Ammonite zones of northern Chihuahua

Keith Young, 1969, pp. 97-101

in:
The Border Region (Chihuahua, Mexico, & USA), Cordoba, D. A.; Wengerd, S. A.; Shomaker, J. W.; [eds.], New Mexico Geological Society 20th Annual Fall Field Conference Guidebook, 228 p.

This is one of many related papers that were included in the 1969 NMGS Fall Field Conference Guidebook.

Annual NMGS Fall Field Conference Guidebooks

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual Fall Field Conference that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

Free Downloads

NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. Non-members will have access to guidebook papers two years after publication. Members have access to all papers. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our operating budget. Therefore, only research papers are available for download. Road logs, mini-papers, maps, stratigraphic charts, and other selected content are available only in the printed guidebooks.

Copyright Information

Publications of the New Mexico Geological Society, printed and electronic, are protected by the copyright laws of the United States. No material from the NMGS website, or printed and electronic publications, may be reprinted or redistributed without NMGS permission. Contact us for permission to reprint portions of any of our publications.

One printed copy of any materials from the NMGS website or our print and electronic publications may be made for individual use without our permission. Teachers and students may make unlimited copies for educational use. Any other use of these materials requires explicit permission.
AMMONITE ZONES OF NORTHERN CHIHUAHUA

by
KEITH YOUNG
Department of Geology, University of Texas at Austin

ABSTRACT

Although the most persistent ammonite zones of northern Chihuahua represent the late Aptian and the Albian, even these stages have an incomplete ammonite zonation. Non-ammonite-bearing rudistid facies are also present in parts of the Albian and Aptian in most areas.

Generally the pre-Upper Aptian rocks are either of the continental facies, or they are not exposed. Consequently, Jurassic ammonites are known from only one northern Chihuahua locality, vicinity of Placer de Guadalupe, and Neocomian ammonites from only two northern Chihuahua localities, vicinity of Placer de Guadalupe and vicinity of Samayaluca.

Lower Cenomanian zones are persistent and wide-spread, but have not been thoroughly studied. Post-Lower Cenomanian zones are known only from that area along the Rio Bravo adjacent to Texas.

The following stages are represented by ammonite zones in Northern Chihuahua: Kimmeridgian and Tithonian (Jurassic), Hauterivian, Aptian, Albian, Cenomanian, Turonian, and Senonian (Cretaceous).

RESUMEN

Aun cuando las zonas de amonitas más persistentes del norte de Chihuahua representan el Aptiano tardío y el Albiano, éstos estados aim tienen una zonation incompleta. Las facies de rudistas sin amonitas también están presentes en partes del Albian y Aptiano, en la mayor parte del área.

Generalmente las rocas del Aptiano Superior son facies continentales ó no están expuestas. Consecuentemente, las amonitas jurasicas se conocen solamente en una localidad del norte de Chihuahua, ésto es, en la vecindad de Placer de Guadalupe; las amonitas neocomianas se conocen en dos localidades en el norte de Chihuahua, que son Placer de Guadalupe y Samayaluca.

Las zonas del Cenomaniano Inferior son persistentes y están ampliamente distribuidas, pero no han sido estudiadas a fondo. Las zonas del post-Cenomaniano Inferior se conocen solamente en el área adyacente a Texas, a lo largo del Rio Bravo.

Los siguientes estados están representados por zonas de amonitas en el norte de Chihuahua Kimeridgiano y Titoniano (Jurásico), Hauteriviano, Aptiano, Albian, Cenomaniano, Turoniano y Senoniano (Cretácico).

