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Spencer G. Lucas and John W. Estep

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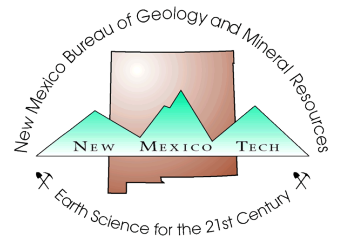
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# The late Albian ammonite *Engonoceras* from southwest New Mexico

by Spencer G. Lucas and John W. Estep

New Mexico Museum of Natural History and Science, 1801 Mountain Road NW, Albuquerque, NM 87104-1375

## Abstract

Specimens of the ammonite *Engonoceras serpentinum* (Cragin) from the upper part of the Mojado Formation in southwest New Mexico indicate a late Albian age (*Drakeoceras drakei* Zone). The top of the Mojado Formation is not as young as the top of the (lowermost Cenomanian) Sarten Formation, nor does the Sarten Formation appear to record a late Albian transgression during *Drakeoceras drakei* time.

## Introduction

Age control of the Lower Cretaceous strata of southwest New Mexico is based mainly on limited and incompletely documented biostratigraphic data (e.g., Zeller, 1965; Zeller and Alper, 1965). Here, we document specimens of the late Albian ammonite *Engonoceras serpentinum* (Cragin) from southwest New Mexico (Fig. 1) originally reported by Zeller (1965) and discuss their biostratigraphic significance.

## Systematic Paleontology

Order AMMONOIDEA Zittel, 1884

Suborder AMMONITINA Hyatt, 1889

Superfamily HOPLITACEAE Douvillé, 1890

Family ENGONOCERATIDAE Hyatt, 1900

Genus *Engonoceras* Neumayr & Uhlig, 1887

*Engonoceras serpentinum* (CRAGIN, 1900)

1900 *Sphenodiscus belviderensis* var. *serpentinus* Cragin, p. 31, pl. 2, figs. 4–6.

1903 *Engonoceras serpentinum* (Cragin): Hyatt, p. 61, 162, pl. XIX, figs. 7–14, pl. XX, figs. 1–5.

1910 *Engonoceras serpentinum* (Cragin): Grabau and Shimer, p. 214, figs. 1487a-c.

1920 *Engonoceras serpentinum* (Cragin): Adkins, p. 84, pl. 4, figs. 3, 5, 6, 12.

1982 *Engonoceras serpentinum* (Cragin): Mancini, pp. 251–253, figs. 4i, 5j.

1982 *Engonoceras* cf. *serpentinum* (Cragin): Mancini, p. 251, figs. 4l, 5i.

## Referred specimens

Specimens collected by Robert A. Zeller, under field number "493-L5K" now reside in the Los Angeles County Museum (LACM) under catalog numbers LACMIP-7292 thru 7304. Zeller's collection consists of 18 specimens, of which 7 are complete or nearly complete (LACMIP-7292, 7293, 7294, 7295, 7301, 7302, and 7303), 5 preserve between a quarter and a half of a whorl (LACMIP-7296, 7297, 7298, 7299, and 7300), and the remaining 6 are either small fragments or extremely weathered (all assigned to LACMIP-7304).

## Locality and horizon

Zeller (1965) indicated that all the LACM specimens are from a single bed in the NW¼SE¼ sec. 20 T32S R15W, Hidalgo County, New Mexico (Fig. 1). This bed is stratigraphically high in the section of the Mojado Formation exposed here, which is the formation's type section. Specifically, the *Engonoceras*-bearing horizon is 1,286 m above the base of the Mojado Formation in a Mojado section that is 1,577 m thick (Zeller, 1965, pl. 5).

