LATE ALBIAN (CRETACEOUS) AMMONITES FROM SIERRA MOJADA, WESTERN COAHUILA, MEXICO

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ABSTRACT.—There are three different species of *Hysteroceras* from the Sierra Mojada, west-central Coahuila, México—*H.* cf. *varicosum* (J. de C. Sowerby), *H.* cf. *binum* (J. Sowerby), and *H.* cf. *famelicum* Van Hoepen. The first two species were originally described from Europe, and Van Hoepen's species was originally described from Angola. Böse had previously described *H. varicosum* from Zacatecas and Young had described species of *Hysteroceras, H. varicosum* and *H. orbignyi* Spath, from Trans-Pecos Texas, where they occurred with other Angolan species such as *Boeseites romeri* (Haas), *B. peramata* (Haas), *B.* cf. *barbouri* (Haas), *B.* cf. *howelli* (Haas), *B. proteus* (Haas), and *Prohysteroceras* cf. *hanhaense* Haas. *B. peramata* and *B. romeri* also are known at Cerro Mercado, near Monclova, eastern Coahuila. The occurrence of a form near *H. famelicum* at Sierra Mojada, Coahuila, is further evidence that these ammonites migrated to México and Texas from Angola over a sag in the boundary of South America and Africa. This would be during the highest stand of sea level of the Lower Cretaceous, which occurred in the early part of the Late Albian, some 12 to 15 million years prior to the completion of the continuous oceanic floor between those two continents. *Key words*: ammonites; Cretaceous; Coahuila, México.

In the middle 1920s, the mining engineer for the properties then owned by ASARCO at Sierra Mojada, Coahuila, was Frank Wingfield. In 1927, W. S. Adkins received from Frank Wingfield a small collection of ammonites of the genus *Hysteroceras*. Other than some Neocomian bivalves from north of the arroyo north of the village of Sierra Mojada, collected by James E. McKee and Norris Jones, these few specimens of *Hysteroceras* are the only fossils I have seen from the Sierra Mojada area. At the present time, the Sierra Mojada represents the least studied, rather accessible, Cretaceous section in all of Coahuila and deserves considerable greater attention (Fig. 1).

The fossils in the Wingfield collection are all pyritized, and there are nine specimens of which six are worthy of illustration (Fig. 2). That the fossils are pyritized indicates they probably were collected from a shaly interval within a section that is mostly of the carbonate facies so representative of Albian rocks of this area. The whorl sections (Fig. 3) generally would seem valid, but it must be remembered that during the process of replacement by pyrite there is frequently distortion. The sutures are rendered inaccurate not only by the distortion of pyritization but also by the distortion inherent in reproduction via a camera lucida. Height and width (both in mm) and height/width ratio are given in that order for each specimen.

