

Acompsoceras inconstans zone, a lower Cenomanian marker horizon in Trans-Pecos Texas, U.S.A.

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With 4 figures in the text

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Abstract: A temporally and geographically restricted fauna from low in the Ojinaga Formation in the southern Quitman Mountains (Hudspeth County, Trans-Pecos Texas) belongs to the *Acompsoceras inconstans* zone that is correlated with the upper lower Cenomanian *Mantelliceras dixonii* zone of northwestern Europe, providing the first direct intercontinental link at this level in the Cenomanian. *Moremanoceras bravoense* n. sp. and *Ojinagiceras ojinagaense* n. g. n. sp. are described.

Zusammenfassung: Eine zeitlich und geographisch beschränkte Ammonitenfauna aus dem unteren Teil der Ojinaga-Formation der südlichen Quitman-Mountains (Hudspeth County, Trans-Pecos Texas) gehört zur *Acompsoceras-inconstans*-Zone. Diese wird mit der *Mantelliceras-dixonii*-Zone (oberes Untercenoman) von Nordwest-Europa korreliert. Dadurch ergibt sich die erste direkte interkontinentale Korrelationsmöglichkeit in diesem Abschnitt des Cenomans. *Moremanoceras bravoense* n. sp. und *Ojinagiceras ojinagaense* n. g. n. sp. werden beschrieben.

Introduction

POWELL (1963) described a sparse ammonite fauna of *Euhystrihoceras adkinsi* POWELL, 1963, *Pseudacompsoceras bifurcatum* POWELL, 1963, and *Desmoceras (Pseudonbligella) elgini* YOUNG, 1958 from what he referred to as his bed A, a "thin petroliferous calcarenite and oolite" within the lower 23 m (75 feet) of the Ojinaga Formation in the southeastern foothills of the Quitman Mountains in Hudspeth County, Texas (Fig. 1). During the course of fieldwork in this area, we independently sampled this same horizon with the assistance of our colleagues J. M. HANCOCK (W. J. K.) and S. C. HOOK (W. A. C.) in 1973 and 1979, respectively, during general surveys of the Cenomanian-Turonian stratigraphy of this part of Trans-Pecos Texas. Other collections from the base of the Chispa Summit

Formation (a lateral equivalent of the Ojinaga) at its type locality at Chispa Summit some 40 km (25 miles) to the northeast (KENNEDY, COBBAN, HANCOCK & HOOK, in press) included large fragments of *Acompsoceras* species, while revision of the northwest European representatives of this genus (WRIGHT & KENNEDY, 1987) revealed the importance of the fauna of POWELLS's bed A for intercontinental correlation of the US Western Interior Cenomanian.

We here recognise, for the first time, an *Acompsoceras inconstans* zone within the lower Cenomanian of the southern United States. It lies between the *Budai-ceras hyatti* zone below and the *Forbesiceras brundrettei* zone above of the sequence outlined by YOUNG & POWELL (1987), and YOUNG (1979, 1986).

Stratigraphic details

The present collections come from the east side of Mule Canyon, 0.85 km (2800 feet) N65°W of Love Triangulation Station, Eagle Mountains SW 7½ minute quadrangle, Hudspeth County, Texas (USGS Mesozoic locality D10757) in a 0.23 m bed of friable, sooty-weathering petroliferous limestone. In thin section this is revealed to be microspar with scattered bioclasts, including calcispheres.

