Journal of South American Earth Sciences 30 (2010) 111–119

Contents lists available at ScienceDirect

Journal of South American Earth Sciences

journal homepage: www.elsevier.com/locate/jsames

Miocene mollusks from the Simojovel area in Chiapas, southwestern Mexico

María del Carmen Perrilliat [a], Francisco J. Vega [a,*], Marco A. Coutiño [b]

[a] Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad Universitaria, Coyoacán, México DF 04510, Mexico
[b] Museo de Paleontología "Eliseo Palacios Aguilera", Instituto de Historia Natural de Chiapas, Calzada de Los Hombres Ilustres s/n, Parque Madero 29000, Tuxtla Gutiérrez, Chiapas, Mexico

ARTICLE INFO

Article history:
Received 17 October 2009
Accepted 22 April 2010

Keywords:
Mollusca
Miocene
Chiapas
Amber
Mexico

ABSTRACT

The fauna of gastropods and bivalves from the amber-bearing lithostratigraphic units of the Simojovel area, Chiapas is reported, including the description of two new species and one subspecies: *Turbinella maya* new species, *Melongena corona tzeltal* new subspecies and *Agladrillia* (*Eumetadrillia*) *vermeiji* new species. Stratigraphic affinities of the previously described species suggest an Early Miocene age for the Mazantic Shale, and a Middle Miocene age for the overlying Balumtum Sandstone. One specimen of gastropod, with a relatively large piece of amber attached to the adapertural part of the shell is representative for an Early Miocene age and estuarine paleoenvironmental interpretation for the Mazantic Shale. Mollusca, Miocene, Chiapas, Amber, Mexico.

1. Introduction

The purpose of this paper is to report and describe the gastropod and bivalve fauna from the Lower and Middle Miocene in Chiapas, in the southwestern part of Mexico. Two new species and one subspecies are described. Previous works devoted to the description of mollusks for that region include Böse (1905); turritellid gastropods by Allison (1967), and Allison and Adegoke (1969). Perrilliat et al. (2004) informally reported gastropods and bivalves from the Simojovel area. The study fauna was collected from the following localities near Simojovel, Chiapas: locality IGM 2023, locality IGM 2024, El Pistón, Los Pocitos, locality Simojovel, locality Huitiupan and locality Km 0 + 1560 Simojovel (Fig. 1). The fauna is represented by 14 genera of the gastropod families Cerithiidae, Turritellidae, Strombidae, Xenophoridae, Cypraeidae, Turbinellidae, Buccinidae, Olividae, Marginellidae, Mitridae, Turridae, Conidae, Terebridae and Architectonicidae, and by 17 genera of the bivalve families Mytilidae, Pectinidae, Lucinidae, Astartidae, Cardiidae, Tellinidae, Veneridae, Corbulidae, Hiatellidae, Pholadomyidae and Gryphaeidae. In addition to two new species and one new subspecies of gastropod, the following species of mollusks were determined (for illustration see Table 1 and Figs. 4 and 5): *Turritella* group of *T. altilira* Conrad, 1857, *Xenophora delecta* (Guppy, 1876), *Cypraea* (*Erosaria*) cf. *C.* (*E.*) *aliena* (Schilder, 1939), *Oliva* cf. *O. dimidiata* Pilsbry and Johnson, 1917, *Persicula* cf. *P. zuliana* (Hodson et al., 1927), *Mitra* (*Tiara*) *henekeni illacidata* Woodring, 1928, *Conus bravoi* Spieker, 1922; bivalves: *Lithophaga* (*Lithophaga*) *nigra* (D'Orbigny, 1853), *Leptopecten* cf. *L. ecnomius* Woodring, 1982, *Nodipecten denaius*? Woodring, 1982, *Lucina* (*Lepilucina*) *gratis* Olsson, 1964, *Linga podagrinus alarantus* Woodring, 1925, *Trachycardium* (*Dallocardia*) cf. *T.* (*D.*) *phlyctaena* (Dall, 1900), *Trigoniocardia* (*Apiocardia*) cf. *T.* (*A.*) *aminensis* (Dall, 1900), *Dosinia* (*Dosinia*) *delicatissima* Brown and Pilsbry, 1913, *Clementia* (*Clementia*) *dariena dariena* (Conrad, 1855), *Cyclinella cyclica* (Guppy, 1866), *Caryocorbula sarda* (Dall, 1898), *Panopea parawhitfieldi* (Gardner, 1928), and *Hyotissa* cf. *H. guppyi* (Woodring, 1925). Their occurrence on the studied localities, along with those specimens which were only identified at supraspecific level is given on Table 1. Table 2 illustrates geographic distribution of previously described species in regions outside Chiapas.

Locality IGM 2023 is Campo Alegre, near Simojovel, Huitiupán County, at 17°06′46″ N and 92°42′08″ W, with gastropods, bivalves and insects in amber. Locality IGM 2024 is Santa Catarina las Palmas, 9 km (N 65°) from Simojovel, on N side of Valle del río Ancora, at 17°11′10″N and 92°40′04″ W, with corals, gastropods and bivalves. El Pistón locality is found 4 km SW of Huitiupán, at 17°08′32″N and 92°38′38″ W, with gastropods, bivalves and crustaceans. Los Pocitos locality is found 2 km NE of Simojovel, at 17°08′53″N and 92°43′45″W, with gastropods, bivalves insects in amber and crustaceans. Simojovel de Allende is found 126 km NNW of Tuxtla Gutiérrez, on Federal Highway 195, to reach road that leads to Puerto Caté; State Highway 173 leads from Puerto Caté to Simojovel. Outcrop is found at 17°10′02″N and 92°42′05″, with gastropods, bivalves and crustaceans. Huitiupán locality is found 1 km E of Huitiupán town, at 17°08′06″N and 92°40′55″W, with

* Corresponding author. Tel.: +52 55 5622 4320.
E-mail address: vegver@unam.mx (F.J. Vega).

0895-9811/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jsames.2010.04.005

