

**Aptian ammonites from Mazapil,
Zacatecas State (north-central Mexico)
studied by BURCKHARDT in 1906: A revision**

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Abstract: Twelve specimens of Aptian ammonites reported and drawn by BURCKHARDT in 1906, from the Mazapil area (Zacatecas State, north-central Mexico), are reviewed for taxonomical purposes. The work by BURCKHARDT was the first report of Aptian ammonoids in Mexico. In addition, it represents the only record of Aptian ammonites known from Zacatecas State. The taxonomic review of the specimens allows for the recognition of *Dufrenoyia* sp., *Colombiceras spathi* HUMPHREY, *Colombiceras mexicanus* (HUMPHREY) n. comb., *Colombiceras* sp., *Colombiceras* spp., and *Acanthohoplites* aff. *bigoureti* (SEUNES). This ammonite assemblage is indicative of a stratigraphic range that spans the uppermost lower Aptian to the upper Aptian interval.

Key Words: BURCKHARDT; ammonites; Aptian; Zacatecas State; Mexico.

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Résumé : *Révision des ammonites aptiennes étudiées par BURCKHARDT en 1906 et provenant de Mazapil, État de Zacatecas (centre nord du Mexique).*- Douze exemplaires d'ammonites aptiennes, provenant de la région de Mazapil (État de Zacatecas, centre nord du Mexique), signalées et illustrées par BURCKHARDT en 1906, sont révisées à des fins taxinomiques. Ce travail de BURCKHARDT constitue le premier rapport mentionnant des ammonoïdés aptiens au Mexique. Il s'agit, en outre, du seul compte-rendu portant des ammonites aptiennes récoltées dans l'État de Zacatecas. La révision taxinomique de ces exemplaires permet l'identification de *Dufrenoyia* sp., *Colombiceras spathi* HUMPHREY, *Colombiceras mexicanus* (HUMPHREY) n. comb., *Colombiceras* sp., *Colombiceras* spp. et *Acanthohoplites* aff. *bigoureti* (SEUNES). Cette association d'ammonites est représentative d'un intervalle stratigraphique s'étendant de la partie sommitale de l'Aptien inférieur à l'Aptien supérieur.

Mots-clefs : BURCKHARDT ; ammonites ; Aptien ; État de Zacatecas ; Mexique.

Introduction

In 1906, BURCKHARDT included an appendix of Lower Cretaceous ammonites in his report on Jurassic ammonoids from the Mazapil area of the Zacatecas State in north-central Mexico. The aim of the present work is to revise the identifications of its Aptian specimens. Since the original work was the first and, at present, the only Aptian ammonoid reported and figured from Zacatecas State, Mexico, its review is crucial to understanding the Aptian ammonoid record of Mexico. During the last century the taxonomical and biostratigraphical knowledge of Aptian ammonoids has significantly evolved. Some biostratigraphic inferences about the assemblage studied are made in this work using the ammonoid zones that were described in MORENO-BEDMAR *et al.* (2013) in Durango State.

However, the focus of that work was centered on the taxonomic revision of the ammonites, as there was no stratigraphic control in the original publication. Posterior works by BURCKHARDT (1925) and others, such as HUMPHREY (1949), made important contributions to the taxonomy of the Aptian ammonoids in Mexico. The systematic framework of the ammonoids reported in those works serves as the context that allows for a proper taxonomic revision of the Aptian ammonoids of Mazapil reported herein.

Systematic paleontology

Repository information: The ammonoids studied by BURCKHARDT (1906a and 1925) are deposited in the Museo María del Carmen PERILLIAT M., Colección Nacional de Paleontología,