Ammonites are abundant as moulds or with calcite-replaced shell, common-

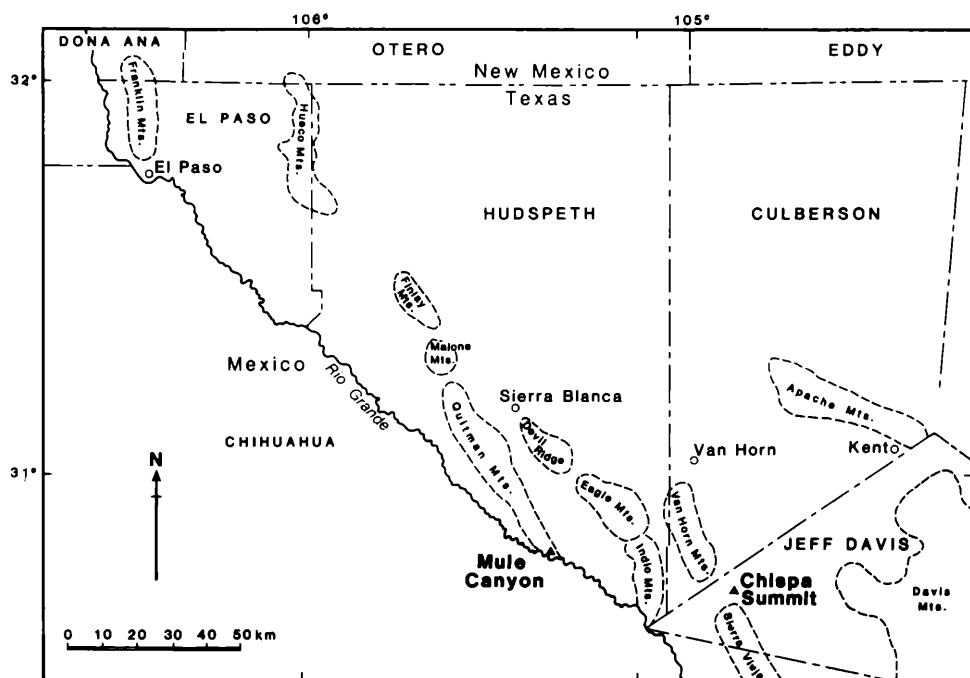


Fig. 1. Sketch map showing localities in Trans-Pecos Texas mentioned in the text.

ly infilled with spar. *Moremanoceras bravoense* n.sp., *Euhystrihoceras adkinsi* POWELL, 1963 and *Ojinagiceras ojinagaense* n.g. et n.sp. are common, with rarer *Stoliczkaia (Lamnayella) chancellori* WRIGHT & KENNEDY, 1984, *Acompsoceras inconstans* (SCHLÜTER, 1871), *Hypoturrilites* cf. *gravesianus* (D'ORBIGNY, 1842) and *Inoceramus* aff. *arvanus* STEPHENSON, 1953.

This fauna occurs 9.2 m (30 feet) above the top of the Buda Limestone. The top surface of the Buda includes moulds of *Mantelliceras* species, and elsewhere in the region it yields other elements of the lower Cenomanian *Budaiceras hyatti* zone. The overlying shales are rather barren in Mule Canyon, but *Ostrea beloiti* LOGAN, 1898, occurs at USGS Mesozoic locality D10758, 50 m to the northwest. As COBBAN & HOOK (1980) discuss, this species ranges from the middle Cenomanian *Conlinoceras tarrantense* zone to the upper Cenomanian *Dunveganoce- ras pondi* zone in the Western Interior.

The *Acompsoceras inconstans* zone is also represented at the base of the Chispa Summit Formation at the type locality in Jeff Davis County (KENNEDY et al., in press). A large fragment of *Acompsoceras* cf. *inconstans* (USNM 419931) was found at USGS Mesozoic locality D10889, and other fragments (USNM 419932, 419933) that may be *Acompsoceras renevieri* (SHARPE, 1857) were found at USGS locality D11181, all in the vicinity of Chispa Summit. This sparse assemblage is followed by limestone beds 2.1 - 3.9 m above the top of the Buda that yield a diverse fauna of the *Forbesiceras brundrettei* zone consisting of *Moremanoceras elgini* (YOUNG, 1958), *Acompsoceras* cf. *renevieri*, *Borissiakoceras?* sp., *Ostlingoceras davisense* YOUNG, 1958, *Mariella* cf. *cenomanensis* (SCHLÜTER, 1876), *Hypoturrilites youngi* CLARK, 1965 and *Inoceramus* aff. *arvanus* STEPHENSON, 1953.

Age of the *Acompsoceras inconstans* zone

The *A. inconstans* zone is certainly older than the *F. brundrettei* zone. The latter yields species of *Ostlingoceras* and *Mariella* that never range above the lower Cenomanian in Western Europe, together with *Hypoturrilites*, which is usually restricted to the lower Cenomanian, although it has been rarely reported from the middle and upper Cenomanian (KENNEDY, 1971; KLINGER & KENNEDY, 1978; KENNEDY & JUIGNET, 1983; ATABEKIAN, 1985). There are no undoubted middle Cenomanian elements in the fauna, and we regard the *brundrettei* zone as lower Cenomanian. Of those species present in the *inconstans* zone, the index species is, where precisely dated, restricted to the upper lower Cenomanian *Mantelliceras dixoni* zone of WRIGHT, KENNEDY & HANCOCK (in WRIGHT & KENNEDY, 1984) and others in England and France. *Stoliczkaia (Lamnayella) chancellori* was known from the holotype only (WRIGHT & KENNEDY, 1984, p.78, pl.10, fig. 11; text-fig. 11E), from either the upper, *M. saxbii* subzone of the *M. mantelli* zone or the *M. dixoni* zone in Devon. *Moremanoceras bravoense* sp. nov. and *Ojinagiceras ojinagaense* gen. et sp. nov. are endemics, whereas *Hypoturrilites gravesianus* ranges throughout the lower Cenomanian, and perhaps

