IJEGEO International Journal of Environment and Geoinformatics 1 (1-3), 29-39 (2014)

Foraminifera Population from South Africa Coast Line (Indian and Atlantic Oceans)

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Received 25 July 2014
Accepted 28 Sept. 2014

Abstract

Cape Town is the second-largest city of the Republic of South Africa. Research is conducted in 3 different stations: Maori Bay, which lies in the southwest of Cape Town, and Pyramid Rock and Partridge Points which lies in the False Bay, southeast part of Cape Town. Samples are taken from young sediments at 10.00 and 20.00 m depths, and collected by scuba-diving method. The aim of the study is to investigate the living benthic foraminifera assemblages in the Atlantic Ocean, and to compare these assemblages with the southeastern part of the Atlantic Ocean, the Arabian Sea, Indian Ocean and Western Pacific assemblages. Moreover, the aim of the study is to determine whether there are any benthic foraminifera forms reaching to the Mediterranean from Pacific Ocean, Indian Ocean or Red Sea via Suez Channel.

Keywords: Foraminifera, South Africa, Cape Town, faunal assemblages.

Introduction

Cape Town is the second most populous city of South Africa with a population of 3.7 million. The legislative capital city of the country is located in the southwestern end of South Africa. First permanent European settlement in South Africa was established in Cape Town, the far end of the African continent to Europe.

The Cape Peninsula has a Mediterranean climate with well-defined seasons. In winter, which last from June to September, large cold fronts come across from the Atlantic Ocean with heavy precipitation and strong north-westerly winds. The winter months are cool, with an average minimum temperature of 7°C (45°F) in July. Most of the city's annual rainfall occurs in wintertime, but due to the mountainous topography of the city, rainfall amounts for specific areas can vary dramatically. Newlands, to the south of the city, is the wettest suburb in South Africa. The valleys and coastal plains average 515 millimeters (20 in) of rain per annum, while mountain areas can average as much as 1,500 millimeters (60 in) per annum. Summer, which last from December to March, is warm and dry. Summer temperatures are mild, with an average maximum of 26°C (79°F). The Peninsula gets frequent strong winds from the south-east, known locally as the Cape Doctor, because it blows away pollution and cleans the air. The south-easterly wind is caused by a high-pressure system which sits in the South Atlantic to the west of Cape Town, known as the South-Atlantic High. Cape Town can be uncomfortably hot when the Berg Wind, meaning "mountain wind" blows from the Karoo interior for a couple weeks in February

or early March (Griffiths et al., 2010). Water temperatures range greatly, between 10°C (50°F) on the Atlantic Seaboard, to 22°C (72°F) in False Bay. Average annual Ocean temperatures are between 13°C (55°F) on the Atlantic Seaboard, and 17 C (63°F) in False Bay ("Cape Town," 2014).

Material and Methods

Samples are collected from 6 points by scuba diving from two different depths (10.00 m & 20.00 m) at 3 different stations, Maori Bay, Pyramid Rock, and Partridge Point (Figure 1 and Table 1).

