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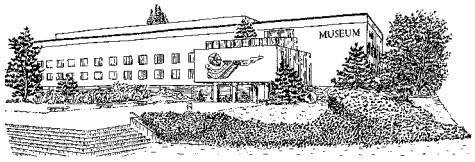

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Four new species of benthonic foraminifera from the Miocene of Trinidad, West Indies, and their palaeobiogeographic importance

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Abstract
Four new species of benthonic foraminifera (*Textularia carrbrowni*, *T. framptoni*, *T. sawhi* and *Bolivina jiattongi*) are described from the middle and upper Miocene of Trinidad, West Indies. *Textularia carrbrowni* n. sp. has previously been illustrated from the Miocene of Puerto Rico as *T. articulata* d'Orbigny, in turn originally described from the Vienna Basin, Austria. The recognition of *T. carrbrowni* as a new species enhances its palaeobiogeographic usefulness. *Textularia sawhi* n. sp. in side view resembles *Textularia gramen* d'Orbigny, also from the Vienna Basin, but possesses a different aperture. Also noted are some other erroneous applications of the name *T. gramen* to Caribbean species. The palaeodepth preferences of all four new species are inferred from the associated foraminiferal assemblages.

Key words
Benthonic foraminifera, Miocene, Trinidad, Caribbean.

I. INTRODUCTION

The benthonic foraminifera of the middle and upper Miocene of northern South America and some nearby Caribbean islands have been the subject of numerous studies (e.g., Galloway & Heminway, 1941, Puerto Rico ; Renz, 1948, western Venezuela ; Bermudez, 1949, Dominican Republic ; Redmond, 1953, Colombia ; Drooger, 1953, Aruba ; Petters & Sarmiento, 1956, Colombia ; Becker & Dusenbury, 1958, Colombia ; Gordon, 1961, Puerto Rico ; Todd & Low, 1976, Puerto Rico ; Whittaker, 1988, Ecuador ; Katz & Miller, 1993, Jamaica ; Bolli *et al*. 1995, southeast Caribbean region). However, only a few papers have reported the benthonic foraminiferal assemblages in the middle and upper Miocene of Trinidad :

1. As an adjunct to a study of the fauna in the Agua Salada Group of western Venezuela, Renz (1948) outlined part of the fauna in the 1200 m-thick, blue-grey clays of the Brasso Formation (*Catapsydrax dissimilis* to *Globorotalia fohsi robusta* planktonic foraminiferal zones of Bolli, 1957) of central Trinidad. Of 239 species of mostly benthonic foraminifera recorded from the Agua Salada Group, he found 159 in the Brasso Formation. However, the nature of his study would have precluded him from describing any new species that he found only on Trinidad ;
2. Wilson (2003) mentioned a few of the more abundant benthonic foraminifera when documenting the planktonic foraminiferal assemblage in a ~150 m-thick outcrop of the Brasso Formation (*Praeorbulina glomerosa* to *Globorotalia fohsi fohsi* Zones), and later (Wilson, 2004) listed the 182 species of benthonic foraminifera in that section ; and
3. Wilson (in press) listed 28 species of benthonic foraminifera in a 6-m section of the grey clays of the 650 m-thick San José Calcareous Silt Member (lower Manzanilla Formation : Upper Miocene *Globorotalia acostaensis-Globorotalia humerosa* Zones) of central Trinidad.

This paper furthers these studies by describing four new species of benthonic foraminifera from the Brasso Formation and San José Calcareous Silt Member of the Manzanilla Formation.

The treatise by d'Orbigny (1846) on the Miocene foraminifera of the Vienna Basin, Austria, influenced some studies of the fauna in the West Indian Miocene, workers erroneously applying species names erected by d'Orbigny to benthonic foraminifera in the middle and upper Miocene of the Caribbean region. This obscured palaeobiogeographic details. Of the four species erected in this paper, *Textularia carrbrowni* sp. nov. has previously been referred to *T. articulata* d'Orbigny, 1846. Furthermore it is noted also that name *Textularia gramen* d'Orbigny, 1846 has been erroneously applied to species from the Caribbean region. The new species *Textularia sawhi* n. sp. resembles *T. gramen* d'Orbigny, 1846 in outline, but possesses a distinctly different aperture.

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II. SYSTEMATICS

Repository : Rock samples are from the writer's personal collection. These and the figured specimens are housed in the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad, the specimens in the foraminiferal microscope-slide collection under numbers FPXUWI-89 to FPXUWI-92.