higher. *Euhystriocheras adkinsi* is known only from Trans-Pecos Texas; the genus seems to be restricted to the lower half of the lower Cenomanian elsewhere (KENNEDY & WRIGHT, 1981, p.433; WRIGHT & KENNEDY, 1984, p.75). The *A. inconstans* zone is undoubtedly early Cenomanian; all the evidence points to it being equivalent to some or all of the upper lower Cenomanian *Mantelliceras dixonii* zone in Northwest Europe.

Repositories of specimens

OUM: Oxford University Museum

PIB: Palaeontological Institute, Bonn University

TMM: Texas Memorial Museum, Austin

USNM: National Museum of Natural History, Washington DC.

BMNH: British Museum (Natural History), London.

Systematic Palaeontology

Order Ammonoidea ZITTEL, 1884

Suborder Ammonitina HYATT, 1889

Superfamily Desmocerotaceae ZITTEL, 1895

Family Desmoceratidae ZITTEL, 1895

Subfamily Desmoceratinae ZITTEL, 1895

Genus *Moremanoceras* COBBAN, 1972

Type species: *Tragodesmoceras scotti* MOREMAN, 1942, p. 208, pl. 33, fig. 8; text-fig. 2d; by original designation.

DISCUSSION: KENNEDY, COBBAN & HOOK (1988) give reasons why *Moremanoceras* should be afforded full generic status, rather than be treated as a subgenus of *Desmoceras* ZITTEL, 1884. They also refer *Desmoceras* (*Pseudouhligella*) *elgini* YOUNG, 1958 (p.292, pl. 39, figs. 4-20, 24, 25, 30, 31; text-figs. 1a-e) to the genus. We here describe as *Moremanoceras bravoense* sp. nov. the oldest member of this endemic Western Interior lineage known to date.

Moremanoceras bravoense n. sp.

Fig. 2A-D

1963 *Desmoceras* (*Pseudouhligella*) *elgini*. — YOUNG; POWELL, p. 310, 314, non pl. 31, figs. 13-16.

Derivation of name: From the Rio Bravo (Rio Grande).

Types: Holotype is USNM 420322, paratypes USNM 420323 to 420325, from POWELL's Bed A, Ojinaga Formation, lower Cenomanian *Acompsoceras inconstans* zone at USGS Mesozoic locality D10757.

Fig. 2. A-D, *Moremanoceras bravoense* n.sp. A, paratype USNM 420323; B, paratype USNM 420324; C, D, holotype USNM 420322; E-G, J, N, *Ojinagiceras ojinagaense* n.g. n.sp.; E, G, holotype USNM 420326; F, paratype USNM 420328; J, paratype USNM 420327; N, paratype USNM 420329; H, I, M, *Euhystriocheras adkinsi* POWELL, 1963; H, USNM 420333; I, USNM 420336; M, USNM 420331; K, L, *Hypoturrilites* cf. *gravesianus* (D'ORBIGNY, 1842), USNM 420338; O, P, *Stoliczkaia* (*Lamnayella*) *chancellori* WRIGHT & KENNEDY, 1984; O, USNM 420334; P, USNM 420335. All from bed A of POWELL in Mule Canyon. A-C, F-J, L, N are x2; E, G, K, M, O, P are x 1.

