

TABLE 1—Measurements and morphological features of LACM 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 *Douvilleicerias mammillatum* Zone (Zeller, 1965; Weise, 1982; Warzeski, 1987; Sandidge, 1985; Lucas, 1989). However, the youngest strata of the U-Bar Formation ("suprareef 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

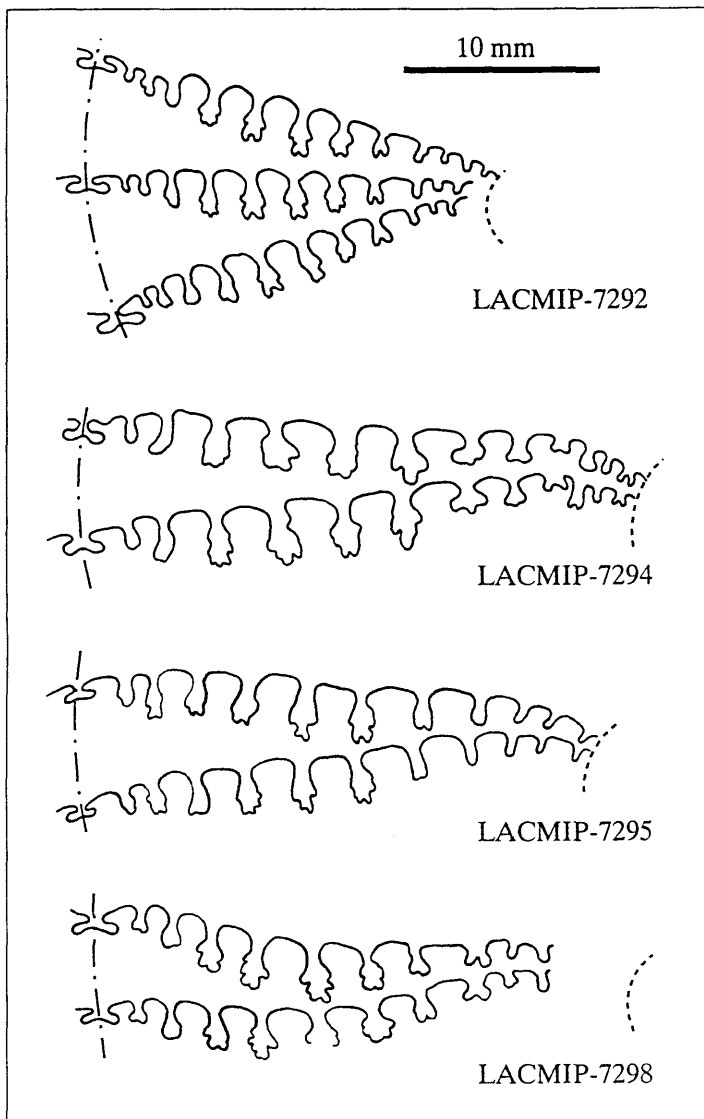
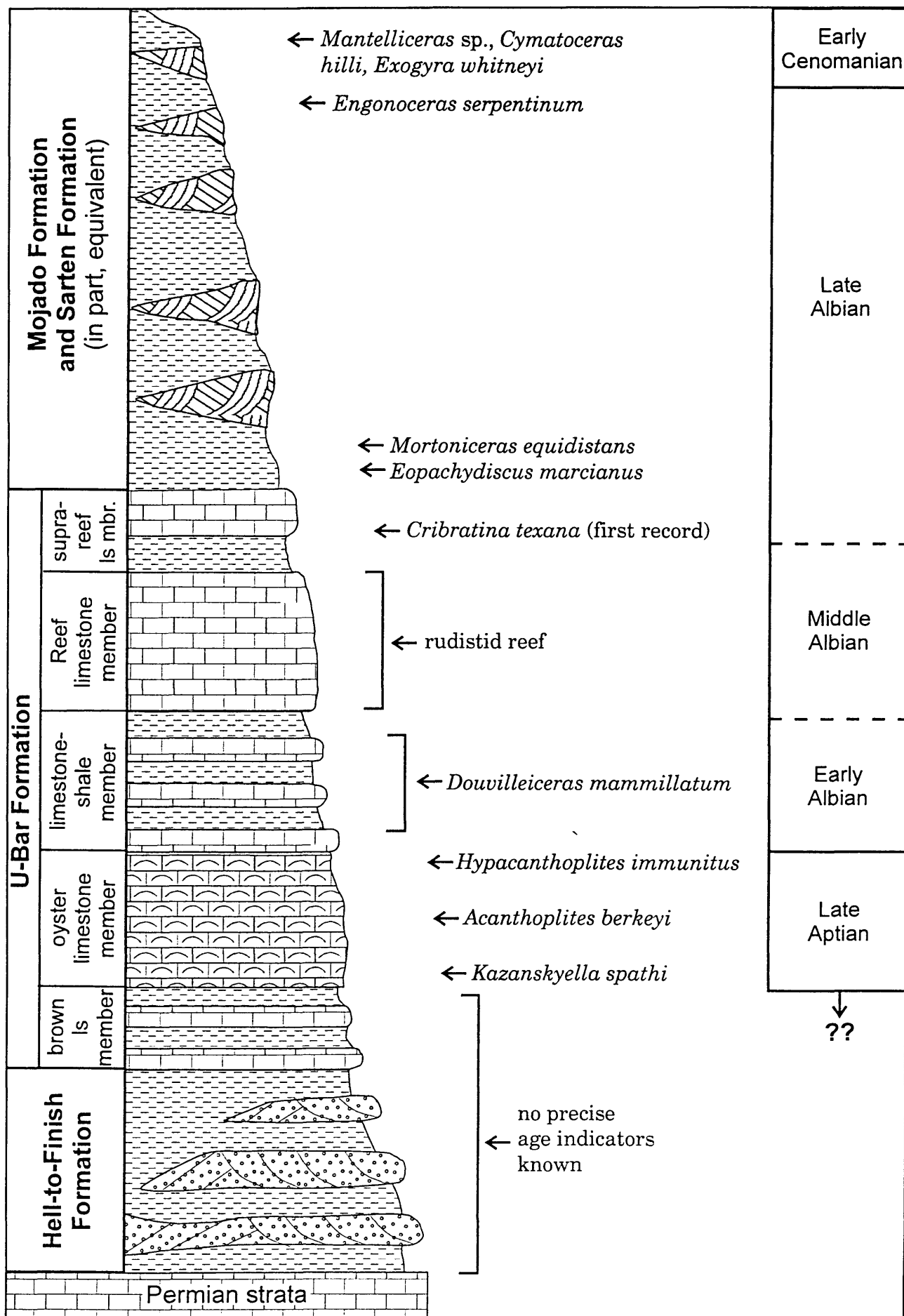


