south of Quseima (Sinai, Egypt), suture lines;
- l. M 3755b;
- m-n. HU 21443;
- m. last suture line;
- n. suture at the beginning of last volution.

o. Roemeroceras tunisiense tunisiense (Hyatt) from Har Loz, M 3756b.

p. Roemeroceras tunisiense constricta n. subsp., from Har Loz, M 3756a.

q. Roemeroceras tunisiense arrondata n. subsp. from Har Loz, M 3756c.

r. Roemeroceras tunisiense laevis Perv., from Har Loz, HU 20932.

Basse (1947, p. 158) recognized that "Tissotia tunisiensis" of North Africa represents a form analogous to Buchiceras bilobatum and regards it as an interesting form in full development (shape, suture line) like Barroisiceras, but differing from it by its more massive form, tabulate venter and smooth keel. Buchiceras bilabatum and the species of Roemeroceras of Hyatt and Lisson show (ibid., p. 155) a plasticity of suture comparable to Barroisiceras onilahyense, as well as to "Tissotia tunisiensis" of North Africa. Basse is inclined (p. 158 and p. 160) to regard all these forms as generically identical and nearly identical specifically.

Wright (1957, p. 424) puts Roemeroceras in synonymy of Buchiceras and classifies the latter in the Tissotiinae. Both, synonymy and classification, are, however, objectionable. To avoid confusion, the reinstatement of the genus Roemeroceras Hyatt is proposed.

Genus Buchiceras Hyatt 1875
Type species: Buchiceras bilobatum Hyatt, 1875.

Diagnosis: Buchiceratinae with deep umbilicus, high umbilical wall, greatest width of whorl in periumbilical region, whorl section subtrapezoidal to trapezoidal; suture line with two lobes on flank, external lobe as deep or deeper as first lateral lobe, subdivided by shallow median saddle.

Buchiceras bilobatum Hyatt [illegible].
Pl. 3, figs. 3-5, text-fig. 5 g-h.

Locality: N. slope of Nahal Karkom (Ubara), coord. 1288/9762.
Age: Coniacian.
Description: A rather evolute Buchiceras, the whorl embracing one half or less of preceding volution, umbilicus wide, whorl about as wide as high, depressed in the adult, whorl section trapezoidal, suture line with all elements angular and denticulated marginally.

The two specimens examined are from the northern slope of Nahal Karkom. One of them (M 3768a) is a nearly complete specimen with body chamber preserved to 1/2 volution but partly damaged flanks and corroded ventral area. The other specimen, M 3768b, with body chamber preserved to more than 1/4 volution, is highly worn; its incomplete penultimate volution was extracted by preparation (pl. 3, fig. 5).

Measurements:

		D	H	H_1	W	O
M 3768a	Ch 1/2 vol.	109	41(0,37)	23	36(0,33)	36(0,33)
	Phr.	82	35(0,41)		32(0,39)	24(0,29)
M 3768b	Ch 1/4 vol.	77	31(0,40)	19	39(0,50)	25(0,32)
	At.	42	19(0,45)		19(0,45)	12(0,28)

Remarks: The specimens differ somewhat from typical Buchiceras bilobatum Hyatt by looser coiling, the whorls embracing only 1/2 and later less than 1/2 of the preceding volution. The width of the umbilicus attains in the late adult one-third of the shell diameter. The umbilical margin is rounded, the umbilical wall high and steep. The maximum width of the whorl is in the periumbilical region, the flanks, relatively short and

slightly curved, converge from the periumbilical region externally. External area tabulate, slightly rounded with ventral shoulders angular, the median keel obliterated by corrosion, marked only by some locally preserved weak, spirally elongated, nodes. The proportions of whorl height and width: shell diameter decrease in the adult. Body chamber preserved to 1/2 volution.

Ornamentation consists of 8-9 strong umbilical nodes, which become weak in the later adult and disappear on body chamber. Low ribs bifurcate from the umbilical nodes, become single and wane out on body chamber. Ventrolateral nodes, about 20-22 per volution, small but well pronounced, persist longer than the ribs.

Suture line, preserved on the inner whorl of one specimen (text-fig. 5h), shows two lobes on the flank, the late adult has a third lobe on the umbilical margin. The external lobe is somewhat deeper than the first lateral lobe, its median saddle is very shallow. The external saddle, half on the ventral area, half on the flank, is wide, angular, marginally indented. The first lateral lobe is deep, narrow, bifid. The suture line of the other specimen, partly preserved, agrees with the suture line figured by Luethy (1918, p. 82, text-fig. 29).

The looser coiling, lower, slightly embracing and thick whorl and greater width of the umbilicus may justify the separation of our specimens as a depressed variety of Buchiceras bilobatum Hyatt.

Genus Roemeroceras Hyatt, 1903
Type species: Roemeroceras gabbi Hyatt, 1903.