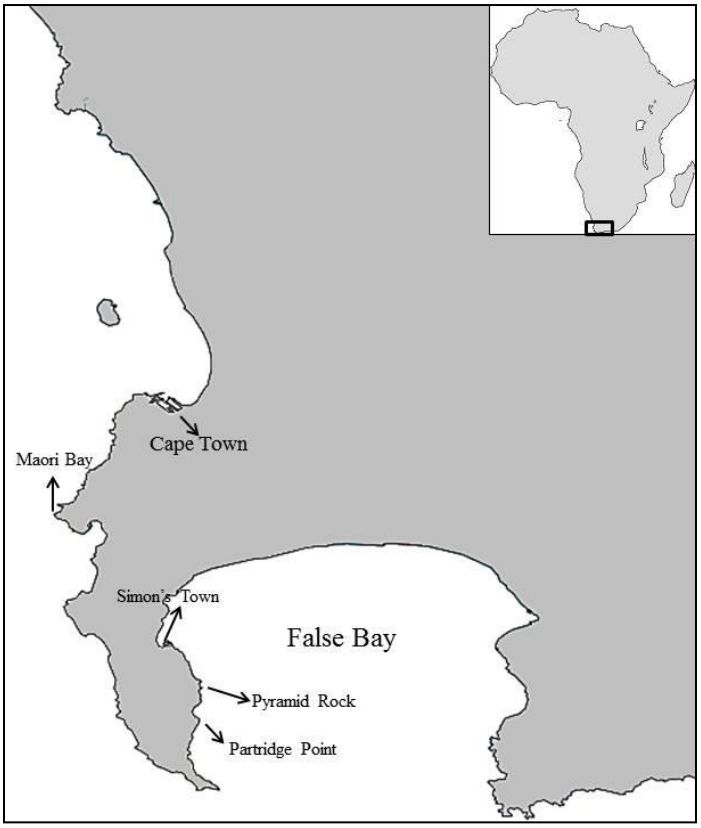

Fig 1. Sampling stations

Table 1. Stations

Stations	**Coordinates**		**Depth (m)**	**Temperature**
	South	**East**		
Partridge Point	34° 16' 36"N	18°29'01"E	10	17°C
			20	
Pyramid Rock	34° 14' 06"N	18°28'39"E	10	17°C
			20	
Maori Bay	34° 02'07"N	18°18'31"E	10	10°C
			20	

Wet samples are weighed in 5 g portions, 10% H2O2 is added and soaked in for 24 hours. Samples are firstly washed on a 0,063-mm sieve with water cannons, and after drying in an oven at 50 °C, samples sieved on 2.00, 1.00, 0,500, 0,250, 0.125 mm sieves, respectively. These samples are analyzed under a binocular microscope and the foraminifera have been identified.

Systematic Descriptions and Faunal Assemblages

Taxonomic identifications of foraminifera were carried out by using the publications of the following researchers: Baccaert, 1987; Loeblich and Tappan, 1988; Haig, 1988; Debenay, 1990; Hatta and Ujiie, 1992; Hottinger et al., 1993; Loeblich and Tappan, 1994; Yassini and Jones, 1995; Hayvard et al., 1999; The classification of Loeblich and Tappan, 1994; Meriç et al., 2008; Sarkar et al., 2009 were used for identification at the generic and suprageneric level.

In examined samples, 24 genus and 31 species found: *Textularia bocki* Höglund, *Spirillina limbata* Brady, *S. vivipara* Ehrenberg, *Turrispirillina depressa* Parr, *Cycloforina contorta* (d'Orbigny), *Massilina gualteriana* (d'Orbigny), *M. secans* (d'Orbigny), *Quinqueloculina bidentata* d'Orbigny, *Q. seminula* (Linné), *Q. vulg*aris d'Orbigny, *Q. viennensis* Le Calvez J. and Y., *Miliolinella elongata* Kruit, *M. subrotunda* (Montagu), Pseudotriloculina sp., *Pyrgo anomala* (Schlumberger), *Triloculina marioni* Schlumberger, *T. terquemiana* (Brady), *Sigmoilinita edwardsi* (Schlumberger), *Sigmoilopsis schlumbergeri* (Silvestri), *Parrina bradyi* (Millet), *Peneroplis pertusus* (Forskal), Lenticulina sp., *Astacolus crepidulus* (Fichtel and Moll), *A. insolithus* (Schwager), Globorotalia sp., *Eponides concameratus* (Williamson), *Neoeponides* cf. *procerus* (Brady), *Milesina* cf. *splendida* Yassini and Jones, *Rosalina bradyi* Cushman, *Lobatula lobatula* (Walker and Jacob), *Pararotalia spinigera* (Le calvez), *Elphidium crispum* (Linné), *E. depressulum* Cushman, Elphidium sp. (Table 2; Plates 1 and 2).

The taxonomy of the observed benthic foraminifera

Loeblich and Tappan, 1988 was taken as the basis for systematic classification.