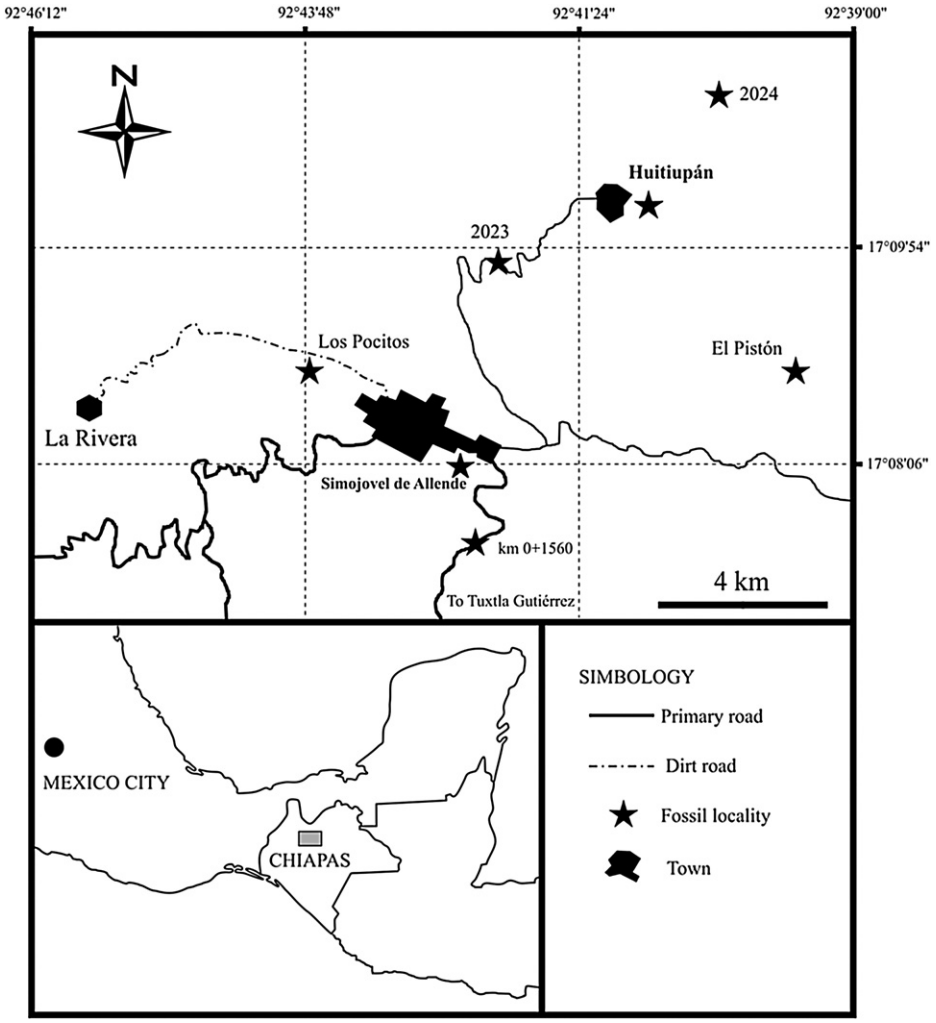

Fig. 1. Location map of Simojovel area, Chiapas, with localities reported in this contribution.

gastropods and bivalves. Locality Km 0 + 1560 is found on Federal Highway 195, 3 km S of Simojovel, at 17°07′46″N and 92°41′59″W, with gastropods and bivalves.

Specimens were collected from two lithostratigraphic units known as the amber-bearing Mazantic Shale and the comformably overlying Balumtum Sandstone (Fig. 2). The amber of Chiapas is famous for its quality and fossil content. Its age has been a matter of debate. A Late Oligocene – Early Miocene age has been proposed in multiple contributions (Langenheim, 1966; Tomasini-Ortíz and Martínez-Hernández, 1984; Santiago-Blay and Poinar, 1993; Bousfield and Poinar, 1994; Poinar and Brown, 2002; Poinar, 2003; Engel, 2004; Castañeda-Posadas and Cevallos-Ferriz, 2007). Ferrusquía-Villafranca (2006) described a new species of artiodactyl from Los Pocitos locality, and considered a Late Oligocene age for these sediments, based on previous biostratigraphic interpretations of Frost and Langenheim (1974) and paleomagnetic studies for which the author did not cited any reference, and suggested "that the age of Los Pocitos strata fall within the 28–26 Ma" (Ferrusquía-Villafranca, 2006, p. 993).

Other authors suggest that the amber-bearing stratigraphic units are of Middle Miocene age, and thus correlatives with the units that produce amber in the Dominican Republic (Meneses-Rocha, 2001; Solórzano-Kraemer, 2007; Solórzano-Kraemer and Mohrig, 2007). At Los Pocitos locality (Fig. 1), dark-gray shales of the Mazantic Shale contain amber fragments, benthic foraminifera, gastropods, bivalves and crustaceans. Based on $^{87}Sr/^{86}Sr$ measurements taken from a well-preserved shell of *Turbinella maya* new species from Los Pocitos, Vega et al. (2009, p. 53) obtained an absolute age of 23 Ma for the Mazantic Shale, placing it right at the limit between the Oligocene and Miocene.

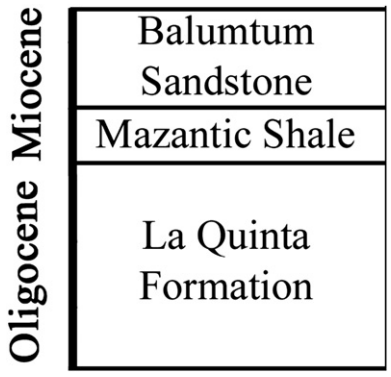

Fig. 2. Amber-bearing lithostratigraphic units that crop out in the Simojovel area.

Table 1
Distribution of species on studied localities of Simojovel area, Chiapas and their illustration.

species	locality							
	Loc. 2023	Loc. 2024	El Pistón	Los Pocitos	Simojovel	Huitiupán	Km 0 + 1560	Figures
Rhinoclavis (*Ochetoclava*) sp.				X				4-1
Turritella group *T. altilira*		X		X				4-2–4
Turritella sp.				X			X	4-5&6
Strombus bifrons				X			X	4-7
Xenophora delecta			X	X				4-8
Cypraea (*Erosaria*) cf. *C.* (*E.*) *aliena*						X		4-9&10
Turbinella maya new species				X				4-11–14
Melongena corona tzeltal new subspecies				X				4-15–21
Oliva cf. *O. dimidiata*				X				4-22
Persicula cf. *P. zuliana*								4-23&24
Persicula (*Rabicea*) sp.								4-25&26
Mitra (*Tiara*) *henekeni illacidata*				X				4-27&28
Agladrillia (*Eumetadrillia*) *vermeiji* new species								4-29&30
Conus bravoi		X		X				4-31
Strioterebrum sp.						X		4-32
Architectonica sp.					X			4-33
Lithophaga (*Lithophaga*) *nigra*				X				5-1&2
Aequipecten sp.				X				5-3&4
Leptopecten cf. *L. ecnomius*					X			5-5&6
Nodipecten denaius?				X				5-7
Pectinidae							X	5-8
Lucina (*Lepilucina*) *gratis*			X					5-9
Linga podagrinus alarantus	X							5-10
Astarte sp.				X				5-11
Trachycardium (*Dallocardia*) cf. *T.* (*D.*) *phlyctaena*			X					5-12
Trigoniocardia (*Apiocardia*) cf. *T.* (*A.*) *aminensis*				X				5-13
Laevicardium sp.				X				5-14–16
Tellina sp.				X				5-17
Dosinia (*Dosinia*) *delicatissima*			X					5-18&19
Clementia (*Clementia*) *dariena dariena*				X				5-20–22
Cyclinella cyclica	X							5-23
Caryocorbula sarda				X				5-24
Panopea parawhitfieldi			X					5-25–27
Pholadomya sp.	X							5-28&29
Hyotissa cf. *H. guppyi*			X					5-30
Ostrea sp.				X			X	5-31&32

The Mexican amber has been interpreted to be the resinous exudates of *Hymenea* sp., a leguminose tree whose communities developed near the ancient coast, in estuarine environments, very similar to mangroves (Poinar, 1992). The amber was then transported to a shallow marine environment (Langenheim, 1995; García-Villafuerte, 2008). An interesting specimen of *Melongena corona tzeltal* new subspecies from the Mazantic Shale, has a piece of amber attached the adaperural portion of the shell (Fig. 3-1). It is