INTRODUCTION

Ammonites of northern Chihuahua have not been studied in great detail. Scott (1940) described late Aptian and early Albian ammonites from the southern Quitman Mountains, Trans-Pecos Texas. These ammonites occur also in adjacent Chihuahua, and many of them occur even farther into Chihuahua. Since the ammonites described by Scott belong to a cosmopolitan fauna, many of them, or closely related forms, are known from other parts of the world (Casey, 1961). Stoyanow (1949) described ammonites of late Aptian and Lower Cenomanian ages from southern Arizona. Unknowingly, Scott (1940) and Stoyanow (1949) described some of the same species under different names (Casey, 1961). The Late Aptian-Early Albian ammonites are a very interesting group, and I have been working on those of northern Mexico, Texas, New Mexico, and Arizona, off and on, for a number of years. It will be at least another five years before I feel confident to publish a thorough study. The incompleteness of these studies accounts for the extensive use of aff. and cf. in the present paper.

Rose's (1910) monograph on the Cerro de Muleros fauna constitutes the only work on Upper Albian ammonites in northern Chihuahua, and is the earliest paper on northern Chihuahua ammonites. The ammonites described by Bose are mostly lower Upper Albian; additional localities for some of these ammonites in northern Chihuahua have been listed recently by Young (1966b, 1968). Powell (1963a, 1963b) has described Cenomanian and Turonian ammonites from northeastern Chihuahua, but he did not collect south and west of the Sobaco syncline just west of Cuchillo Parado. The age of Upper Cretaceous shales, such as those east of Aldama (Diaz, 1956) is not known. Young (1966a) has studied the occurrence of lower Cenomanian ammonites from the Sierra Lágrima (see also Haenggi, 1966).

Wolleben (1967) has described Santonian and Campanian ammonites from the Ojinaga area and adjacent Texas. These ammonites had not been described previously, except for the ammonites Hyatt (1903) described from the "San Carlos Beds." San Carlos Formation is no longer applied to the beds from which Hyatt described "San Carlos" ammonites, and these beds are now referred to the Ojinaga Formation.

It should be pointed out that as early as 1918 and 1919...
W. T. Keller had a group of Swiss geologists in northern Chihuahua, working for "El Aguila" (La Compania de Méxicana de Shell). Keller collected Campanian fossils in the vicinity of Ojinaga and La Mula, and Jurassic fossils at San Sostenes. These fossils were taken to Tampico and were eventually deposited in the University of Texas collections as the "El Aguila" part of the W. S. Adkins collection. These fossils had also been seen by Burkhardt (1933) and still accompany a label bearing the name of the collector, the date, and the locality.

REMARKS ON AMMONITE ZONATION

The ammonite zones of Tables 1 and 2 are incomplete. There are three reasons for incomplete ammonite zonation: (1) collection failure, (2) wrong environment, e. g., ammonites are not found in non-marine rocks, nor are they found in rudist-beariing strata, and (3) lacunae. The first two examples appear to be mainly responsible for the absence of many ammonite zones in northern Chihuahua.

JURASSIC ZONES

I have listed only two Jurassic zones from northern Chihuahua. W. S. Adkins and R. E. King collected the fossils, and Imlay (1943) described them. However, there may be more than two zones, as indicated by the age comparisons of Imlay (1943, p. 529).

The absence of Upper Kimmeridgian and Lower Tithonian zones in the Placer de Guadalupe area is probably the result of collection failure in rocks that do not abound with fossils. Upper Tithonian and Lower Neocomian (Berriasian and Valanginian zones) are likewise probably absent by collection failure in this vicinity; they could be cut out by complex structure, or these slightly fossiliferous beds may not as yet have yielded fossils. No one has found a Jurassic-Cretaceous unconformity in this area, but I must admit that not many have tried. Fossils of the Kosmatia rancheriensis Imlay zone also occur in the Jurassic Malone Formation of the Malone Mountains; the specimen that I have identified is a Kosmatia kingi Imlay. Otherwise, the Jurassic is not known north or northeast of the vicinity of Placer de Guadalupe, unless the Jurassic at Sierra de Ojo Caliente, stop 4 of trip A-13, 20th International Geological Congress (Diaz, 1956, p. 312, Fig. 4) has been correctly dated.