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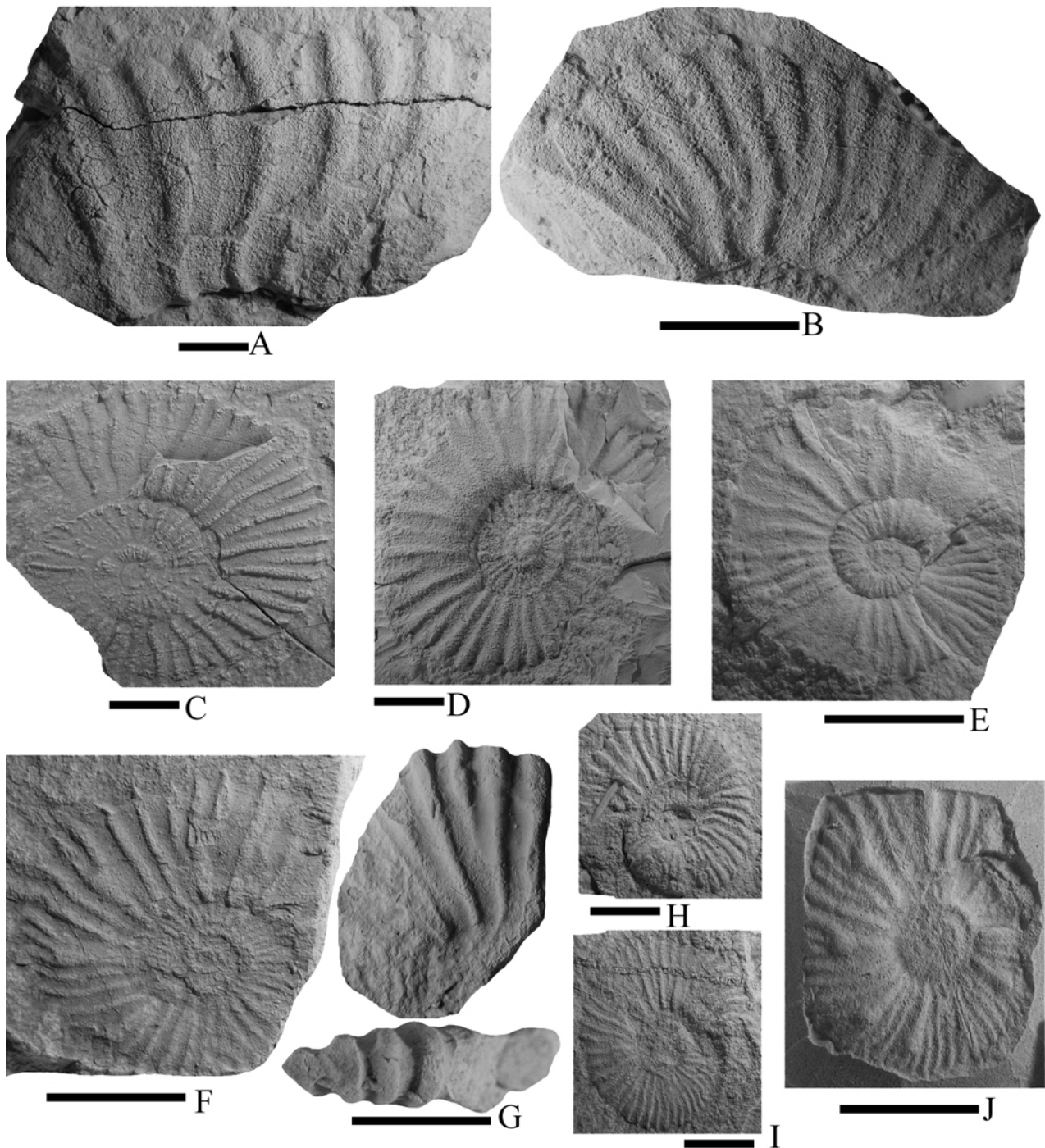


Figure 1: **A:** *Dufrenoyia* sp. lateral view of the specimen IGM 292. **B:** *Dufrenoyia* sp. lateral view of the specimen IGM 300. **C:** *Colombiceras* sp. lateral view of the specimen IGM 301. **D:** *Colombiceras spathi* lateral view of the specimen IGM 307. **E:** *Colombiceras* spp. lateral view of the specimen IGM 305. **F:** *Colombiceras* spp. lateral view of the specimen IGM 298. **G:** *Colombiceras* spp. lateral and ventral views of the specimen IGM 304. **H:** *Colombiceras spathi* lateral view of the specimen IGM 306. **I:** *Colombiceras mexicanus* lateral view of the specimen IGM 303. **J:** *Acanthohoplites* aff. *bigoureti* lateral view of the cast of the specimen IGM 299. Scale bar is 10 mm.

held by the Instituto de Geología of the UNAM (=Universidad Nacional Autónoma de México) in Mexico City, Mexico with IGM numbers (=Instituto Geológico de México). In this work we also review two ammonites that were studied by

HUMPHREY (1949) that are housed in the UMMP (=University of Michigan Museum of Paleontology) in Ann Arbor (Michigan, United States of America).

Order Ammonoidea ZITTEL, 1884**Suborder Ancyloceratina
WIEDMANN, 1966****Superfamily Deshayesitaceae
STOYANOW, 1949****Family Deshayesitidae STOYANOW, 1949****Subfamily Deshayesitinae
STOYANOW, 1949****Genus *Dufrenoyia*
KILIAN & REBOUL, 1915*****Dufrenoyia* sp.**

(Fig. 1.A-B)

- v. 1906a *Parahoplites* cfr. *aschiltaensis* ANTHULA, BURCKHARDT, p. 192, Pl. 42, fig. 8.
- v. 1906a *Parahoplites* cfr. *Treffryanus* ANTHULA non KARSTEN, BURCKHARDT, p. 193, Pl. 43, fig. 2.

Material: Two fragmentary specimens: IGM 292 and IGM 300, Cañón de San José, Sierra de la Caja (Appendix: Geologic cartography Map 1, blue arrow number 1).

Description: Due to the fragmentary condition of both specimens, only the rib pattern can be described. The specimens have falciform primary ribs that rise in the umbilical margin and project to the lateral region. The secondary ribs are intercalated 1:1 starting at the middle to upper part of the flank. Primary ribs are spatulate, a characteristic that can be also clearly observed in the secondary ribs. In the specimen IGM 292 only, the whorl height (=H) can be measured. It is 39 mm. For the other more complete specimen, IGM 300, the maximum diameter (=D) is 42 mm and H is 16.2 mm. In addition, we can count 13 ribs on the half preserved whorl.