Roemeroceras gabbi Hyatt is quite different from Buchiceras bilobatum by whorl shape, ornamentation and suture line (Lisson, 1925, p. 23-25, pl. I, figs. 1-2). The other species of Roemeroceras such as R. syriaciforme Hyatt, R. subplanum Hyatt, as well as R. tunisiense (Hyatt) are clearly distinct from Buchiceras by different type of coiling. The inner whorls are much more involute, deeply embracing the preceding volution, uncovering only one fourth of its flank. In the mature volutions, the umbilicus becomes wider, the whorl embracing 1/3 of the preceding one and in the last volution the umbilicus is widely eccentric. The form of the whorl is entirely different from that of B. Bilobatum. The suture line is more developed and has three lobes on the flank.

Roemeroceras tunisiense tunisiense (Hyatt), 1903
Pl. 3, fig. 6, text-fig. 5 e and o.

Buchiceras fourneli Peron, 1889, p. 9, pl. XVII, figs. 1-3 (non pl. XV).
Tissotia cf. fourneli Peron, 1897, p. 67, pl. XII, figs. 7-8, pl. XVIII, fig. 4.
Tissotia aff. T. fourneli Pervinquière, 1903, p. 114 and 125.
Pseudotissotia tunisiensis Hyatt, 1903, p. 36.
Tissotia tunisiensis Pervinquière, 1907, p. 369, pl. XXVI, figs. 1-4.

Hyatt has referred this species with a query to Pseudotissotia, but remarks that the sutures, especially the ventral lobe with its steep, denticulated sides and truncated siphonal saddle, are similar to the suture of the old stage of Roemeroceras syriaciforme and that the form and ornamentation also agree with this determination, but the keel is more prominent than is usual in this genus.

Pervinquière (1907, p. 371) remarks that the lobes of the North African species show the feeble denticulation usual in Tissotia, "sans branche latéro-externe bien individualisée" and includes it in Tissotia, although he is aware that this classification renders the definition of the genus Tissotia unclear (ibid.). The observation of Pervinquière that the keel of T. tunisiensis is feebly serrated in the mature whorls supports Hyatt's comparison of this species with Roemeroceras syriaciforme.

Basse (1947) correctly believes that "Tissotia tunisiensis" is near to Buchiceras bilobatum. Its generic position is undecided and it was repeatedly referred by Basse to Roemeroceras.

From the material of the Negev, some observations can be added to the detailed description of Pervinquière.

Material examined: 5 specimens (M 3756 b, d, e, f, g) from the southern slopes of Har Loz, coord. 1197/9863 where they occur in a chalky limestone underlying the Santonian Menuha Chalk. 3 specimens (M 3759 a, b, c) from south of Har Arod, coord. 1269/9907; 1 specimen M 3757 near the same locality.

Measurements:

		D	H	W	O
M 3756b	Ch 3/4 vol.	106	53(0,50)	36(0,34)	18(0,17)
	Ch 1/2 vol.	95	50(0,52)	33(0,34)	13(0,14)
	Ch 1/4 vol.	78	39(0,50)	30(0,38)	9(0,12)
M 3756d	Ch 1/2 vol.	85	42(0,49)	36(0,42)	14(0,16)
M 3756f	Ch 1/3 vol.	88	43(0,49)	30(0,34)	15(0,17)
M 3759a	Ch 1/2 vol.	112	51(0,45)	-	24(0,22)
	Ch 1/4 vol.	98	48(0,49)	28(0,28)	18(0,17)
M 3759c	Ch 1/2 vol.	83	42(0,50)	27(0,32)	16(0,19)

Description: The size is moderate, the height of whorl about 1/2 of shell diameter. The width of the whorl is variable, in M 3756d the body chamber is much inflated, but in all other respects there is no difference. The umbilicus increases with age and size and becomes scaphitoid, the umbilical wall is vertical, but becomes oblique in the late adult. The flanks are slightly curved, the ventrolateral margins angular. The external region is tabulate and becomes slightly rounded on later part of body chamber. The keel, serrated in the mature stage, is prominent, but disappears on body chamber. The whorl embraces 2/3 of the preceding volution.

The body chamber is preserved to 3/4 of a volution, it becomes rounded on its later part.

Ornamentation of about 6 strong umbilical tubercles, which weaken and disappear on body chamber; ventrolateral tubercles about 20 per volution, elongated spirally. Ribs bifurcating above umbilical tubercles, become single on body chamber; their continuations on the ventral region are directed anteriorly. In typical specimens ventrolateral tubercles and ribs persist on body chamber. Growth lines are flexuous.

Suture line very variable, having a deep ventral lobe with truncated, incised median saddle. The saddles are angular, bifid, more or less completely denticulated. The lobes, three on the flank, are narrow and bifid.

Roemeroceras tunisiense laevis (Pervinquière).
Pl. 3, figs. 7-9, text-fig. 5 f and r.