Order TEXTULARIIDA Lankester, 1885
Superfamily TEXTULARIACEA Ehrenberg, 1838
Family Textulariidae Ehrenberg, 1838
Subfamily Textulariinae Ehrenberg, 1838
Genus Textularia Defrance, 1824
Textularia bocki
Order SPIRILLINIDA Corbachik and Montsurova, 1980
Suborder SPIRILLININA Hohenegger and Piller, 1975
Family Spirillinidae Reuss and Fritsch, 1861
Genus Spirillina Ehrenberg, 1843
Spirillina limbata Brady
Spirillina vivipara Ehrenberg
Turrispirillina depressa Parr
Order MILIOLIDA Lankeseter, 1885
Suborder MILIOLINA Delage and Heouard, 1896
Superfamily MILIOLACEA Ehrenberg, 1839
Family Hauerinidae Schwager, 1876
Subfamily Haauerininae Schwager, 1876
Genus Cycloforina Luczkowska, 1972
Cycloforina contorta (d'Orbigny)
Genus Massilina Schlumberger, 1893
Massilina gualteriana (d'Orbigny)
Massilina secans (d'Orbigny)
Genus Quinqueloculina d'Orbigny, 1826
Quinqueloculina bidentata d'Orbigny
Quinqueloculina seminula (Linné)
Quinqueloculina viennensis le Calvez J. and Y.
Quinqueloculina vulgaris d'Orbigny
Subfamily Miliolinellinae Vella, 1957
Genus Miliolinella Wiesner, 1931
Miliolinella elongata Kruit
Miliolinella subrotunda (Montagu)
Genus Pseudotriloculina Cherif, 1970
Pseudotriloculina sp.
Genus Pyrgo Defrance, 1824
Pyrgo anomala (Schlumberger)
Genus Triloculina d'Orbigny, 1826
Triloculina marioni Schlumberger
Triloculina terquemiana (Brady)
Genus Sigmoilinita Seiglie, 1965
Sigmoilinita edwardsi (Schlumberger)
Subfamily Sigmoilopsinae Vella, 1957
Genus Sigmoilopsis Finlay, 1947

Sigmoilopsis schlumbergeri (Silvestri)
Subfamily Tubinellinae Rhumbler, 1906
Genus Parrina Cushman, 1931
Parrina bradyi (Millet)
Superfamily SORITACEA Ehrenberg, 1839
Family Peneroplidae Schlutze, 1854
Genus Peneroplis de Montfort, 1803
Peneroplis pertusus (Forskal)
Order LAGENIDA Lankester, 1885
Superfamily NODOSARIACEA Ehrenberg, 1838
Family Vaginulinidae Reuss, 1860
Subfamily Lenticulininae Chapman, Parr and Collins, 1934
Genus Lenticulina Lamarck, 1804
Lenticulina sp.
Subfamily Marginulininae Wedekind, 1936
Genus Astacolus de Montfort, 1808
Astacolus crepidulus (Fichtel and Moll)
Astacolus insolithus (Schwager)
Order ROTALIIDA Lankester, 1885
Superfamily DISCORBACEA Ehrenberg, 1838
Family Eponididae Hofker, 1951
Subfamily Eponininae Hofker, 1951
Genus Eponides de Montfort, 1808
Eponides concameratus (Williamson)
Family Neoeponididae Loeblich and Tappan, 1994
Genus Neoeponides Reiss, 1960
Neoeponides cf. procerus (Brady)
Family Rosalinidae Reiss, 1963
Genus Rosalina d'Orbigny, 1826
Rosalina bradyi Cushman
Genus Milesina McCulloch, 1981
Milesina cf. splendida Yassini and Jones
Superfamily PLANORBULINACEA Schwager, 1877
Family Cibicididae Cushman, 1927
Subfamily Cibicidinae Cushman, 1927
Genus Lobatula Fleming, 1828
Lobatula lobatula (Walker and Jacob)
Superfamily ROTALIACEA Ehrenberg, 1839
Family Rotaliidae Ehrenberg, 1839
Subfamily Pararotaliinae Reiss, 1963
Genus Pararotalia le Calvez, Y., 1949
Pararotalia spinigera (le Calvez)
Family Elphidiidae Galloway, 1933
Subfamily Elphidiinae Galloway, 1933
Genus Elphidium de Montfort, 1808
Elphidium crispum (Linné)
Elphidium depressulum Cushman
Elphidium sp.