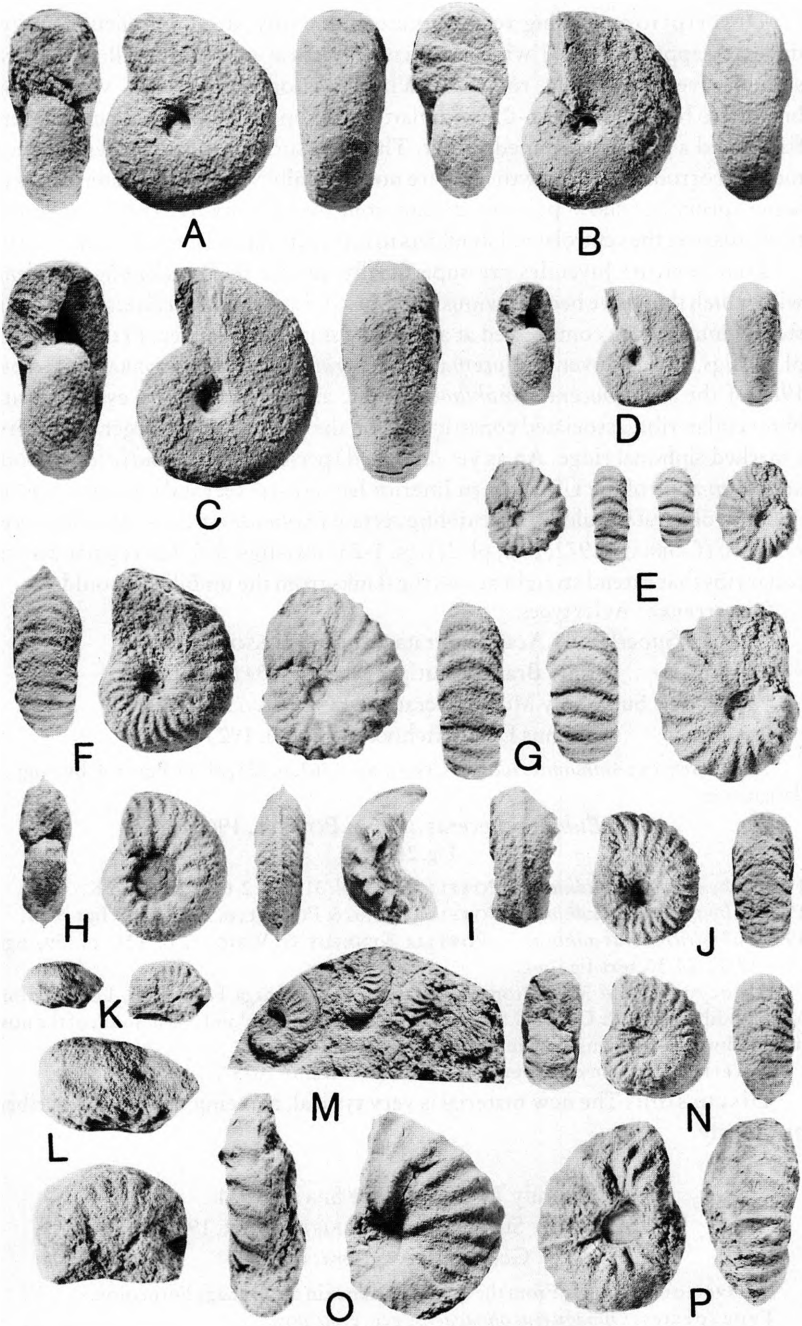


Fig. 2 (Legend see p. 136)

Description: Coiling very involute with a tiny, deep umbilicus (10% of diameter approximately) with a flattened, vertical umbilical wall. Umbilical shoulder very narrowly rounded. Whorl section compressed, with whorl breadth to height ratio 0.86-0.9 with flattened subparallel to slightly convergent flanks and a broadly rounded venter. The shell surface of most juvenile specimens is corroded, and growth lines are not generally visible. The outer flanks of some specimens show periodic distant concave prorsiradiate ribs that sweep forwards over the ventrolateral shoulders to form a thickened linguoid ventral peak.

Discussion: Juveniles are superficially similar to *Pseudoublighella elgini* with which they have been previously confused. *Pseudoublighella elgini* is consistently much more compressed at all but the smallest diameters (YOUNG, 1958, pl. 39, figs. 12-17). Juvenile *Moremanoceras straini* KENNEDY, COBBAN & HOOK, 1988 of the *Acanthoceras amphibolum* zone are generally more evolute, with blunt collar-ribs, associated constrictions on the mould and, at larger diameters, a marked siphonal ridge. An as yet unnamed species from the *Calycoceras canitaurinum* zone of the US Western Interior has a sharp keel and concave ribs on the ventrolateral shoulders, resembling certain *Damesites* species. *Moremanoceras scotti* (COBBAN, 1972, p. 6, pl. 2, figs. 1-23; text-figs. 3-5) has regular distant collar ribs that extend straight across the flanks from the umbilical shoulder.