## Description and identification

Damage from differential weathering and breakage obscures some details on most specimens. The unweathered specimens vary

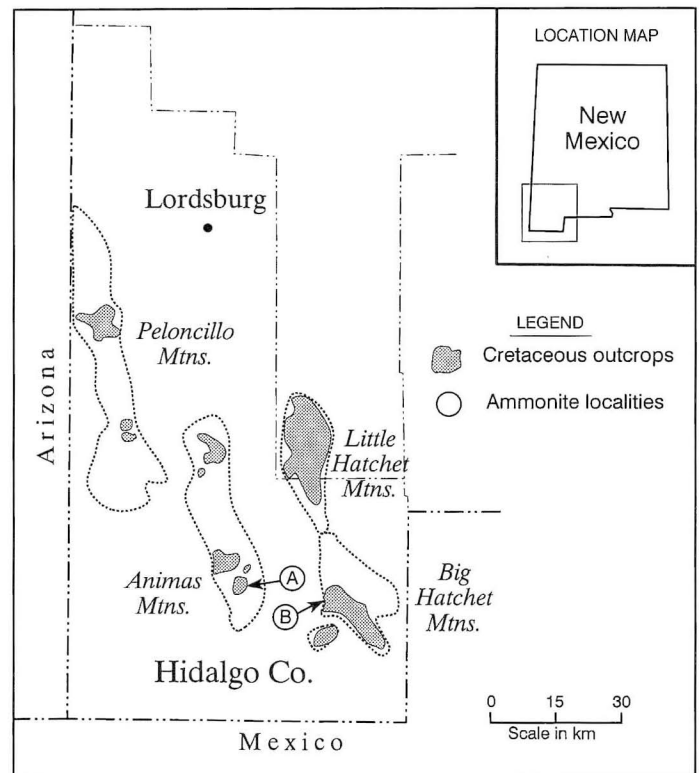
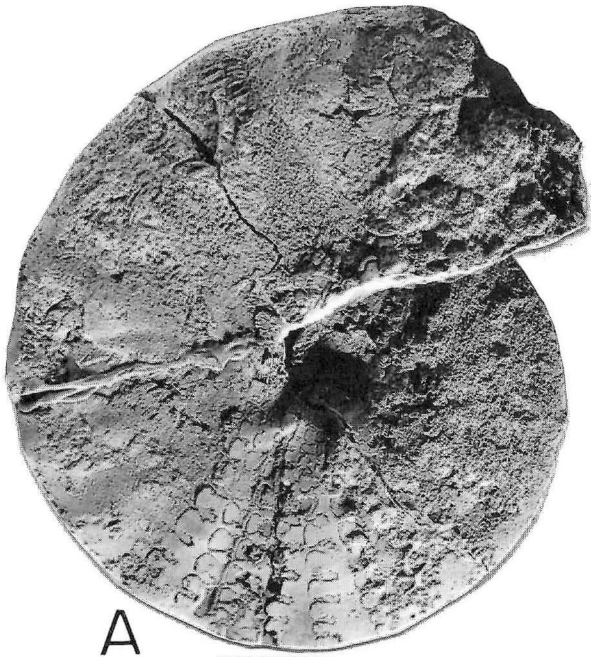


FIGURE 1—Part of southwest New Mexico showing distribution of Lower Cretaceous strata and location of the two *Engonoceras* sites: A, Cowboy Spring, Animas Mountains; B, Mojado Pass, Big Hatched Mountains.

FIGURE 2—Selected specimens of *Engonoceras serpentinum* from the Mojado Formation in the Big Hatched Mountains. Bar scale = 10mm. A–D, LACMIP-7294, lateral (A–B) and ventral (C–D) views. E, LACMIP-7292, lateral view. F, LACMIP-7293, lateral view. G–I, LACMIP-7295, lateral (G, I) and ventral (H) views.

from brownish gray (5YR 4/1) to dark yellowish brown (10YR 4/2); the weathered specimens are a moderate yellowish brown (10YR 5/4). The encasing matrix is mostly olive gray (5Y 4/1) when fresh. Although the specimens display some minor individual variation, all of them are sufficiently similar in their suite of characteristics to warrant assignment to the same species, *Engonoceras serpentinum* (Figs. 2–3, Table 1).

