Short notes

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CRETACEOUS RADIOLARIAN CHERTS OF WESTERN CUBA°

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INTRODUCTION

Radiolarian-bearing rocks crop out in several Mesozoic sequences of the Pinar del Rio province (Western Cuba). The bedded cherts, which are rhythmic alternations of radiolarite beds and shale interbeds, occur in a time-interval which grossly coincides with the transition from Early to Late Cretaceous. In Western Cuba, bedded cherts occur both in the continental margin sequences of the Guaniguanico Terrain and in the Northern Ophiolite belt. The Northern Ophiolite belt is tectonically superimposed on the Guaniguanico belt (Fig. 1) (Iturralde, 1994). For an exhaustive description of the Western Cuba geology and a new lithostratigraphic scheme of the Guaniguanico Terrain see Iturralde (1994) and Pszczolkowski (1994).

The Guaniguanico Terranes include several continental margin sequences, which range from Middle Jurassic to Middle Eocene, such as: Los Organos, Rosario South, Rosario North, Quiñones and Felicidades (Fig. 1). All these sequences are now stacked in NNW dipping thrust belts. According to Iturralde (1994), the original position of the Guaniguanico belt could have been at the eastern margin of the Yucatan platform.

The Northern Ophiolites consist of an allochthonous ophiolite melange (Iturralde, 1994) including a melanocratic basement (Late Triassic? - Early Cretaceous) and of the oceanic complexes (Hauterivian - Turonian) where tholeiitic basalts are associated with cherts, limestones and shales (Encrusijada Formation).

In this paper we present some data on the sedimentology of the bedded cherts of Western Cuba and new age determination with radiolarian biostratigraphy both on cherts of both the continental margin (Santa Teresa Fm.) and the oceanic complexes (Encrusijada Formation).

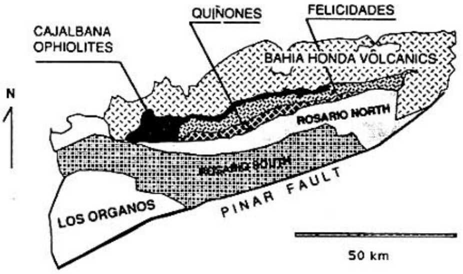

Fig. 1 - Geological sketch of the Pinar del Rio area (after Iturralde, 1994 modified).

CONTINENTAL MARGIN CHERTS: THE SANTA TERESA FORMATION

The Santa Teresa Formation occurs both in Western Cuba and in the Placetas Sequences of Central Cuba (Pszczolkowski, 1994). In the Rosario Sequences of Western

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Cuba the formation consists of reddish to gray radiolarian chert beds alternated to siliceous claystones. Its thickness ranges from 5 to 40 m, but thickness estimations are difficult because only the lower boundary has been clearly observed. Pszczolkowski (1994) assigned to the Santa Teresa a Hauterivian(?)-Cenomanian age in the southern sequences and an Aptian(?)-Cenomanian age in the northern sequences. Datations have been made with planktonic Foraminifera in thin sections. The Santa Teresa sections studied in this paper are four: two in the Rosario South sequence and two in the Rosario North sequence.

Two outcrops have been studied in the Rosario North sequence (Fig. 2): 1) along the road from Soroa to Cinqos Pesos; 2) North of El Roble. Here the Santa Teresa Fm. overlies the turbiditic sandstones and the siltstone beds of the El Roble member of the Polier Formation. The transition between these two formations occurs trough a few meters thick horizon in which the beds of El Roble alternate with the first claystones and chert beds of Santa Teresa.

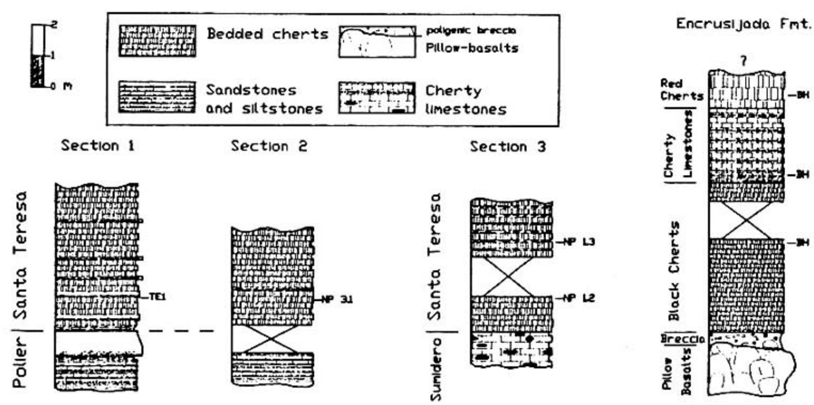

Fig. 2 - Stratigraphical columns: section 1 and 2 Santa Teresa Fm. in the northern Rosario Sequence, section 3 and 4 Santa Teresa Fm. in the southern Rosario Sequence.

