Tarrantites, a new heteromorph ammonite genus from the Albian of Texas and Pakistan

Herbert Christian Klinger
Natural History Collections Department, Iziko South African Museum, P.O. Box 61, Cape Town, 8000 South Africa
and
Department of Geological Sciences, University of Cape Town, Private Bag, Rondebosch, 7701 South Africa
E-mail: hklinger@iziko.org.za

William James Kennedy
Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW, U.K.
E-mail: jim.kennedy@oum.ox.ac.uk

&

Keith P. Minor
Texas Research Institute, Austin, 415 Crystal Creek Drive, Austin TX78746, U.S.A.
E-mail: kminor@tri-austin.com

(with 6 figures)
Received 12 March 2010. Accepted 30 March 2010

A new heteromorph ammonite genus, *Tarrantites*, is proposed for *Hamites adkinsi* Scott, 1928. The description of the new genus is based mainly on a near-complete specimen from the Middle Albian part of the Goodland Limestone of Tarrant County, Texas, the holotype, and on an abraded mould on a pebble from the bed of a stream in Hill County, Texas. In addition, we record the presence of the genus in the Albian of Pakistan. *Tarrantites* shows a remarkable resemblance to the labeceratine genera *Labeceras* Spath, 1925 and *Myloceras* Spath, 1925: in coiling and size to the former, and in ornamentation to the latter, but is excluded from the subfamily Labeceratinae Spath, 1925, because it has a distinct bifid adventive (A) lobe. This latter feature, and the ornamentation, rather suggest affinities of *Tarrantites* with the family Anisoceratidae Hyatt, 1900.

Key words: Albian, heteromorph ammonite, *Tarrantites*, Anisoceratidae, labeceratine homoeomorph, Texas, Pakistan.

CONTENTS

REPOSITORY OF SPECIMENS

The following abbreviations are used to indicate the repositories of specimens mentioned in the text and figures:
GSP: Geological Survey of Pakistan;
JPCC: J.P. Conlin Collection;
NMB: Van Hoepen Collection, currently in the Natural History Collections Department, Iziko, South African Museum;
NPL: Non-vertebrate Paleontology Lab, Texas Natural Science Center, the University of Texas at Austin;
SAM: Natural History Collections Department, Iziko South African Museum, Cape Town;
TM: Ditsong National Museum of Natural History, formerly Transvaal Museum, Northern Flagship Institution, Pretoria;
TCU: Department of Geology, Texas Christian University, Fort Worth, Texas.

SYSTEMATIC PALAEONTOLOGY

Suborder **ANCYLOCERATINA** Wiedmann, 1966

Superfamily **TURRILITOIDEA** Gill, 1871
Family **?ANISOCERATIDAE** Hyatt, 1900

Genus ***Tarrantites* gen. nov.**

Derivation of name
From Tarrant County, Texas.

Type species
Hamites adkinsi Scott, 1928, p. 116, pl. 16, figs 10, 13 from the middle of the Comanche Peak Limestone near Valley Mills, Bosque County, Texas.

Diagnosis
Shell small; early whorls unknown, but probably coiled in an open criocone, followed by a straight shaft and recurved hook. Ornamentation on earliest preserved section and shaft consists of single, increasingly prorsiradiate ribs on the flanks that link to ventral tubercles, and are joined over the venter by initially single ribs, and by looped or incipiently zigzag ribs in later ontogenetic stages. Tubercles

disappear or become very weak on the crozier, the ribs becomes finer and more closely spaced, bi- or trifurcate or intercalate on the ventral third of the flanks. The suture has a distinctly bifid adventive (A) lobe (= L of Kullmann & Wiedmann 1970).

Tarrantites adkinsi (Scott, 1928)

Figs 1–4

1928 *Hamites adkinsi* n. sp. Scott, p. 116, pl. 16, figs 10, 13.
1928 *Hamites adkinsi* Scott; Adkins, p. 208.
1963 *Hamites intermedius* J. Sowerby; Swensen, p. 60, pl. 1, fig.14 *non* fig. 10 = *Hamites* sp.
1965 *Hamites intermedius* J. Sowerby; Clark, p. 19, pl. 1, fig. 14 *non* fig. 10 (= *Hamites* sp.); ? text-fig. 3a.

Type

The holotype, by monotypy, is TCU1046, the specimen figured by Scott (1928, p. 116, pl. 16, figs 10, 13) from the 'middle of the Comanche Peak limestone near Valley Mills, Texas'; and refigured by Swensen (1963, p. 60, pl. 1, fig. 14 only) and Clark (1965, p. 19, pl. 1, fig. 14 only (as *Hamites intermedius,* non J. Sowerby).

Material

In addition to the holotype, TCU 1046, we have three specimens. NPL 19645, collected loose at outcrop, derived from the upper Middle Albian *Oxytropidoceras carbonarium* Zone of the Goodland Limestone on Dutch Branch, Benbrook, Tarrant County, Texas. It is housed in the Texas Natural Science Center at the University of Texas at Austin. An external mould of the crozier in a pebble from the bed of Rock Creek, near Blum in Hill County, Texas, J.P. Conlin Collection JPCC 7295. Conlin's associated note says he thought the lithology to be like that of the Duck Creek Limestone. There is no justification for this in our view. We also have part of a septate shaft preserved as a phosphatic internal mould, GSP11657, from the top of the Lumishwal Formation, south of Fort Lockhart in the Samana Range, western Kohat, Pakistan.

