Journal of South American Earth Sciences 71 (2016) 71–81

Contents lists available at ScienceDirect

Journal of South American Earth Sciences

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

Permian (Leonardian) brachiopods from Paso Hondo Formation, Chiapas, southern Mexico. Paleobiogeographical implications

Miguel A. Torres-Martínez [a, *], Francisco Sour-Tovar [b], Ricardo Barragán [a]

[a] Departamento de Paleontología, Instituto de Geología, Circuito de la Investigación Científica, Avenida Universidad No. 3000, Colonia Universidad Nacional Autónoma de México, Delegación Coyoacán, Cd. Mx, C.P. 04510, Mexico
[b] Museo de Paleontología, Departamento de Biología Evolutiva, Facultad de Ciencias, Universidad Nacional Autónoma de México, Av. Universidad No. 3000, Colonia Universidad Nacional Autónoma de México, Delegación Coyoacán, Cd. Mx, C.P. 04510, Mexico

ARTICLE INFO

Article history:
Received 4 May 2016
Received in revised form
30 June 2016
Accepted 30 June 2016
Available online 2 July 2016

Keywords:
Brachiopods
Paso Hondo Formation
Leonardian
Grandian Province
Mexico

ABSTRACT

One of the most important marine sequences of calcareous rocks from the Paleozoic of Mexico outcrops in southern Chiapas. It is composed by different units from Early Permian, being the Paso Hondo Formation the youngest with a Leonardian age. Different groups of marine invertebrates as corals, bivalves, gastropods, bryozoans, brachiopods and crinoids have been previously reported of this unit. Five brachiopod species of the orders Productida, Athyridida, Spiriferida and Spiriferinida from the Barrio Allende section of this unit are herein described. The new species *Dyoros* (*Lissosia*) *maya* and *Hustedia shumardi* are proposed. Sedimentology and paleoecology of the Paso Hondo Formation, suggest a well-lighted shallow lagoon environment with continuous terrigenous input. The subgenus *Dyoros* (*Lissosia*), the genus *Paucispinifera* and the species *Hustedia shumardi*, *Spiriferella propria* and *Spiriferellina tricosa* are typical taxa from Permian localities of Texas, New Mexico and Coahuila. Their presence in the studied area suggests that during Early Permian there was a geographic connection between the different localities of the biotic Grandian Province (southern USA, northern Mexico and Venezuela) and southeastern Chiapas.

1. Introduction

One of the most extensive Late Paleozoic carbonate sequences of Mexico outcrops in southeast Chiapas State and it was first described by Sapper (1896). Permian units in particular are composed of rocks dated as Wolfcampian-Leonardian (=Cisuralian), being the Paso Hondo Formation the youngest with a Leonardian age (=Artinskian-Kungurian); the geochronological units of southwestern United States and their correspondence with the established by the International Union of Geological Sciences are shown in Table 1 (Modified of Yugan et al., 1997). This unit is characterized by the presence of the fusulinids *Staffella centralis*, *Eoverbeekina americana* and *Nankinella* sp. and is correlated with the Victoria Peak Limestone and the Bone Spring Limestone that outcrop in western Texas and southeastern New Mexico (Thompson and Miller, 1944; Kling, 1960; Hernández-García, 1973). The Paso Hondo Formation can be also correlated with the Chochal Limestone from Guatemala which is lithologically similar (Hernández-García, 1973; Vachard et al., 1996).

In the Paso Hondo Formation have been reported different groups of marine invertebrates such as sponges, corals, gastropods, bivalves, ammonoids, ostracods, bryozoans, brachiopods and crinoids (Thompson and Miller, 1944; Hernández-García, 1973). The gastropod *Bellerophon* (*Bellerophon*) *crassus* Meek and Worthen (Buitrón-Sánchez, 1977) and the ammonoids *Perrinites hilli* (Smith) and *Peritrochia mullerriedi* Miller and Furnish are the only invertebrates formally described, and they allowed to correlate the Paso Hondo Formation with outcrops of the Leonard Series from Coahuila, Texas, New Mexico and Oklahoma (Müllerried et al., 1941; Thompson and Miller, 1944). Nonetheless, brachiopods are abundant and diverse in the unit. This paper aims to study the brachiopods from the Paso Hondo Formation, in order to improve the knowledge of the Late Paleozoic faunas from Chiapas. We describe brachiopods belonging to the orders Productida, Athyridida, Spiriferida and Spiriferinida, collected in calcareous rocks of the Barrio Allende section. Also the paleoenvironmental conditions of the

* Corresponding author.
E-mail addresses: miguelatm@geologia.unam.mx (M.A. Torres-Martínez), fcosour@ciencias.unam.mx (F. Sour-Tovar), ricardor@geologia.unam.mx (R. Barragán).

http://dx.doi.org/10.1016/j.jsames.2016.06.012
0895-9811/

Table 1
Geochronological units of southwestern United States and their correspondence with the established by the International Union of Geological Sciences (Modified of Yugan et al., 1997).

Period	SW USA		International	
	Epoch	Age	Epoch	Age
PERMIAN	*Guadalupian*	Roadian	*Guadalupian*	Roadian
	Leonardian	Kungurian	*Cisuralian*	Kungurian
		Artinskian		Artinskian
	Wolfcampian	Sakmarian		Sakmarian
		Asselian		Asselian
CARBONIFEROUS	*Late Pennsylvanian*	Virgilian	*Late Pennsylvanian*	Gzhelian

bearing strata are discussed, along with the paleogeographical implications of the taxa described, in particular their relationship with faunas of the biotic Grandian Province.