Occurrence: As for types.

Superfamily Acanthocerataceae DE GROSSOUVRE, 1894

Family Brancoceratidae SPATH, 1934 (1900)

Subfamily Mortoniceratinae H. DOUVILLÉ, 1912

Genus *Euhystrichoceras* SPATH, 1923

Type species: *Ammonites nicaisei* COQUAND, 1862, p. 323, pl. 35, figs. 3, 4, by original designation.

Euhystrichoceras adkinsi POWELL, 1963

Fig. 2H, I, M

1963 *Euhystrichoceras adkinsi*. — POWELL, p. 311, pl. 31, figs. 2-6, 8; text-fig. 3K.

1978 *Euhystrichoceras adkinsi*. — POWELL; YOUNG & POWELL, p. xxv.4, pl. 3, figs. 9-11.

1981 *Euhystrichoceras adkinsi*. — POWELL; KENNEDY & WRIGHT, p. 421, pl. 59, figs. 17-20, 24-30, text-fig. 2a-c.

Holotype: TMM 36217 from POWELL's bed A, Ojinaga Formation, Love Station, 600 m southeast of U.S.C. and G.S. triangulation station 'Love' and 275 m south of the nose of a southwards-plunging syncline, Hudspeth County.

Material: 12 specimens from USGS Mesozoic locality 10757.

Discussion: The new material is very typical, agreeing with that described previously.

Family Lyelliceratidae SPATH, 1921

Subfamily Stoliczkaiinae BREISTROFFER, 1953

Genus *Ojinagoceras* n.g.

Derivation of name: From the type occurrence in the Ojinaga Formation.

Type species: *Ojinagoceras ojinagaense* gen. et sp. nov.

Diagnosis: Very small, adult at 14 mm or less. Involute with small umbilicus, whorl section compressed with subparallel flanks, venter fastigiate in juveniles, rounding and

flattening at maturity. Earliest ornamented whorls coronate with strong conical ventrolateral tubercles and flank ribs, tubercles decline and ribs strengthen to give middle growth stages with coarse primaries arising singly or in pairs from umbilical bullae, with one, rarely two intercalatories. Ribs flexuous and prorsiradiate on flank, projected on ventrolateral shoulders to a progressively weakening tubercle and crossing the venter in a broad convexity. Venter broadens and rounds and ornament declines on last part of mature body chamber.

Discussion: Presence of a single row of ventrolateral tubercles rather than both inner and outer show *Ojinagiceras* to be *Stoliczkaia* rather than *Mantelliceratinae*. The venter is fastigiate but does not show a clearly differentiated siphonal tubercle. This leads us to suggest it is allied to *Stoliczkaia* rather than to *Faraudiella* or *Budaiceras*, where this tubercle is well developed (YOUNG, 1979). The specimens show adult features indicating them to be adults rather than juveniles, so that *Ojinagiceras* is a genuinely diminutive genus. We presume it to be a progenic dwarf derivative of normal-sized *Stoliczkaia*. It most closely resembles *Stoliczkaia* (*Shumarinaia*) (MATSUMOTO & INOMA, 1975, p. 276; type species *Stoliczkaia* (*Shumarinaia*) *hashimotoi* MATSUMOTO & INOMA, 1975, p. 277, pl. 39, figs. 1-3; text-fig. 10, which also seems to be a progenic dwarf. The new genus is broader whorled, finer-ribbed and has strong tubercles in early growth, a feature not seen in *Shumarinaia*. Such similarities as there are between the two taxa reflect the generalised features of small *Stoliczkaia* and the common origin of both in some normal sized members of the subfamily.

Occurrence: Lower Cenomanian *Acompsoceras inconstans* zone of Trans-Pecos Texas.

Ojinagiceras ojinagaense n.g., n.sp.
Fig. 2E-G, J, N

Derivation of name: tautonomy.

Types: Holotype is USNM 420326; there are 3 figured paratypes USNM 420327 to 420329, and 17 unfigured paratypes, USNM 420330, from POWELL's bed A, Ojinaga Formation, lower Cenomanian *Acompsoceras inconstans* zone at USGS Mesozoic locality D10757.

Diagnosis: With the characters of the genus.