Conclusion

The study area and the contents of foraminifera samples examined from False Bay Southwest, Pyramid Rock and the Partridge Point, show that the sediments are rich in foraminifera assemblages content. The richest samples in foraminifera content are from Partridge Point. 19 species have been identified at 10.00 m and 22 species at 20.00 m at Partridge Point (Table 2). There are 14 species at 10:00 m and 12 species at 20.00 m in the samples taken from the Pyramid Rock. Samples from the western region of Cape Town, Maori Bay is very poor in foraminifera content: there are 8 species observed at 10.00 m and 3 species at 20.00 m.

The discrepancy in foraminifera content between the Atlantic Ocean (Maori Bay) and Indian Ocean (False Bay) regions can be due to the the southern Benguela Current (cold) running through west of Southern part of Africa Continent and Agulhas Current (hot) running through the eastern part (Figure 2 and 3) (Langer and Schmidt-Sinns, 2006). Therefore, hot and cold water currents in the SE and SW parts of South Africa, Indian Ocean and the Atlantic Ocean namely, have an impact on the regional fauna, especially foraminifera assemblages. This shows that sea water temperature is one of the key factor for determining the fauna.

Table 2. Foraminifera distribution by station and depth

FORAMINIFERA	Pyramid Rock		Partridge Point		Maori Bay	
	10m	20m	10m	20m	10m	20m
Textularia bocki	*		*	*	*	
Spirillina limbata	*					
Spirillina vivipara			*	*		
Turrispirillina depressa	*	*	*	*		
Cycloforina contorta			*			
Massilina gualteriana	*			*		
Massilina secans			*	*		
Quinqueloculina bidentata	*			*	*	
Quinqueloculina seminula	*	*	*	*	*	
Quinqueloculina vulgaris			*			
Quinqueloculina viennensis	*		*	*		
Miliolinella elongata			*	*		
Miliolinella subrotunda			*	*	*	*
Pseudotriloculina sp.			*			
Pyrgo anomala			*	*		
Triloculina marioni		*	*	*		
Triloculina terquemiana		*				
Sigmoilinita edwardsi			*		*	
Sigmoilopsis schlumbergeri			*			
Parrina bradyi			*			
Peneroplis pertusus	*					
Lenticulina sp.			*			
Astacolus crepidulus		*				
Astacolus insolithus		*				
Globorotalia sp.	*					
Eponides concameratus				*		
Neoeponides cf. *procerus*		*	*	*		
Milesina cf. *splendida*	*					
Rosalina bradyi	*	*		*		
Lobatula lobatula	*		*		*	
Pararotalia spinigera		*	*	*	*	*
Elphidium crispum	*	*	*	*	*	*
Elphidium depressulum	*	*	*	*		
Elphidium sp.		*		*		