CRETACEOUS ZONES

The collection in the summer of 1968 by D. S. Webb of a good specimen of Leopoldia victoriensis Imlay (1938) from the sandstones along the highway south of Samalayuca has changed the age of these rocks, formerly reported as Jurassic by William E. Humphrey (Diaz, 1956, p. 28) on field identification only. These rocks are lower Haueterian.

The same rocks with the same fossils occur at Placer de Guadalupe where Bridges (1962, 1965, pp. 74-76) reported them as Jurassic because I made misidentifications similar to Humphrey's. An isolated specimen, in different lithology, of Leopoldia sp. cf. leopoldinus (d'Oriibigny), collected by DeFord from near the picachos in the vicinity of Placer de Guadalupe, likewise is lower Haueterian. Two Lower Cretaceous ammonites (presumably pre-Aptian) are rumored to have come from near Cuchillo Parado, but these seem to be misplaced. No pre-Aptian ammonites from northern Chihuahua, other than those mentioned above, are known to the writer.

Jurassic and Cretaceous fossils are reported at Sierra de Ojo Caliente (Diaz, 1956, p. 26, 31, 32). I have seen no identifiable fossils from this locality.

The absence of upper Haueterian, Barremian, and most of the Lower Aptian ammonites from northern Chihuahua can usually be attributed to the occurrence of the wrong facies. In many localities the Navarette evaporite section is overlain by continental deposits, as on the west flank of the Sierra de la Aldea, east of Cuchillo Parado. At this locality, above the evaporites, pulmonate land snails have been collected by Young, Powell, Diaz, and DeFord. In the southern Quitman Mountains, dinosaur bones were collected by Donald Campbell (1968) and Bill Jones (1968) from the Las Vegas formation. How much of the Las Vegas Formation is terrestrial is debatable, but the Las Vegas and Navarette formations certainly represent environments inhospitable to ammonites.

The first ammonites above the lower Haueterian represent the latest Lower Aptian. These are Cheloniceras sp., one specimen from the Sierra del Presidio; Cheloniceras adkinsi Scott, from the southern Quitman Mountains, which may not be a Cheloniceras; and a specimen of Cheloniceras from just above the redbed sequence on the east flank of Sierra Cuervo, north of Aldama. Only in these three areas have probable late Lower Aptian fossils been collected.

Upper Aptian fossils are well known in northern Chihuahua and adjacent Trans-Pecos Texas (Table 1).

The zone of Dufrenoyia justinae (Hill) is not as widespread as heretofore assumed, since myself and others have misidentified Hycanchtolithes bakeri Scott as D. justinae on more than one occasion. In addition, the Dufrenoyia justinae zone may represent other zones too, but the geological sections have not been collected in detail, and none have received the type of study necessary to produce exact collections.

Overlying the zone of Dufrenoyia justinae in the southern Quitman Mountains of Trans-Pecos Texas, the Sierra del Presidio, and the Bisbee district of southeastern Arizona is the zone of Kazanskyella trinitense (Scott). Finer collecting may also produce a more detailed zonation at this level. This fauna has not been collected to the south of these areas, probably because it is replaced by the late Aptian-lower Albian rudist complex. Gillerman (1958, pp. 47-50) collected a fauna of approximately the same age from the Carbonate Hill Limestone in the central Peloncillo Mountains. Some of his specimens seem to be closely related to Kazanskyella n. sp. from the Bexar Shale in the Spahn well in Gonzales County, south Texas. I also have a good specimen of Kazanskyella trinitense (Scott) from the Sierra de Sabinas-Lampazos, northwest of Sabinas Hidalgo, Nuevo Leon.

The Lower Albian zone of Hypacantholithes bakeri Scott
is widespread. In addition to the localities mentioned (Table 1), H. bakeri Scott was collected by R. E. King and W. S. Adkins at Cerro Chino, north of Coyame, and by Haenggi, Young, Gries, and Heiken, on the east flank of the Sierra Lagrima, opposite Rancho la Bomba.

