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## *Ammonite zones of northern Chihuahua*

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# AMMONITE ZONES OF NORTHERN CHIHUAHUA

by

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## 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 Samayalucha.

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), and 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 Albian, estos estados aún 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 o no están expuestas. Consecuentemente, las amonitas jurásicas 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 Samayalucha.

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 Río 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 Rose 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 Mexicana 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 rudistid-bearing 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 Kossmatia rancheriaensis Imlay zone also occur in the Jurassic Malone Formation of the Malone Mountains; the specimen that I have identified is a Kossmatia 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 Hauerivian. 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'Orbigny), collected by DeFord from near the picachos in the vicinity of Placer de

Guadalupe, likewise is lower Hauerivian. 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 Hauerivian, 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 Vigas formation. How much of the Las Vigas Formation is terrestrial is debatable, but the Las Vigas and Navarette formations certainly represent environments inhospitable to ammonites.

The first ammonites above the lower Hauerivian 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 *Hypacanthoplites 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 rudistid 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 *Hypacanthoplites 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 Lágrima, 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 wide-ranging 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 *Mananiceras 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 rudistid facies of this age appear to be more complete, and ammonites have not been recovered.

The zones of *Adkinsites bravoensis* (Bose) and *Boesestites 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.

## PRE-FINLAY AMMONITE ZONES OF NORTHERN CHIHUAHUA (CRETACEOUS AND JURASSIC)

## CUCHILLO FORMATION

Zone of "*Sonneratia*" *whitneyi* Scott (Middle Albian)

*"Sonneratia"* *whitneyi* Scott

*Hypacanthoplites* n. sp.

Zone of *Douvilleiceras quitmanense* Scott (Middle Albian)

*Douvilleiceras quitmanense* Scott

(= *Trinitoceras rex* Scott)

(= *Douvilleiceras offarcinatum* Scott non White)

*Douvilleiceras spathi* Scott

*D. reesidei* (Scott)

*D. cuchillense* Scott

*D. (?) dunlapii* (Scott)

*D. spp. cf. mammillatum* (Schlotheim) s. l.

Zone of *Quitmanites ceratitosus* Scott (Lower Albian)

*Quitmanites ceratitosus* Scott

*Quitmanites evolutus* (Scott)

*Quitmanites* n. sp. aff. *evolutus* (Scott)

Zone of *Hypacanthoplites mayfieldensis* Scott (Lower Albian)

*Hypacanthoplites mayfieldensis* Scott

(= *Dufrenoyia robusta* Scott)

(= *Hypacanthoplites cragini* Scott)

*Hypacanthoplites rugosus* Scott

*Hypacanthoplites bakeri* Scott

Zone of *Kazanskyella trinitensis* (Scott) (Upper Aptian-Clansayes)

*Kazanskyella trinitensis* (Scott)

(= *K. spathi* Stoyanow)

*Kazanskyella minima* (Scott)

(= *K. arizonica* Stoyanow)

*Kazanskyella cuchillensis* (Scott)

*Kazanskyella* n. sp.

TQ

T

QV

Q

T

T

QP

Q

T

QPT

QPT

QFPV

QPAB

QPA

Q

B

*Hypacanthoplites immunitus* (Stoyanow)

H. sp. aff. *immunitus* (Stoyanow)

Zone of *Dufrenoyia justinae* (Hill) (Upper Aptian)

*Dufrenoyia justinae* (Hill)

(= *Dufrenoyia texana* Burckhardt)

(= *Hoplites roemeri* Cragin)

(= *Dufrenoyia burckhardt* Scott)

Zone of *Cheloniceras* sp. (Lower Aptian)

*Cheloniceras* sp. cf. *fossae* Humphrey

PA

P

PQT

P

LAS VICAS FORMATION (with great latitude—may be equivalent to Navarette Formation also).

Zone of *Leopoldia victoriensis* Imlay (Hauterivian, probably Lower)

*Leopoldia victoriensis* Imlay

S

*Neocomites* sp. aff. *neocomiensis* (d'Orbigny)

GS

*Neocomites* sp. cf. *neocomiensis* (d'Orbigny)

M

*Leopoldia* sp. cf. *leopoldinus* (d'Orbigny)

G

*Kilianella* (?) sp.

GS

RANCHERIAS FORMATION

Zone of *Kossmatia rancheriaensis* Imlay (Tithonian, probably Middle)

*Kossmatia varicostata* Imlay

GM

*Kossmatia kingi* Imlay

G

K. sp. cf. *alamitoensis* (Aguilar & Castillo)

G

*K. rancheriaensis* Imlay

G

Zone of *Waagenia* spp. (Kimmeridgian, Middle)

*Waagenia* sp. cf. *knopi* (Neumayr)

G

*Waagenia* sp. cf. *beckeri* (Neumayr)

G

*Waagenia* sp. cf. *harpephora* (Neumayr)

G

## 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 Samalayuca, 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 *Plesioturritilites 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 Creta-

ceous shales some 20 miles by road toward Ciudad Chihuahua 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.