Discussion: About the generic identification of these ammonites: The ornamentation pattern clearly belongs to the Deshayesitidae family. In Mexico, and it seems in the entire American continent, this family is only represented by the genera *Dufrenoyia* and *Burckhardtites* (MORENO-BEDMAR *et al.*, 2012a). The characteristics of the studied specimens allow attribution without any doubt to the *Dufrenoyia* genus. The fragmentary condition of the specimens and the impossibility of observing their ventral regions, prevent an unambiguous specific determination.

Occurrence: The genus *Dufrenoyia* is characteristic of the *Dufrenoyia justinae* Zone, uppermost lower Aptian.

Family Parahoplitidae SPATH, 1922**Subfamily Acanthohoplitinae
STOYANOW, 1949****Genus *Colombiceras* SPATH, 1923*****Colombiceras spathi* HUMPHREY, 1949**

(Figs. 1.D, 1.H & 2 - 3 - 4)

- v. p. 1906a *Parahoplites* cfr. *Millettianus* PICTET sp. non ORB., BURCKHARDT, p. 194, Pl. 43, fig. 4.
- v. p. 1906a *Parahoplites* sp. ind., BURCKHARDT, p. 195, Pl. 43, fig. 6.
- v. p. 1925 *Parahoplites* "several undetermined forms", BURCKHARDT, p. 23, Pl. 3, figs. 11-12, ?13.
- v. 1949 *Colombiceras spathi* HUMPHREY, p. 151, Pl. 18, figs. 7-8.
- 1976 *Colombiceras spathi* HUMPHREY, CANTÚ CHAPA, Pl. 1, figs. 8-8.a.
- v. 1989 *Colombiceras spathi* HUMPHREY, CARREÑO *et al.*, p. 198, Fig. 69.h (= HUMPHREY, 1949, Pl. 18, fig. 7).
- 1992 *Colombiceras spathi* HUMPHREY, CONTRERAS y MONTERO *et al.*, p. w.n. (=without number), Fig. w.n.
- 1992 "*Parahoplites* cf. *millettianus*" PICTET sp. non ORB., CONTRERAS y MONTERO *et al.*, p. w.n., Fig. w.n. (= BURCKHARDT, 1906, Pl. 43, fig. 4).
- v. 2000 *Colombiceras spathi* HUMPHREY, BARRAGÁN, p. 117, Pl. 57, figs. 3-10.
- v. 2001 *Colombiceras spathi* HUMPHREY, BARRAGÁN, p. 194, Fig. 4 (5).
- v. 2003 *Colombiceras spathi* HUMPHREY, MÉNDEZ-FRANCO, p. 69, Pl. 7, figs. 1-3.
- v. 2005 *Colombiceras spathi* HUMPHREY, AVILA-LICONA, p. 34, Pl. 2, fig. 3.
- v. 2008 *Colombiceras spathi* HUMPHREY, BARRAGÁN and MAURRASSE, p. 152, Fig. 3.f.
- v. 2012b *Colombiceras* aff. *spathi* HUMPHREY, MORENO-BEDMAR *et al.*, Figs. 7.P & VII.G-I.

Material: Two specimens: IGM 306 Sierra south of Sierra de San José (Appendix: Geologic cartography Map 2, blue arrow number 1) and IGM 307, Puerto Arrieros camino de Santa Rosa (Appendix: Geologic cartography Map 2, blue arrow number 2).

Description: The shell is evolute. The ornamentation consists of irregularly alternating primary and secondary ribs. Primary ribs rise on the umbilical wall and the secondary ribs start at the middle to lower part of the flank. In the juvenile and sub-adult stages, ribs are strongly spatulate and thicker than the interspaces (Fig. 2). As the ammonites approach the adult stage, the interspaces become wider than the ribs, which become less pronounced (Figs. 1.D & 2 - 3 - 4). In the specimen IGM 306 D is 25.8 mm and H is 10.1 mm. We count 20 ribs on the last half whorl. For the other specimen, IGM 307, D is 39.5 mm and H is 15.1 mm. We count 18 ribs on the last half whorl.

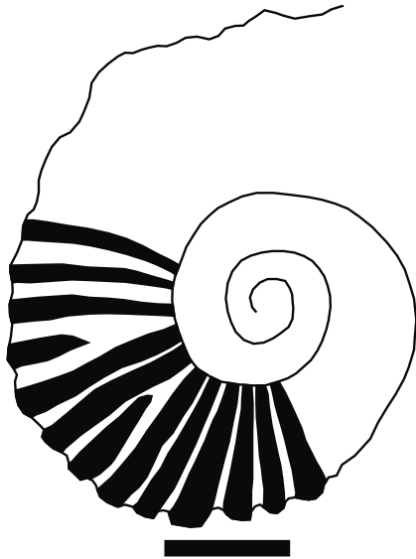


Figure 2: Schematic drawing of the specimen IGM 307, see photography in Figure 1.D. Scale bar 10 mm.

Discussion: The two specimens assigned to this taxon match very well with the morphology of the holotype UMMP 24298 (Fig. 3). BURCKHARDT (1925) described two specimens of *Colombiceras* under the generic name of *Parahoplites*. One of them, illustrated in Figure 4, can be assigned without doubt to *C. spathi*.