The zone of Quitmanites ceratitosus (Scott) seems to lie between the zone of Douvilleiceras and the zone of Hypacanthoplites bakeri. Collecting has not been in sufficient detail to verify this additional zone, especially since Scott's (1940, pp. 981-984) Locality MI would seem to range through at least three zones.

The zone of Douvilleiceras mammilatum s.l. is widespread throughout much of the world at the base of the middle Albian. The zone of D. mammilatum s.l. probably includes the zone of "Sonneratia" whitneyi Scott. Therefore I have used two zones, "S." whitneyi above and Douvilleiceras quitmanensis below. "Sonneratia" whitneyi is not a Sonneratia, and may turn out to be a special offshoot of Hypacanthoplites with flexuous ribs. Its occurrence with Hypacanthoplites n.sp. is apparently another example of endemic species of relict genera behind the Texas-Mexico barrier reef system (Young, 1966a, 1969). In this zone endemic species of Hypacanthoplites range into rocks younger than those represented for the genus in other parts of the world.

Except for a clay-marl facies at Banco Lucero (Webb, D. S., 1969, personal communication) apparently extending into the region from the southwest, the remainder of the Middle Albian in northern Chihuahua is represented by reef facies (Finlay Limestone, etc.). Webb has collected, from the pinchout of the clay-marl facies, a couple of small ammonites that appear to be related to Tegoceras, but they are poorly preserved and more specimens are needed before a zone can be set up.

The next overlying ammonite zone is the zone of Manuiceras powelli Young, which represents the base of the Upper Albian. Fossils of this zone have been found only at the north end of the Sierra del Presidio (Rancherias, collected by Diaz and others in 1945) and in the southern Quitman Mountains (collected by T. W. Stanton, and later by Bill Jones). The fossils collected by Diaz and others and T. W. Stanton are in the United States National Museum. The fossils collected by Bill Jones are in the collections at the University of Texas. South of these areas rudist facies of this age appear to be more complete, and ammonites have not been recovered.

The zones of Adkinsites bravensis (Bose) and Boesites romeri (Haas) are widespread from the vicinity of Placer de Guadalupe to the north into Texas and to the east into Nuevo Leon (Young, 1966b, 1968). In northern Chihuahua they occur in the Benevides Formation. The occurrence of the overlying zone of Pervinquieria equi-

### TABLE 1.

**CUCHILLO FORMATION**

| Zone of "Sonneratia" whitneyi Scott (Middle Albian) | Hypacanthoplites n. sp. |
| "Sonneratia" whitneyi Scott | T |
| Douvilleiceras quitmanense Scott (Middle Albian) | D. reesidei (Scott) |
| (= Triuoceras res Scott) | D. (?) dublapi (Scott) |
| (= Douvilleiceras affinis Scott non White) | D. spp. cf. mammilatum (Schlotheim) s. l. |
| Zone of Quitmanites ceratitosus Scott (Lower Albian) | Hypacanthoplites mayfieldensis Scott |
| Quitmanites ceratitosus Scott | Hypacanthoplites mayfieldensis Scott |
| Quitmanites n. sp. aff. evolutus (Scott) | Hypacanthoplites mayfieldensis Scott |
| Zone of Hypacanthoplites mayfieldensis Scott (Lower Albian) | (= Hypacanthoplites cragini Scott) |
| Hypacanthoplites rugosus Scott | (= Hypacanthoplites cragini Scott) |
| Hypacanthoplites bakeri Scott | Hypacanthoplites cragini Scott |
| Zone of Kazaksyella trinitensis (Scott) (Upper Aptian-Clamsayers) | (Kazaksyella trinitensis (Scott) |
| Kazaksyella trinitensis (Scott) | (Kazaksyella trinitensis (Scott) |
| Kazaksyella minima (Scott) | (Kazaksyella minima (Scott) |
| Kazaksyella cuchillensis (Scott) | Kazaksyella cuchillensis (Scott) |
| Kazaksyella n. sp. | Kazaksyella n. sp. |