#### OJINAGA & SAN CARLOS FORMATIONS

- Zone of *Delawarella delawarensis* (Morton) (Lower Campanian)
  - Delawarella delawarensis* (Morton)
  - Pseudoschloenbachia mexicana* (Renz)
  - Submortoniceras vanuxemi* (Morton)
  - Submortoniceras sancarlosense* Young
  - Submortoniceras candelariae* Young
  - Menabites belli* Young
  - Placenticeras syrtale* (Morton)

#### OJINAGA FORMATION

- Zone of *Submortoniceras tequesquitense* Young (Lower Campanian)
  - Submortoniceras tequesquitense* Young
  - Submortoniceras candelariae* Young
  - Placenticeras syrtale syrtale* (Morton)
  - Placenticeras syrtale* (Morton) adkinsi Wolleben
  - Texanites shiloensis* Young
  - Texanites lonsdalei* Young
  - Texanites* sp. aff. *omeraensis* Reeside
  - Bevahites behavensis* Collignon
  - Bevahites costatus* Collignon *coahuilaensis* Young
  - Pseudoschloenbachia chispaensis* Adkins
  - Glyptoxoceras ellisoni* Young
- Zone of *Texanites stangeri densicostus* (Spath) (Lower Santonian)
  - Texanites* sp. aff. *stangeri* (Spath) *densicostus* (Spath)
- Zone of *Prionocycloceras gabrieliense* Young (Upper Coniacian)
  - Prionocycloceras adkinsae* Young
  - Placenticeras colquitti* Wolleben
- Zone of *Collignoniceras chispaense* (Adkins) (Upper Turonian)
  - Collignoniceras chispaense* (Adkins)
  - Mammites depressus* Powell
  - Neptychites xetiformis* Pervinquiere
  - N. gorguechoni* Pervinquiere
  - Romaniceras* sp.
  - Coilopoceras* sp.
  - Spathites rioensis* Powell
- Zone of *Mammites nodosoides* (Schlotheim) (Lower Turonian)
  - Mammites nodosoides* (Schlotheim)
  - Acanthoceras calvertense* Powell
  - Acanthoceras* sp. aff. *hippocastanum* (J. Sowerby)
  - Pseudaspidooceras flexuosum* Powell
  - Vascoceras* sp.
  - Fagesia harmanni* (Böse)
  - Pachyvascoceras globosum* Reymont
  - Pachyvascoceras compressum* (Barber)

#### ALLOCRIOCERAS

- Allocrioceras* sp.
- Quitmaniceras reaseri* Powell
- Quitmaniceras brandi* Powell
- Zone of *Euhystrichoceras adkinsi* Powell (Lower Cenomanian)
  - Euhystrichoceras adkinsi* Powell
  - Desmoceras (Pseudouhligella) elgini* Young
  - Pseudadcompsoceras bifurcatum* Powell

#### DEL RIO CLAYSTONE

- Zone of *Graysonites lozoi* Young (Lower Cenomanian)
  - Graysonites* spp.
  - Prionocyloides* sp.
  - Ficheuria* sp.
  - Worthoceras* sp.

#### ESPY FORMATION

- Zone of *Plesioturritilites brazoensis* (Romer) (Lower Cenomanian)
  - Plesioturritilites brazoensis* (Romer)

#### BENEVIDES FORMATION

- Zone of *Pervinquiera equidistans* (Cragin) (Upper Albian)
  - Pervinquiera equidistans* (Cragin)
    - [= *Pervinquiera kiliani* (Lasswitz)]
- Zone of *Boesites romeri* (Haas) (Upper Albian)
  - Boesites romeri* (Haas)
  - Boesites* sp. aff. *armatum* (Haas)
  - Hysteroceras* sp.
  - Prohysteroceras* sp. cf. *angolanum* (Haas)
- Zone of *Adkinsites bravoensis* (Böse) (Upper Albian)
  - Adkinsites bravoensis* (Böse)
  - Adkinsites imlayi* Young
  - Manuaniceras elaboratum* Young, s. l.

#### BUDA LIMESTONE

- Zone of *Budaiceras hyatti* (Shattuck) (Lower Cenomanian)
  - Budaiceras hyatti* (Shattuck)
  - Budaiceras franciscoense* (Kellum and Mintze)
  - Faraudiella* n. sp.
  - Sharpeiceras* sp. cf. *tlahualilloense* (Kellum and Mintze)

#### FINLAY LIMESTONE (usually in interbeds between reefs or north of reefs).

- Zone of *Manuaniceras powelli* Young (basal Upper Albian)
  - Oxytropidoceras stenzeli* Young
  - Venezoliceras acutocarinatum* (Shumard)

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.

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