Class Foraminiferea Lee, 1990
Family Textulariidae Ehrenberg, 1838
Subfamily Textulariinae Ehrenberg, 1838

Textularia carrbrowni new species
Plate I, figs 1-4

1941. *Textularia articulata* Galloway & Heminway, p. 329, pl. 8, figs 1a, b (not d'Orbigny, 1846)

Diagnosis : An elongate, slowly-flaring *Textularia*, with a distinctive protrusion of the final chamber, oval in apertural view.

Description : Wall arenaceous, rough ; test elongate, flaring slowly, apex bluntly rounded, apertural end concave around aperture due to protrusion of final chamber ; test oval in apertural view, slightly compressed ; up to sixteen chambers, increasing slowly in size, not inflated ; sutures very slightly depressed, especially in later chambers, giving slightly lobate outline ; aperture a low arch at base of final chamber.

Etymology : In honour of Mr. Barry Carr-Brown, Caribbean micropalaeontologist, for his contributions to Trinidad foraminiferal biostratigraphy.

Type : The holotype (FPXUWI –90 ; Pl. I, figs 3-4) is located at the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Other material : The paratype (Pl. I, figs 1-2) has been assigned the number FPXUWI-90a. Other specimens examined are from samples JBW-78 to JBW-80 (Brasso Formation at Brasso Gorge, Brasso Village, Trinidad), slides for which are housed in the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Occurrence : The type locality of *T. carrbrowni* n. sp. is in the Brasso Formation where exposed in the banks of the Upper Caparo River at Brasso Village, Central Trinidad. The outcrop lies ~20 m upstream of the bridge at Trinidad Government Cadastral Coordinates N1151439, E0683382 links, in the *Globorotalia fohsi robusta* Zone (see Kugler, 1996, map 20).

Discussion : In Trinidad *Textularia carrbrowni* n. sp. has so far only been found at the type locality, in rocks that remainder of the foraminiferal fauna suggests were deposited at middle neritic depths.

Galloway & Heminway (1941) illustrated *T. carrbrowni* n. sp. from the San Sebastian formation of Puerto Rico, but called it *T. articulata*. This name has been erroneously applied to at least two species in the Miocene of the Americas, perhaps because d'Orbigny (1846), when describing *T. articulata* from the Miocene of the Vienna Basin, Europe, gave only stylised figures. Lectotypes of *T. articulata* from d'Orbigny's original collection, illustrated by Papp & Schmid (1985, pl. 89, pl. 82, figs 1-3) using SEM photographs, have a sharp margin not found in *T. carrbrowni* n. sp. Furthermore, Papp & Schmid (1985) concluded *T. articulata* to be an ecological variant of *T. mariae* d'Orbigny, 1846, the lateral margins of which bear spines not found in *T. carrbrowni*, although Marks (1951) noted that the development of spines can vary on a single test of *T. mariae*.

The name *Textularia articulata* was applied by Cushman & Ponton (1932) and Snyder *et al*. (1988) to foraminifera from the Miocene of Florida and North Carolina respectively. Examination of the illustrations suggests these specimens may be conspecific. However, they belong to neither *T. articulata* d'Orbigny, 1846 nor *T. carrbrowni* n. sp., differing from the latter in having an angular periphery, and in being smoother and less coarsely agglutinated.

Textularia framptoni new species
Pl. I, figs 6-8

2004. *Textularia* sp. C Wilson (list)

Diagnosis : A small, fragile, coarsely agglutinated *Textularia*, invariably crushed, that flares slowly.

Description : Wall arenaceous, rough, white ; test squat, flaring slowly, apex blunt ; ten to twelve chambers, each about as broad as long ; sutures very slightly depressed, especially in later chambers, giving slightly lobate outline ; aperture a low arch at the base of the final chamber.

Etymology : In honor of Dr. John Frampton, micropalaeontologist, in recognition of his contributions to Trinidad geology and foraminiferal biostratigraphy.

Type : The holotype (FPXUWI –89 ; Pl. I, fig. 8) is located at the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Other material : The paratype (Pl. I, figs 6-7) has been assigned the number FPXUWI-89a. Other specimens examined are from samples JBW-20 to JBW-24 (Brasso Formation along the Guaico Tamana Road, Trinidad), foraminiferal assemblage slides for which are housed in the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad. Scattered occurrences have also been noted in the Manzanilla Formation at Manzanilla Point, northeast Trinidad.