All specimens indicate an ammonoid with a compressed, involute to slightly convolute shell of typical oxycone morphology. They have a narrow, slightly concave, sharp-edged, bicarinate venter on the early whorls, becoming more convex and nodose on later whorls as a result of the alternating tubercles and ribbing that develops on the shoulder of the venter. The transition from a bicarinate to a nodose venter occurs over a short distance, commonly within one-eighth of a whorl. Not only does the venter outline zigzag laterally, but the nodes also raise the edge of the venter outwardly. Three sets of tubercles develop on the flanks of the latest whorls: clavate along the shoulder of the venter, clavate about one-third of the way in from the venter, and bullate close to the umbilical shoulder. The umbilical tubercles are the sharpest of the tubercles and the first to express themselves on smaller specimens. These tubercles are connected by faint, broad, distant, slightly sinuous radial ribbing that also develops on the later whorls. The



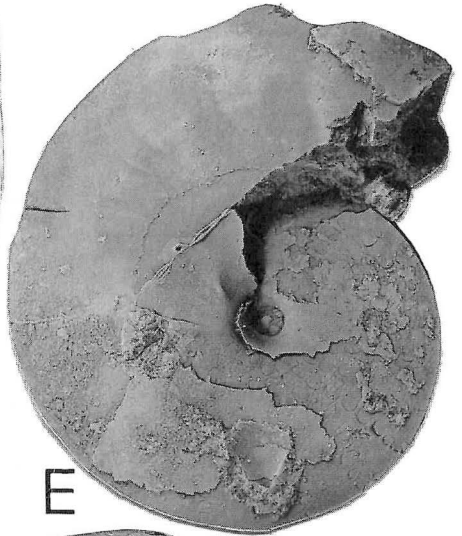
A



C



D



E



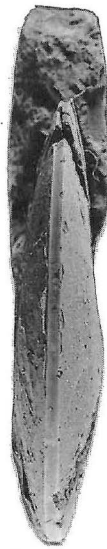
B



F



G



H



I

TABLE 1—Measurements and morphological features of LACMIP specimens of *Engonoceras serpentinum* from the Mojado Formation in the Big Hatchet Mountains.

LACMIP	Condition	Max diameter	Major radius	Minor radius	Ratio min:maj	Suture lobes	Suture saddles	Half nodes (both sides)	Nodose venter	Umbilical tubercles	Lateral tubercles	Faint ribbing
-7292	whole	52.0	31.0	21.0	0.677	13	12	—	none	weak	weak	none
-7293	whole	69.0	40.0	29.0	0.725	12	12	—	weak	weak	weak	none
-7294	whole	66.0	38.0	28.0	0.737	13	13	18 in 180°	strong	strong	weak	weak
-7295	whole	53.0	31.5	21.5	0.683	13	13	—	none	strong	weak	none
-7296	fragment	—	30.0	—	—	—	—	7 in 70°	strong	—	moderate	moderate
-7297	fragment	—	27.5	—	—	—	—	11 in 90°	strong	—	moderate	moderate
-7298	fragment	—	29.5	—	—	12	12	9 in 90°	strong	strong	strong	weak
-7299	fragment	—	—	26.0	—	—	—	10 in 90°	strong	weak	weak	none
-7300	fragment	—	—	19.0	—	—	—	—	—	moderate	moderate	none
-7301	whole	49.0	27.0	22.0	0.815	—	—	13 in 140°	moderate	weak	weak	moderate
-7302	inrock	50.0	29.0	21.0	0.724	—	—	—	strong	strong	strong	weak
-7303	inrock	—	31.0	—	—	10	10	14 in 140°	weak	strong	strong	weak

spacing of the alternating nodes at the venter shoulder varies between 8 and 11° of circumference per node.

The pseudoceratitic septal suture is plainly visible on most specimens, with four specimens (LACMIP-7292, 7294, 7295, and 7298) yielding moderately incised suture lines extending almost from venter to umbilicus (Figs. 2–3). The knob-like saddles are quite

simplified, with slightly flattened tops. Whereas the innermost and outermost lobes display a simple club-shape, the central-most four or five lobes have between three and five gentle digitations. The suture patterns of Zeller's specimens exhibit the typical variability of *Engonoceras serpentinum* described by Hyatt (1903), Adkins (1920), and Mancini (1982).