**LAS VIGAS FORMATION**

| Zone of Leopoldia victoriensis Imlay (Upper Albian) | Neocomites spp. aff. neocomiensis (d'Orbigny) |
| Neocomites spp. aff. neocomiensis (d'Orbigny) | Neocomites spp. aff. neocomiensis (d'Orbigny) |
| Leopoldia sp. cf. leopoldinus (d'Orbigny) | Killanea (?) sp. |

**RANCHERIAS FORMATION**

| Zone of Kossinatia rancheriensis Imlay (Tithonian, probably Middle) | Kossinatia varicosata Imlay |
| Kossinatia varicosata Imlay (Kossinatia kingi Imlay) | K. sp. cf. alamiteoniensis (Aguilera & Castillo) |
| K. rancheriensis Imlay | Zone of Waagenia spp. (Kimmeridgian, Middle) |
| Waagenia sp. cf. knoppi (Neumayr) | Waagenia sp. cf. beckeri (Neumayr) |
| Waagenia sp. cf. harpephora (Neumayr) | Waagenia sp. cf. harpephora (Neumayr) |

Key to symbols for localities:
A—Southeastern Arizona.
B—Bexar Shale, South Texas subsurface.
V—Sierra de la Ventana, northeastern Chihuahua.
G—Placer de Guadalupe and vicinity, Chihuahua.
M—Malone Mountains, Texas.
P—Sierra del Presidio, northeastern Chihuahua.
Q—Quitman Mountains (southern) and vicinity, Texas.
S—Vicinity of Sanalayuca, northern Chihuahua.
T—Central Texas.
distans (Cragin) is spotty, however, being replaced by rudistid facies in most areas. Rudistid facies occupy the interval between the zones of P. equidistans and Plesiotturritilites brazoensis (Romer), and in some areas even replace the P. brazoensis zone. An exception to this statement is an area generally north of the rudistid facies of this age, from which Bose (1910) described the Cerro de Muleros fauna.

The boundary between the Upper and Lower Cretaceous (Albian-Cenomanian) is at the base of the P. brazoensis zone and is gradational throughout the area.

The Del Rio Claystone and Buda Limestone zones are Lower Cenomanian and include the zone of Graysonites lozoi Young in the Del Rio and the zone of Budaiceras hyatti (Shattuck) in the Buda Limestone.

The post-lower Cenomanian zones are restricted to that part of Chihuahua along the Rio Bravo next to Texas, except for a bed of Spathites in the Ojinaga Shale in the Sobaco syncline west of Cuchillo Parado (Powell, I. Dan, personal communication). The presumably Upper Cretaceous shales some 20 miles by road toward Ciudad Chihuahu from Placer de Guadalupe have not yet yielded fossils (Diaz, 1956, p. 34). Eventually some of the zones of the Ojinaga Formation may be found in the synclines of northern Chihuahua.

**SUMMARY**

In summary, I would like to point out that the above zonation is, as yet, highly incomplete. Detailed sections need to be measured, and many, many more fossils need to be collected before the zonal scheme can become entirely satisfactory. In addition, there is a great opportunity to collect rudists from the more massive limestone formations between the ammonite zones. Rudistid zones can then be intercalated with the ammonite zones so that a rudistid-ammonite zonation may be compiled that will be satisfac-