Description

The most complete specimen, NPL19645 (Fig. 2A–F), is nearly 50 mm long. It is a composite internal mould, with part of the phragmocone filled with sparry calcite and the main part of the body chamber shaft and hook filled with cream-coloured limestone. The early whorls are missing, but the curvature of the earliest preserved part of the phragmocone suggests an open criocone. This is followed by a nearly straight shaft, and ends in a distinct recurved hook. The phragmocone is partially damaged due to the fragile calcitic preservation, but clearly shows ornamentation consisting of single, radial to prorsiradiate ribs on the earliest preserved section, numbering about three per whorl height. Each of these ends in a faint ventral tubercle. On the shaft, ribbing becomes bolder, originating near the dorsum, with a forward curvature over the flanks and ending in a distinct clavate ventral tubercle. These are initially connected over the venter by strong, single ribs, but towards the beginning of the crozier, may loop or zigzag over the venter. On the hook of the body chamber, ornamentation changes markedly. The ventral tubercles disappear, and the ribs become narrower, closely spaced, and generally bifurcate over the venter, with single or trifurcating intercalated ribs in *Labeceras*-like fashion. Towards the end of the hook, ribbing becomes crowded, with angular ventral edges suggesting incipient tuberculation. These are probably indications of the proximity of the adult aperture. Part of the suture line is preserved in the calcitic section of the early phragmocone; this clearly features a bifid adventive lobe (A) in the sense of Korn *et al.* (2003) or lateral lobe (L) as used by Kullmann & Wiedmann (1970) (Fig. 3A).

JPCC7295 (Fig. 4A–B) is a poorly preserved external mould of part of the crozier. This, and a synthetic cast of the mould, clearly show the prorsiradiate, widely-spaced ribs on the ascending part of the shaft, and the change in ornamentation on the crozier with finer, more closely-spaced and intercalatory ribs.

GSP11657 (Fig. 4C–F) is part of a phragmocone shaft, which preserves two partial sutures, Only four ribs are present, but these show a rib-index similar to that of NPL19645, *circa* three and a half per whorl height. The prorsiradiate, slightly backwardly curved ribs clearly show the ventral tubercles. The suture (Fig. 3B) is badly corroded but does show deeply incised bifid saddles with narrow stems, and a deeply incised bifid A.

DISCUSSION

In his description of the holotype, Scott (1928, p. 118) mentioned faint indications of ventral tubercles on the recurved part of the crozier, as shown in Fig. 1J, but is quite emphatic in stating that 'Elsewhere the specimen is absolutely devoid of tubercles'. The holotype is a poorly preserved internal mould, consisting of only part of the adapical shaft, and the final hook (Fig. 1A–K). However, the mode of ribbing on the flanks is identical to that of NPL19645 and JPCC7295 and we suggest that the absence of distinct ventral tubercles on the shaft is in part due to the poor preservation, and the proximity to the crozier where the major ribs and associated ventral tubercles become weaker and may disappear. It is probably because of this apparent lack of ventral tubercles, that the species was referred to the genus *Hamites* by Swensen (1963) and followed by Clark (1965). Their identification of the Texas specimen as *Hamites intermedius* J. Sowerby (Sowerby, 1814, p. 139, pl. 62, fig. 4a,b) is incorrect. Admittedly, the prorsiradiate ribbing on the ascending shaft of *T. adkinsi* resembles that of *H. intermedius,* especially the forms described and illustrated by Spath (1941, p. 633, pl. 71, figs 4,6) as var. *distincta.* These, however, are distinct hamitids and they lack the change in ornamentation between the ascending and descending shaft. In addition, the latter shaft is much longer than in *T. adkinsi.* The specimen figured as *Hamites* sp. aff. *H. intermedius* by Clark (1965, pl. 1, fig. 10) (TCU1144), however, is a *Hamites.* Monks (2002, p. 695), in his cladistic analysis of the Hamitidae, also incorrectly included *T. adkinsi* in the synonymy of *H. intermedius* (which he referred to *Hamites* Parkinson, 1811, *sensu stricto*).

At first sight *T. adkinsi,* especially the near-complete specimen NPL19645, recalls representatives of the genus *Labeceras* Spath, 1925 (Fig. 5D–F) as far as coiling, size and ornamentation on the crozier are concerned. The clavate ventral tubercles and the mode of ribbing on the venter of

the phragmocone shaft resemble those of some *Myloceras* species; e.g. *M. serotinum* Spath, 1925 (Fig. 5A–C), but *Myloceras* species are generally much larger. *Tarrantites adkinsi* thus combines morphological features of both of these genera. Apart from the enigmatic genus *Hamitoides* Spath, 1925, the Labeceratinae are geographically restricted to the Southern Hemisphere Gondwanan regions (see Klinger, 1989 for discussion) and are absent from the Atlantic region apart from the Austral Basin in southern Patagonia (*cf.* Aguirre Urreta & Riccardi 1988). (The identity of the Austrian species *Labeceras* (*?) collignoni* (Föllmi 1989, p. 129, pl. 5, fig. 15) is problematic. It is based on body chamber specimens; until the suture line is known we prefer to exclude it from the Labeceratinae). The presence of a labeceratid in the Gulf Coast Region of North America would thus be a biogeographical anomaly. The adventive (A) lobe (lateral lobe (L) of Kullmann & Wiedmann 1970) of Labeceratinae is distinctly trifid (Fig. 6A–D). That of *Tarrantites adkinsi* and the Pakistani specimen is, in contrast, distinctly bifid (Figs 3A, B), and the resemblance to the Labeceratinae is thus merely an example of homoeomorphy both in terms of coiling and ornamentation.