Occurrence: The range of this species must be made more precise in future works. Our current knowledge allows assignment to an imprecise position between ammonite zones *Dufrenoyia furcata* and *Caseyella aguilerae*, which are uppermost lower Aptian and lowermost upper Aptian, respectively. However, *Colombiceras spathi* seems to be a primitive *Colombiceras* and probably is restricted to the *Dufrenoyia justinae* Zone.

***Colombiceras mexicanus*
(HUMPHREY, 1949) n. comb.**

(Figs. 1.I & 5)

- v. p. 1906a *Parahoplites* cfr. *Milletianus* PICTET sp. non ORBIGNY, BURCKHARDT, p. 194, Pl. 43, fig. 10.
- v. 1949 *Parahoplites mexicanus* HUMPHREY, p. 137, Pl. 12, figs. 7-8.
- ? 1992 *Parahoplites mexicanus* HUMPHREY, CONTRERAS y MONTERO *et al.*, p. w.n., Fig. w.n.
- v. 2000 *Parahoplites mexicanus* HUMPHREY, BARRAGÁN, p. 130, Pl. 59, figs. 1-11.
- v.? 2003 *Parahoplites mexicanus* HUMPHREY, MÉNDEZ-FRANCO, p. 83, Pl. 8, figs. 4-6.
- v.? 2005 *Parahoplites mexicanus* HUMPHREY, AVILA-LICONA, p. 46, Pl. 9, fig. 9.

Material: One specimen: IGM 303, Puerto Arrieros camino de Santa Rosa (Appendix: Geologic cartography Map 2, blue arrow number 2).

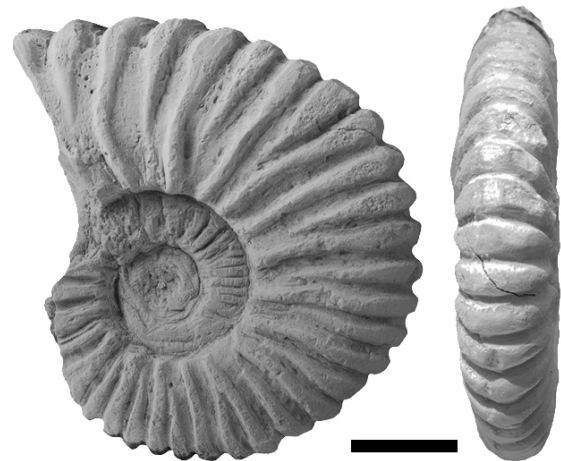


Figure 3: Holotype of *Colombiceras spathi* UMMP 24298, La Peña Formation, Rincón de Los Potreritos, Sierra del Caporal, Coahuila State, northern Mexico. Newly photographed for this work. Scale bar 10 mm.



Figure 4: *Colombiceras spathi* IGM 1879. Specimen described by BURCKHARDT (1925), Pl. 3, figs. 11-12, as belonging to the genus *Parahoplites*, La Peña Formation, Loma Verde, Río Nazas, Durango State, northern Mexico. Newly photographed for this work. Scale bar 10 mm.

Description: The shell is evolute. The ornamentation consists of primary and secondary rectiradial and non-spatulate thin ribs. The width of the ribs and interspaces is constant and similar. The secondary ribs are intercalated and/or bifurcated around the lower third of the flank. The costation density is high.

Discussion: The specimens originally identified by BURCKHARDT (1906a) as *Parahoplites* cfr. *Milletianus* are reassigned in this work to the species *Colombiceras mexicanus*. A careful review of the holotype of this species (UMMP 22668) was carried out to support this reassignment. The holotype (Fig. 5) is a well preserved specimen that displays an evolute shell with a compressed whorl section, flat flanks and a relatively flattened ventral region. When the

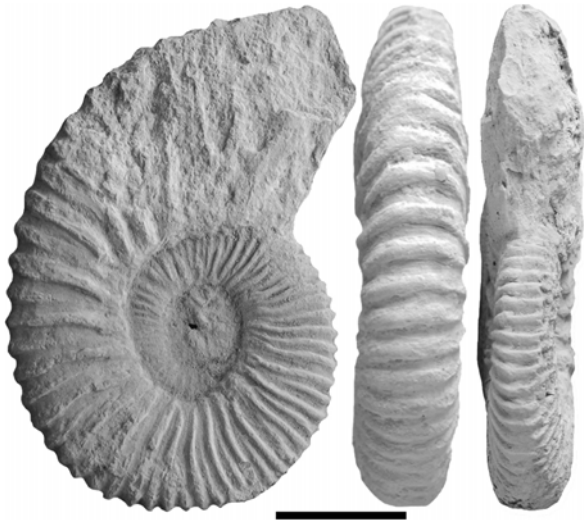


Figure 5: Holotype of *Colombiceras mexicanus* UMMMP 22668, La Peña Formation, Rincón de Los Potreritos, Sierra del Caporal, Coahuila State, northern Mexico. Newly photographed for this work. Scale bar 10 mm.

ammonite grows, the whorl section becomes rounded. These features correspond to the genus *Colombiceras*. The genera *Parahoplites* and *Kazanskyella* have a more involute shell, with a less compressed oval whorl section. *Colombiceras mexicanus* does not display spatulate ribs, a feature that usually identifies the rest of species of the genus *Colombiceras*. However, its ribs have more relief and are wider in the ventral region, which are typical characteristics of the genus. In our opinion, specimens assigned to the genus *Parahoplites* in America can be reassigned, generally, to the endemic American genus *Kazanskyella*. In the recent Bachelor thesis of OVANDO-FIGUEROA (2016) the differences between the genera *Parahoplites* and *Kazanskyella* are discussed. It seems that the genus *Parahoplites* is not present in America and previous assignments in several papers are due to generic misidentifications, such as the current case where the species *Parahoplites mexicanus* corresponds to *Colombiceras mexicanus*.