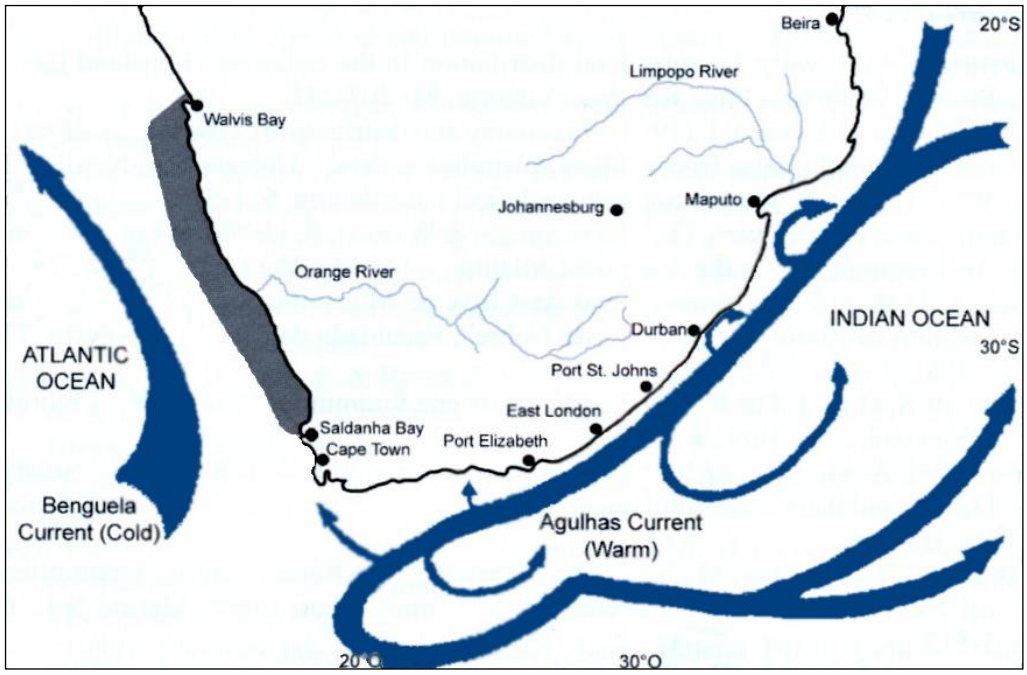

Fig. 2. Status of currents (Langer and Schmidt, 2006).

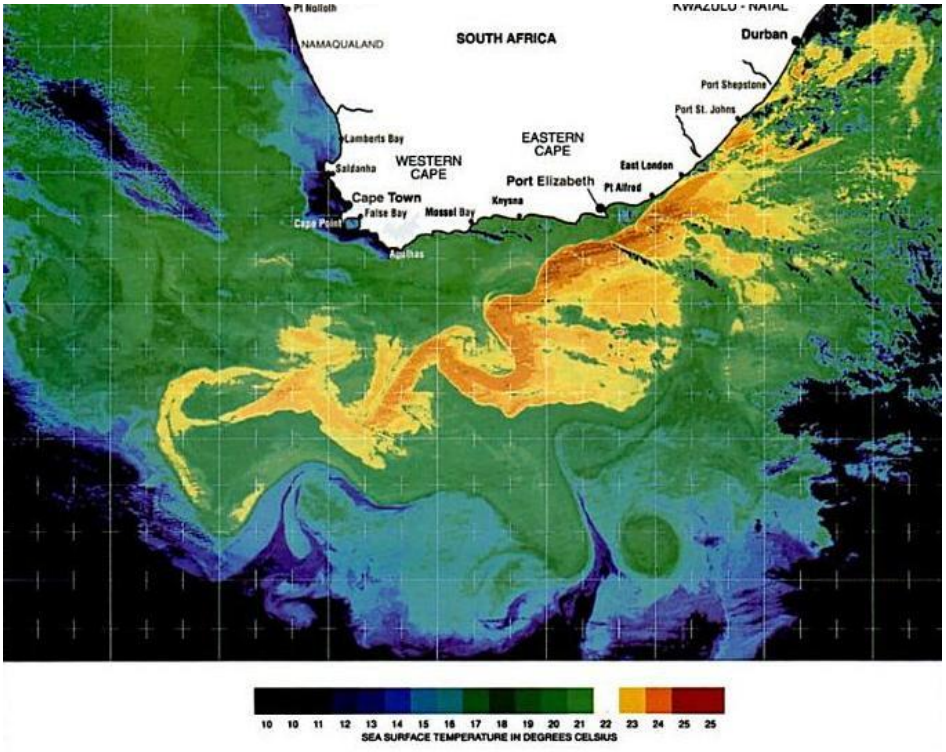

Fig. 3. Satellite photograph of the coast of Southern Africa (Biastoch et al., 2008)