No single genus or species referred to the family Anisoceratidae combines the unique features of coiling and ornamentation of *Tarrantites,* although some bear resemblance in some features. Kennedy (1972) discussed the confusion of the early Late Albian *Idiohamites ellipticoides* Spath, 1939 with *Labeceras* (*cf.* Owen, 1970). This species has similar branched ribbing on the crozier, but, apart from a single specimen (Kennedy 1972, pl. 74, fig. 9a–c), lacks ventral tubercles, and is thus easily distinguished from the present species.

Klinger & Kennedy (2008) recently described another labeceratid homoeomorph, *Mkuzeiella andersoni,* from the Middle Albian of KwaZulu, South Africa. Fragments of this had earlier been referred to *Labeceras* (*Labeceras*) sp. nov. aff. *L.* (*L.*) *crassicostatum* by Klinger (1976, p. 41, pl. 12, figs 3,4,6; text-figs 7i, j, 8a) and subsequently as gen. et sp. indet (*Hamites*?) (Klinger 1989, p. 192, fig. 1). *Mkuzeiella andersoni* is larger, has aspinoceratid coiling, and lacks the distinct tubercles on the phragmocone of *Tarrantites;* it also lacks the branching ribbing on the crozier. The only resemblance to *Tarrantites* is the strong ribbing on the later parts of the phragmocone. Another micromorphic Albian heteromorph from KwaZulu, *Ndumuiceras variabile* (Klinger & Kennedy 2009) also has a bifid adventive (A) lobe, but has crioceratitid to aspinoceratid coiling and is quadrituberculate in the early ontogenetic stages.

GSP11657 (Figs 3B, 4C–F) is from a condensed fauna of the Lumishwal Formation, Hazara, Pakistan, that includes *Lemuroceras aburense, Prolyelliceras flandrini, Anisoceras arrogans, Hamites* sp., *Douvilleiceras mammillatum* and *Lyelliceras pseudolyelli,* which indicate several levels in the Lower Albian (elsewhere in the region the Lumishwal Formation yields Middle and Late Albian ammonites). Some of the ammonite faunas from Hazara were briefly discussed and illustrated by Spath (1930). Apart from GSP11657, we suspect that some of the specimens referred to *Metahamites* by Spath may also belong here, but for the present we can only refer GSP11657 with confidence to *Tarrantites*

Idiohamites pygmaeus Cooper & Kennedy (1979, p. 224, fig. 31j–n) is a similarly small species (52 mm in length) from the Upper Albian of Angola, but is clearly far more robustly ornamented, and is quadrituberculate; it also lacks the *Labeceras*-like ribbing on the crozier of *T. adkinsi*.

Occurrence

Upper Middle Albian of Texas and Albian of Pakistan.

ACKNOWLEDGEMENTS

We thank Arthur Busbey at the Department of Geology at Texas Christian University for loan of the specimens TCU1046 and TCU1144. We also thank Ann Molineux at the Texas Natural Science Center at the University of Texas at Austin for loan of the specimen NPL19654. Klinger thanks the National Research Foundation, South Africa, for financial assistance. Kennedy acknowledges the technical support of the staff of the Department of Earth Sciences, Oxford and the Oxford University Museum of Natural History.

REFERENCES

ADKINS, W.S. 1928. Handbook of Texas Cretaceous fossils. *University of Texas Bulletin* **2838**: 1–385.

AGUIRRE URRETA, M.B. & RICCARDI, A.C. 1988. Albian heteromorph ammonoids from southern Patagonia, Argentina. *Journal of Paleontology* **62**: 598–614.

CLARK, D.L. 1965. Heteromorph ammonoids from the Albian and Cenomanian of Texas and adjacent areas. *Geological Society of America Memoir* **95**: viii+1–99.

COOPER, M.R. & KENNEDY, W.J., 1979. Uppermost Albian (*Stoliczkaia dispar* Zone) ammonites from the Angolan littoral. *Annals of the South African Museum* **77**: 175–308.

FÖLLMI, K.B. 1989. Beschreibung neugefundener Ammonoidea aus der Vorarlberger Garschella-Formation (Aptian–Albian). *Jahrbuch der Geologischen Bundesanstalt Wien* **132**: 105–189.

FÖRSTER, R. 1975. Die geologische Entwicklung von Süd-Mozambique seit der Unterkreide und die Ammoniten-Fauna von Unterkreide und Cenoman. *Geologisches Jahrbuch* **B12**: 3–324.

GILL, T. 1871. Arrangement of the families of Mollusks. *Smithsonian Miscellaneous Collections* **227**: xvi + 1–49.

HYATT, A. 1900. Cephalopoda. p. 502–592. *In*: ZITTEL, K.A. von. *Textbook of Paleontology,* 1st English edn. Translated by C.R. Eastman. MacMillan: London & New York.

KENNEDY, W.J. 1972. The affinities of *Idiohamites ellipticoides* Spath (Cretaceous Ammonoidea). *Palaeontology* **15**: 400–404.