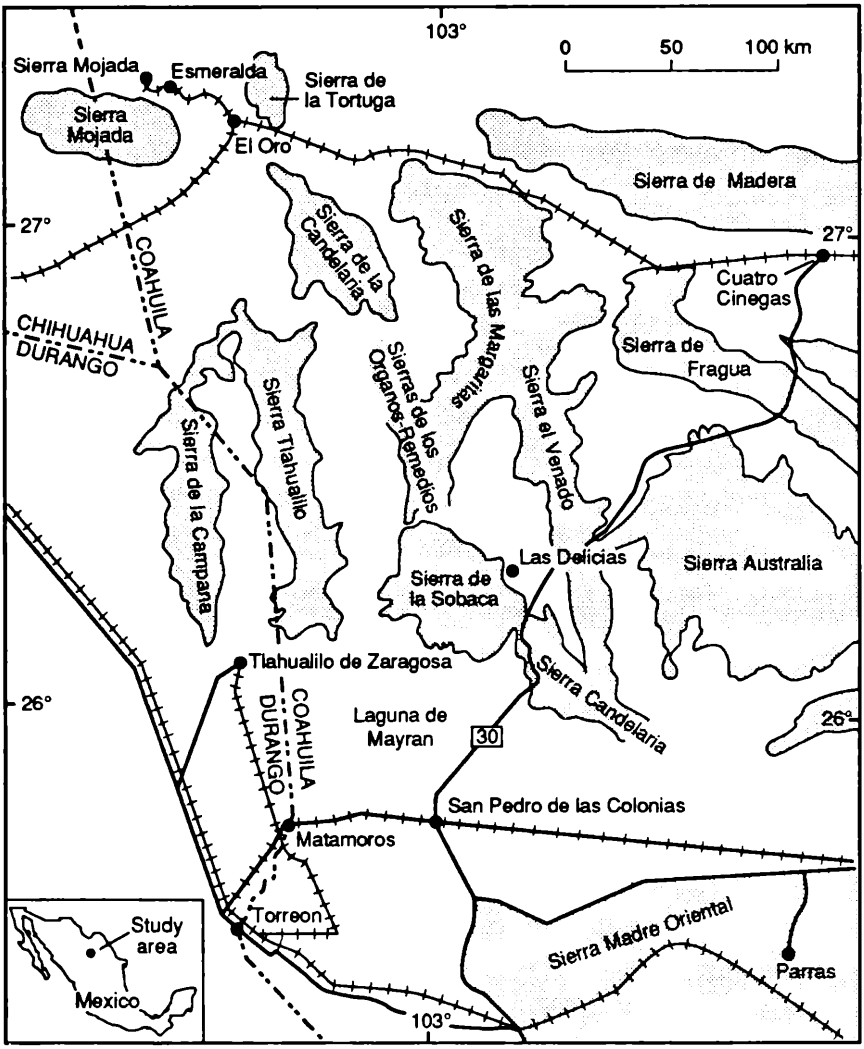
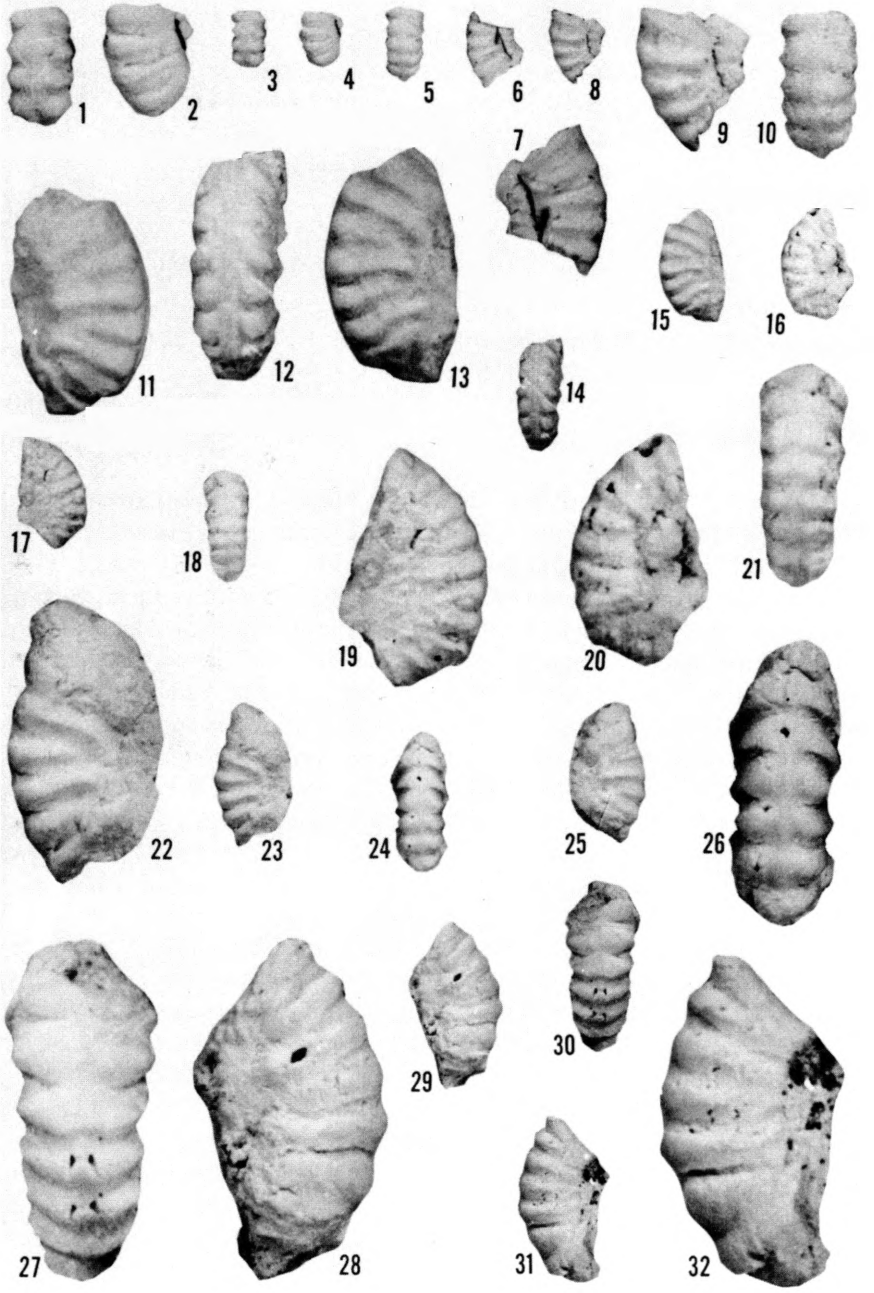