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Plate 1

1. *Textularia bocki* Höglund. External view, Partridge Point, 10.00 m, South Africa.
2. *Textularia bocki* Höglund. External view, Partridge Point, 10.00 m, South Africa.
3. *Spirillina vivipara* Ehrenberg. External view, Partridge Point, 10.00 m, South Africa.
4. *Spirillina vivipara* Ehrenberg. External view, Partridge Point, 20.00 m, South Africa.
5. *Turrispirillina depressa* Parr. External view, Partridge Point, 10.00 m, South Africa.
6. *Turrispirillina depressa* Parr. External view, Partridge Point, 20.00 m, South Africa.
7. *Spirillina limbata* Brady. External view, Partridge Point, 20.00 m, South Africa.
8. *Massilina secans* (d'Orbigny). External view, Partridge Point, 10.00 m, South Africa.
9. *Quinqueloculina bidentata* d'Orbigny. External view, Pyramid Rock, 20.00 m, South Africa.
10. *Quinqueloculina bidentata* d'Orbigny. External view, Pyramid Rock, 20.00 m, South Africa.
11. *Quinqueloculina seminula* (Linné). External view, Pyramid Rock, 10.00 m, South Africa.
12. *Quinqueloculina seminula* (Linné). External view, Pyramid Rock, 10.00 m, South Africa.
13. *Quinqueloculina seminula* (Linné). External view, Partridge Point, 10.00 m, South Africa.
14. *Quinqueloculina viennensis* Le Calvez J. and Y. External view, Partridge Point, 20.00 m, South Africa.
15. *Quinqueloculina viennensis* Le Calvez J. and Y. External view, Partridge Point, 20.00 m, South Africa.
16. *Miliolinella subrotunda* (Montagu). External view, Pyramid Rock, 10.00 m, South Africa.
17. *Miliolinella subrotunda* (Montagu). External view, Partridge Point, 10.00 m, South Africa.