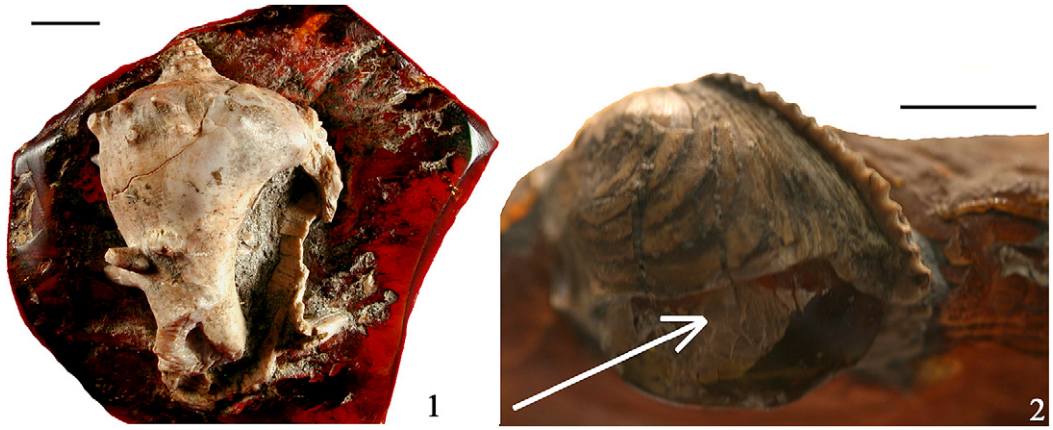

Fig. 3. Mollusk shells associated to amber. 1, *Melongena corona tzeltal* new subspecies, specimen 10-461859, Los Pocitos, Mazantic Shale, under custody of Centro INAH-Chiapas (CONACULTA-INAH-MEX), image reproduction authorized by the Instituto Nacional de Antropología e Historia. 2, Articulated ostreid valves intruded by amber (see arrow), Los Pocitos, Mazantic Shale, collection of Museo Piedra Escondida, San Cristóbal de Las Casas, Chiapas. Scale bars equals 1 cm.

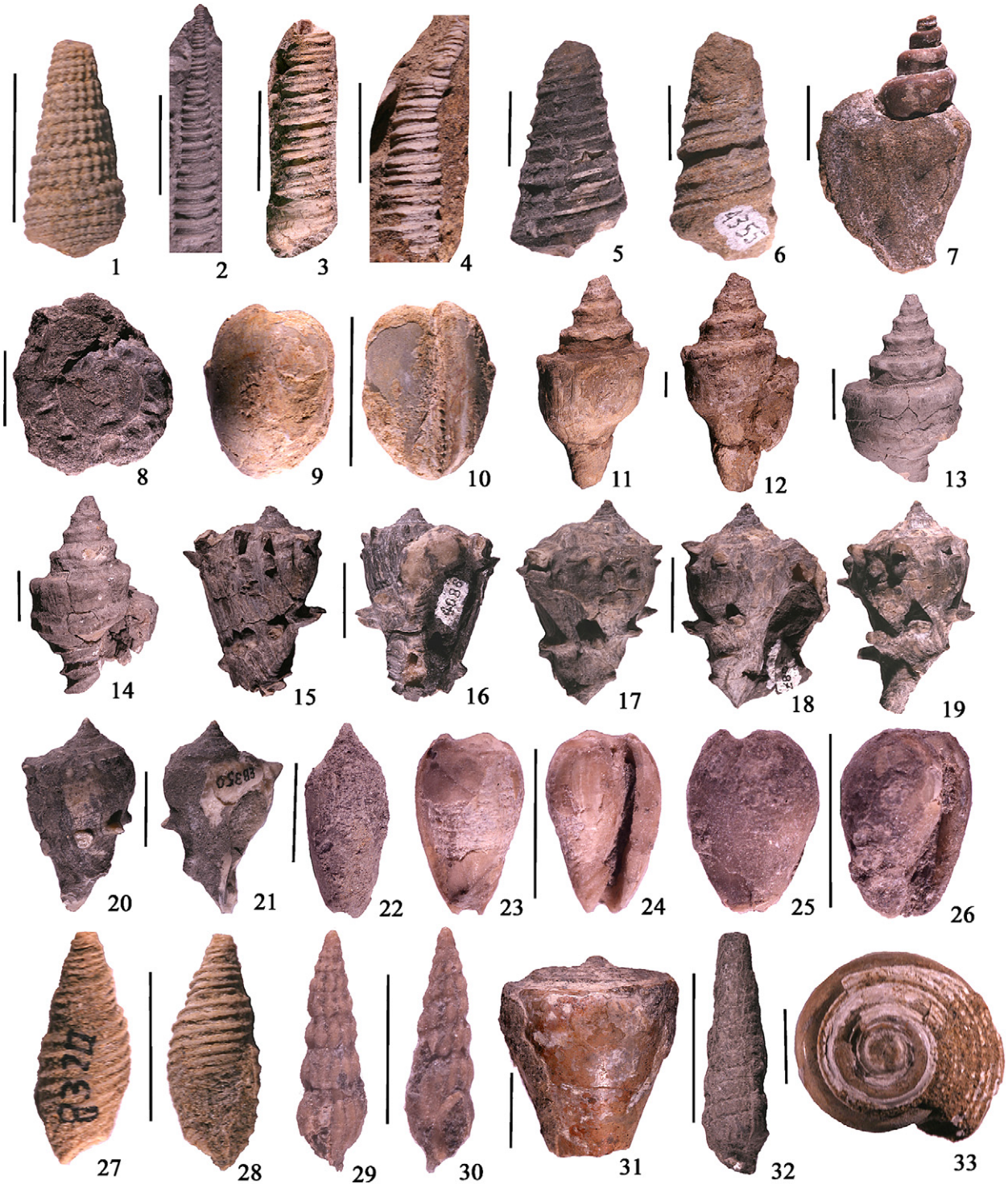

Fig. 4. 1–4, *Rhinoclavis* (*Ochetoclava*) sp., adapertural view, hypotype IHNFG 2389, Balumtum Sandstone; 2–4, *Turritella* group *T. altilira* Conrad, 1857, 2, adapertural view, plastotype IGM 7388, Mazantic Shale; 3, adapertural view, hypotype IGM 7608, Balumtum Sandstone; 4, adapertural view, hypotype IGM 5856, Balumtum Sandstone; 5, 6, *Turritella* sp., 5, adapertural view, hypotype IHNFG 0522, Mazantic Shale; 6, apertural view, hypotype IHNFG 0523, Balumtum Sandstone; 7, *Strombus bifrons* Sowerby, 1850, adapertural view, hypotype IHNFG 0524, Balumtum Sandstone; 8, *Xenophora delecta* (Guppy, 1876), dorsal view, hypotype IHNFG 2360, Balumtum Sandstone; 9, 10, *Cypraea* (*Erosaria*) cf. *C.* (*E.*) *aliena* (Schilder, 1939), 9, adapertural view, hypotype IHNFG 2468, Balumtum Sandstone; 10, apertural view, hypotype IHNFG 2468, Balumtun Sandstone; 11–14, *Turbinella maya* new species, 11, adapertural view, holotype IGM 7609, Mazantic Shale; 12, apertural view, holotype IGM 7609, Mazantic Shale; 13, adapertural view, paratype IHNFG 0533, Mazantic Shale; 14, apertural view, paratype IHNFG 0533, Mazantic Shale; 15–21, *Melongena corona tzeltal* new subspecies, 15, adapertural view, holotype IHNFG 0525, Mazantic Shale; 16, apertural view, holotype IHNFG 0525, Mazantic Shale; 17, adapertural view, paratype IHNFG 0526, Mazantic Shale; 18, apertural view, paratype IHNFG 0526, Mazantic Shale; 19, adapertural view, paratype IHNFG 0526, Mazantic Shale; 20, adapertural view, paratype IHNFG 0527, Mazantic Shale; 21, apertural view, paratype IHNFG 0527, Mazantic Shale; 22, *Oliva* cf. *O. dimidiata* Pilsbry and Johnson, 1917, adapertural view, hypotype IHNFG 0528, Mazantic Shale; 23, 24, *Persicula* cf. *P. zuliana* (F. Hodson, in Hodson et al., 1927), 23, adapertural view, hypotype IGM 7804, Mazantic Shale; 24, apertural view, hypotype IGM 7804, Mazantic Shale; 25, 26, *Persicula* (*Rabicea*) sp., 25, adapertural view, hypotype IGM 7805, Mazantic Shale; 26, apertural view, hypotype IGM 7805, Mazantic Shale; 27, 28, *Mitra* (*Tiara*) *henekeni illacidata* Woodring, 1928, 27, adapertural view, hypotype IHNFG 2357, Balumtum Sandstone; 28, apertural view, hypotype IHNFG 2357, Balumtum Sandstone; 29, 30, *Agladrillia* (*Eumetadrillia*) *vermeiji* new species, 29, adapertural view, holotype IGM 7880, Mazantic Shale; 30, apertural view, holotype IGM 7880, Mazantic Shale; 31, *Conus bravoi* Spieker, 1922, adapertural view, hypotype IGM 7881, Balumtum Sandstone; 32, *Strioterebrum* sp., adapertural view, hypotype IHNFG 2471, Mazantic Shale; 33, *Architectonica* sp., dorsal view, hypotype IHNFG 2331. Specimens 1, 2, 4–6, 11–30 are from locality Los Pocitos; 7, 8 are from locality El Pistón, 3, 32 are from locality IGM 2024; 9, 10, 31 are from locality Huitiupan, and 33 is from locality Simojovel. Scale bars equals 1 cm.