The sections of the Rosario South sequence are located: 3) about 2 km East of Niceto Péres, along the road to Cinqos Pesos, and 4) in a quarry North of Sabanilla (Fig. 2). In both outcrops the Santa Teresa Fm. overlies the grey, radiolarian bearing, knobby cherty limestones of the Sumidero Member (Artemisa Formation). The transition consists of a horizon about 1 m thick horizon where limestone beds alternate with the chert beds. The two outcrops differ in the colour of the cherts: dark-grey in section 3) and reddish in section 4).

The rhythmic bedding in Santa Teresa Fm. is often very regular: reddish-brown radiolarite beds, 6 cm thick in average, alternate with 1-2 cm thick siliceous shale layers. In the northern sequences, radiolarians are generally better preserved.

The chert beds show several sedimentary structures that include: normal and reversal grading of the radiolarian skeletons and/or of the silica/clay ratio, parallel and low-angle laminations and starved ripples. In many chert beds, a ribbon-like banding of alternating lighter and darker layers can be observed. The light layers are texturally coarser, contain thicker radiolarian skeletons and often silt-size grains. In the dark layers, instead the radiolarian skeletons are thinner

and scattered in the shaly matrix, which is generally more abundant. The boundaries between these layers can be sharp or gradual. As proposed by Pszczolkowski (1982), we can suggest that the Santa Teresa cherts formed in part by re-depositional processes, as fine-grained turbidites and/or bottom currents winnowing.

CHERT ON VOLCANICS: THE ENCRUSIJADA FORMATION

The studied outcrop of the Encrusijada Fm. is located 10 km South of Bahia Honda, in the Las Pozas River. This section is overturned, folded and tectonically overlain by serpentinites. The sedimentary cover of the basalts consists of both chert and limtone beds. The chert beds are in average 3 cm thick and alternate with millimeter thick claystones. Both cherts and claystones are mainly black and strongly recrystallized. Only toward the top of the section the chert beds become thicker, red in color and contain well preserved radiolarian skeletons. The limestone beds crop out in the upper half of the section, where they interbed with black cherts. The limestones are usually dark-grey, laminated, and often contain lenses of black chert.

Due to strong tectonization and bad exposure, sampling and lithostratigraphic study of this outcrop has been limited to the first fifteen meters.

RADIOLARIAN BIOSTRATIGRAPHY

We examined several samples collected both in the Santa Teresa and Encrusijada Formations (see Fig. 2 for samples location).

The radiolarians have been extracted from the cherts following to the method proposed by Dumitrica (1970) and Pessagno and Newport (1972). The crushed rocks have been treated with a hydrochloric acid solution (12%). Then the rocks have been splitted in two portions: one half treated with a diluted hydrofluoric acid solution 2% (for 4 days), the other with HF 4% (for 4 days). These treatments have been repeated three times for each rock portion. We thus obtained six residues per sample.

Taxa / Sample	BH 1.4	NP 3.1	TE 1
Archaeodictyomitra lacrimula Foreman'			*
Archaeodictyomitra sp.	*	*	*
Dictyomitra montisserei (Squinabol) sensu O'Dogherty	*		
Holocryptocanium barbui Dumitrica	*		*
Holocryptocanium (?) sp.		*	*
Mesosaturnalis sp.	*		
Mita sp. cf. M. gracilis (Squinabol)			*
Napora sp.	*		
Praeconocaryomma sp. cf. P. californiaensis Pessagno	*		
Praeconocaryomma sp.	*		
Pseudodictyomitra sp. cf. P. lodogaensis Pessagno		*	
Stichomitra communis Squinabol	*		
Stichomitra sp. cf. S. communis Squinabol	*	*	
Stichomitra sp.		*	
Thanarla brouweri (Tan) sensu O'Dogherty			*
Thanarla sp. cf. T. brouweri (Tan)	*		*
Thanarla pacifica Nakaseko and Nishimura sensu O'Dogherty			*
Thanarla sp.	*		*

Fig. 3 - Distribution of radiolarians in the samples.

In samples BH 1.4 and TE 1, the radiolarian assemblages are well preserved but poorly diversified; sample NP 3.1 yielded poorly preserved radiolarian fauna; samples NP 1.2 and NP 1.3 are barren (Fig. 3).

In this paper several zonations proposed by Pessagno (1976, 1977b), Sanfilippo and Riedel (1985), Thurow (1985), Gorican (1994), Jud (1994) and O'Dogherty (1994) have been used.

Sample NP 3.1

The sample was located at about 3 meters from the lower boundary of Santa Teresa Formation. A middle Aptian - Cenomanian age is suggested by the presence of *Pseudodictyomitra* sp. cf. P. *lodogaensis* Pessagno (*P. lodogaensis* ranges from lower Aptian, U.A. 4 Verbeeki subzone after O'Dogherty 1994, to late Cenomanian, Zone 10 af-

ter Pessagno 1976 and 1977b, Thurow 1988) and *Stichomitra* sp. cf. *S. communis* Squinabol (*S. communis* ranges from lower Aptian, U.A. 5 top of Verbeeki subzone after O'Dogherty 1994, to Turonian: Thurow 1988; U.A. 48 lower Turonian? after Gorican 1994; U.A 21 Superbum Zone lower Turonian after O'Dogherty 1994).