Occurrence: Upper Aptian, probably not the lowermost part. The record of the genus *Colombiceras* starts in the uppermost lower Aptian, *Dufrenoyia justinae* Zone, becoming more abundant during the upper Aptian. The first species of the genus in the stratigraphic record are clearly distinguished by their robust spatulate ribs. This morphological feature spans from the uppermost lower Aptian to the lowermost upper Aptian *Caseyella aguilerae* Zone. Upwards, above the lowermost upper Aptian, the ribs on the species of the genus become less to non-spatulate, as in the case of the species *Colombiceras mexicanus*. In summary for this species, very likely, middle to upper part of *Caseyella aguilerae* Zone.

Colombiceras sp.

(Fig. 1.C)

- v. p. 1906a *Parahoplites* cfr. *Milletianus* PICTET sp. non ORBIGNY, BURCKHARDT, p. 194, Pl. 43, fig. 5.
1992 *Colombiceras* cf. *tobleri* SINZOW, non JACOB, CONTRERAS y MONTERO *et al.* p. w.n., Fig. w.n.

Material: One specimen: IGM 301, Sierra to the south of Cerro Colorado, Santa Rosa (Appendix: Geologic cartography Map 2, blue arrow number 3).

Description: The shell is evolute. The ornamentation consists of a very regular alternating pattern of rectiradiate primary and secondary ribs. The interspaces are wider than the ribs. Additionally, in the inner whorls, some primary ribs display a tubercle at the middle of the flank, from which a bifurcated secondary rib arises. This characteristic is typical of the genus *Colombiceras*. The density of the ribs is lower than in *Colombiceras mexicanus* and is fairly constant throughout the whole coiling.

Discussion: This specimen presents a constant rib width. This characteristic stands out because species of *Colombiceras* usually have spatulate ribs. These features can be observed in the Mexican species *Colombiceras mexicanus*. However *Colombiceras* sp., described herein, presents a less dense ribbing and is similar to the specimen named as *Colombiceras tobleri* by CONTRERAS y MONTERO *et al.* (1992) from Michoacán State, western Mexico. These authors used SINZOW's (1908) conception of *C. tobleri*, which is very close to JACOB and TOBLER's (1906) proper conception of the taxon. Both conceptions of *C. tobleri* differ from the Mexican forms by presenting more robust and slightly spatulate ribs, especially in the inner whorls.

Occurrence: Upper Aptian, not the lowermost part, perhaps the middle-upper part of *Caseyella aguilerae* Zone.

Colombiceras spp.

(Fig. 1.E-F & 1.G1-G2)

- v. p. 1906a *Parahoplites* sp., BURCKHARDT, p. 192, Pl. 42, figs. 9-10; Pl. 43, fig. 3.
v. p. 1906a *Parahoplites* cf. *Milletianus* PICTET sp. non ORB., BURCKHARDT, p. 194, Pl. 43, figs. 8-9.

Material: Five specimens: IGM's 297, 298, 305, Puerto Arrieros camino de Santa Rosa, (Appendix: Geologic cartography Map 2, blue arrow number 2); IGM 304, Sierra de los Gallos Blancos (Appendix: Geologic cartography Map 2, blue arrow number 4) and IGM 7175, Sierra south of Cerro Colorado, Santa Rosa (Appendix: Geologic cartography Map 2, blue arrow number 3).

Discussion: Under *Colombiceras* spp. we include what are probably several species of the genus *Colombiceras*. The specimens could not be studied in detail due to their juvenile stage (Fig. 1.E-F), or fragmentary condition (Fig. 1.G). The generic attribution of these five specimens to the genus *Colombiceras* is clear. The characteristic tubercles in some primary ribs and the bifurcation of secondary ribs can be observed in some juvenile specimens (see Fig. 1.E-F). In other specimens, features such as the typical spatulate form of the ribs, as well as ribs with more relief that become wider in the ventral region, can be appreciated (Fig. 1.G1).

Occurrence: Uppermost lower Aptian – upper Aptian. A more precise age-assignment is difficult to infer due to the impossibility of identifying the species.