Occurrence : Wilson (2004) recorded abundant *Textularia framptoni* in the early Middle Miocene *Globorotalia fohsi peripheroronda* and *Globorotalia fohsi fohsi* Zones

along the Guaico-Tamana Road of Central Trinidad (Trinidad Government Cadastral Coordinates N1161709, E0701400 links). Because this site has overgrown since Wilson (2003, 2004) published his work, the type locality is selected as comprising the bank of the Upper Caparo River at Brasso Village, Central Trinidad, ~20 m upstream of the bridge at Trinidad Government Cadastral Coordinates N1151439, E0683382 links. This outcrop lies within the *Globorotalia fohsi robusta* Zone (see Kugler, 1996, Map 20). *Textularia framptoni* has also been found in San José Calcareous Silt Member of the Manzanilla Formation at Manzanilla Point, northeast Trinidad (late Miocene *Globorotalia acostaensis* Zone : author's unpublished data). All rocks yielding *T. framptoni* were deposited in the middle neritic.

Discussion : The fragile test in *Textularia framptoni* is invariably crushed, usually obliquely, and the aperture is rarely visible. The apex is frequently broken.

Textularia sawhi n. sp.
Pl. I, figs 5, 9-11

Diagnosis : A smooth-walled species of *Textularia* with a rapidly flaring test and a semicircular aperture.

Description : Test small, rapidly flaring, finely arenaceous, frequently with a polished appearance ; triangular in side view, outline very slightly lobate ; rhomboidal in apertural view, chamber periphery broadly angled and subrounded ; sutures little depressed ; aperture a high, narrow, semicircular arch at the base of the final chamber.

Etymology : In honour of Mr. L. R. Sawh, for his support over the past three years.

Type : The holotype (FPXUWI –91 ; Pl. I, figs 9-10) is located at the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Other material : The paratype (Pl. I, figs 5 and 11) has been assigned the number FPXUWI-91a. Other specimens examined are from samples JBW-79 and JBW-80 (Brasso Formation at Brasso Village, Brasso Gorge, Central Trinidad), and from the San José Calcareous Silt Member of the Manzanilla Formation at Manzanilla Point, northeast Trinidad. Foraminiferal assemblage slides for the relevant samples are housed in the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Occurrence : Both the holotype and paratype of *Textularia sawhi* n. sp were collected from the San José Calcareous Silt Member of the Manzanilla Formation where exposed in cliffs at Manzanilla Point, NE Trinidad (see Kugler, 1996, map 21), 10 m below the top of the exposed sequence. It has been encountered most frequently in the San José Calcareous Silt Member of the Manzanilla Formation (late Miocene *Globorotalia acostaensis* Zone), but rare specimens have been recovered from the Brasso Formation (Middle Miocene *Globorotaliafohsi robusta* Zone) where it is associated with *Textularia carrbrowni*. All rocks containing *T. sawhi* were deposited in the middle neritic.

Discussion : In lateral view *T. sawhi* resembles *T. gramen* d'Orbigny, 1846 (topotype illustrated by Papp & Schmid, 1985, p. 87, pl. 81, figs 1-3). However, d'Orbigny's type illustration indicates that the periphery in *T. gramen* is sharply angled, and the aperture a broad, low arch.

Cushman (1930) and Galloway & Heminway (1941) illustrated from the Choctawhatchee Formation of Florida and the San Sebastian formation of Puerto Rico respectively a species that they called *Textularia gramen*. Their illustrations suggest that their species differs from *T. gramen* d'Orbigny, 1846 in having higher chambers, and from *T. sawhi* in having a low, wide aperture.

Family Bolivinidae Glaessner, 1937
Genus *Bolivina* d'Orbigny, 1839

Bolivina jiattongi n. sp.
Pl. I, figs 12-13

Diagnosis : A species of *Bolivina* in which an adapically-directed extension of the chambers forms a pronounced central ridge.

Description : Test expanding rapidly in side view, rhomboidal in apertural view ; chambers numerous, low, increasing slowly in height ; sutures limbate, raised ; a raised extension of each chamber and suture sweeps back obliquely along the test axis towards the proloculus to form a wide but sharply-defined ridge with a plaited appearance ; test periphery blunt, with a thickened keel formed by the amalgamation of raised sutures ; aperture an elongate, narrow loop at base of last chamber, with a raised lip around part of the periphery, surrounded by a broad imperforate area.