KENNEDY, W.J. & KLINGER, H.C. 1975. Cretaceous faunas from Zululand and Natal, South Africa. Introduction, Stratigraphy. *Bulletin of the British Museum of Natural History* (Geology) **25**: 263–315.

KLINGER, H.C. 1976. Cretaceous heteromorph ammonites from Zululand. *Memoir of the Geological Survey of South Africa* **69**: ix + 1–142.

KLINGER, H.C. 1989. The ammonite subfamily Labeceratinae Spath, 1925; systematics, phylogeny, dimorphism and distribution (with a description of a new species). *Annals of the South African Museum* **98**: 189–219.

KLINGER, H.C. & KENNEDY, W.J. 2008. *Mkuzeiella andersoni* gen. et sp. nov. (Cephalopoda, Ammonoidea) from the Albian Mzinene Formation of KwaZulu-Natal, South Africa. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre* **78**: 179–191.

KLINGER, H.C. & KENNEDY, W.J. 2009. The heteromorph ammonite *Ndumuiceras variabile* gen. et sp. nov. from the Albian Mzinene Formation, KwaZulu-Natal, South Africa. *African Natural History,* **5**: 43–47.

KORN, D., EBBIGHAUSEN, V., BOCKWINKEL, J. & KLUG, C. 2003. The A-mode sutural ontogeny of prolecanitid ammonoids. *Palaeontology* **46**: 1123–1132.

KULLMANN, J. & WIEDMANN, J. 1970. Significance of sutures in phylogeny of Ammonoidea. *University of Kansas, Paleontological Contributions* **42**: 1–32.

MONKS, N., 2002. Cladistic analysis of a problematic ammonite group: the Hamitidae (Cretaceous, Albian–Turonian) and proposals for new cladistic terms. *Palaeontology* **45**: 689–707.

OWEN, H. 1970. The stratigraphy of the Gault in the Thames Estuary and its bearing on the Mesozoic tectonic history of the area. *Proceedings of the Geologists' Association* **82**: 187–209.

PARKINSON, J. 1811. *The Fossil Starfish, Echini, Shells, Insect, Amphibia, Mammalia &c. The Organic Remains of a Former World,* vol. 3, Sherwood, Neely and Jones: London.

SCOTT, G., 1928. Ammonites of the genus *Dipoloceras,* and a new *Hamites* from the Texas Cretaceous. *Journal of Paleontology* **2**: 108–118.

SOWERBY, J. 1812–1846. *In:* SOWERBY, J. & SOWERBY, J. De C. *The mineral Conchology of Great Britain.* Meredith: London.

SPATH, L.F. 1925. On Upper Albian Ammonoidea from Portuguese East Africa. With an appendix on Upper Cretaceous Ammonites from Maputoland. *Annals of the Transvaal Museum* **11**: 179–200.

SPATH, L.F. 1930. The fossil fauna of the Samana Range and some neighbouring areas, part V. The Lower Cretaceous Ammonoidea; with notes on Albian Cephalopoda from Hazara. *Memoirs of the Geological Survey of India, Palaeontologia Indica,* new series, **15**: 51–66.

SPATH, L.F. 1939. A monograph of the Ammonoidea of the Gault. Part 13. *Palaeontographical Society Monograph* **93**: 541–608.

SPATH, L.F., 1941. A monograph of the Ammonoidea of the Gault. Part 14. *Palaeontographical Society Monograph* **95**: 609–668.

SWENSEN, A.J. 1963. Anisoceratidae and Hamitidae (Ammonoidea) from the Cretaceous of Texas and Utah. *Brigham Young University Geology Studies* **9**: 53–82.

WIEDMANN, J. 1966. Stammesgeschichte und System der Posttriadischen Ammonoideen. Ein Überblick. 2. Teil. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **127**: 13–81.