Genus *Acanthohoplites* SINZOW, 1907

Acanthohoplites aff. *bigoureti* (SEUNES, 1887)

(Figs. 1.J & 6)

- 1887 *Acanthoceras Bigoureti* SEUNES p. 566, Pl. 14, figs. 3-4.a-b.
- 1900 *Parahoplites Bigoureti* SEUNES, ANTHULA, p. 117 (63), Pl. 13 (12), fig. 2.a-c.
- 1902 *Parahoplites Bigoureti* SEUNES, LIEBUS, p. 115, Pl. 6, fig. 2.
- ? 1905 *Douvilleiceras Bigoureti* SEUNES, JACOB, p. 415, Fig. 7; Pl. 13, fig. 6.a-b.
- ? 1905 *Douvilleiceras Bigoureti Seunesi*, JACOB, p. 416, Pl. 13, figs. 7.a-b.
- 1906a *Parahoplites* sp. ind., BURCKHARDT, p. 192, Pl. 43, fig. 1.
- 1907 *Douvilleiceras bigoureti* SEUNES, PERVINQUIÈRE, p. 195, Fig. 75; Pl. 7, fig. 37.a-b & 38.a-b.
- 1907 *Douvilleiceras Bigoureti* SEUNES, COLLET, p. 526, Fig. 10.
- 1908 *Acanthohoplites Bigoureti* SEUNES, SINZOW, p. 488, Pl. 6, figs. 4, 4.a, 5, 5.a & 6.
- ? 1913 *Acanthohoplites Bigoureti* SEUNES, SINZOW, p. 111, Pl. 6, fig. 3.
- 1936 *Acanthohoplites bigoureti* SEUNES, BESAIRIE, p. 153, Pl. 15, figs. 1-2 & 9.
- ? 1938 *Acanthohoplites bigoureti* SEUNES, RIEDEL, p. 45, Pl. 8, fig. 7; Pl. 14, fig. 24.
- ? 1955 *Acanthohoplites bigoureti* SEUNES, ERISTAVI, p. 101, Pl. 4, fig. 1.
- ? 1955 *Acanthohoplites bigoureti* v. *seunesi* JACOB, ERISTAVI, p. 101, Pl. 4, fig. 3.
- 1960 *Acanthohoplites bigoureti* SEUNES, DRUSHCHITS and KUDRYAVTSEV, p. 321, Pl. 8, figs. 1.a, 1.6, 2.a & 2.6.
- 1961 *Chelonicerias bigoureti* SEUNES, ERISTAVI, p. 58, Pl. 4, fig. 1.
- 1961 *Acanthohoplites bigoureti* (SEUNES), LUPPOV, p. 182, Fig. 5; Pl. 1, figs. 4.a, 4.6, 4.b, 5.a & 5.6.
- 1962 *Acanthohoplites bigoureti* SEUNES var. *analavelonensis* COLLIGNON, p. 47, Pl. 234, figs. 1000-1004.
- 1965 *Acanthohoplites* (?) *bigoureti* SEUNES, EGOIAN, p. 127, Pl. 5, figs. 2.a, 2.6, 2.B, 3.a, 3.6 & 3.B.
- 1968 *Acanthohoplites* aff. *bigoureti* SEUNES, CANTÚ CHAPA, p. 9, Pl. 2, fig. 2.
- 1969 *Acanthohoplites* (?) *bigoureti* SEUNES, EGOIAN, p. 162, Pl. 23, fig. 33.
- ? 1971 *Acanthohoplites bigoureti* (SEUNES), KVANTALIANI, p. 42, Fig. 22.a, 22.6, 22.B & 22.s; Pl. 4, fig. 3.a, 3.6 & 3.B.
- 1971 *Acanthohoplites bigoureti luppowi* (SEUNES), KVANTALIANI, p. 45, Figs. 23.a, 23.6, 23.B, 23.F, 23.D & 24; Pl. 4, fig. 4.a, 4.6 & 4.B; Pl. 5, fig. 5.a, 5.6 & 5.B.
- ? 1971 *Hypacanthohoplites* aff. *bigoureti* (SEUNES), KEMPER, Pl. 24, fig. 2.a-b.
- 1974 *Acanthohoplites* aff. *bigoureti* (SEUNES), DESTOMBES *et al.*, p. 63, Pl. 3, fig. 5.
- 1974 "*Acanthohoplites*" aff. *seunesi* (JACOB), DESTOMBES *et al.*, p. 65, Fig. 5.1; Pl. 3, figs. 6.a-b.
- ? 1975 *Hypacanthohoplites* aff. *bigoureti* (SEUNES), KEMPER, Pl. 3, figs. 2.a-b, 3.a-b, 4.a-b & 5-6.
- 1975 *Acanthohoplites bigoureti* (SEUNES), FÖRSTER, p. 205, Pl. 9, fig. 4.a-b.
- 1980 *Hypacanthohoplites bigoureti* (SEUNES), SEYED-EMAMI, p. 726, Pl. 3, figs. 7.a-c & 11.a-c.
- 1980 *Acanthohoplites bigoureti* (SEUNES), THOMEL, p. 132, Figs. 261-262.
- ? 1982 *Acanthohoplites* cf. *bigoureti* SEUNES, LESHCHUKH, p. 129, Pl. 10, figs. 6-7.
- 1984 *Acanthohoplites* ex. gr. *bigoureti* (SEUNES), MICHALIK and VAŠIČEK, p. 570, Pl. 1, fig. 5.
- 1987 *Acanthohoplites* aff. *bigoureti* (SEUNES), IMMEL, p. 123, Pl. 13, fig. 5.
- ? 1987 *Acanthohoplites bigoureti* SEUNES, LESHCHUKH, p. 118, Pl. 13, fig. 8.
- ? 1990 *Acanthohoplites bigoureti bigoureti* (SEUNES), IVANOV and STOYKOVA, Pl. 2, fig. 1.
- 1992 *Acanthohoplites* aff. *bigoureti* SEUNES, CONTRERAS y MONTERO *et al.*, p. w.n., fig. w.n. (= CANTÚ CHAPA, 1968, Pl. 2, fig. 2).
- 1994 *Acanthohoplites bigoureti* (SEUNES), MARÉCHAL, p. 85, Pl. 2, fig. 8.a-b.
- ? 2001 *Acanthohoplites* cf. *bigoureti* SINZOW non SEUNES, AVRAM *et al.*, p. 16, Pl. 3, fig. 18.
- 2005 *Acanthohoplites bigoureti bigoureti* SEUNES, KOTETISHVILI *et al.*, p. 399, Pl. 102, figs. 3.a, 3.6 & 3.B (= KVANTALIANI, 1971, Pl. 4, fig. 3.a, 3.6 & 3.B).
- v. non 2005 *Acanthohoplites bigoureti* (SEUNES), MORENO, p. 98, Pl. 8, figs. 9-10.
- non 2006 *Acanthohoplites bigoureti* (SEUNES), RAISOSSADAT, p. 915, fig. 5.A-B.
- 2007 *Acanthohoplites bigoureti* (SEUNES), SZIVES, p. 68, Pl. 9, fig. 5.a-b; Pl. 10, figs. 1 & 7.
- 2008 *Protacanthohoplites* gr. *bigoureti* SEUNES, MORENO-BEDMAR *et al.*, p. 156, in Fig. 1.