---

**TABLE 2.**

**POST-FINLAY AMMONITE ZONES OF NORTHERN CHIHUAHUA.**

| Zone of Submortoniceras tequesquitense Young (Lower Cenomanian) | Zone of Delawarea delawarensis (Morton) (Lower Campanian) |
| Zone of Submortoniceras candelaricae Young | Delawarea delawarensis (Morton) |
| Placentites sylterae (Morton) adkinsi Wollenben | Placentites sylterae (Morton) adkinsi Wollenben |
| Texanites shihensis Young | Texanites shihensis Young |
| Texanites sp. aff. omeresiensis Reeside | Bevahites behaensis Collignon |
| Bevahites costatus Collignon coshuaslensis Young | Pseudochloenbachia chihuensensis Adkins |
| Glyptoxoceras ellisoni Young | Zone of Texanites stagneri densicostus (Spacht) (Lower Santonian) |
| Texanites sp. aff. stagneri (Spacht) densicostus (Spacht) | Zone of Pterocoryx benunensae Yeatson (Upper Coniacian) |
| Pterocoryx adkinsiae Yeatson | Zone of Pervinquiera equidistans (Cragin) (Upper Albian) |
| Pterocoryx adkinsiae Yeatson | Zone of Pervinquiera equidistans (Cragin) |
| Collignoniceras spaethi Powell | Zone of Pervinquiera equidistans (Cragin) [== Pervinquiera kiliani (Lasswitz)] |
| Mammites depressus Powell | Zone of Boecheites roemeri (Haas) (Upper Albian) |
| Neoptychites xefiformis Pervinquiere | Boecheites roemeri (Haas) |
| N. gorgiochoni Pervinquiere | Boecheites sp. aff. armatum (Haas) |
| Romaniceras sp. | Hysterocecas sp. |
| Calopoceras sp. | Zone of Arkiniceras bravoensis (Boe) (Upper Albian) |
| Spathites riocensis Powell | Arkiniceras bravoensis (Boe) |
| Zone of Mammites nodosoides (Schlotheim) (Lower Turonian) | Arkiniceras bravoensis (Boe) |
| Mammites nodosoides (Schlotheim) | Zone of Arkiniceras bravoensis (Boe) (Upper Albian) |
| Acanthoceras caviortense Powell | Arkiniceras bravoensis (Boe) |
| Acanthoceras sp. aff. hippocastanum (J. Sowerby) | Zone of Arkiniceras bravoensis (Boe) (Upper Albian) |
| Pseudospicularia flexuosa Powell | Zone of Mammites nodosoides (Schlotheim) |
| Vasoceras sp. | Mammites nodosoides (Schlotheim) |
| Fagesia harmanni (Boe) | Mammites nodosoides (Schlotheim) |
| Phacysassoceras globosum Reynment | Mammites nodosoides (Schlotheim) |
| Phacysassoceras compressum (Barber) | Mammites nodosoides (Schlotheim) |
tory for the entire northern Chihuahua area and adjacent
Trans-Pecos Texas. The zonation presented here is the most
reasonable for the present data, but can easily be altered
with future data and more time.

REFERENCES

Bose, Emil, 1910, Monografía geológica y paleontológica del Cerro de
Muleros cerca de ciudad Juarez, Estado de Chihuahua y descripción
de la fauna Cretácea de la Encantada, Placer de Guadalupe, Estado
de Chihuahua, Mexico: Inst. Geol. Mexico Bol., no. 25, vi + 193
pp., 48 pls., + maps and cross-sections.

Bridges, L. W., 1962, Geology of Mina Plumas Area, Chihuahua,
Mexico: Univ. of Texas, dissertation, 241 pp., + appendix, 34 figs.,
3 pls., 11 tbs.

, 1965, Geología del Area de Plomosas, Chihuahua: pp. 1-
134, figs. 1-21, maps 1-3, tbs. 1-11, in BRIDGES, L. W., &
ZOLTAN DE CSERNA, Estudios Geológicos en el Estado de Chi-
huahua: Inst. Geol. Mexico Bol., no. 74, 148 pp., il. [translated by
Diego A. Cordoba].

Burchhardt, Carlos, 1930, etude synthétique sur le Mesozoïque Mex-
icain: Soc. PaMont. Suisse, Mem., v. 49 & 50, 280 pp., il.

Campbell, D. H., 1968, Petrol ogy of the Early Cretaceous Yucca
Formation, Southern Quitman Mountains and Vicinity, Trans-
Pecos Texas: Texas A&M Univ., dissertation, xvi 323 pp., 16 figs.,
11 pls.