2. Locality and stratigraphy

The Paso Hondo Formation, is the youngest Permian lithostratigraphic unit from the region studied, is well exposed in the Chicomuselo area, and it extends from the western portion of Paso Hondo to Chicomuselo towns (Thompson, 1956). In particular, the Barrio Allende section where the material herein studied was sampled, is bounded by coordinates 15° 39′ N – 92° 13′ W, 700 m to the north of the Allende village, Bella Vista Municipality, Chiapas state (Fig. 1).

The Late Paleozoic succession in the Chiapas area, is represented by the carbonate deposits of the Santa Rosa Formation

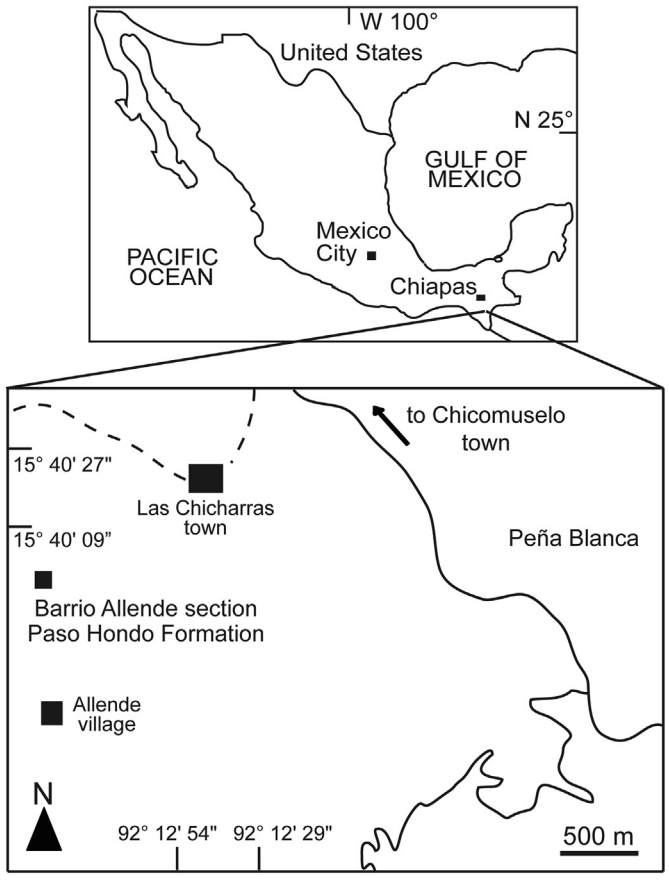

Fig. 1. Geographic location of the Barrio Allende section, Paso Hondo Formation, from where the specimens of brachiopods were collected.

(Mississippian-Pennsylvanian), Grupera Formation (Wolfcampian), La Vainilla Limestone (Wolfcampian-Leonardian), and the youngest Paso Hondo Formation (Leonardian) studied herein (Fig. 2).

The Paso Hondo Formation overlays the La Vainilla Limestone transitionally and is composed of approximately 600 m of rarely stratified massive limestone, with intercalations of silicified shale near its base (Gutiérrez-Gil, 1956). Facies of this unit record different associations of fusulinids, sponges, corals, bivalves, gastropods, bryozoans, brachiopods and crinoids from the Leonardian (Artinskian-Kungurian). Overlying unconformably to the Paso Hondo Formation is the Todos Santos Formation, composed by a group of red sandstone strata intercalated with fine layers of shale dated as Triassic-Jurassic (Gutiérrez-Gil, 1956).

The Barrio Allende section records 6.40 m of the Paso Hondo Formation, and is composed of 21 well-defined horizontal calcareous strata. At its base, it records 30 cm of brown calcarenite intercalated with dark gray limestone, above which rests a 1.70 m package of seven strata, composed of light gray limestone with intercalations of fine layers of orange or light brown calcarenite. Upwards, there is an about 4.40 m package of 13 strata of dark gray limestone without fossils. The specimens described herein occur in the light gray mudstones and orange calcarenites.

3. Systematic paleontology

The material described is housed at the National Collection of Paleontology of the Institute of Geology, National Autonomous University of Mexico. Both, the classification and morphological terminology are based on the Treatise on Invertebrate Paleontology (Brunton et al., 2000; Alvarez and Jia-Yu, 2002; Carter and Johnson, 2006; Carter et al., 2006; Alvarez, 2007; Brunton, 2007; Gourvennec and Carter, 2007). Figured and type specimens are designated in the descriptions by the prefix IGM.

Phylum Brachiopoda Duméril, 1805.

Subphylum Rhynchonelliformea Williams, Carlson, Brunton, Holmer and Popov, 1996.

Class Strophomenata Williams, Carlson, Brunton, Holmer and Popov, 1996.

Order Productida Sarytcheva and Sokolskaya, 1959.

Suborder Chonetidina Muir-Wood, 1955.

Superfamily Chonetoidea Bronn, 1862.

Family Rugosochonetidae Muir-Wood, 1962.

Subfamily Svalbardiinae Archbold, 1982.

Genus *Dyoros* Stehli, 1954.

Subgenus *Dyoros* (*Lissosia*) Cooper and Grant, 1975.

Type species: *Dyoros* (*Lissosia*) *concavus* Cooper and Grant, 1975. Texas, USA. Leonardian.

Dyoros (*Lissosia*) *maya* sp. nov. (Figs. 3.1–3.10).

Holotype: Calcified complete shell (IGM 10154; Figs. 3.1–2).

Paratypes: Calcified specimens preserved as three complete shells (IGM 10155, IGM 10157, IGM 10160), four ventral valves (IGM