Tissotia tunisiensis var. laevis Pervinq., 1907, p. 371. pl. XXVI, fig. 4.
? Buchiceras bilobatum var. laeve Brueggen, 1910, p. 7, pl. XXVIII, fig. 2.
? Buchiceras bilobatum laeve Brueggen, Steinmann, 1929, p. 157, fig. 189.

Material examined: 6 specimens (M 3756h, HU 20932, 20933 a-b, 20942 a-b) from the SE slope of Har Loz, coord. 1197/9863; and one specimen (M 3758) from SW of Har Arod, coord. 123/990.

Measurements:

		D	H	W	O
M 3758	Ch 1/4 vol.	80	41(0,50)	26(0,32)	14(0,17)
HU 20932	Ch 1/2 vol.	132	61(0,46)	46(0,35)	30(0,22)
	Ch 1/4 vol.	112	54(0,48)	42(0,32)	25(0,22)
HU 20942b	Ch 2/3 vol.	115	50(0,43)	31(0,27)	24(0,21)
	Ch 1/4 vol.	94	48(0,51)	28(0,30)	16(0,17)

Description: Body chamber smooth; ornamentation, except ventrolateral tubercles disappears completely. Flexuous growth lines are pronounced. Venter flat or flatly rounded, bordered by ridge-like ventrolateral margins with prominent ventrolateral tubercles.

This form, regarded as a subspecies, attains a large size. A fragment of the penultimate volution, extracted from specimen HU 20933-a, shows a tabulate, but narrow venter. Ornamentation consisting of strong umbilical tubercles and rounded ribs, of a prominent, serrated median keel of the mature shell (pl. 3, fig. 7) and of the orad continuation of ribs on ventral area.

The specimen figured by Brueggen and Steinmann as Buchiceras bilobatum var. laeve is a Roemeroceras; it does not posses the ventrolateral ridges of R. tunisiense laevis (Pervinq.) and by its whorl section it seems to be a smooth variety of R. syriaciforme Hyatt.

Roemeroceras tunisense constricta n. subsp.
Pl. 3, figs. 10-11, text-fig. 5 p.

Holotype: Pl. 3, figs. 10-11, text-fig. 5 p. M 3756a.

Derivation of name: From the strong constrictions of the shell.

Locality: Southern slopes of Har Loz.

Occurrence and age: Chalky limestone underlying Menuha Chalk. Upper Coniacian.

Material examined: One specimen, M 3756a from the SE slope of Har Loz, coord. 1197/9863.

Measurements:

		D	H	H_1	W	O
M 3756a	Ch 2/3 vol.	140	62(0,44)	27	40(0,28)	35(0,25)
	Ch 1/2 vol.	130	59(0,45)		39(0,30)	31(0,23)

Description: Heavy, massive shell of large size, characterized by periodical, sudden jumps of growth, at intervals of about 1/3 of a volution. More or less pronounced constrictions are usual in most shells of Roemeroceras tunisiense and can be recognized also on the specimen figured by Pervinquiere (1907, pl. XXVI, fig. 2 a). In our specimen, the sudden acceleration of growth is marked by a strong constriction followed by a flared rib. Other peculiar features are the irregular increase of the umbilicus, the strongly eccentric coiling of the last whorl which uncovers at its beginning 1/4 and at its end 3/4 of the preceding volution, and the suture line with broad lobes, as against the usually narrow lobes of Roemeroceras tunisiense. The body chamber is preserved to 3/4 volution. The ornamentation, except umbilical nodes, persists on the body chamber but disappears on its adapertural part.

Roemeroceras tunisiense arrondata n. subsp.
Pl. 3, figs: 12-13, text-fig. 5 q.

Holotype: Pl. 3, figs. 12-13, text-fig. 5 q. M 3756c.
Derivation of name: From the rounded form of the shell.
Type locality: Southern slope of Har Loz.
Occurrence and age: Chalky limestone underlying Menuha Chalk, Upper Coniacian.
Material examined: The figured specimen (M 3756c) and a body chamber fragment of 1/4 volution (M 3756), both from the SE slope of Har Loz, coord. 1197/9863.
Measurements:

		D	H	W	O
M 3756c	Ch 1/2 vol.	126	58(0,46)	39(0,31)	29(0,23)
	Ch 1/4 vol.	104	50(0,48)	35(0,33)	21(0,20)

Description: The body chamber of 3/4 volution is smooth like subsp. laevis. The shell is distinct by the neatly rounded venter, fine ornamentation and fine, dense growth lines. The ventrolateral nodes below the curved margin become on the body chamber obliquely elongated with the orally directed ribs and growth lines.

CONCLUSIONS

The Coniacian ammonites of the Negev show evolutionary tendencies characteristic of this group. One of them is the tendency to simplification of the suture line, encountered in Coilopoceras zihoricum n. sp., Roemeroceras tunisiense (Hyatt), Allotissotia galeppei (Perv.), in some specimens of Barroisiceras and in Harbeites bentori n. sp.