Description: Coiling involute with small umbilicus of moderate depth with flattened subvertical umbilical wall. At diameters of 5 mm and less the whorls are depressed and reniform, becoming slightly compressed at larger diameters, with flattened subparallel flanks and a venter that changes from fastigiate on the phragmocone to broadly rounded at the end of the adult body chamber. The earliest ornamented stages have simple flank ribs with strong conical ventral tubercles. In early middle growth coarse, blunt primary ribs arise singly or in pairs from blunt umbilical bullae while one, rarely two shorter ribs arise low on the flank. The ribs are flexuous and prorsiradiate, sweeping forwards over the ventrolateral shoulder to the ventrolateral tubercle, which weakens and declines at this stage. The ribs are coarse and blunt over the venter, which they cross in a broad convexity. There are generally 24-26 ribs per whorl. On adult body chambers the tubercles have disappeared, while flank ribbing and umbilical bullae may weaken just before the adult aperture.

Sutures not seen.

Occurrences: As for types.

Genus *Stoliczkaia* NEUMAYR, 1875

Type species: *Ammonites dispar* D'ORBIGNY, 1841, p. 142, pl. 45, figs. 1, 2, by subsequent designation by DIENER, 1925, p. 179.

Subgenus *Lamnayella* WRIGHT & KENNEDY, 1978, p. 394.

Type species: *Stoliczkaia (Lamnayella) juigneti* WRIGHT & KENNEDY, 1978, p. 398, pl. 37, figs. 1-10; pl. 38, figs. 1-12, by original designation.

Stoliczkaia (Lamnayella) chancellori WRIGHT & KENNEDY, 1984

Fig. 2 0, P,

1984 *Stoliczkaia (Lamnayella) chancellori*. — WRIGHT & KENNEDY, p. 78, pl. 10, fig. 11; text-fig. 11E.

Holotype: BMNH C83582, from the lower Cenomanian, *M. mantelli* zone, *M. saxbii* subzone or *M. dixonii* zone fauna of the Cenomanian Limestone at Shapwick Grange, Devon, England.

Material: 4 specimens including USNM 420334 and 420335, from POWELL's Bed A, Ojinaga Formation, lower Cenomanian *Acompsoceras inconstans* zone at USGS Mesozoic locality D10757.

Description: Coiling is fairly involute with a small, deep umbilicus comprising an estimated 22% of diameter. Umbilical wall rounded, umbilical shoulder outward inclined. Whorl section depressed, circular to subreniform with greatest breadth below mid-flank intercostally and at umbilical bullae costally.

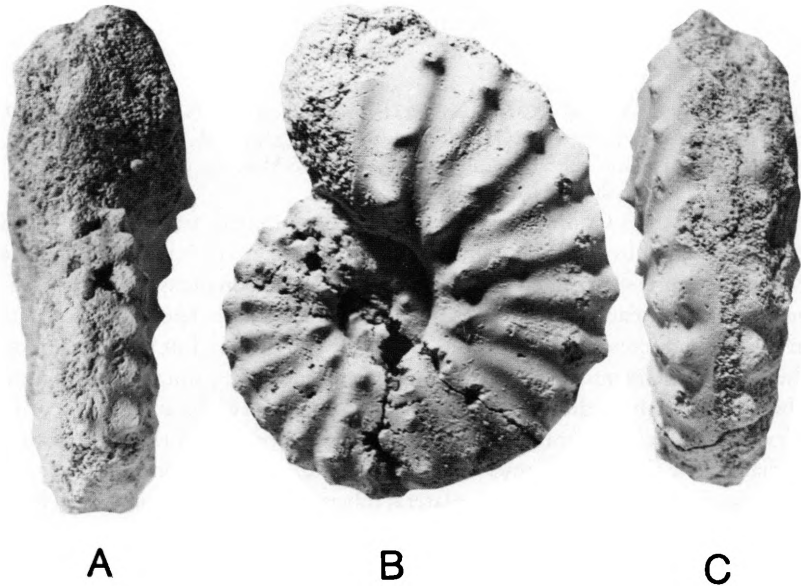


Fig. 3. A-C, *Acompsoceras inconstans* (SCHLÜTER, 1871), BMNH C84918, from the *Mantelliceras dixonii* zone fauna of the 'Grizzle', White Hart Sandpit, Wilmington, Devon. x 1.