### Biostratigraphy

Lower Cretaceous strata exposed in southwest New Mexico were deposited in a rift basin during the Aptian–Albian (e.g., Mack et al., 1986). The three Lower Cretaceous formations generally recognized in southwest New Mexico are the (ascending) Hell-to-Finish, U-Bar, and Mojado Formations of Zeller (1965). These strata are genetically related to correlative rocks in southeast Arizona, and northern Chihuahua–Sonora Mexico, and for that reason we place them in the Bisbee Group. Here, we review age constraints for the Bisbee Group in New Mexico (Fig. 4), placing the *Engonoceras* specimens documented here in that context.

Age constraints for the Hell-to-Finish Formation are poor because it has produced only unidentifiable fossil wood and bivalves. Because it grades upward into upper Aptian strata of the lower U-Bar Formation, the Hell-to-Finish is generally assigned an Aptian age, though it could include strata as old as Neocomian or Late Jurassic (e.g., Wengerd, 1970; Warzeski, 1987).

The oldest biochronologically significant ammonites from the U-Bar Formation represent the upper Aptian *Kazankyella spathi* Zone, and the youngest U-Bar ammonites are of the lower Albian *Douvilleiceras mammillatum* Zone (Zeller, 1965; Weise, 1982; Warzeski, 1987; Sandidge, 1985; Lucas, 1989). However, the youngest strata of the U-Bar Formation (“suprereef limestone member” of Zeller, 1965) produce the large, uniserial foraminiferan *Cribratina texana* (Conrad), indicative of a middle to late Albian age (Lucas, 1991; Lucas et al., 1988).

The Mojado Formation of Zeller (1965) is homotaxial with the Sarten Formation of Darton (1916). The oldest Mojado/Sarten ammonites are of late Albian age and belong to the *Eopachydiscus marcianus* and *Mortoniceras equidistans* Zones (Cobban, 1987; Lucas et al., 1988). The youngest Sarten strata are of early Cenomanian age (*Budaiceras hyatti* Zone), but preserved Mojado strata are not younger than late Albian.

Indeed, the specimens of *Engonoceras serpentinum* reported here are from the uppermost part of the Mojado Formation and indicate a late Albian age in the *Drakeoceras drakei* Zone (Young and Powell, 1976). These *Engonoceras* are associated with specimens of two taxa