Material: One specimen: IGM 299 from Puerto Arrieros camino de Santa Rosa (Appendix: Geologic cartography Map 2, blue arrow number 2) preserved as an external mould.



Figure 6: Partial and schematic drawing of the cast of the specimen IGM 299, see photography in Figure 1.J. Scale bar 10 mm.

Description: The shell is evolute. The ornamentation consists of an irregular pattern of alternating ribs. Primary ribs rise on the umbilical wall and display large tubercles around the middle of the flank. Primary ribs trifurcate from those tubercles (Fig. 6). Secondary ribs can also appear in the umbilical wall or in the lower third of the flank.

Discussion: The trifurcate primary ribs from large tubercles are characteristic of the species *Acanthohoplites bigoureti* (SEUNES). Nonetheless, the majority of the species of the genus display a pattern of bifurcating ribs just as in the genus *Colombiceras*. However, their primary ribs are more robust and the tubercles are larger than in the latter species. Some species of *Acanthohoplites* present two tubercles in their primary ribs. The conspicuous feature of trifurcation usually is related to the species *Acanthohoplites bigoureti* (SEUNES). However, several of the illustrated specimens of this taxon display a bifurcation pattern. The better examples of trifurcated forms of *Acanthohoplites bigoureti* (SEUNES) are illustrated by EGOIAN (1965) and MORENO-BEDMAR *et al.* (2008). In Mexico there are numerous citations and illustrations of some specimens assigned to the genus *Acanthohoplites*, but in our opinion the majority of them correspond to specimens of the genus *Colombiceras*. The best example of a clear report of the genus *Acanthohoplites* in Mexico is from Michoacán State, western Mexico, which was shown by CANTÚ CHAPA in 1968 as *Acanthohoplites* aff. *bigoureti*. Later, the same specimen was described by CONTRERAS y MONTERO *et al.* in 1992. The specimen illustrated herein is very similar to that showed by CANTÚ CHAPA (1968) and shows great affinity to *Acanthohoplites bigoureti*. However, its fragmentary condition forces us to leave the Mexican specimen with an open name as an *affinis*.

Occurrence: Upper part of the upper Aptian, clearly this ammonite must be younger than the *Caseyella aguilerae* Zone.

Conclusions

The current work allows the reassignment of the original identifications of BURCKHARDT (1906a) to *Dufrenoyia* sp., *Colombiceras spathi* HUMPHREY, *Colombiceras mexicanus* (HUMPHREY) n. comb., *Colombiceras* sp., *Colombiceras* spp. and *Acanthohoplites* aff. *bigoureti* (SEUNES).

Reports of the genus *Parahoplites* in America seem to be due to the generic misidentifications. In the current work, one of these assignments must be reassigned to the genus *Colombiceras* that constitutes a new combination for *Colombiceras mexicanus* (HUMPHREY).

The ammonite fauna collected by BURCKHARDT is the only reported occurrence of Aptian ammonoids from Zacatecas State, prompting us to reexplore BURCKHARDT's localities in the future to conduct a systematic bed-by-bed sampling of one or several stratigraphic sections if appropriate outcrops can be found. One of these localities, Puerto Arrieros camino de Santa Rosa, seems particularly interesting due to the presence of the genus *Acanthohoplites* which is quite rare in Mexico and in consequence scarcely known.

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Appendix

► **Map 1:** Location map, adapted from BURCKHARDT's geological map (1906b).