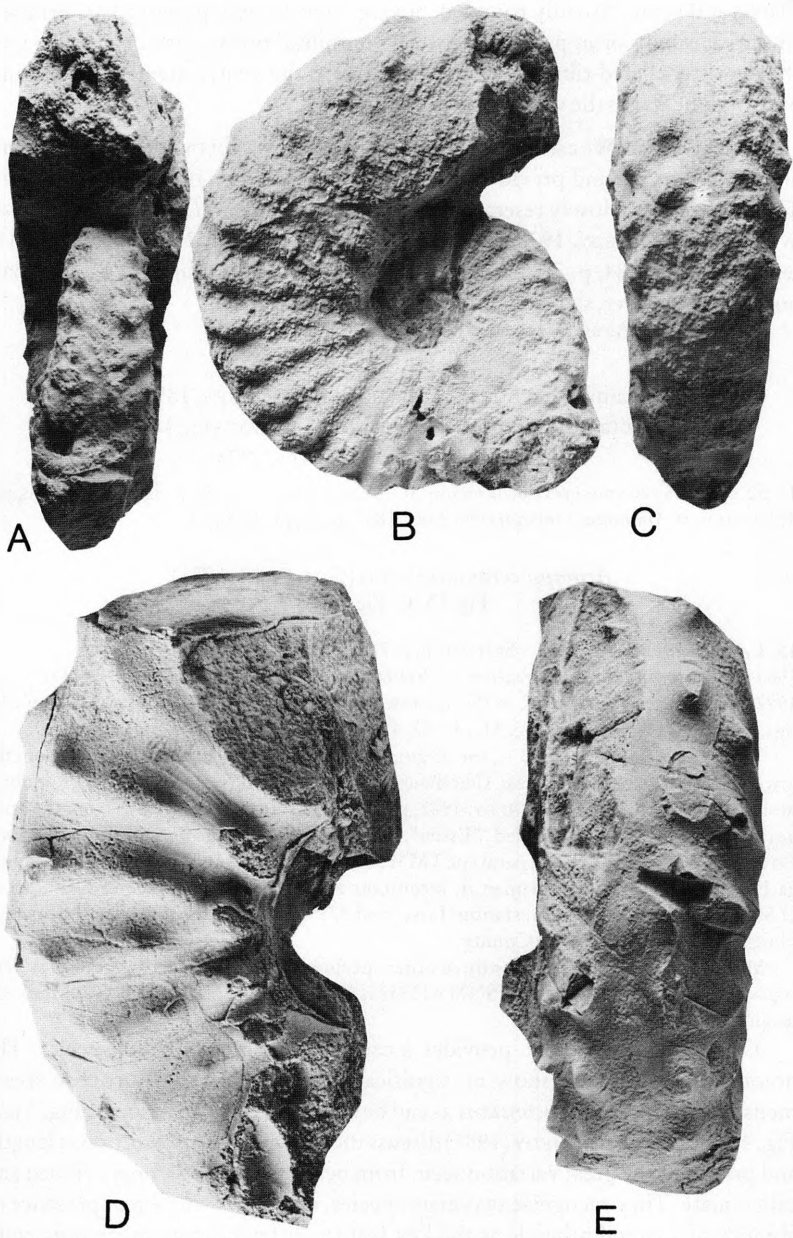


Fig. 4. A-E, *Acompsoceras inconstans* (SCHLÜTER, 1871), A-C, TMM 36228, the holotype of *Acompsoceras bifurcatum* POWELL, 1963; D, E, paratype TMM 30950, from bed A of POWELL in Mule Canyon.

Flanks and venter broadly rounded. Strong blunt straight prorsiradiate primary ribs arise, singly or in pairs, from strong umbilical bullae with one, rarely two shorter intercalated ribs. All ribs strengthen on the ventrolateral shoulder and pass straight across the venter.

Discussion: We can detect no significant differences between these specimens and the holotype (and previously only known) specimen of *S. (L.) chancellori*. This species most closely resembles the somewhat older *S. (L.) sanctaecatherinae* WRIGHT & KENNEDY, 1978 (p. 402, pl. 38, figs. 13-16, 22, 23; pl. 39, figs. 9-11; text-fig. 4a-c; 1984, p. 78, pl. 10, figs. 12, 14, 15, 16?; text-fig. 11b), which has, however, narrower, sharper, more distant ribs and bullae.

Occurrence: As under type and material.

Family Acanthoceratidae DE GROSSOUVRE, 1894
Subfamily Acanthoceratinae DE GROSSOUVRE, 1894
Genus *Acompsoceras* HYATT, 1903

Type species: *Ammonites bochumensis* SCHLÜTER, 1871, p. 1, pl. 1, figs. 1-4, by original designation = *Ammonites renevieri* SHARPE, 1857, p. 44, pl. 20, fig. 2.