FIGURE 1. Map of central Coahuila, México, showing the location of the Sierra Mojada in relation to other principal localities.

FIGURE 2. *1-10, 17-26—Hysteroceras* cf *varicosum* (J. de C. Sowerby, 1824); *1-4*, WSA-2238F; *5-10*, WSA-2238-E; *17-21*, WSA-2238-D; *22-26*, WSA-2238-G. *11-16—Hysteroceras* cf. *binum* (J. Sowerby, 1815), WSA-2238-C. *27-32—Hysteroceras* cf *famelicum* Van Hoepen, 1944, WSA-2238-B. All specimens are from the early part of the Late Albian, *varicosum* zone, from the Sierra Mojada, Coahuila, México; they were collected by Frank Wingfield in the middle 1920s and are now part of the W. S. Adkins Collection of the Texas Memorial Museum, The University of Texas, Austin, Texas. *1, 2, 7, 9-13, 19-22, 26-28, 32,* × 2.0; *3-6, 8, 14-18, 23-25, 29-31,* × 1.0.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TAXONOMY

Order AMMONOIDEA
Suborder AMMONITINAE Hyatt, 1889
Superfamily ACANTHOCERATACEAE Hyatt, 1900
Family BRANCOCERATIDAE Spath, 1933
Subfamily BRANCOCERATINAE Spath, 1933

Genus *Hysteroceras* Hyatt, 1900

Type species.—*Ammonites varicosus* J. de C. Sowerby, 1824. See Arkell et al. (1957) for synonymy.

Hysteroceras cf. *varicosum* (J. de C. Sowerby, 1824)
Figs. 2:1-10, 17-26; 3:1-3, 6, 7, 9, 10

Material.—Specimens WSA-2238-D, WSA-2238-E, WSA-2238-F, and WSA-2238-G, from the early Late Albian of Sierra Mojada, Coahuila, México.