evident that the amber was still soft at the moment it made contact with the shell. A possible explanation is that the shell was carried by a paguroid crab in the estuarine environment, with the shell accidentally sticked to the soft resin near the *Hymenea* sp. tree. Since the oldest record for the *Melongena* is from the Lower Miocene, presence of the new subspecies reinforces the interpretation for a basal Miocene age for the Mazantic Shale. An ostreoid specimen, also from the Mazantic Shale, with amber intruding valves (Fig. 3-2), confirm that the amber was deposited in an estuarine environment while still soft. The ostreoids were probably attached to the roots of *Hymenea* sp., and the soft resin may have filled the open valves of a the dead ostreoid.

The overlying gray-blue to gray-green sandstones of the Balumtum Sandstone crop out at El Pistón (Fig. 1). Gastropods, bivalves and crustaceans are found in this locality. Most of the species here reported come from this unit, and the stratigraphic range for most of them seem to confirm a Middle Miocene age for the Balumtum Sandstone (Table 3). There are, however, species with a stratigraphic range as wide as Late Eocene to Recent, but they represent a small percentage of the total of species; from 20, only four species occur in different ages than Middle Miocene.

As description of most of the species here mentioned is not being modified, only the description of new taxa is presented.

2. Systematic paleontology

The studied material is deposited in the Instituto de Historia Natural de Chiapas, and in the Colección Nacional de Paleontología, Museo Ma. del Carmen Perrilliat, Instituto de Geología, Universidad Nacional Autónoma de México. Types are included in the Type Collection and classified under the acronyms IHNFG and IGM respectively.

Class Gastropoda Cuvier, 1797
Order Neogastropoda Thiele, 1929–35
Superfamily Muricoidea Rafinesque, 1815
Family Turbinellidae Swainson, 1835
Genus *Turbinella* Lamarck, 1799

Type species. *Voluta pyrum* Linnaei, 1758. Dall, 1906, by subsequent designation. Recent. India.

Turbinella maya new species

Diagnosis. Shell large-sized, biconic. Teleoconch whorls with 10 tubercles. Slope straight and steep.

Description. Shell large-sized, biconic. Protoconch unknown. Teleoconch of five whorls. First whorls preserved without sculpture. Third whorl with 10 small tubercles increasing in size; fourth whorl with 10 tubercles of the same size; last whorl with 10 tubercles. No spiral sculpture. Above the shoulder there is a steep, straight slope to the suture. Besides the tubercles there is no other sculpture present except for growth lines along all the whorls. Basal half of the last whorl with seven or eight spiral ribs. Inner lip not preserved. Columella with three strong plaits.

Etymology. The name of the species is taken from the ancient Maya, prehispanic culture of SE Mexico.

Type. Holotype IGM 7609, height 128.4 mm, diameter 65.2 mm; paratype IHNFG 0533, height108.8 mm, diameter 70.3 mm.

Occurrence. Mazantic Shale, Lower Miocene.

Discussion. The Mexican specimens differ from *Xancus aviaguensis* H. K. Hodson and Hodson (1931, p. 38, pl. 19, Fig. 2) from the Cauderalito Member (Aquitanian) of the lower Miocene Agua Clara Formation in being more wider; do not present the presutural band ornamented with rather fine longitudinal threads crossed by few rather faint spirals. The ramp between the suture is straight not concave. Vokes (1964, p. 49) stated that this species "in view of the strong resemblance of the shell of *T. aviaguensis* to that of *T. valida*, combined with the almost simultaneous geologic occurrence, the two species are placed in synonymy"; we do not concur, as *T. valida* Sowerby (1850, p. 50) from the Baitoa Formation, Lower Miocene of the Dominican Republic in not having spiral sculpture along all the whorls of the teleoconch.

The genus *Turbinella* is reported as far as the Eocene from the Restin Formation of Peru (Olsson, 1928, p. 89, pl. 21, Fig. 5) as *Xancus peruvianus* Olsson. The Mexican specimen is different, because the first one is larger and present 10 tubercles on the last whorl. Another species *Turbinella falconensis* (H. K. Hodson, in Hodson et al., 1927, p. 40, pl. 22, Figs. 1–3) from the Middle Miocene Cantaure Formation, Paraguaná Peninsula, Venezuela, and from the Middle Miocene Gatun Formation of Panama (Woodring, 1964, p. 286, pl. 46, Figs. 4–6) is larger than the Mexican specimen and lack tubercles on the last whorl. The Mexican specimen differ also from *Turbinella gratus* (Maury) (1924, p. 142, 153, pl. 7, Fig. 4) in that this last species is delicately spirally striated. *Turbinella amazonianum* (Ferreira and Cunha) (1957a, p. 35–37, pl. 2, Fig. 7, 8) is represented by an incomplete specimen with very weak tubercles (the single specimen is a mold and is very similar to *T. validus*). *Turbinella mauryae* (Ferreira and Cunha) (1957b, p. 24–28, pl. 2, Fig. 1) is considered to be *T. laevigata*, and *Turbinella tuberculatus* (Ferreira) (1964, p. 1–5, pl. 1) is a larger species and presents less tubercles than the ones observed on the Mexican specimens. All of the previously mentioned species are from the Middle Miocene Pirabas Formation of Brazil.

Family Buccinidae Rafinesque, 1815
Subfamily Melongeninae Gill, 1871
Genus *Melongena* Schumacher, 1817

Type species. *Melongena fasciata* Schumacher, 1817, by monotypy. Recent. West Indies and the Caribbean.

Melongena corona tzeltal new subspecies

Diagnosis. Shell medium-sized, convex, shouldered. First teleoconch whorls depressed. Last whorl with two rows of 10 large spines, one at the shoulder and the other at the base of the whorl.

Description. Shell medium-sized, convex, shouldered. Protoconch not preserved. Teleoconch of five whorls. First four whorls subdepressed. Suture imbricate. Last whorl with two rows of ten large spines at the whorl shoulder and another at the base of the whorl. Outer lip thin. Aperture ovate. Inner lip with a thin callus.