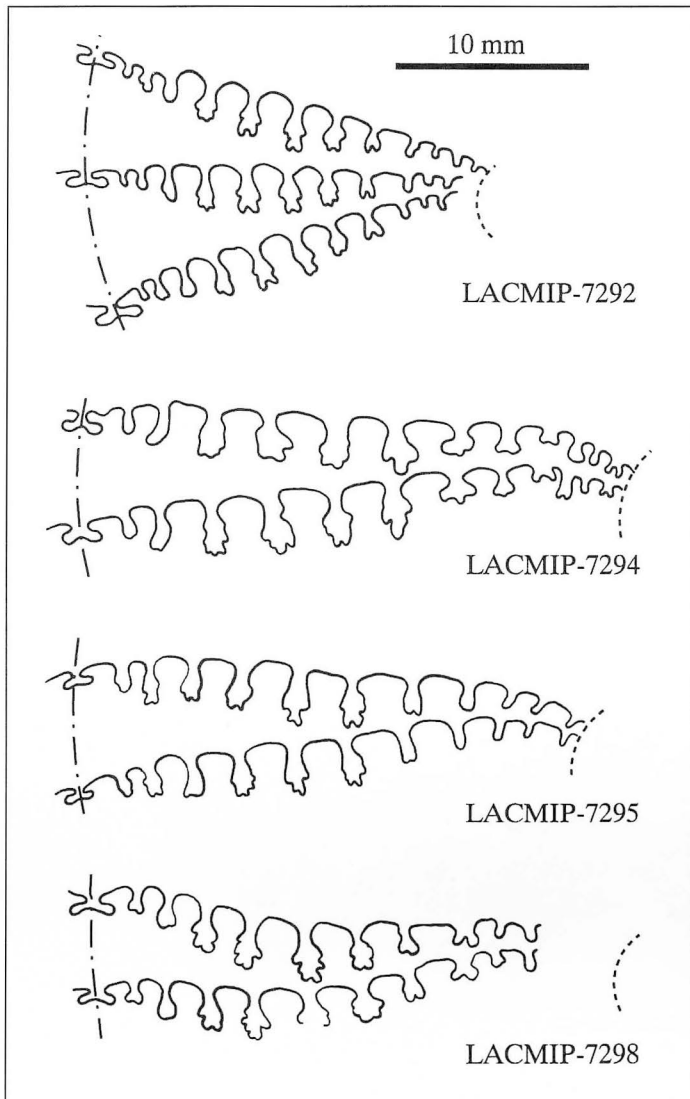
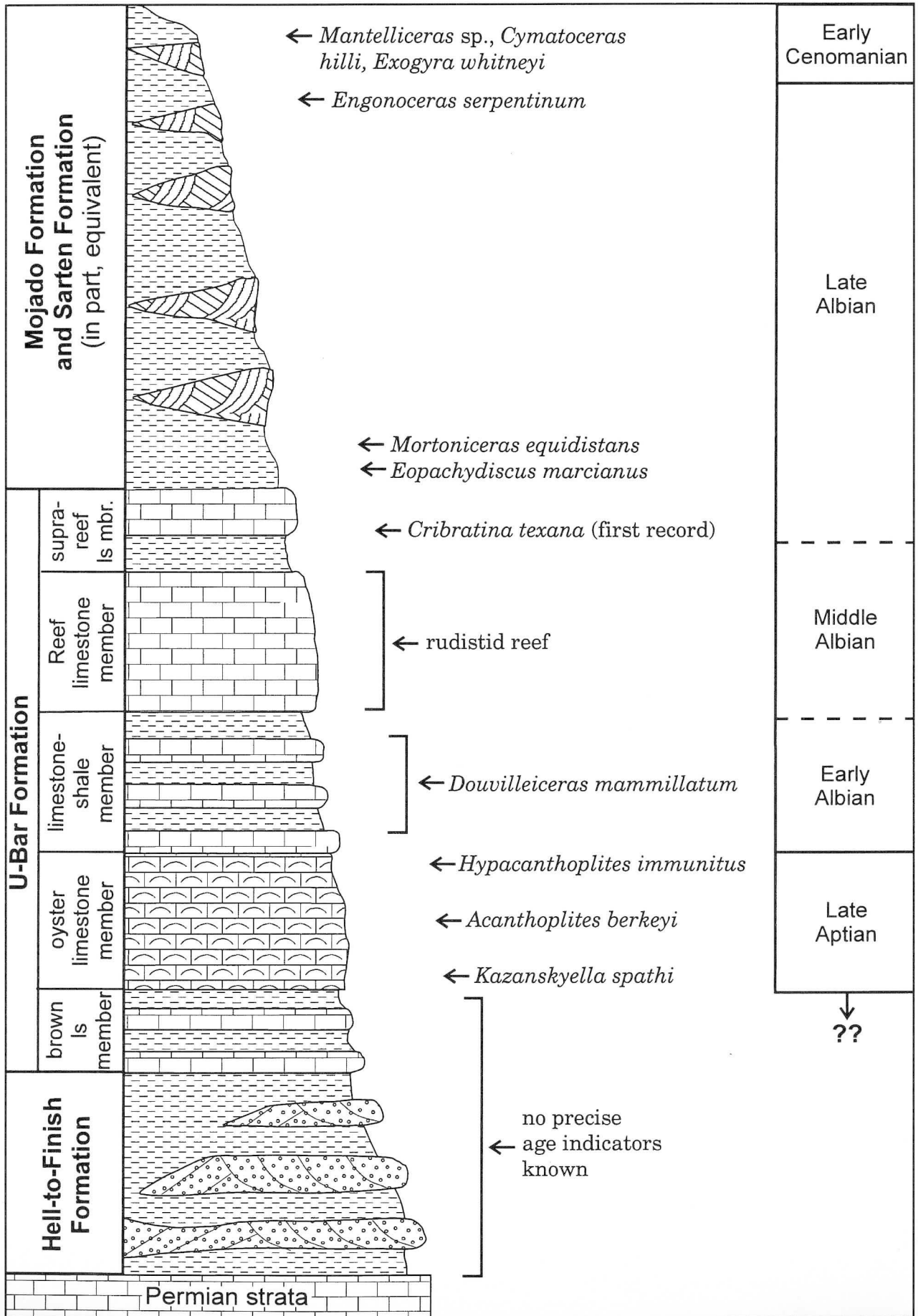


FIGURE 3—Suture lines of selected specimens of *Engonoceras serpentinum* from the Mojado Formation in the Big Hatchet Mountains.