Acompsoceras inconstans (SCHLÜTER, 1871)
Fig. 3A-C; Fig. 4A-E

1871 *Ammonites inconstans*. — SCHLÜTER, p. 7, pl. 3, figs. 1-5.

1963 *Pseudacompsoceras bifurcatum*. — POWELL, p. 311, pl. 31, figs. 1, 7; text-fig. 31.

1987 *Acompsoceras inconstans*. — (SCHLÜTER, 1871); WRIGHT & KENNEDY, p. 143, pl. 42, figs. 4, 6, 7; pl. 43, fig. 1; text-fig. 34c, 41, 42, 43a-c, 44 (with full synonymy).

Types: Lectotype is PIB 30a, the original of SCHLÜTER, 1871, pl. 3, figs. 1-3, from the lower Cenomanian Tourtia near Oberhausen Station, Essen, German Federal Republic, designated by WRIGHT & KENNEDY, 1987, p. 143. Paralectotype PIB 30B is from the same horizon, and is simply labelled "Essen". The holotype of *Acompsoceras bifurcatum* POWELL, 1963 is TMM 36228, paratype TMM 30950, they are from POWELL's bed A, Ojina-ga Formation, lower Cenomanian *A. inconstans* zone, Love Station, 600 m southeast of U.S.C. and G.S. triangulation station 'Love' and 275 m south of the nose of a southward-plunging syncline, Hudspeth County.

Material: POWELL mentions three other specimens, without specifying them as syntypes, in the TMM collections. USNM 420337 is from the same horizon a USGS Mesozoic locality D10757.

Discussion: POWELL provides a careful description of this species. The holotype and paratype show no significant differences from European specimens of *Acompsoceras inconstans* as can be seen from a comparison of Fig. 3 and Fig. 4. WRIGHT & KENNEDY (1987) discuss the European *Acompsoceras* at length, and point out the great variation seen, from near-smooth to strongly ribbed and tuberculate. They recognise two main species, using the criterion of presence or absence of a lateral tubercle as the key feature differentiating *inconstans* (with *vectense* of SPATH, 1925 and *levense* of THOMEL, 1972 as synonyms) from *A. renevieri* (SHARPE, 1857) (p. 44, pl. 20, fig. 2) which lacks the tubercle (with *sarthensis* of GUÉRANGER, 1867, *bochumensis* and *essendiensis* of SCHLÜTER, 1871 as the most important synonyms).

Occurrence: Where well-dated in north-west Europe this species belongs to the lower Cenomanian *Mantelliceras dixonii* zone. There are records from southern England, Haute Normandie, Sarthe and Provence in France, the German Federal Republic, North Africa, Madagascar, and Trans-Pecos Texas.

Order Lytoceratida HYATT, 1889

Suborder Ancyloceratina WIEDMANN, 1966

Superfamily Turrilitaceae GILL, 1871

Family Turrilitidae GILL, 1871

Genus *Hypoturrilites* DUBOURDIEU, 1953

Type species: *Turrilites gravesianus* D'ORBIGNY, 1842, p. 596, pl. 144, figs. 3-5; by original designation.

Hypoturrilites cf. *gravesianus* (D'ORBIGNY, 1842)

Fig. 2K, L

Compare:

1842 *Turrilites gravesianus*. – D'ORBIGNY, p. 596, pl. 144, figs. 3-5.

1985 *Hypoturrilites gravesianus*. – (D'ORBIGNY); ATABEKIAN, p. 64, pl. 18, figs. 4-6; pl. 19, figs. 1-8; pl. 20, figs. 1-11; pl. 21, figs. 1, 2, 5-7 (with full synonymy).

Material: USNM 420338 from POWELL's bed A, Ojinaga Formation, lower Cenomanian *Acompsoceras inconstans* zone at USGS Mesozoic locality D10757.

Discussion: This tiny fragment is only 5.5 mm in maximum whorl height. It nevertheless shows a strongly rounded outer whorl face ornamented by an upper row of very large, distant tubercles with a second row of much smaller, more numerous spirally elongated tubercles low on the outer whorl face and a third row, close to the second and connected to delicate radial ribs on the lower whorl face. The relative proportions of the tubercles suggests *H. gravesianus*, which possesses, however, three rows of smaller tubercles rather than the two shown by our specimen.

Acknowledgements

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