Etymology. The name of the species is taken from the most numerous ethnic group of Chiapas, the Tzeltal.

Type. Holotype IHNFG 0525, height 55.5 mm, diameter 40.8 mm; paratype IHNFG 0526, height 49.7 mm, diameter 36.5 mm; paratype IHNFG 0527, height 37.7 mm, diameter 18.7 mm.

Occurrence. Los Pocitos, Mazantic Shale, Lower Miocene.

Discussion. The genus *Melongena* is known from the Upper Oligocene of Mississippi, with *Melongena* (*Myristica*) *crassicornuta* Conrad from the Byram Formation (Conrad, 1858, p. 286) and from Vicksburg Group (MacNeil and Dockery, 1984, p. 1–43, pl. 32, Fig. 14, 15) The Mexican specimens differ from *Melongena* (*Rexmela*) *corona corona* Gmelin, 1791, p. 3552 in having a shorter spire and being smaller in size.

In the Recent fauna *M. corona* is restricted to Florida. "According to Dall (1890, p. 118) various members of the Melongenidae appeared in the Upper Eocene. So far we can trace *Melongena* appeared in the Pliocene of Central Florida" (Clench and Turner, 1956, p. 175). However, *Melongena* has been known since Miocene time in the Early Miocene (Burdigalian) Cantaure

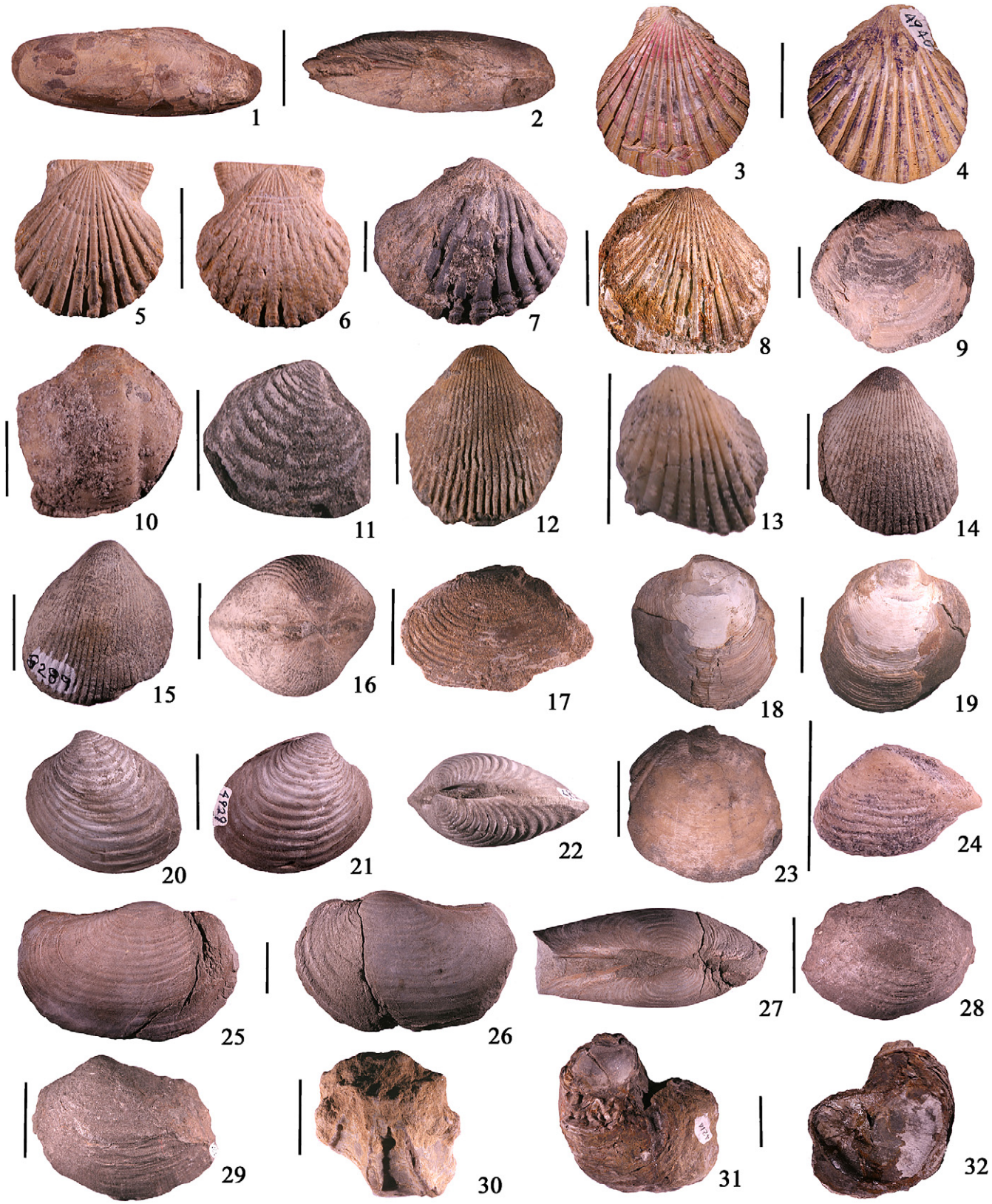

Fig. 5. 1, 2. *Lithophaga* (*Lithophaga*) *nigra* (D'Orbigny, 1853), 1, left valve, hypotype IHNFG 2289, Balumtum Sandstone; 2, dorsal view, hypotype IHNFG 2289; 3, 4, *Aequipecten* sp. 3, right valve, hypotype IHNFG 2300, Balumtum Sandstone; 4, left valve, hypotype IHNFG 2300; 5, 6, *Leptopecten* cf. *L. ecnomius* Woodring, 1982, 5, right valve, hypotype IHNFG 2299, Balumtum Sandstone; 6, left valve, hypotype IHNFG 2299; 7, *Nodipecten denaius*? Woodring, 1982, left valve, hypotype IGM 8026, Balumtum Sandstone; 8, Pectinidae, right valve hypotype IHNFG 0530, Balumtum Sandstone; 9, *Lucina* (*Lepilucina*) *gratis* Olsson, 1964, right valve, hypotype IGM 8042, Mazantic Shale; 10, *Linga podagrinus alarantus* Woodring, 1925, left valve, hypotype IGM 8043, Balumtum Sandstone; 11, *Astarte* sp., right valve, hypotype IGM 8044, Balumtun Sandstone; 12, *Trachycardium* (*Dallocardia*) cf. *T.* (*D.*) *phlyctaena* (Dall, 1900), right valve, hypotype IGM 8045, Balumtum Sandstone; 13, *Trigoniocardia* (*Apiocardia*) cf. *T.* (*A.*) *aminensis* (Dall, 1900), left valve, hypotype IGM 8046, Mazantic Shale; 14–16, *Laevicardium* sp., 14, right valve, hypotype IHNFG 2455, Balumtum Sandstone; 15, left valve, hypotype IHNFG 2455; 16, dorsal view, hypotype IHNFG 2455; 17, *Tellina* sp.,

Table 2
Distribution of reported species in other countries of the Caribbean and Gulf of Mexico.