Casey, Raymond, 1961, The Stratigraphical Paleontology of the
Lower Greensand: Paleontology, v. 3, pp. 487-621, 14 text figs.,
pls. 77-84.

23-32, 4 figs., in DIAZ, TEODORO, ET AL., Estratigrafía Meso-
zoica y Tectónica de la Sierra de Chihuahua: Périmo de Placer de
Guadalupe, Chih.: Geohidrologia de la Region Laguna: Estratigrafía
Mesozoica y Tectónica de la SierradMadre Oriental entre
Mapimi, Dgo. y Monterrey, N. L.: Congreso Geol. Internacional,
Excursion A-13, 120 pp., il.

Gillerman, Elliot, 1958, Geology of the Central Peloncillo Moun-
tains, Hidalgo County, New Mexico, and Cochise County, Arizona:
New Mexico Bur. of Mines and Mineral Resources, Bull. 57, 152
pp., 1 fig., 14 pls., 2 tbs.

Haenggi, Walter T., 1966, Geology of El Cuervo Area, Northeastern
Chihuahua, Mexico: University of Texas dissertation, 401 pp., 37
figs., 7 pls., 22 tbs.

Hyatt, Alpheus, 1903, Pseudoceratites of the Cretaceous: U.S. Geol.

Imlay, Ralph W., 1938, Ammonites of the Taraires Formation of
Northern Mexico: Geol. Soc. Am., Bull. v. 49, pp. 539-602, 4 figs.,
15 pls.

, 1940, Neocomian Faunas of Northern Mexico: Geol. Soc.
Am. Bull., v. 51, pp. 117-190, 7 figs., 21 pls.

, 1943, Upper Jurassic Ammonites from the Placer de
527-654, 1 text fig., pls. 87-95.

Jones, B. R., 1968, Geology of the Southern Quitman Mountains and
vicinity, Hudspeth County, Texas: Texas A&M Univ., dissertation,
162 pp., il.

Powell, J. Dan, 1963a, Cenomanian-Turonian (Cretaceous) Am-
onites from Trans-Pecos Texas and northeastern Chihuahua,
Mexico: Jour. Paleontology, v. 37, pp. 309-322, 3 figs., pls. 31-34.

, 1963b, Turonian (Cretaceous) Ammonites from north-
eastern Chihuahua, Mexico: Jour. Paleontology, v. 37, pp. 1217-
1232, 6 text-figs., pls., 166-171.

Ramirez, M. Jaime C., and Francisco Acevedo C., 1957, Notas Sobre
la Geologia de Chihuahua: Assoc. Mexicana de Geólogos Petroleros,
v. 9, pp. 583-770, 61 figs., 7 tbs., 6 strat. columns.

Scott, Gayle, 1940, Cephalopods from the Cretaceous Trinity Group
of the south-central United States: The Univ. of Texas Publ. 3945,
p. 969-1125, figs. 138-179, pls. 55-68.

Stoyanow, Alexander, 1949, Lower Cretaceous Stratigraphy in south-
pls.

Wolleben, J. A., 1967, Senonian (Cretaceous) Mollusca from Trans-
Pecos Texas and northeastern Chihuahua, Mexico: Jour. Paleon-
tology, v.41, pp. 1150-1165, 8 text figs., pls. 147-152.

Young, Keith, 1966a, Relict Lyellicerid Fauna of Texas and Northern
116.

, 1966b, Texas Mojisoviciiinae (Ammonoidea ) and the
zonation of the Fredericksburg: Geol. Soc. Am. Memoir 100, viii
+ 225 pp., 21 figs., 38 pls., 5 tbs.

, 1968, Upper Albian (Cretaceous, M. romeri zone) am-
onites in Texas and Mexico: Jour. Paleontology, v. 42, pp. 70-80,
1 text fig., pls., 15-19.

, 1969, Comanchean Barrier Reefs and Endemism of Co-
manchean Faunas: Carribean Geol. Assoc., 21 pp., 4 figs., 2 tbs.
in press].