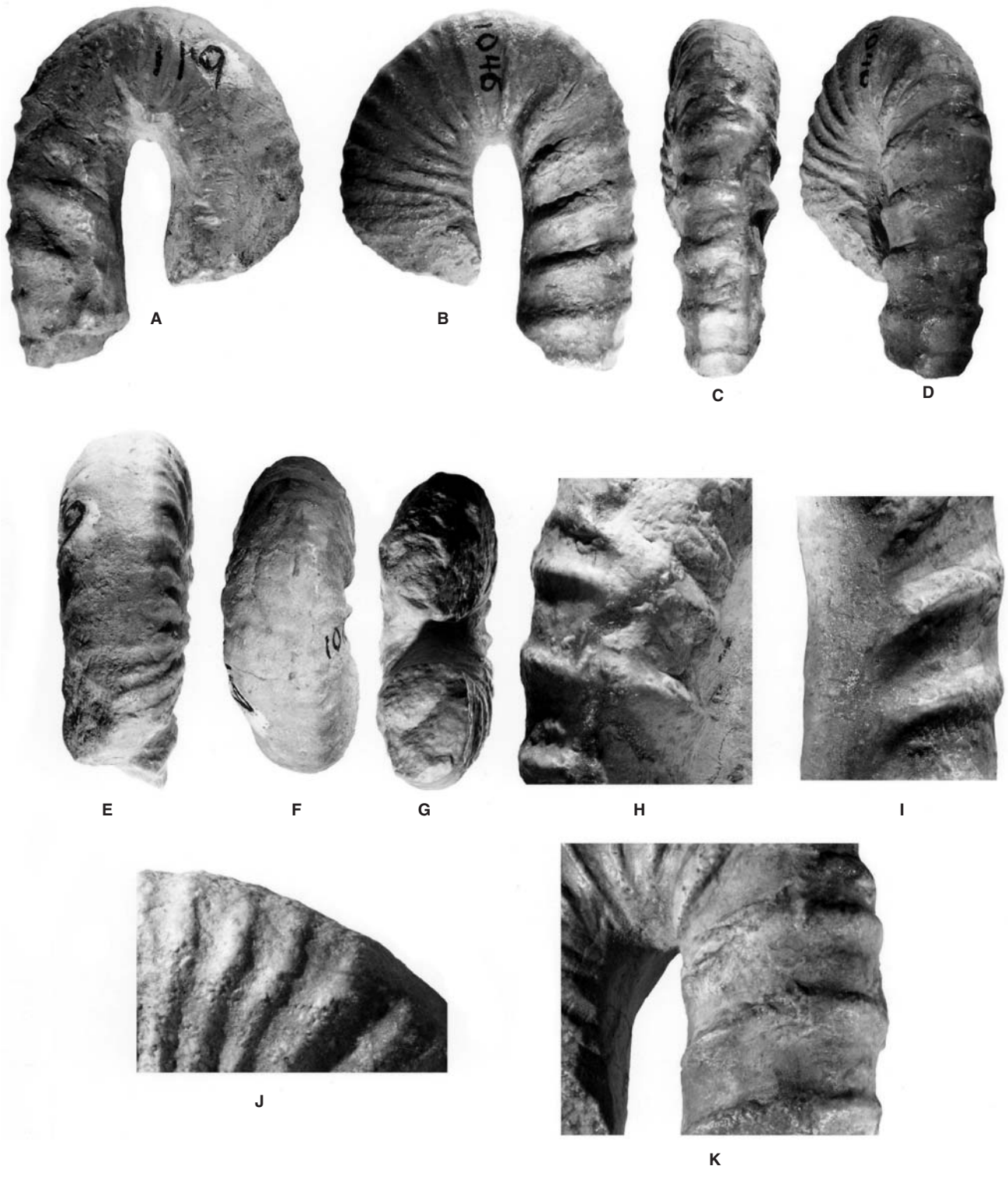

Fig. 1. **A–K**, *Tarrantites adkinsi* (Scott, 1928). The holotype, TCU1046 , the original of Scott, 1928, p. 112, pl. 16, figs 10,13, from the middle of the Comanche Peak Limestone near Valley Mills, Bosque County, Texas. Note the incipient tuberculation on the crozier in Fig. 1J. Figs A–G ×1.8; H–K ×3.2.