The importance of this character was recognized by Peron and was extensively discussed in the literature. Hyatt (1903, p. 42, 43) has repeatedly emphasized that definitions based upon the suture cannot be accepted when not correlatable with external characters. A similar view is put forward by Douvillé (1911, p. 289) who believes that the significance of the tendency to a ceratitoid type is not a character of the group, but only a character of evolution; it is encountered on the extremities of the branches and cannot characterize genera. Consequently it cannot be considered as a basis for the establishment of a natural family (ibid., p. 302).

On the other hand, it should not be overlooked that individuals of these forms show often the opposite tendency, viz. to complication of the suture by additional accessory

elements and frilling, especially in the external parts of the suture. The material discussed here consists of internal molds in which the sutures are generally not perfectly preserved and are certainly far from their original aspect. Many differences in the dissection of the suture may be due to the state of preservation, especially to corrosion or other dammage of the fine edges of the chamber walls. The variability of the suture in the same individual or on opposite sides of the individual in our material suggests two opposite tendencies.

Similarly, a great variability of the whorl shape and dimension is found in all species, when a larger number of specimens is available; but the general pattern of the whorl section, the style of coiling, and the characters of the umbilicus appear to be essentially stable. Other variations which reveal an evolutionary tendency are the old age changes, like widening of the umbilicus, rounding or flattening of the external region and flanks. Such changes are extremely variable in all species studied.

Unfortunately, ontogenetic stages could not be recognized, owing to the state of preservation of the material. However, the different evolution of the whorl sections in Buchiceras and Roemeroceras or the different evolution of the ornamentation in the Barroisiceratinae and Buchiceratinae are stable characters whereby these forms are differentiated.

The high, lamelliform keel of Coilopoceras zihoricum n. sp. and Allotissotia galeppei (Pervinq.) appears to be an evolutionary character parallel to that of their allies Hoplitoides and Heterotissotia. By loss of the carina a tabulate (bi-or tricarinate) siphonal area appears which indicates that these oxycones are cryptotabulate and very intimately connected with their tabulate allies. Thus, the derivation of a tabulate shell from an oxycone seems not less possible than the derivation of an oxycone from a tabulate form. These parallel forms may have a common, either tabulate or monocarinate ancestor of the Pseudotissotiinae. Such oxycones, usually regarded as end-forms or dead-end offshoots (Arkell, 1950, p. 356) show often, as in the case of Allotissotia galeppei, a great variability and plasticity of evolutionary characters.

These considerations are important for the classification of the Tissotiidae. Peron (1897, p. 74) believes that Hemitissotia is a transition form from Pseudotissotia to true Tissotia. Hyatt, however, insists (1903, p. 38) that Hemitissotia is more intimately related to Choffaticeras than to Tissotia and other genera which have similar forms, but sutures with smooth saddles. They are, in his opinion, simply parallel and analogous to some of the Tissotiidae, but actually in the genetic line of Choffaticeras and cannot be placed anywhere in the genetic lineage between Pseudotissotia and Subtissotia on account of the absence of channels and ridges on either side of the keel. All their characters accord best with the view that they are distinct descendants of Choffaticeras (ibid., p. 39).

Hyatt's view is supported by Pervinquière (1907, p. 361). The photograph of the type specimen of Hemitissotia morreni (Coq.) shows that the figure of Coquand, although restored, reproduces well the form of the ammonite, which has essentially the same suture as var. coquandi of Peron and that the drawing of Coquand is not at all so fantastic as assumed by Peron. The disposition of the suture lines, particularly the width and dentation of the first lateral lobe are not more stable than the general form of Hemitissotia morreni and cannot serve for distinction of species. H. cazini appears, therefore, to be a flat variety of the same species (viz. morreni). Pervinquière concludes that a close relationship of parentage unites Hemitissotia with Pseudotissotia, especially with representatives of the subgenus Choffaticeras and that their relationship is even closer than assumed by Peron. It would be difficult to distinguish the two genera, but the representatives of the genus Hemitissotia have never lateral carinae or ranges of tubercles capable

to substitute these keels and cannot be, therefore, united with Choffaticeras (ibid., p.356, 358).

Pervinquière has consequently included the species massipiana in Choffaticeras, but has connected his species galeppei with Hemitissotia, disregarding his own statement that by its form and angular umbilicus it is more close to Choffaticeras luciae than to Hemitissotia. It is obvious that Pervinquière has only provisionally included his North African species in Hemitissotia until a thorough revision of this genus could be made (ibid., p. 350, 351).

Douvillé (1911, p. 312) concludes that the simplification of the sutures ensues shortly and progressively, so that it is often difficult to use this character as a base for a clear separation; these passage forms correspond to Hemitissotia Peron, a heterogenous group, and represent only a stage of evolution which can be encountered in different branches. Douvillé proposes, therefore, to restrict this genus to the best characterized group of Hemitissotia morreni.