species	country													
	Florida USA	Mexico	Nicaragua	Costa Rica	Panama	Colombia	Venezuela	Ecuador	Peru	Jamaica	Dominicana	Puerto Rico	Trinidad	Antigua
GASTROPODA														
Turritella group *T. altilira*		X			X	X	X							
Xenophora delecta					X		X	X		X	X			
Cypraea (*Erosaria*) cf. *C.* (*E.*) *aliena*													X	
Oliva cf. *O. dimidiata*											X			
Persicula cf. *P. zuliana*						X								
Mitra (*Tiara*) *henekeni illacidata*										X				
Conus bravoi					X	X		X	X					
BIVALVIA														
Lithophaga (*Lithophaga*) *nigra*	X					X					X	X		X
Leptopecten cf. *L. ecnomius*					X									
Nodipecten denaius?					X									
Lucina (*Lepilucina*) *gratis*					X			X						
Linga podagrinus alarantus										X				
Trachycardium (*Dallocardia*) cf. *T.* (*D.*) *phlyctaena*	X				X									
Trigoniocardia (*Apiocardia*) cf. *T.* (*A.*) *aminensis*					X						X			
Dosinia (*Dosinia*) *delicatissima*					X									
Clementia (*Clementia*) *dariena dariena*		X	X	X	X	X	X	X	X				X	
Cyclinella cyclica					X	X	X				X		X	
Caryocorbula sarda	X													
Panopea parawhitfieldi	X	X			X									
Hyotissa cf. *H. guppyi*										X				

Formation, Paraguaná Peninsula with *Melongena venezuelana* Gibson-Smith and Gibson-Smith, 1983, p. 720, Figs. 1–5, 13. The Mexican specimens differ from this species in being smaller in size and having more spines. Also *Melongena candelariana* Gibson-Smith and Gibson-Smith, 1983, p. 723, Fig. 6, 7 from the Early Miocene (Burdigalian?) La Candelaria Beds, Paraguaná Peninsula, Venezuela differ in being smaller in size and in having less spines.

Superfamily Conoidea Rafinesque, 1815
Family Turridae Swainson, 1840
Subfamily Drillinae Olsson, 1964
Genus *Agladrilllia* Woodring, 1928

Type species. *Agladrillia callothyra* Woodring, 1928, by original designation Miocene. Bowden, Jamaica.

Subgenus *Eumetadrillia* Woodring, 1928

Type species. *Agladrillia* (*Eumetadrillia*) *serra* Woodring, 1928, by original designation. Miocene. Bowden, Jamaica.

Agladrillia (Eumetadrillia) vermeiji new species

Diagnosis. Shell small-sized. Teleoconch of eight whorls with rounded axial ribs. No spiral sculpture.

Description. Shell small-sized, slender. Protoconch one and a half smooth whorls. Teleoconch of eight whorls with straight profile. Suture impressed. Sculpture consisting of rounded axial ribs, 11 in all whorls. Interspaces narrow and deep. No spiral sculpture present. Aperture narrow. Siphonal notch moderately deep.

Etymology. The species name is dedicated to Dr. Geerat Vermeij, whose contributions on the evolution of mollusks, particularly gastropods, brought light to our comprehension of recent biodiversity.

Type. Holotype IGM 7880, height 7.3 mm, diameter 2.4 mm.

Occurrence. Los Pocitos, Mazantic Shale, Lower Miocene.

Discussion. The Chiapas specimen is not like any other species described from the Miocene of North America. *Eumetadrillia dodona* Gardner (1937, p. 313, pl. 40, Fig. 31) from the Middle Miocene Oak Grove sand, Florida is a larger species and has only nine axial ribs.

Eumetadrillia rabdotacona Gardner (1937, p. 314, pl. 40, Fig. 23, 27) from the Middle Miocene Shell Bluff, Shoal River Formation, Walton County, Florida, also is a larger species and the first whorls of the teleoconch with 10–12 axial ribs and in the last whorl only 10 to 11 axial ribs.

Agladrillia (*Eumetadrillia*) *thalmanni* Perrilliat (1973, p. 52, pl. 24, Figs. 7–12) from the Pliocene Agueguexquite Formation, Santa Rosa, Veracruz is slender, with nine axial ribs and with the interspaces wide and concave.

right valve, hypotype IHNFG 2436, Mazantic Shale; 18, 19, *Dosinia* (*Dosinia*) *delicatissima* Brown and Pilsbry, 1913, 18, left valve, hypotype IGM 8047, Balumtum Sandstone; 19, right valve, hypotype IGM 8047; 20–22, *Clementia* (*Clementia*) *dariena dariena* (Conrad, 1855), 20, left valve, hypotype IHNFG 0531, Balumtum Sandstone; 21, right valve, hypotype IHNFG 0531, Balumtum Sandstone; 22, dorsal view, hypotype IHNFG 0531; 23, *Cyclinella cyclica* (Guppy, 1866), right valve, hypotype IGM 8049, Balumtum Sandstone; 24, *Caryocorbula sarda* (Dall, 1898), left valve, hypotype IHNFG 2445, Balumtum Sandstone; 25–27, *Panopea parawhitfieldi* (Gardner, 1928), 25, right valve, hypotype IGM 8050, Balumtum Sandstone; 26, left valve, hypotype IGM 8050; 27, dorsal view, hypotype IGM 8050; 28, 29, *Pholadomya* sp., right valve, hypotype IGM 8051, Balumtum Sandstone; 29, left valve, hypotype IGM 8051; 30, *Hyotissa* cf. *H. guppyi* (Woodring, 1925), right valve, hypotype IGM 9130, Mazantic Shale; 31, 32, *Ostrea* sp., 31, right valve, hypotype IHNFG 0532, Mazantic Shale; 32, interior right valve, hypotype IHNFG 0532. Specimens 1–4, 7, 11, 13–22, 24 are from locality Los Pocitos; 5, 6 are from locality Simojovel; 8, 31, 32 are from locality Km 0 + 1560; 9, 12, 25–27, 30 are from locality El Pistón; 10, 23, 28, 29 are from locality IGM 2023. Scale bars equals 1 cm.

Table 3
Stratigraphic distribution of species found in Miocene deposits of Simojovel area, Chiapas.

species	age						
	Late Eocene	Late Oligocene	Miocene			Pliocene	Recent
			Lo	M	La		
GASTROPODA							
Turritella group *T. altilira*			X	X	X	X	
Strombus bifrons				X			
Xenophora delecta				X	X		
Cypraea (*Erosaria*) cf. *C.* (*E.*) *aliena*						X	
Oliva cf. *O. dimidiata*				X			
Persicula cf. *P. zuliana*			X				
Mitra (*Tiara*) *henekeni illacidata*				X			
Conus bravoi				X			
BIVALVIA							
Lithophaga (*Lithophaga*) *nigra*	X	X		X			X
Leptopecten cf. *L. ecnomius*				X			
Nodipecten denaius?		X					
Lucina (*Lepilucina*) *gratis*				X			
Linga podagrinus alarantus				X			
Trachycardium (*Dallocardia*) cf. *T.* (*D.*) *phlyctaena*		X	X				
Trigoniocardia (*Apiocardia*) cf. *T.* (*A.*) *aminensis*				X			
Dosinia (*Dosinia*) *delicatissima*				X			
Clementia (*Clementia*) *dariena dariena*			X	X	X		
Cyclinella cyclica				X	X		
Caryocorbula sarda				X			
Panopea parawhitfieldi			X	X			
Hyotissa cf. *H. guppyi*				X			

3. Conclusion

This is the first formal report on mollusks from the amber-bearing lithostratigraphic units of Chiapas. Most of the species here reported have been described from Middle Miocene formations of the Caribbean region. Previous isotopic studies, along with biostratigraphic affinities of the molluscan fauna indicate an Early to Middle Miocene age for the Mazantic Shale and Balumtun Sandstone in the Simojovel area. Presence of estuarine mollusks with pieces of amber attached or even intruding their shells seem to confirm an estuarine paleoenvironment for the deposition of the Mazantic Shale. From the 36 taxa here reported, only three new taxa are described, suggesting that most of the molluskan fauna from the Caribbean province are already well known.