FIGURE 4—Summary of significant biostratigraphic age data for the Bisbee Group in southwestern New Mexico (based largely on data in Zeller, 1965; Weise, 1982; Sandidge, 1985; Warzeski, 1987; Cobban, 1987; and Lucas et al., 1988).



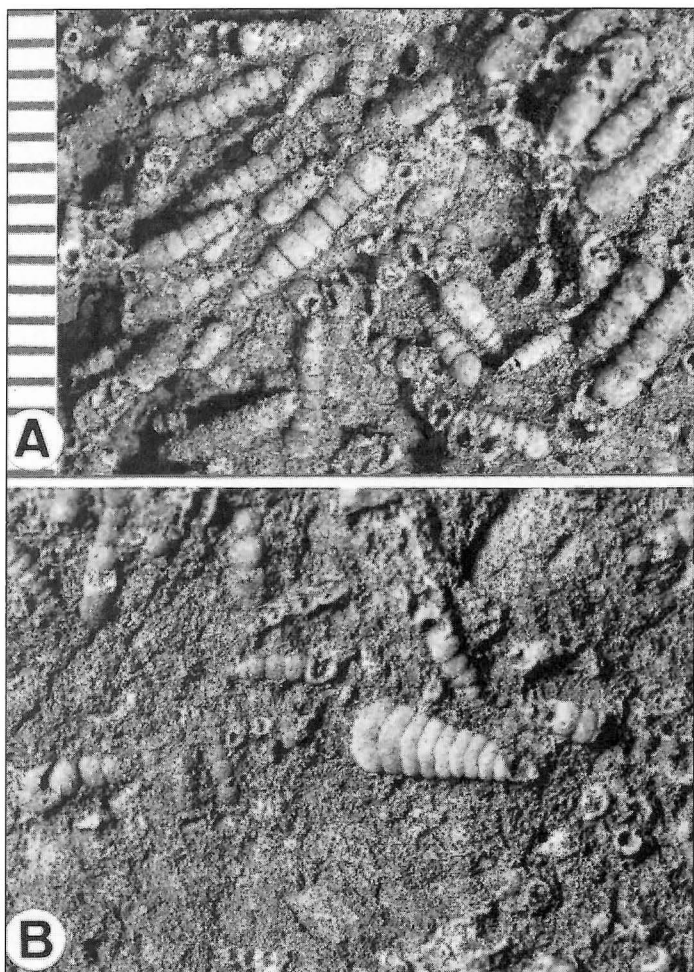


FIGURE 5—Large arenaceous foraminifers from the uppermost Mojado Formation in the Big Hatchet Mountains at NMMNH (New Mexico Museum of Natural History) locality 3358 (scale in mm). A, *Cribratina texana* (NMMNH P-26143). B, fragmentary *Cribratina texana* and a single *Polychasmina pawpawensis* (NMMNH P-26144). Note that specimens of *C. texana* have circular cross sections and straight sutures, unlike the compressed rectangular cross section and arcuate sutures of *P. pawpawensis*.

of large, uniserial, arenaceous foraminifers *Cribratina texana* (Conrad, 1957) (Fig. 5A–B) and *Polychasmina pawpawensis* (Loeblich and Tappan, 1946) (Fig. 5B). These taxa also indicate a late Albian age. Zeller and Alper (1965, p. 20) also reported *Engonoceras serpentinum* from the upper part of the Mojado Formation at Cowboy Spring in the Animas Mountains (Fig. 1).

Given that erosion has removed the top of the Mojado Formation in southwest New Mexico, it is impossible to say if it originally preserved deposition of strata as young as the uppermost Sarten Formation. However, it is clear that the youngest marine transgression recorded by the Mojado Formation in southwest New Mexico is late Albian in the zone of *Drakeoceras drakei*.

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