The examination of Allotissotia galeppei from Israel confirms the suggestion of Douvillé and shows that by inclusion of this species in Hemitissotia the delimitation of the genus becomes unclear. It seems thus reasonable to separate galeppei as a distinct genus for which the generic name Allotissotia nov. gen. is proposed. Type species: Hemitissotia galeppei Perv., 1907. Diagnosis: smooth oxycone, eccentrically coiled, with flanks convex, venter narrow with high lamelliform keel and deeply seated siphuncle, umbilicus with sharp overhanging edge; suture with saddles bifide and weakly incised marginally, first lateral lobe, irregularly bifid to subprionidian.

Hemitissotia ceadouroensis Choffat, 1898 is probably an Allotissotia; it is distinct by its narrow, nearly closed umbilicus.

Allotissotia is externally different from Hemitissotia Peron by the complete absence of ornamentation. Hemitissotia is distinguished by regular coiling, blunt ventral edge, rounded not overhanging umbilical edge and simpler suture line.

Reyment considers that Tissotia is derived from Choffaticeras and describes (1955, p. 72, pl. XVI, fig. 2) an intermediate form, "Choffaticeras" sp., with small umbilicus and fastigate venter, which has in the inner whorls three keels, clavate ventrolateral tubercles taking the place of the ventrolateral keels.

It is now admitted that the subfamily Tissotiinae may comprise several offshoots of different members of Pseudotissotiinae, but relationships are not yet certain (Wright, 1957, pl. L 424). There cannot be any doubt that Hemitissotia and Heterotissotia do not belong to the same genetic lineage as Tissotia. It seems, therefore, justified to separate the forms which are more directly connected with Choffaticeras (Leoniceras) as a subfamily, HEMITISSOTIINAE comprising the genera: Hemitissotia Peron, Plesiotissotia Peron, Heterotissotia Peron, and Allotissotia n. gen. These genera are probably parallel developments or — according to Wright (1952, p. 213) — several strands of different representatives of Choffaticeras (Leoniceras), but so intimately connected by morphological and sutural characters, that they can be regarded as a well defined, natural group, clearly distinct from both the Pseudotissotiinae and Tissotiinae.

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EXPLANATION OF PLATE 1

Unless otherwise indicated all figures reduced to 2/3 of natural size. All photos on this and the following plates were taken by M. Raab (GSI Paleontology Div.).

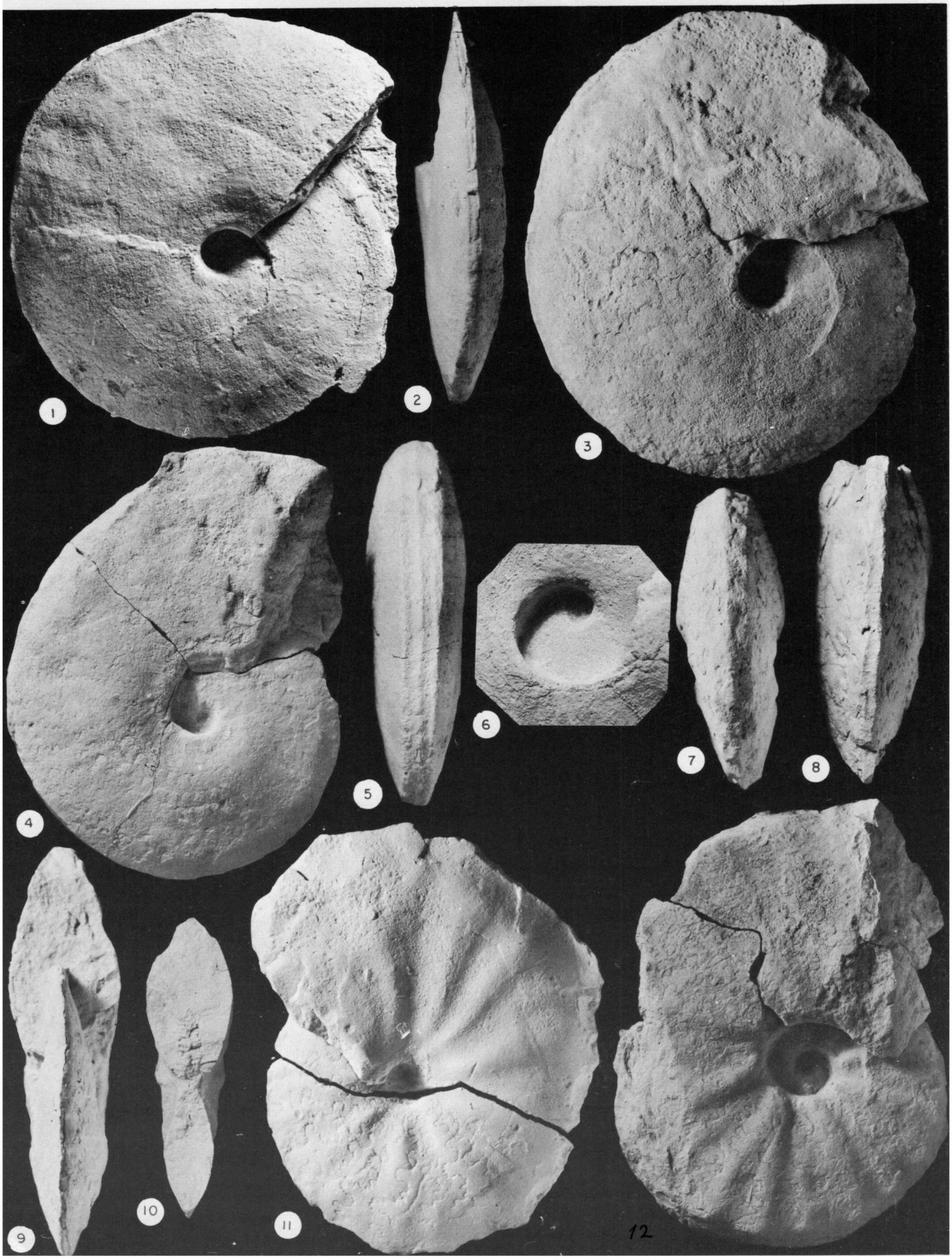
Figs:

1-6. Allotissotia galeppei (Pervinquière)
1-2. Very flat form. From southeast of Har Arod, M-3705 b; side and ventral views, showing part of lamelliform median keel on the beginning of the volution and narrow, tricarinate siphonal area where the median keel is broken away.
3. Inflated form. From 10 kms south of Quseima (Sinai, Egypt), M 3755 b: side view showing deep umbilicus with strongly overhanging sharp umbilical edge.
4-5. Flat form. From southeast of Har Arod, M 3752b; side and ventral views showing flat umbilicus, eccentric coiling, rounded external region and tabulate tricarinate siphonal area.
6. Periumbilical region of strongly inflated form, from 10 kms south of Quseima (Sinai, Egypt), M 3755a, showing deep eccentric umbilicus with strongly reclined wall and sharp edge.

7. Barroisiceras onilahyense Basse. From the south side of Nahal Neqarot, HU 20935, ventral view.

8-11. Coilopoceras zihoricum n. sp.
8. Part of giant specimen, from Nahal Zihor, coord. 1433/9586, HU 20925.♀; ventral view showing narrow, bicarinate siphonal area. Reduced 1/2 of natural size.
9. Flat form. From the upper reaches of N. Zihor, coord. 1317/9535, HU 20929a; apertural view of septate shell.
10-11. Holotype, from N. Zihor, coord. 1433/9586, HU 20925a; frontal view of phragmocone and side view of body chamber.

12. Barroisiceras onilahyense Basse. From the southern side of Nahal Neqarot, coord. 1336/9961, M 3748; side view.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EXPLANATION OF PLATE 2

(Unless otherwise indicated all figures reduced to 2/3 of natural size).

Figs:

1-6. Barroisiceras neqarotense n. sp., from Nahal Neqarot, coord. 1285/9922.
1-2. Paratype, M 3746, side and apertural views.
3-4. Compressed form. M 3738b, side view with body chamber and ventral view of body chamber.
5-6. Holotype, M 3735, side view with body chamber and ventral view of early part of body chamber.

7-8. Forresteria cf. allaudi (BLT), from the southern side of Nahal Neqarot, HU 20947, ventral and side views. Natural size.

9. Proplacenticeras sp., fragment from Har Hemda, coord. 1565/9675; HU 20937; side view showing fine riblets on the middle of the flank. Natural size.

10-12. Harleites bentori n. sp., from N. Neqarot, coord. 1285/9922.
10. Holotype, M 3761a, side view.
11-12. Paratypes. 11. HU 20935c, side view. 12. HU 20934, apertural view.


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EXPLANATION OF PLATE 3

(Unless otherwise indicated all figures reduced to 2/3 of natural size).

Figs:

1-2. ? Harleites, sp. from Nahal Neqarot, coord. 1285/9922; M 3761d; apertural view of phragmocone and side view with body chamber.