Acknowledgments

We are grateful to Centro INAH Chiapas, for the loan and permit to illustrate gastropod specimen 10-461859. Iván Milani (Museo Piedra Escondida, San Cristóbal de Las Casas, Chiapas) allow reproduction of an important specimen deposited in that museum. Gerardo Carbot-Chanona and Javier Avendaño-Gil (Museo de Paleontología "Eliseo Palacios Aguilera", Instituto de Historia Natural de Chiapas) offered support with loan of specimens, illustrations and information of localities.

References

Allison, R C., 1967. The Cenozoic Stratigraphy of Chiapas, Mexico, with Discussions of the Classification of the Turritellidae and Selected Mexican representatives. Berkeley, University of California. Ph. D. thesis, 449 p., Unpublished.

Allison, R.C., Adegoke, O.S., 1969. The *Turritella rina* group (Gastropoda) and its relationship to *Torcula* Gray. Journal of Paleontology 43 (5), 1248–1266.

Böse, E., 1905. Reseña acerca de la Geología de Chiapas y Tabasco, vol. 20. Boletín Instituto Geológico de México, 116 pp.

Bousfield, E.L., Poinar Jr., G.O., 1994. New terrestrial amphipod from Tertiary amber deposits of Chiapas province, southern Mexico. Historical Biology 7, 105–114.

Brown, A.P., Pilsbry, H.A., 1913. Fauna of the Gatun formation, Isthmus of Panama; pt. 2. Proceedings of the Academy of Natural Science of Philadelphia 64, 509–519.

Castañeda-Posadas, C., Cevallos-Ferriz, C.R.S., 2007. *Swietenia* (Meliaceae) flower in Late Oligocene–Early Miocene amber from Simojovel de Allende, Chiapas, Mexico. American Journal of Botany 94 (11), 1821–1827.

Clench, W.J., Turner, R.D., 1956. The Family Melongenidae in the Western Atlantic. Johnsonia 3, 161–188.

Conrad, T.A., 1855. Report on the fossil shells collected in California by W.P. Blake, geologist of the expedition under the command of Lieutenant R.S. Williamson. Appendix to the preliminary geological report of William P. Blake. U.S. 33d Congress, 1st. Session, Home Document 129, 5–20.

Conrad, T.A., 1857. Description of the Tertiary fossils collected on the survey [Williamson's survey in California and Oregon]. U.S. Pacific Rail Road Exploration 6 (2), 69–73.

Conrad, T.A., 1858. Observations on the Eocene formation and description of one hudred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi, with an Appendix. Proceedings of the Academy of Natural Sciences of Philadelphia 3, 280–299.

Cuvier, G., 1797. Tableau élémentaire de l'histoire naturelle des Animaux. Paris, 710 p.

d'Orbigny, A., 1842–53. Mollusques, in Sagra, Ramón de la, Histoire physique, politique, et naturelle de l'Ile de Cuba. Paris. A. Bertrand, vol. 2, 380 pp. 1853; atlas (1842).

Dall, W.H., 1898. Contributions to the Tertiary fauna of Florida with especial reference to the Silex Beds of Tampa and the Pliocene Beds of the Caloosahatchie River. Part IV. Prionodesmacea, Teleodesmacea. Transactions of the Wagner Free Institute of Science of Philadelphia 3 (4), 571–947.

Dall, W.H., 1890. Contributions to the Tertiary Fauna of Florida with especial reference to the Silex Beds of Tampa and the Pliocene Beds of the Caloosahatchie River. Part I. Pulmonate, Opistobranchiate and Orthodont Gastropods. Transactions of the Wagner Free Institute of Science of Philadelphia 3 (1), 1–200.

Dall, W.H., 1900. Contributions to the Tertiary fauna of Florida with especial reference to the Silex Beds of Tampa and the Pliocene Beds of the Caloosahatchie River. Part V. Teleodesmacea. Transactions of the Wagner Free Institute of Science of Philadelphia 3 (5), 949–1218.

Dall, W.H., 1906. Early history of the generic name *Fusus* [includes list of Bolten genera with type designation]. Journal of Conchology 11, 289–297.

Engel, M.S., 2004. Arthropods in Mexican amber, Biodiversidad, Taxonomia y Biogeografia de Artropodos de Mexico. In: Llorente-Bousquets, J.E., Morrone, J.J., Yáñez-Ordóñez, O., Vargas-Fernández, I. (Eds.), Biodiversidad, Taxonomía, y Biogeografía de Artrópodos, vol. IV. UNAM/CONABIO First Edition, México D.F, pp. 175–186.

Ferreira, C.S., 1964. Contribução à Paleontologia do Estado do Parà. Um novo *Xancus* da Formação Pirabas. VII (Mollusca-Gastropoda). Boletim do Museo Paraense Emilio Goeldi, nova serie Geologia 10, 8.

Ferreira, C.S., Cunha, O.R., 1957a. Contribução à Paleontologia do Estado do Parà. Notas sòbre a formação Pirabas, com descriçõnes de novos invertebrados fósseis. I (Mollusca–Gastropoda). Boletim do Museu Paraense Emilio Goeldi, nova serie Geologia n 2, 61.