Etymology : In honour of Ms. Jacqueline Ingrid Attong, for her help in fieldwork on many occasions.

Type : The holotype (FPXUWI –92 ; Pl. I, figs 12-13) is located at the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Other material : Specimens of *Bolivina jiattongi* n. sp. have been recovered from samples JBW-84 through JBW-89, all taken from San Fabien Quarry, near Gasparillo, western Central Trinidad, West Indies (grid reference : UTM Zone 20, 672300, 1143000). Foraminiferal assemblage slides for these samples are housed in the Petroleum Geoscience Unit, Department of Chemical Engineering, The University of the West Indies, Trinidad.

Occurrence : *Bolivina jiattongi* n. sp. has so far been found only in the 6 m-high exposure of the Brasso Formation in the northern wall of the St. Fabien Quarry. Associated planktonic foraminifera indicate *B. jiattongi* to be of Middle Miocene age (*Globorotalia fohsi robusta* Zone). The abundance of associated planktonics suggests that *B. jiattongi* lived at upper bathyal palaeodepths.

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REFERENCES

BECKER, L. E. & A. N. DUSENBURY (1958) - Mio-Oligocene (Aquitanian) Foraminifera from the Goajira Penisula, Colombia. *Cushman Foundation for Foraminiferal Research,* Special Publication, 4 : 48 p.

BERMUDEZ, P. J. (1949) - Tertiary smaller foraminifera of the Dominican Republic. *Cushman Laboratory for Foraminiferal Research,* Special Publication, 18 : 322 p.

BOLLI, H. M. (1957) - Planktonic Foraminifera from the Oligocene-Miocene Cipero and Lengua Formations of Trinidad, B.W.I. *United States National Museum Bulletin*, 215 : 97-123.

BOLLI, H. M., J.-P. BECKMANN & J. B. SAUNDERS (1995) - *Benthic foraminiferal biostratigraphy of the south Caribbean region*. Cambridge University Press, England, 408 p.

CUSHMAN, J. A. (1930) - The Foraminifera of the Choctawhatchee Formation of Florida. *Florida State Geological Survey Bulletin*, 4 : 63 p.

CUSHMAN, J. A. & G. M. PONTON (1932) - The foraminifera of the upper, middle and part of the lower Miocene of Florida. *Florida State Geological Survey Bulletin*, 9 : 147 p.

D'ORBIGNY, A. (1846) - *Foraminifères fossiles du Bassin Tertiaire de Vienne*. Gide et Comp., Libraires-Editeurs, Paris : 321 p.

DROOGER, C. W. (1953) - Miocene and Pleistocene foraminifera from Oranjestad, Aruba (Netherlands Antilles). *Contributions from the Cushman Foundation for Foraminiferal Research*, 4 : 116-147.

GALLOWAY, J. J. & C. E. HEMINWAY (1941) - The Tertiary Foraminifera of Porto Rico. *Scientific Survey of Porto Rico and the Virgin Islands*, 3 : 275-447.

GORDON, W. A. (1961) - Foraminifera from the 4CPR oil test well near Arecibo, Puerto Rico. *Oil and Gas Possibilities of Northern Puerto Rico, Puerto Rico Mining Commission, San Juan* : 27-40.

KATZ, M. E. & K. G. MILLER (1993) - Miocene-Pliocene bathyal benthic foraminifera and the uplift of Buff Bay, Jamaica. *In* : WRIGHT, R.M. & E. ROBINSON (Eds). *Biostratigraphy of Jamaica, Geological Society of America Memoir* 182 : 219-254.

KUGLER, H. M. (1996) - *Treatise on the Geology of Trinidad : Detailed geological maps and sections*. Natural History Museum Basel, Switzerland, editors.

MARKS, P. (1951) - A revision of the smaller foraminifera from the Miocene of the Vienna Basin. *Contributions of the Cushman Foundation for Foraminifera Research,* 2 : 33-73.

PAPP, A. & M E. SCHMID (1985) - The Fossil Foraminifera of the Tertiary Basin of Vienna : Revision of the monograph by Alcide d'Orbigny (1846). *Abhandlungen der Geologischen Bundesanstalt*, 37 : 311 p.

PETTERS, V. & S. SARMIENTO (1956) - Oligocene and Lower Miocene biostratigraphy of the Carmen-Zambraon area, Colombia. *Micropaleontology*, 2 : 7-35.