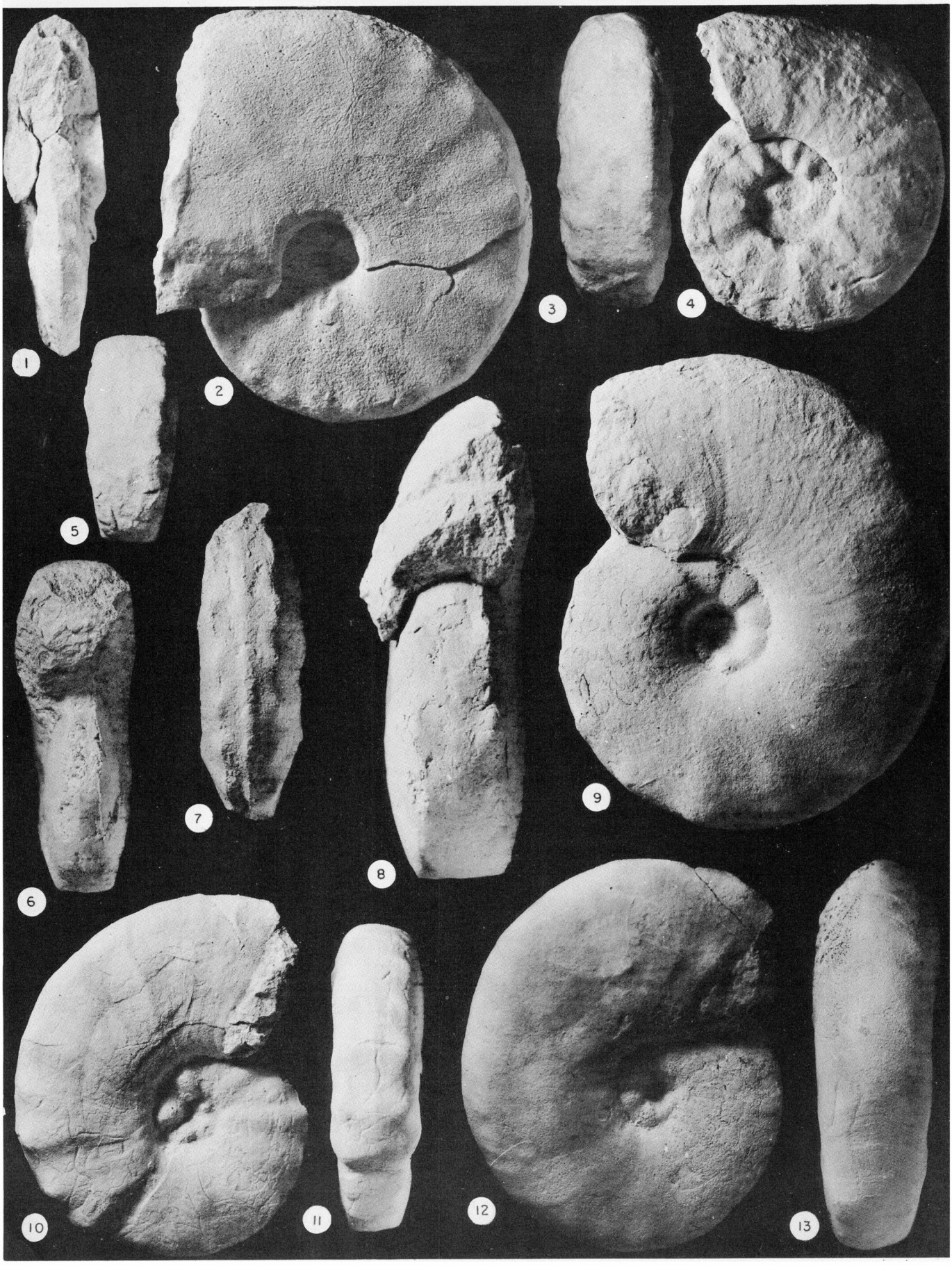
3-5. Buchiceras bilobatum Hyatt, from Nahal Karkom, coord. 1288/9762.
3-4. M 3768a; ventral and side views of phragmocone.
5. Inner whorl of M 3768b, ventral view, Natural size.

6. Roemeroceras tunisiense tunisiense (Hyatt). From the southeastern slope of Har Loz; cord. 1197/1863. Apertural view of typical specimen, M 3756b.

7-9. Roemeroceras tunisiense laevis Pervinquière:
7. inner whorl of HU 20933a; ventral view.
8-9. HU 20932, apertural and side views.

10-11. R. tunisiense constricta n. subsp.; 3756a; side and ventral views.