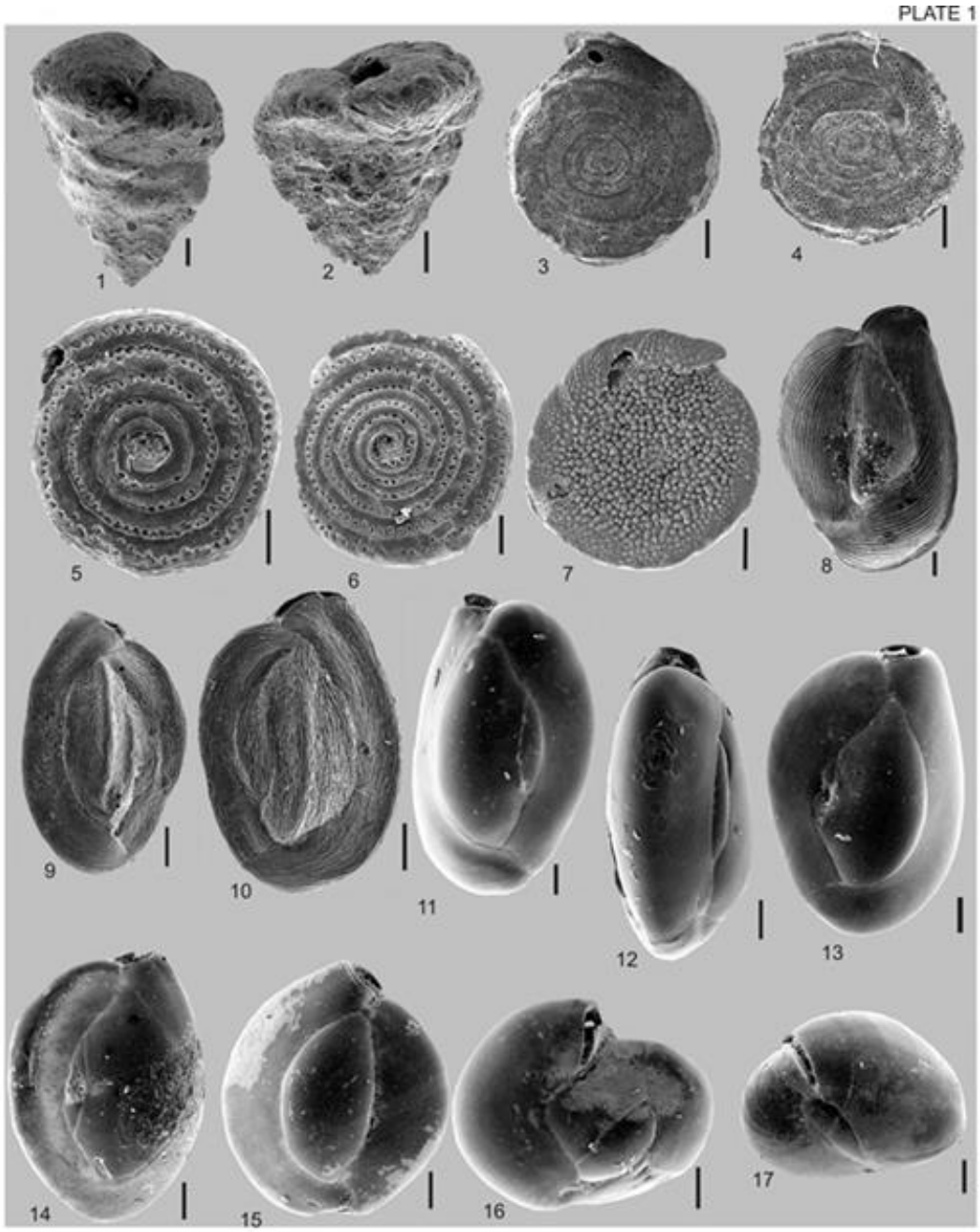
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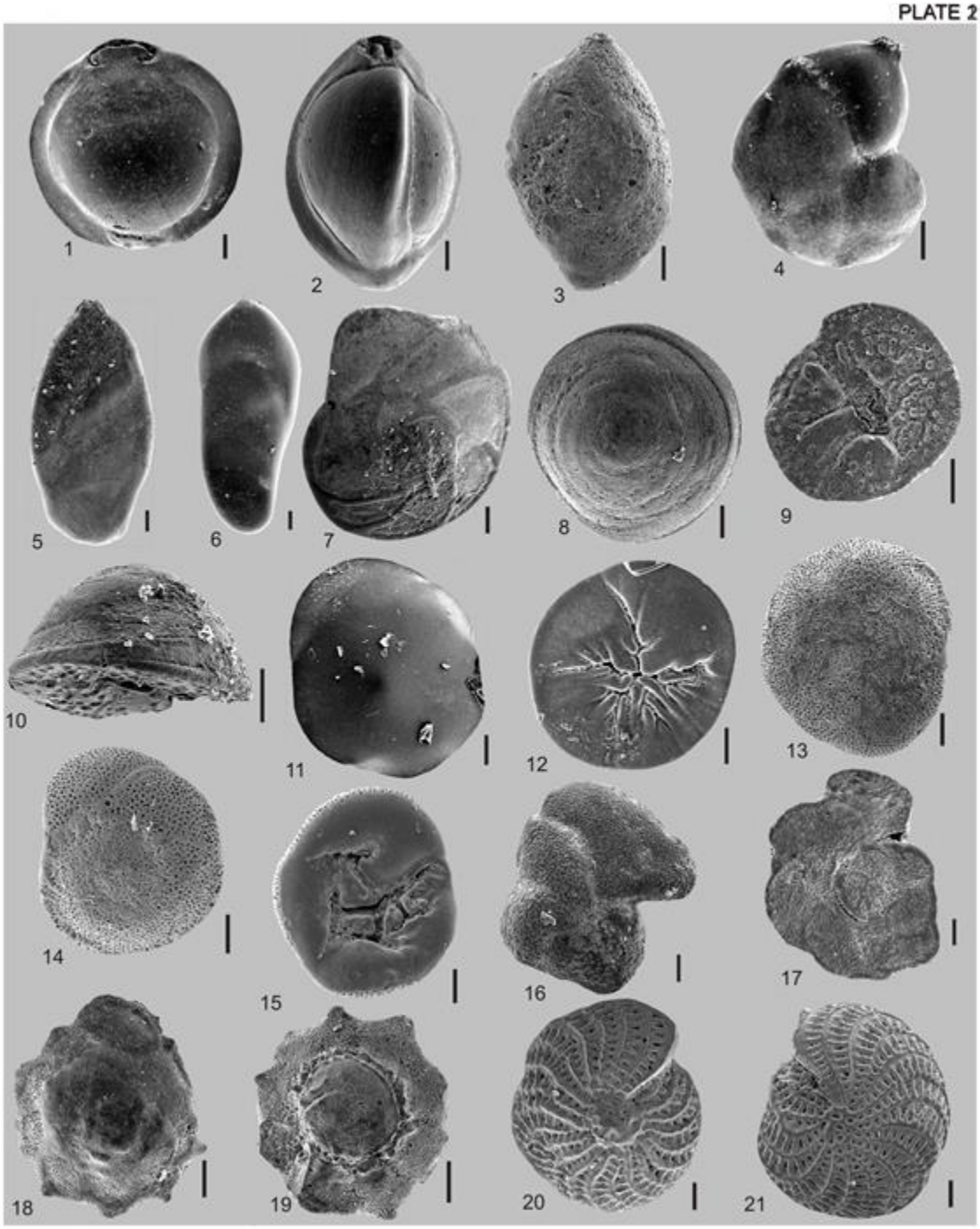
Plate 2