This age assignment is very uncertain because of the bad preservation of these species.

Sample TE 1

It has been taken in the transitional facies from Polier to Santa Teresa. The age is Valanginian - middle Aptian for the occurrence of *Thanarla brouweri* (Tan) sensu O'Dogherty (1994) and *Thanarla pacifica* Nakaseko and Nishimura sensu O'Dogherty (1994).

Thanarla brouweri (Tan) ranges from Valanginian (*Thanarla conica* in Thurow 1988) to middle Albian (U.A. 11, top of Romanus subzone after O'Dogherty 1994).

Thanarla pacifica Nakaseko and Nishimura ranges from Hauterivian (Nakaseko and Nishimura 1981 report this species from a sample of possible Hauterivian age 1994) to middle Aptian (U.A 6, lower part of Costata subzone after O'Dogherty 1994).

Sample BH 1.4

This sample was collected about 12 m from the pillow basalts. The age is middle Albian - Cenomanian due to the occurrence of *Dictyomitra montisserei* (Squinabol) sensu O'Dogherty 1994, *Holocryptocanium. barbui* Dumitrica and *Thanarla* sp. cf. *T. brouweri* (Tan).

The lower limit of this age is given by *Dictyomitra montisserei* (Squinabol) that ranges from middle Albian to lower Turonian (U.A. 10-20, from Spoletoensis Zone to the lower part of Superbum Zone after the zonation proposed by O'Dogherty 1994).

Holocryptocanium barbui Dumitrica ranges at least from middle Berriasian (U.A 12, Baumgartner 1984, updated by O'Dogherty et al. 1989) to late Cenomanian (Zone 10 Pessagno 1976, 1977b; O. somphedia Zone of Sanfilippo and Riedel in Thurow 1988).

Thanarla sp. cf. *T. brouweri* (Tan), this specimen (see plate 1.18) is poorly preserved, but it is important because the genus Thanarla ranges only to the latest Cenomanian.

CONCLUSION

i) Two samples collected in Santa Teresa of the northern Sequences of the Guaniguanico terrain have been dated. The age determined with the sample TE1 indicates that the base of the formation could ranges from Valanginian to middle Aptian. The middle Aptian - Cenomanian age of NP 3.1 is in according to Pszczolkowski (1994), but it is worth nothing that the radiolarians in this sample are not well preserved.

ii) We have dated for the first time the radiolarites in the Encrusijada Formation. Their middle Albian to Cenomanian age resulted quite similar to the age of Santa Teresa Formation. This involve that the cherts in both continental margin and oceanic crust sequences could have the same origin.

We think that to better understand these problems further investigations of these formations must be carried out.

Acknowledgement

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CAPTION OF THE PLATE

Plate 1 - *Archaeodictyomitra lacrimula* Foreman TE 1, x190; 2 - *Archaeodictyomitra* sp. TE 1, x140; 3 - *Dictyomitra montisserei* (Squinabol) sensu O'Dogherty 1994 BH 1.4, x140; 4 - *Dictyomitra montisserei* (Squinabol) [sensu O'Dogherty 1994] BH 1.4, x140; 5 - *Holocryptocanium barbui* Dumitrica BH 1.4, x234; 6 - *Holocryptocanium barbui* Dumitrica TE 1, x190; 7 - *Holocryptocanium* (?) sp. NP 3.1, x156; 8 - *Holocryptocanium* (?) sp. TE.1, x140; 9 - *Mita* sp. cf. *M. gracilis* (Squinabol) TE 1, x140; 10 - *Praeconocaryomma* sp. cf. *P. californiaensis* Pessagno BH 1.4, x190; 11 - *Pseudodictyomitra* sp. cf. *P. lodogaensis* Pessagno NP 3.1, x335; 12 - *Stichomitra communis* Squinabol BH 1.4, x95; 13 - *Stichomitra* sp. cf. *S. communis* Squinabol NP 3.1, x190; 14 - *Stichomitra* sp. cf. *S. communis* Squinabol BH 1.4, x140; 15 - *Stichomitra* sp. NP 3.1, x140; 16 -*Thanarla brouweri* (Tan) sensu O'Dogherty 1994 TE 1, x190; 17 - *Thanarla* sp. cf. *T. brouweri* (Tan) BH 1.4, x190; 18 - *Thanarla* sp. cf. *T. brouweri* (Tan) BH 1.4, x140; 19 - *Thanarla pacifica* Nakaseko and Nishimura sensu O'Dogherty 1994 TE 1, x140.

Plate 1