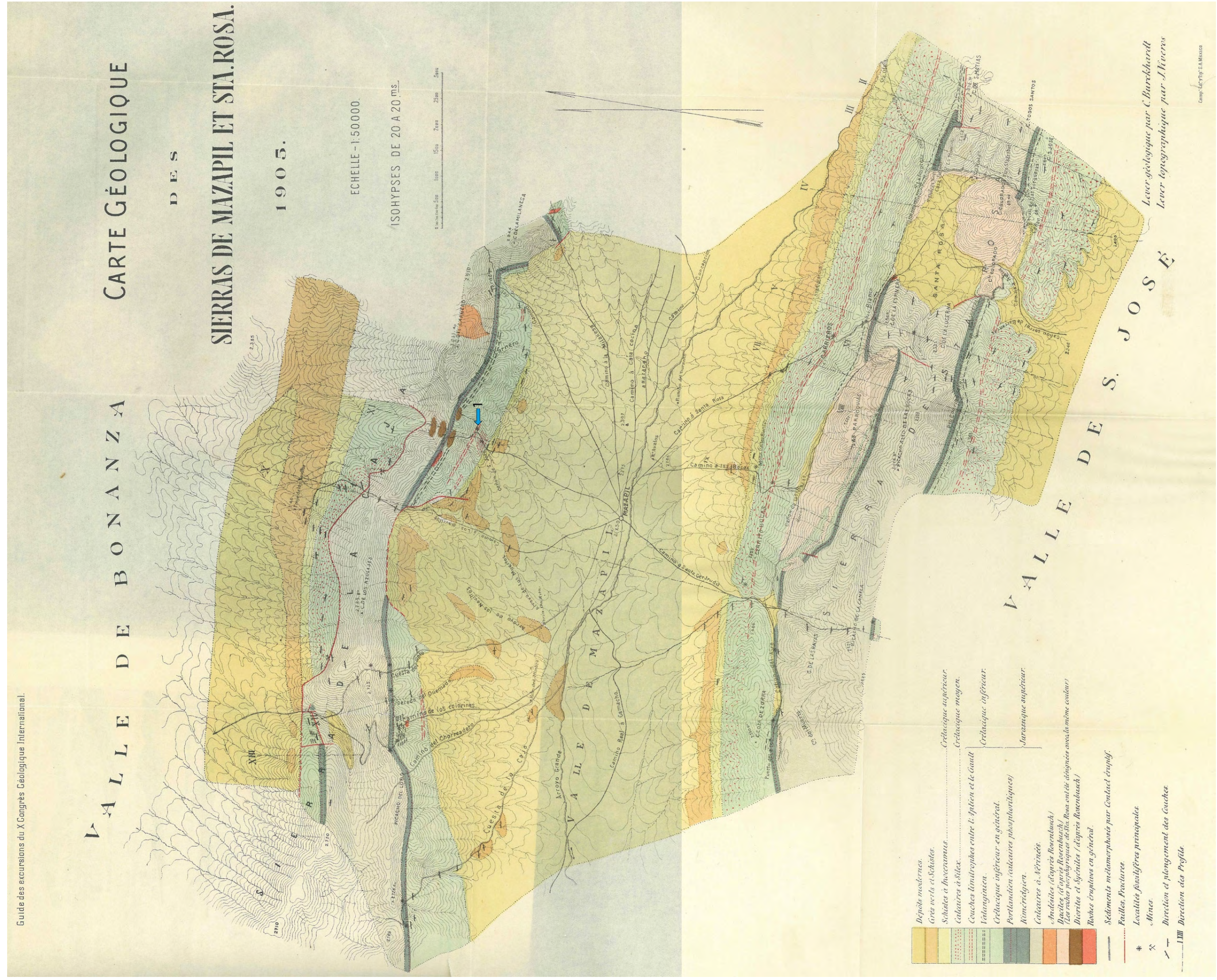
Guide des excursions du X Congrès Géologique International.

VALLE DE BONANZA
DES
SIERRAS DE MAZAPIL ET STA. ROSA.
1905.

ECHELLE - 1:50,000.

ISOHYPSES DE 20 A 20 m.

0 500 1000 1500 2000 2500 3000



- Deposits modernes.
- Grès verts et schistes.
- Schistes à Inoceramus
- Calcaires à Silex.
- Couches limitrophes entre E. Iptien et le Haut Valanginien.
- Crétacique inférieur en général.
- Portlandien (calcaires phosphoriques)
- Kiméridgien.
- Calcaires à Atrypa.
- Andaltes (après Rosenbusch)
- Duclès (après Rosenbusch)
- Les roches porphyriques de Sta. Rosa ont été désignées sous le même nom.
- Diorites et Syénites (après Rosenbusch)
- Roches éruptives en général.
- Sédiments métamorphosés par Contact éruptif.
- Fautes, Fractures.
- * Localités fossilifères principales
- × Mines
- Direction et plongement des Couches
- Direction des Profils.

Levier géologique par C. Barckhardt
Levier topographique par J. J. J. J.

Comp. Lit. P. P. S. A. Mexico

► **Map 2:** Location map, adapted from BURCKHARDT's geological map (1906b).