12-13. R. tunisiense arrondata n. subsp.; M 3756c; side and ventral views.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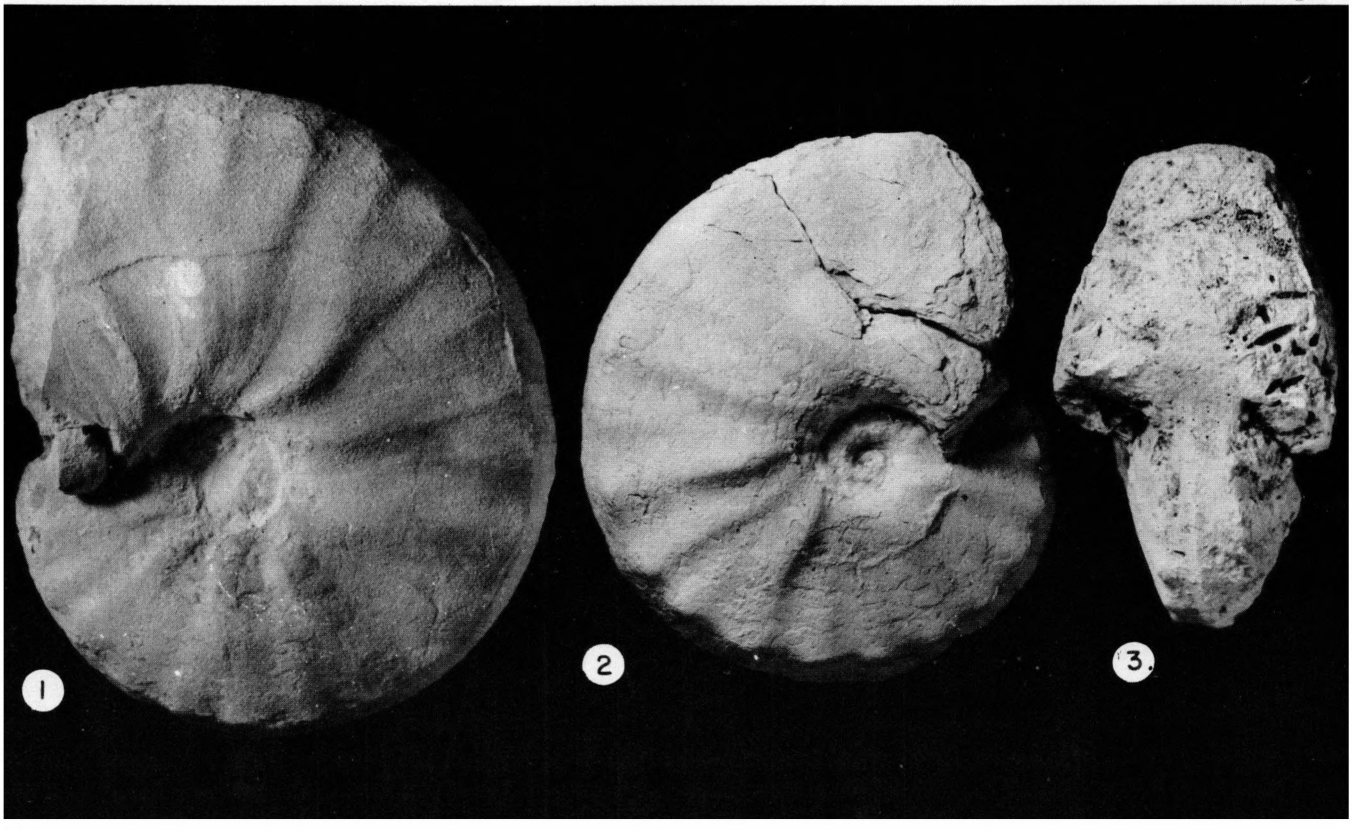
EXPLANATION OF PLATE 4

Figs:

1-2. Barroisiceras onilahyense Basse, sideviews, × 2/3;
1. from south of Shen Ramon, HU 20948;
2. from Bir Hassana (Sinai, Egypt), HU 20944.

3. Barroisiceras neqarotense n. sp., trapezoidal form, from Nahal Qetura, M 4794, apertural view, natural size.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אמוניטים של קוניאסיון בנגב

א. פרנס

המכון הגיאולוגי והאוניברסיטה העברית, ירושלים

אמוניטים מגיל קוניאסיון מצויים בנגב, באזור שבין הר צניפים ובין המדרונות הדרומיים של רמון. מתוארות 15 צורות השייכות לסוגים Proplacenticeras, Coilopoceras, Hemitissotia, Barroisiceras, Harleites, Forresteria, Buchiceras, Roemeroceras. בצורות המתוארות — שלשה מינים חדשים ושני תת-מינים חדשים.

מתוך ברור הצורה Hemitissotia galeppei Perv. נסתבר, שיש להפרידה מהסוג Hemitissotia ולקבעה בסוג מיוחד בשם Allotissotia n. gen. שיכלל בתת משפחה HEMITISSOTIINAE יחד עם הסוגים Hemitissotia, Plesiotissotia, Heterotissotia.

נבחן המעמד הטקסונומי של הסוג Harleites. מוצע להחזיר ולקיים את הסוג Roemeroceras Hyatt. שבוטל על ידי מחברים קודמים ולכלול אותו יחד עם Buchiceras בתת-משפחה BUCHICERATINAE (במקום Buchiceratidae Hyatt) ועל פי קירבתם היתרה ל Barroisiceras לכוללם במשפחה COLLIGNONICERATIDAE.

ERRATA

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27	3	Oded	Arod
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	12	"	"
30	14	"	"
31	8	"	"
34	8	slowly	shortly
	21	lobe irregularly	lobe, irregularly
38	6	Oded	Arod
	10	"	"

מדינת ישראל

משרד הפתוח
המכון הגיאולוגי

בולטין מס׳ 39

אמוניטים של קוניאסיון בנגב (דרום ישראל)

א. פרנס
המכון הגיאולוגי, המחלקה לפליאונטולוגיה והאוניברסיטה העברית,
מחלקה לגיאולוגיה

י ר ו ש ל י ם
דצמבר, 1964