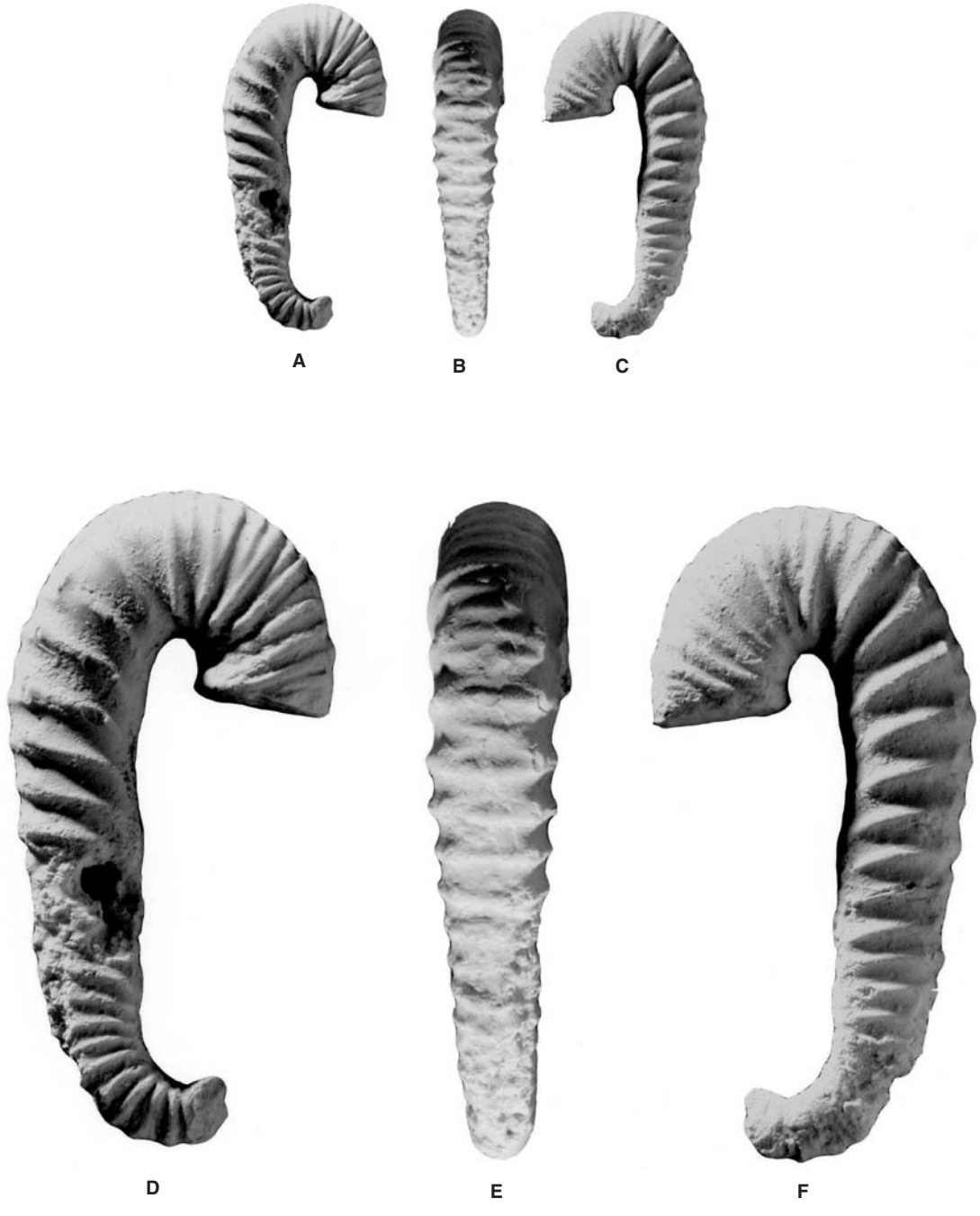

Fig. 2. **A–F**, *Tarrantites adkinsi* (Scott, 1928). NPL 19645, from the lower Upper Albian Goodland Limestone on Dutch Creek, Benbrook, Tarrant County, Texas. A–C ×1; D–F ×2.

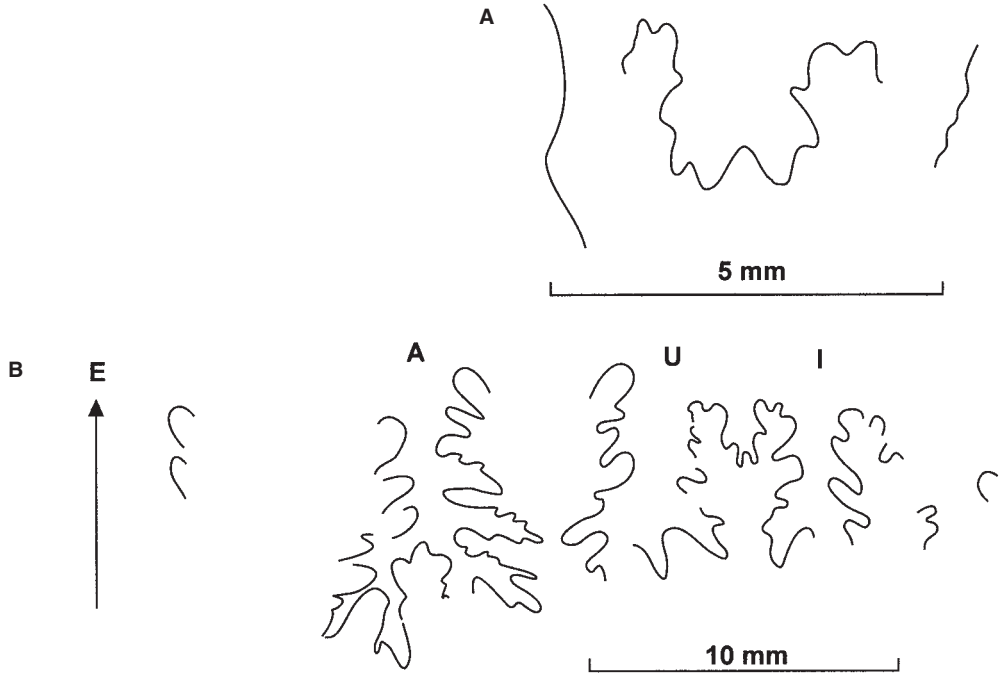

Fig. 3. *Tarrantites adkinsi* (Scott, 1928). **A**, Partial suture of NPL19645 to illustrate the bifid A lobe (= L lobe of Kullmann & Wiedmann 1970); **B**, partial suture of GSP11657.