Remarks.—Although all are fragmental, these ammonites from Sierra Mojada appear to be quite close to *Hysteroceras varicosum* (J. de C. Sowerby, 1824), and are probably conspecific with it. The density of ribbing, the absence or near-absence of a keel, the ribs often meeting across the venter, the slight ventrad increase in width of the ribs, and the generally rectiradiate ventral ends of the ribs all indicate Sowerby's species. Stieler's (Spath, 1934: text figs. 163 and 164; Marcinowski and Wiedmann, 1990: pl. 8, figs. lab) variety *binodosa* seems to be eliminated because its ribbing is less dense. *Hysteroceras sparsicostatum* Van Hoepen (1944, pl. 24, figs. 7-9, which is a homonym of *H. semileve* Haas var. *sparsicostatum* Haas, 1942) cannot be eliminated as a possibility for these specimens from Sierra Mojada. But *H. sparsicostatum* Van Hoepen, 1944 (non Haas, 1942) is probably a synonym of *H. varicosum* (Sowerby, 1824) anyway.

The sutures of the Sierra Mojada specimens (Figs. 3:2, 5, 9) seem normal enough, except for the wide ventral saddle also frequently shortened in the adorad-aborad direction, but such sutures seem to be typical of juveniles (Spath, 1934: text fig. 161s), and even for the genus (Wiedmann and Dieni, 1968: fig. 85; Spath, 1934: text fig. 161).

Measurements.—WSA-2238-D, 6.4, 6.0, 1.07; WSA-2238-E, 4.2, 4.7, 0.89; WSA-2238-F, 4.9, 4.0, 1.23; WSA-2238-G, 7.1, 5.9, 1.20.

Comparisons.—Among comparable species *Hysteroceras amplificatum* Van Hoepen (1944: pl. 24, figs. 3-4) has mostly bifurcating ribs, and with *H. adele* Van Hoepen (1944: pl. 23, figs. 1-2) the ribbing is largely rursiradiate. In *H. varicosum angolana* Haas (1942: pl. 1, fig. 21 and pl. 2, figs. 1-17), the cross-section is more squared, but this may not be of subspecific importance. *H. anguinum* Van Hoepen (1944: pl. 23, figs. 11-12), *H. choffati* Spath (1925: pl. 28, figs. lab, 4) *H. ascendens* Spath