FIGURE 3—Suture lines of selected specimens of *Engonoceras serpentinum* from the Mojado Formation in the Big Hatchet Mountains.

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).



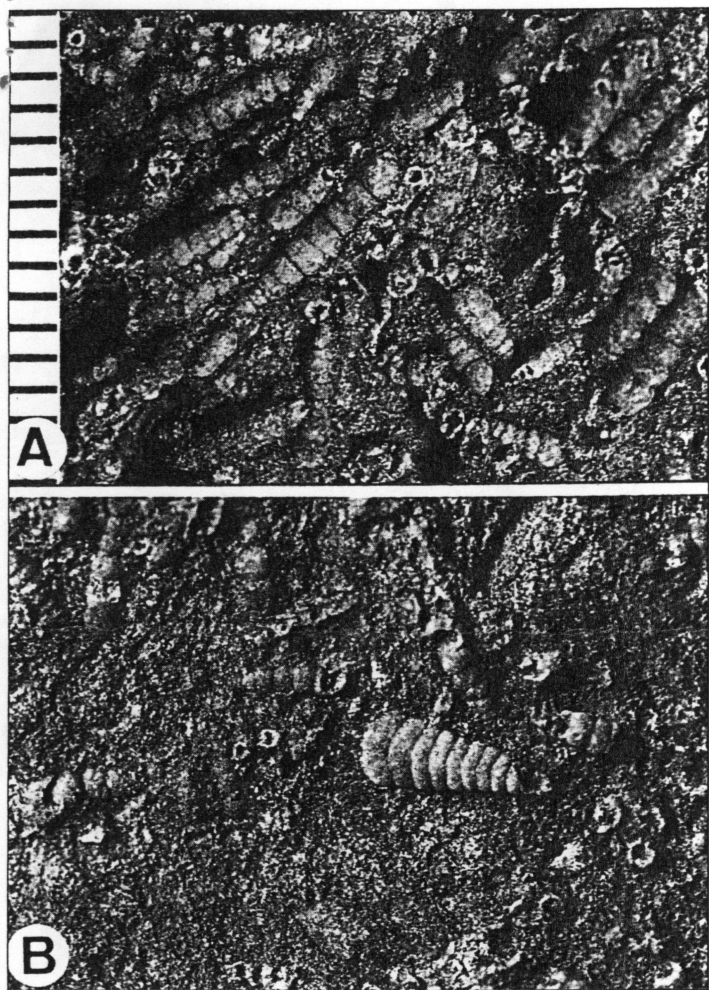


FIGURE 5—Large arenaceous foraminifers from the uppermost Mojado Formation in the Big Hatchet Mountains at NMMNH (New Mexico Museum of Natural History) locality 3358 (scale in mm). A, *Cribratina texana* (NMMNH P-26143). B, fragmentary *Cribratina texana* and a single *Polychasmina pawpawensis* (NMMNH 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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