Ferreira, C.S., Cunha, O.R., 1957b. Contribução à Paleontologia do Estado do Parà. Novos invertebrados fósseis e descrições de mais duas espécies da formação Pirabas. III (Mollusca – Gastropoda). Boletim do Museu Paraense Emilio Goeldi, nova serie Geologia 4, 33.
Ferrusquía-Villafranca, I., 2006. The first Paleogene mammal record of middle America: *Simojovelhyus pocitosense* (Helohyidae, Artiodactyla). Journal of Vertebrate Paleontology 26 (4), 989–1001.
Frost, S.H., Langenheim, R.L., 1974. Cenozoic Reef Biofacies; Tertiary Larger Foraminifera and Scleractinian Corals from Chiapas, Mexico. Northern Illinois University Press, De Kalb, 388 pp.
García-Villafuerte, M.A., 2008. Primer registro fósil del género *Hemirraghus* (Araneae, Theraphosidae) en ámbar del Terciario, Chiapas, México. Revista Ibérica de Aracnología 16, 43–47.
Gardner, J.A., 1928. The molluscan fauna of the Alum Bluff group of Florida. Part V. Tellinacea, Solenacea, Mactracea, Myacea, Molluscoidea. U.S. Geological Survey Professional Paper 142-E, 185–249.
Gardner, J.A., 1937. The molluscan fauna of the Alum Bluff group of Florida. U.S. Geological Survey, Professional Paper 142-F, 251–435.
Gibson-Smith, J., Gibson-Smith, W., 1983. Neogene melongenid gastropods from the Paraguaná Peninsula, Venezuela. Eclogae Geologicae Helvetiae 76 (3), 719–728.
Gill, T., 1871. Arrangement of the families of mollusks. Smithsonian Miscellaneous Collections, 227, xvi+49 pp.
Gmelin, J.F., 1791. Caroli a Linné Systema Naturae per regna tria naturae. Editio decima tertia. London, vol. 1, pt. 6, cl. 6, Vermes, pp. 3021–3910. Leipzig.
Guppy, R.J.L., 1866. On the relations of the Tertiary formations of the West Indies. The Quarterly Journal of the Geological Society of London 22, 570–590.
Guppy, R.J.L., 1876. On the Miocene fossils of Haiti. The Quarterly Journal of the Geological Society of London 32, 516–532.
Hodson, F., Hodson, H.K., 1931. Some Venezuelan mollusks. Bulletins of American Paleontology 16 (59), 94.
Hodson, F., Hodson, H.K., Harris, G.D., 1927. Some Venezuelan and Caribbean mollusks. Bulletins of American Paleontology 13 (49), 1–160.
Lamarck, J.B.P.de, 1799. Prodrome d'une nouvelle classification des coquilles. Memoires de la Societé d'Histoire Naturelle de Paris 1, 63–91.
Langenheim, J., 1966. Botanical source of amber from Chiapas, Mexico. Ciencia, 24, 201–211.
Langenheim, J.H., 1995. Biology of amber-producing trees: focus on case studies of Hymenea and Agaths. In: Anderson, K.B., Krelling, J.C. (Eds.), ACS symposium series 617: Amber, resinite, and fossil resins. American Chemical Society, Washington, pp. 1–31.
Linnaei, C. 1758. Systema naturae per regna tria naturae. Ed. 10. Stockholm, 824p.
MacNeil, F.S., Dockery III, D.T., 1984. Lower Oligocene Gastropoda, Scaphopoda, and Cephalopoda of the Vicksburg Groupin Mississippi. Mississippi Department of Natural Resources, Bureau of Geology, Bulletin 124, 415.
Maury, C.J., 1924. Fosseis Terciarios do Brasil com descripção de novas formas cretáceas. Serviço Geologico e Mineralogico do Brasil. Monographia IV, 665.
Meneses-Rocha, J.J., 2001. Tectonic evolution of the Ixtapa graben, an example of a strike-slip basin in southeastern Mexico: implications for regional petroleum systems. In: Bartolini, C., Buffler, R.T., Cantú-Chapa, A. (Eds.), The Western Gulf of MexicoBasin: Tectonics, Sedimentary Basins, and Petroleum Systems. American Association of Petroleum Geologists, Memoir, vol. 75, pp. 183–216.
Olsson, A.A., 1928. Contributions to the Tertiary Paleontology of Northern Peru: Part 1, Eocene Mollusca and Brachiopoda. Bulletins of American Paleontology 14 (52), 51–200.
Olsson, A.A., 1964. Neogene Mollusks from Northwestern Ecuador. Paleontological Research Institution, Ithaca, New York, 256 pp.
Perrilliat, M.C., 1973. Monografía de los moluscos del Mioceno medio de Santa Rosa, Veracruz, México. Parte II (Gasterópodos: Mitridae a Terebridae). Universidad Nacional Autónoma de México. Instituto de Geología. Paleontología Mexicana 35, 97.
Perrilliat, M.C., Vega, F.J., Avendaño-Gil, J., Coutiño, M.A., 2004. Bioestratigrafía de moluscos como base para una edad correspondiente al Mioceno medio en el área de Simojovel, Chiapas. In: IX Congreso Nacional de Paleontología, Tuxtla Gutiérrez Chiapas, p. 48.
Pilsbry, H.A., Johnson, C.W., 1917. New Mollusca of the Santo Domingan Oligocene. Proceedings of the Academy of Natural Science of Philadelphia 69, 150–202.
Poinar Jr., G., 1992. Life in Amber. StanfordUniversity Press, Stanford, 350 pp.
Poinar Jr., G., 2003. Coelomycetes in Dominican and Mexican amber. Mycological Research 107 (1), 117–122.
Poinar Jr., G., Brown, A.E., 2002. *Hymenea mexicana* sp. nov. (Leguminosae: Caesalpiniodeae) from Mexican amber indicates Old World connections. Botanical Journal of the Linnean Society 139, 125–132.
Rafinesque, C.S., 1815. Analyse de la nature, ou Tableau de l'univers et des corps organisées. Palermo, 224 p.
Santiago-Blay, J.A., Poinar Jr., G.O., 1993. First scorpion (Buthidae: Centruroides) from Mexican amber (lower Miocene to upper Oligocene). Journal of Arachnology 21, 147–151.
Schilder, F.A., 1939. Cypraeacea aus dem Tertiär von Trinidad, Venezuela und den Antillen. Abhandlungen der Schweizerischen Palaeontologischen Gesellschaft 62, 1–35.
Schumacher, H.C.F., 1817. Essai d'un nouveau système des habitations des Vers testacés. Copenhagen, i–iv, 1–287 pp.
Solórzano-Karemer, M.M., Mohrig, W., 2007. *Schwenckfeldina archoica* n. sp. (Diptera, Sciaridae) from the middle Miocene Mexican amber. Alavesia 1, 105–108.
Solórzano-Kraemer, M.M., 2007. Systematic, paleoecology, and paleobiogeography of the insect fauna from Mexican amber. Palaeontographica Abteilung A 282, 1–133.
Sowerby, G., 1850. Descriptions of new species of fossil shells found by J.S. Heniker. Quarterly Journal Geological Society of London 6, 44–53.
Spieker, E.M., 1922. The Paleontology of the Zorritos Formation of the North Peruvian Oil Field, vol. 3. The JohnsHopkins University Studies in Geology, pp. 1–196.
Swainson, W., 1835. The elements of modern conchology. London.
Swainson, W., 1840. A treatise on malacology or shells and shellfish. London, 419p..
Thiele, J., 1929–35. Handbuch der Systematischen Weichtierkunde. Jena: gusstav Fischer, Band I, Teil I, p. 1–376, 47o text figs. (1929); Band I, teil II, p. 377–778, 313 text figs. (1931); Band II, Teil III, p. 779–1023, 110 text figs (1934); Band II, teil IV, p. 1023–1154, 4 text figs. (1935).
Tomasini-Ortíz, A.C., Martínez-Hernández, E., 1984. Palinología del Eoceno-–Oligoceno de Simojovel, Chiapas. Universidad Nacional Autónoma de México, Instituto de Geología. Paleontología Mexicana 50, 60.
Vega, F.J., Nyborg, T., Coutiño, M.A., Solé, J., Hernández-Monzón, O., 2009. Neogene Crustacea from southeastern Mexico. Bulletin of the MizunamiFossil Museum 35, 51–69.
Vokes, E.H., 1964. The genus *Turbinella* (Mollusca, Gastropoda) in the New World. Tulane Studies in Geology and Paleontology 2 (2), 39–68.
Woodring, W.P., 1925. Miocene Mollusks from Bowden, Jamaica. Pelecypods and Scaphopods. Contribution to the Geology and Paleontology of the West Indies. Carnegie Institution of Washington, Publication n 366, 222 p.
Woodring, W.P., 1928. Miocene Mollusks from Bowden, Jamaica. Part II. Gastropoda and Discussion of Results. Carnegie Institution of Washington, Publication n 385, 564 p.
Woodring, W.P., 1964. Geology and Paleontology of Canal Zone and Adjoinig Parts of Panama. Description of Tertiary Mollusks (Gastropods: Columbellidae to Volutidae). United States Geological Survey. Professional Paper 306–C, 241–297.
Woodring, W.P., 1982. Geology and Paleontology of Canal Zone and Adjoining parts of Panama. Description of Tertiary mollusks (Pelecypods: Propeamussiidae to Cuspidariidae; additions to families Covered in P 306-E; additions to gastropods; Cephalopods). U.S. Geological Survey Professional Paper 306-F, 541–759.