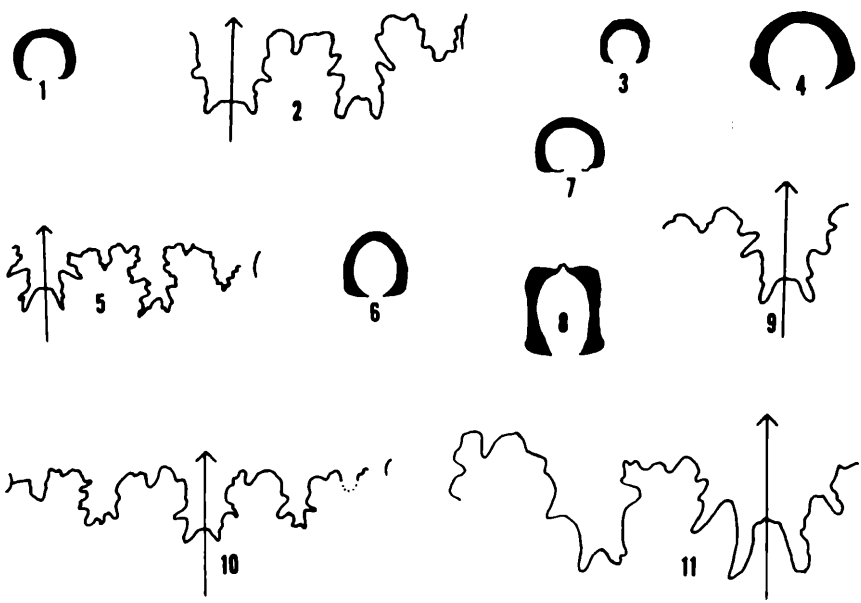

FIGURE 3. *1-3, 6, 7, 9, 10—Hysteroceras* cf. *varicosum* (J. de C. Sowerby, 1924); *1*, WSA-2238-G, × 1.0; *2, 3*, WSA-2238-F, *2* ×, 4.5 @ H = 4.2 mm, *3*, × 1.1; *6, 10*, WSA-2238-F, *6*, × 1.0, *10*, × 4.0 @ H = 4.9 mm; *7, 9*, WSA-2238-D, *7*, × 1.0, *9*, × 4.6 @ H = 4.5 mm. *4, 11—Hysteroceras* cf. *famelicum* Van Hoepen, 1944, WSA-2238-B, *4*, × 1.2, *11*, × 5.0 @ H = 4.8 mm. *5, 8—Hysteroceras* cf. *binum* (J. Sowerby, 1815), WSA-2238-C, *5*, × 3.5 @ H = 7.4 mm, *8*, × 1.8. All specimens are from the lower part of the Late Albian, *varicosum* zone, from Sierra Mojada, Coahuila, México.

(1934: pl. 56, fig. 11), and *H. bucklandi* Spath (1934: pl. 56, fig. 1 and text figs. 170a-d) are all much more densicostate. The specimens from Sierra Mojada compare favorably with specimens described by Young (1984) from Trans-Pecos Texas.

Hysteroceras cf. *binum* (J. Sowerby, 1815)
Figs. 2:11-16; 3:5,8

Material.—One specimen, WSA-2238-C.

Remarks.—WSA-2238-C has ribbing much like the specimens compared to *H. varicosum* (J. de C. Sowerby, 1824), but there is a definite, continuous keel, as in most nonadult specimens of *H. binum* (J. Sowerby) (Spath, 1934: pl. 53, figs. 8, 9 and text fig. 165). The height is also considerably greater than the width, as is also true of *H. binum*. The ribs are also not as strong at midflank as on the remainder of the conch.

Measurements.—WSA-2238-C, 7.1, 6.2, 1.15.

Comparisons.—Species comparable to *H. binum* (Sowerby) are *H. antipodium* Etheridge and *H. carinatum* Spath. *H. antipoduim* Etheridge (Henderson, 1990: figs. 3a-c, f-o, and fig. 4) has much wider ribs with

narrower interribs than WSA-2238-C, and *H. corinatum* Spath (1934: pl. 53, figs. 4,5) does not have a weakening of the ribs at midflank.

Hysteroceras cf. *famelicum* Van Hoepen, 1944

Figs. 2:27-32; 3:4, 11

Material.—One specimen, WSA-2238-B

Remarks.—WSA-2238-B is an unusually robust specimen with strong, rectiradiate ribs that slowly expand ventrad and cross over the venter without diminution. Interribs are slightly narrower than ribs. Ribs may bifurcate, but some are also single, primary, with shorter intercalations. Height and width are about equal. This specimen more closely resembles *Hysteroceras famelicum* Van Hoepen (1944: pl. 21, figs. 7-9) than other species.

Measurements.—WSA-2238-B, 9.4, 9.0, 1.04.

Comparisons.—Species with comparable ribbing include *H. binum* var. *lobitoensis* Haas, 1942, *H. pseudocornutum* Spath, 1934, *H. tholei* Van Hoepen, 1944, and *H.* aff. *bucklandi* Spath, 1934. *Hysteroceras bucklandi* Spath, of course, has ribs that meet in chevrons pointing adorad on the venter, and usually has a keel, except, perhaps, on the body chamber. *H.* aff. *bucklandi* Spath (1934: text-figs. 169b-c) has more the appearance of *H. famelicum* Van Hoepen (1944: pl. 21, figs. 7-9), except there does seem to be the remnant of a keel associated with each rib as that rib crosses the venter. *H. binum* var. *lobitoensis* Haas (1942: pl. 4, figs. 13-19) has similar ribbing, but the height/width ratio is somewhat greater than 1.0. Both *H. pseudocornutum* Spath (1934: text figs. 172a-e and pl. 53, figs. 3a-b, 4a-b) and *H. tholei* Van Hoepen (1944: pl. 22, figs. 1-3) have ribbing similar to that of *H. famelicum* Van Hoepen, but there is also a remnant of a keel in each species, and each species has a height/width ratio of somewhat less than 1.0.