REDMOND, C. D. (1953) - Miocene Foraminifera from the Tubara Beds of northern Colombia. *Journal of Paleontology*, 27 : 708-733.

RENZ, H. H. (1948) - Stratigraphy and fauna of the Agua Salada Group, State of Falcón, Venezuela. *Geological Society of America Memoir*, 32 : 219 p.

SNYDER, S. W., V. J. WATERS & T. L. MOORE (1988) - Benthic foraminifera and paleoecology of Miocene Pungo River Formation sediments in Onslow Bay, North Carolina continental shelf. *In* : SNYDER, S.W. (Ed.). Micropaleontology of Miocene sediments in the shallow subsurface of Onslow Bay, North Carolina Continental Shelf. *Cushman Foundation for Foraminiferal Research,* Special Publication, 25 : 43-96.

TODD, R. & D. LOW (1976) - Smaller Foraminifera From Deep Wells on Puerto Rico and St. Croix. *United States Geological Survey Professional Paper*, 863 : 32 p.

WHITTAKER, J. E. (1988) - *Benthic Cenozoic Foraminifera from Ecuador.* London, England, British Museum (Natural History), 194 p.

Plate I

SEM photographs of new benthonic foraminiferal species from the middle and upper Miocene of Trinidad, West Indies.

Figs 1-2 : *Textularia carrbrowni* n. sp. paratype (FPXUWI-90a), *1*, paratype in edge view, x50, *2*, paratype in side view, x50.

Figs 3-4 : *Textularia carrbrowni* n. sp. holotype (FPXUWI-90), *3*, holotype in apertural view, x88 4, holotype in side view, x64.

Figs 5, 11 : *Textularia sawhi* n. sp. paratype (FPXUWI-91a), *5,* paratype in side view, x45, *11*, paratype in apertural view, showing aperture as a semicircular arch, x79.

Figs 9, 10 : *Textularia sawhi* n. sp. holotype (FPXUWI-91), *9*, holotype in side view, showing early chambers, but proloculus broken, x49, *10*, holotype in apertural view, showing aperture as partial semicircular arch, x64.

Figs 6-7 : *Textularia framptoni* n. sp. paratype (FPXUWI-89a), *6*, paratype in side view, showing obliquely crushed chambers, x70, *7*, paratype in opposite side view, x70.

Fig. 8 : *Textularia framptoni* n. sp. holotype (FPXUWI-89a) in side view, showing low arch of aperture, x58.

Figs 12-13 : *Bolivina jiattongi* n. sp. holotype (FPXUWI-92), *12*, side view, x44, *13*, apertural view, x60.

Plate I

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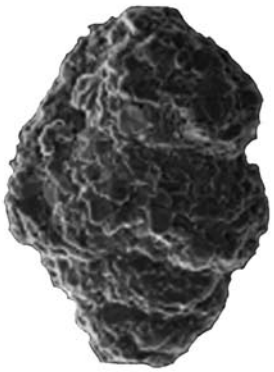

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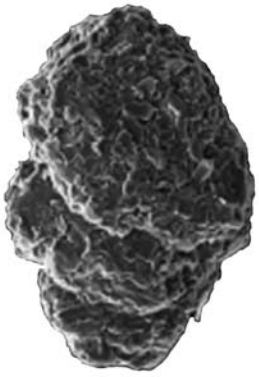

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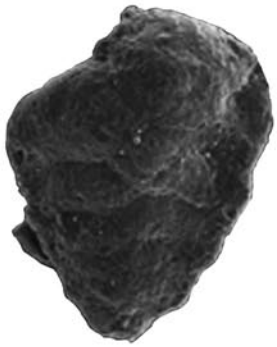

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WILSON, B. (2003) - Foraminifera and Paleodepths in a Section of the Early to Middle Miocene Brasso Formation, Central Trinidad. *Caribbean Journal of Science*, 39 : 209-214.

WILSON, B. (2004) - Benthonic Foraminiferal Paleoecology Across a Transgressive-Regressive Cycle in the Brasso Formation (Early-Middle Miocene) of Central Trinidad. *Caribbean Journal of Science*, 40 : 126-138.

WILSON, B. (2004) - Foraminiferal Biostratigraphy and Paleo-Ecology of the San José Calcareous Silt Member (Manzanilla Formation) at the Forres Park Landfill, Central Trinidad, West Indies. *Caribbean Journal of Science*, 40 : 388-391.

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