1. *Pyrgo anomala* (Schlumberger). External view, Partridge Point, 10.00 m, South Africa.
2. *Triloculina marion*i Schlumberger. External view, Partridge Point, 10.00 m, South Africa.
3. *Sigmoilopsis schlumbergeri* (Silvestri). External view, Partridge Point, 10.00 m, South Africa.
4. *Lenticulina* sp. External view, Partridge Point, 10.00 m, South Africa.
5. *Astacolus insolithus* (Schwager). External view, Pyramid Rock, 20.00 m, South Africa.
6. *Astacolus crepidulus* (Fichtel and Moll). External view, Pyramid Rock, 20.00 m, South Africa.
7. *Eponides concameratus* (Williamson). External view, Partridge Point, 20.00 m, South Africa.
8. *Neoeponides* cf. *procerus* (Brady). Spiral side , Partridge Point, 10.00 m, South Africa.
9. *Neoeponides* cf. *procerus* (Brady). Umbilical side, Partridge Point, 10.00 m, South Africa.
10. *Neoeponides* cf. *procerus* (Brady). Edge view, Partridge Point, 10.00 m, South Africa.
11. *Milesina* cf. *splendida* Yassini and Jones. Spiral side, Pyramid Rock, 10.00 m, South Africa.
12. *Milesina* cf. *splendida* Yassini and Jones. Umblical side, Pyramid Rock, 10.00 m, South Africa.
13. *Rosalina bradyi* Cushman. External view, spiral side Partridge Point, 20.00 m, South Africa.
14. *Rosalina bradyi* Cushman. Spiral side, Pyramid Rock, 10.00 m, South Africa.
15. *Rosalina bradyi* Cushman. Umblical side, Pyramid Rock, 10.00 m, South Africa.
16. *Lobatula lobatula* (Walker and Jacob). Umblical sde, Partridge Point, 10.00 m, South Africa.
17. *Lobatula lobatula* (Walker and Jacob). Spiral side Partridge Point, 10.00 m, South Africa.
18. *Pararotalia spinigera* Le Calvez. Spiral side, Partrdge Point, 10.00 m, South Africa.
19. *Pararotalia spinigera* Le Calvez. Umblical side, Partridge Point, 10.00 m, South Africa.
20. *Elphidium crispum* (Linné). External view, Pyramid Rock, 10.00 m, South Africa.
21. *Elphidium depressulum* Cushman.External view, Pyramid Rock, 10.00 m, South Africa.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