Conclusions

Hysteroceras was described from México by Böse (1923: pl. 11, figs. 41, 45-51) as *Branoceras* aff. *varicosum* (Sowerby); specimens in his figs. 45 and 49 could conceivably by conspecific with the *Hysteroceras* cf. *famelicum* illustrated herein (figs. 2:27-32). Young (1984) described *Hysteroceras varicosum* (Sowerby, 1824), *H. orbignyi* Spath, *H.* cf *orbignyi* Spath, and *H.* (?) n. sp. from the *Boeseites* fauna of Trans-Pecos Texas. All of these fossils probably represent the *varicosum* zone of the lower part of the Late Albian. Böse (1923) referred to his as Vraconian, but Böse interpreted the Vraconian as synonymous with Upper Albian as used today. These fossils represent deposition during the highstand of sea level that occured during the early part of the Late Albian.

Young (1984) proposed that the *Boeseites romeri* (Haas) fauna of the *varicosum* zone of Angola had migrated via an eperic sea across a sag

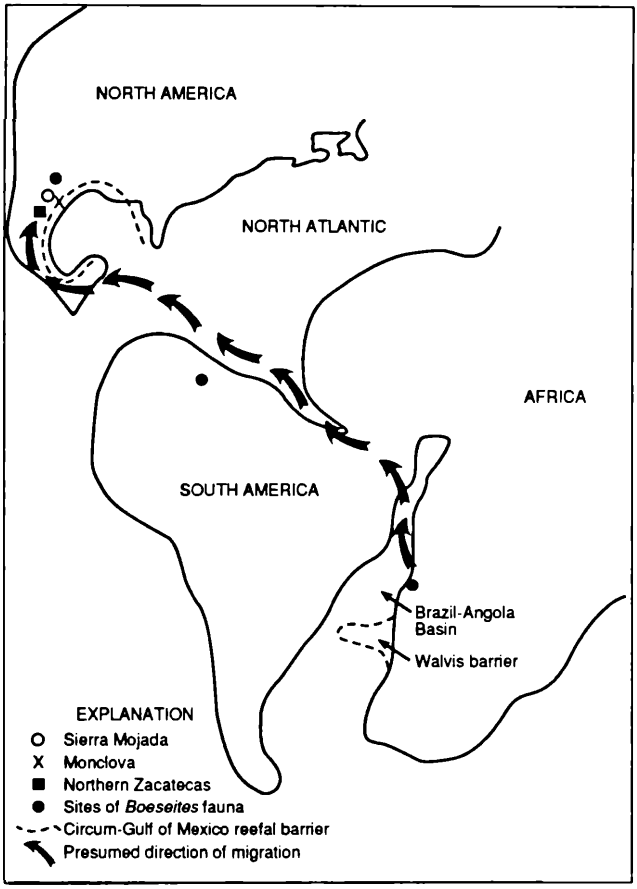

FIGURE 4. Proposed route of migration of the *Boeseites* fauna from Angola to Texas and México via a sag between South America and North Africa at the highstand of sea level in the early part of the Late Albian (*varicosum* zone). Modified from Young (1984).

(Kennedy and Cooper, 1975; Sclater et al., 1977) along the boundary of South America and Africa some 15 million years before these were separated by an oceanic connection (Fig. 4). The occurrence of *Hysteroceras* much like, if not conspecific with, *H. famelicum* Van Hoepen (1944) at Sierra Mojada emphasizes this connection, because *H. famelicum* previously has been reported only from Angola.

ACKNOWLEDGMENTS

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