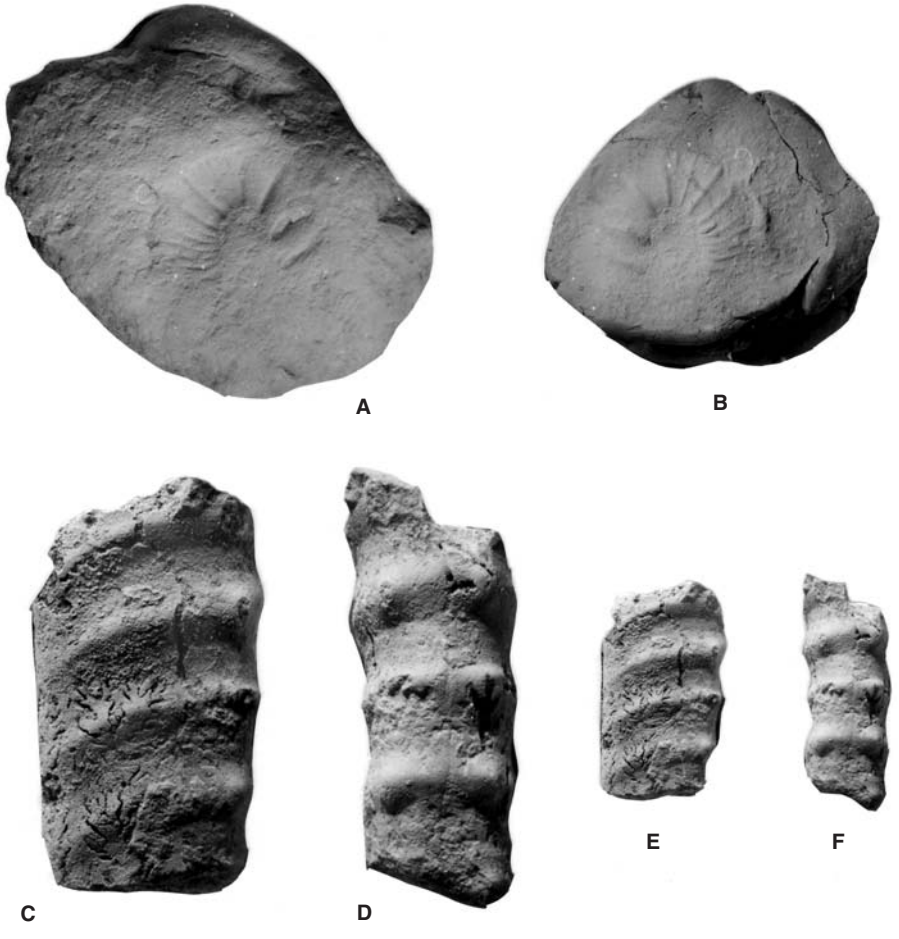

Fig. 4. *Tarrantites adkinsi* (Scott, 1928). **A–B**, JPCC7295, An external mould and synthetic cast of the crozier in a pebble from the bed of Rock Creek near Blum in Hill County, Texas; **C–F**, GSP11657, a phosphatic internal mould from the top of the Lumishwal Formation, south of Fort Lockhart in the Samana Range, Western Kohat, Pakistan. A–B, E–F ×1; C–D ×2.

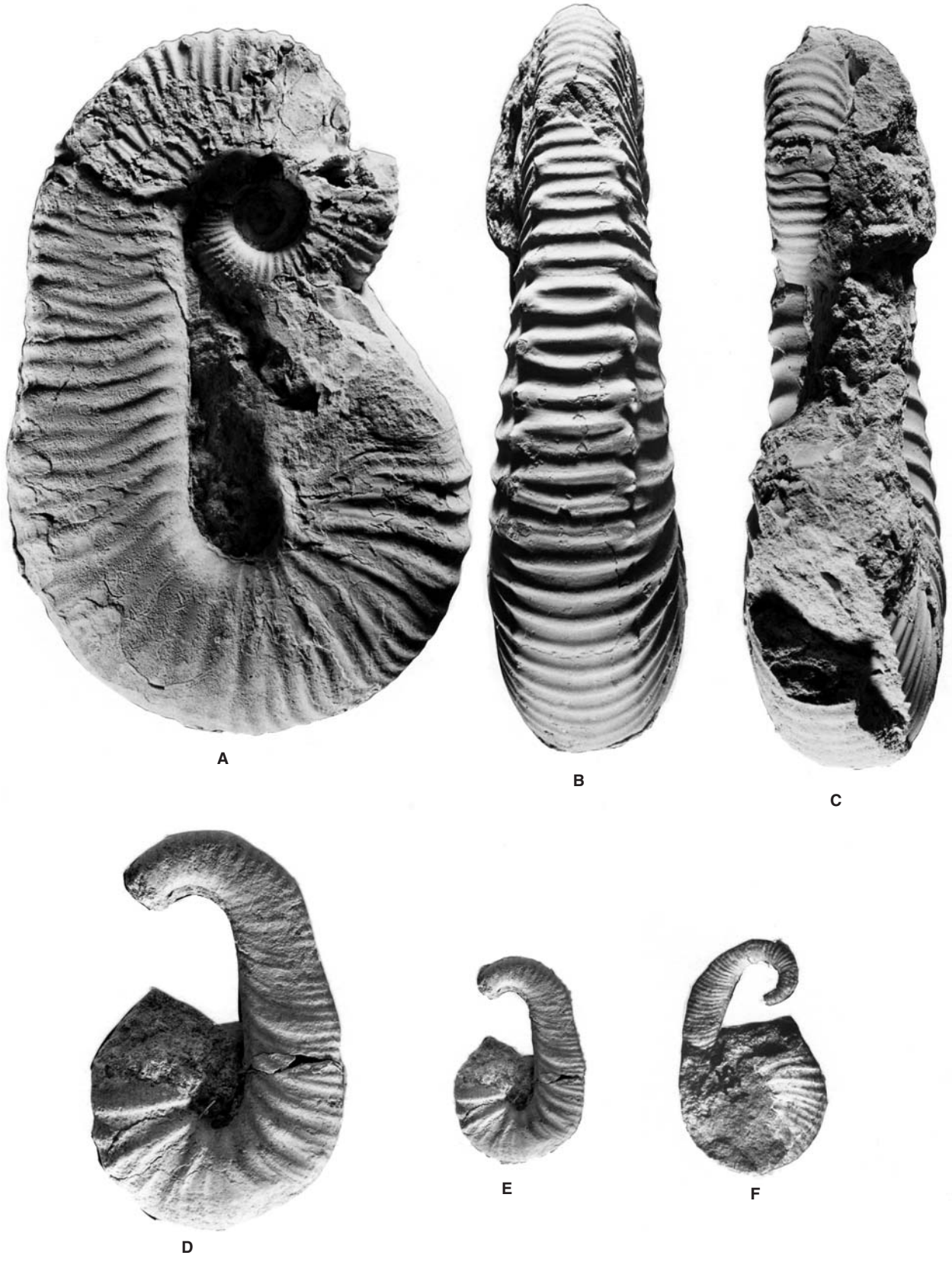

Fig. 5. **A–C**, *Myloceras serotinum* Spath, 1925. **A**, SAM-PCZ7665; **B–C**. SAM-PCZ22337 (ex Z174), both from locality 64 of Kennedy & Klinger (1975, p. 289, river drift on the south side of the southern tributary of the Munywana, KwaZulu-Natal. **D–E**, *Labeceras inflatum* Förster, 1975. NMB-D2702 from locality 57, all from the Mzinene Formation, Albian V. **F**, *Labeceras plasticum* Spath, 1925, the holotype, TM 1350 from the Upper Albian of Catuane, Mozambique. A–C, E–F ×1, D ×2.

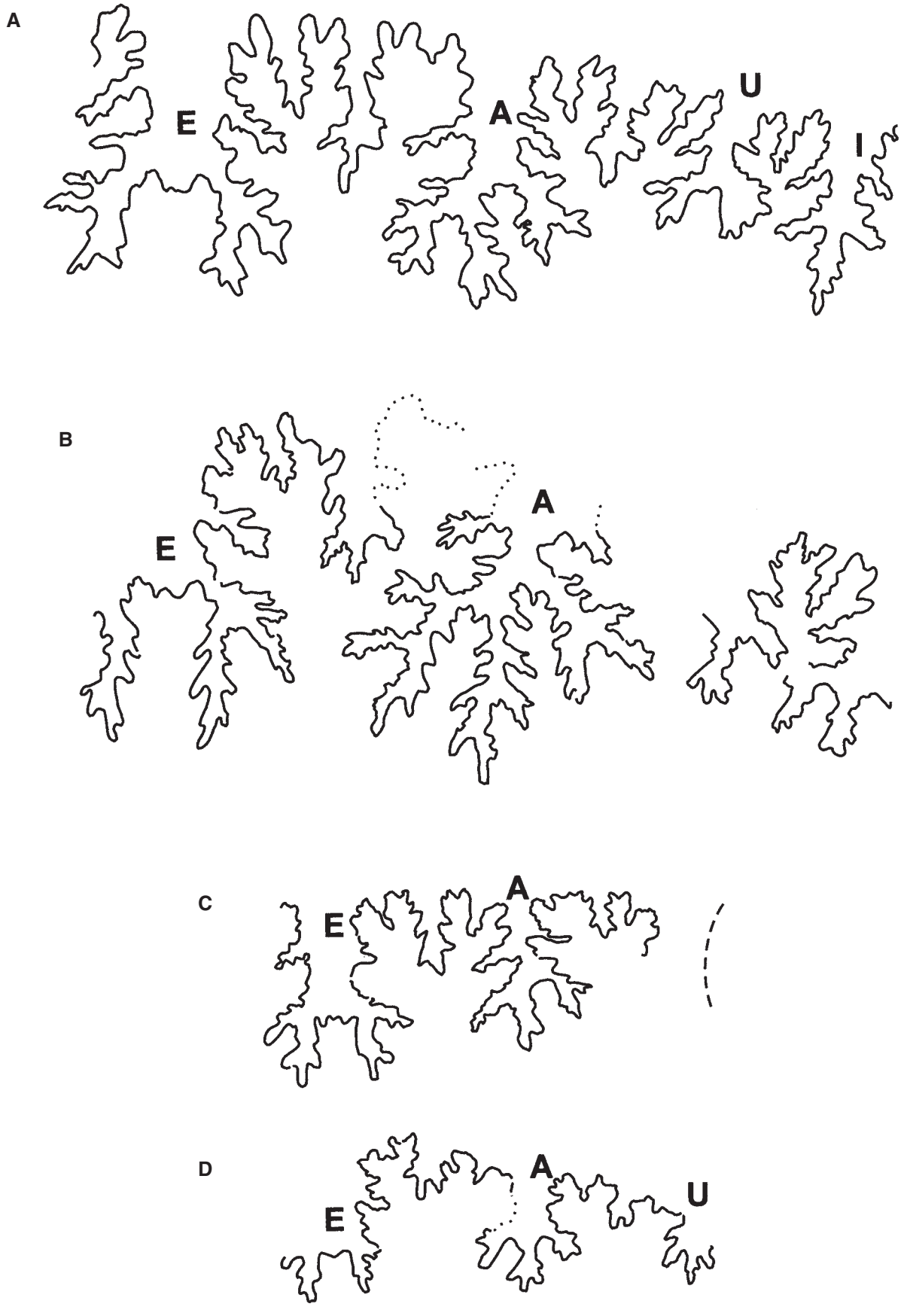

Fig. 6. Labeceratid sutures. **A–C**, *Myloceras rotundum* Klinger, 1976. **D**, *Myloceras cornucopia* Spath, 1925. After Klinger (1976, text-fig. 9 f, j,e , h).