Publication: Cape Argus (AM Edition)
Date: 26 Aug 2016
Page: 11

‘Origins of life’ story found in SA’s waters

Living marine stromatolites oldest type of calcified formation on Earth

Nicky Willemse
SPECIAL CORRESPONDENT

SEA CLUES TO EARLY LIFE: Nelson Mandela Metropolitan University’s Professor Renzo Perissinotto, right, collects samples with students at rare living rock pool systems in the Eastern Cape. PICTURE: LYNETTE CLENNELL

IN A HANDFUL of rock pools around the globe, one of the world’s earliest life forms – dating back about 3.5 billion years, according to fossil records – can still be found.

It is a bacteria-based system responsible for “growing” the calcified walls of coastal rock pools and it was recently discovered, in abundance, in the Eastern Cape.

Regarded as the oldest type of biologically-mediated calcified formations on Earth, other rare living examples of these systems are found in Shark Bay in Australia and the Exumas in the Bahamas.

But scientists have been taken aback by the number found along the coast, south of Port Elizabeth.

These colonies are giving scientists a glimpse into the hydrospheric (water) conditions that prevailed at the onset of life on Earth.

“They were the only living things in those days – they disappeared with the advent of other, more evolved organisms,” said Professor Renzo Perissinotto, who holds a research chair in shallow water ecosystems at Nelson Mandela Metropolitan University.

He is part of a high-profile team – including two other South African chairs and five international collaborators from universities in Norway, Italy, Poland, Sweden and the US – which has been studying this phenomenon over the past two years.

“These bacteria-based systems provided the first photosynthetic process that led to the transitioning of the early Earth’s atmosphere into its current, productive oxygen-rich state.”

He explained these bacteria-based formations – called living marine stromatolites – occur when freshwater seepage from the land comes together with seawater in the inter-tidal area, and cyanobacteria (blue-green algae), under certain conditions, play a role in depositing calcite crystals.

“Although other rare, isolated examples of similar formations have been reported to occur from Port Elizabeth to Tofu in Mozambique, the recent discovery of numerous and closely-spaced living stromatolites on the coastline south of Port Elizabeth appears to be extraordinary. We have discovered over 500 actively-growing marine stromatolites from Cape Recife to Storms River.

“They are a unique feature and are very different to those found in Australia and the Bahamas.”

If you saw one today, you would be forgiven for thinking it was a stagnant rock pool covered in a green carpet of algae – not realising the same growth process that occurred billions of years ago was taking place before your eyes.

“The process requires super-saturation of the water by calcium carbonate ($CaCO_3$), which only occurs in today’s marine environment under special conditions, for example, under states of hyper-salinity, excess evaporation or the mixing of extremely different water types.”

> *“WE HAVE DISCOVERED OVER 500 ACTIVELY-GROWING MARINE STROMATOLITES FROM CAPE RECIFE TO STORMS RIVER*

Perissinotto said the research team, which includes NMMU research chair in earth systems science, Professor David Bell, and Rhodes University research chair in marine natural products, Professor Rosemary Dorrington, along with staff and postgraduate students from NMMU’s Geoscience, Chemistry, Zoology and Botany departments, had conducted a year-long baseline survey relating to the structure, functioning and age of the stromatolites.

The five international universities involved in the research are the Norwegian University of Science and Technology, the University of Padova (Italy), the University of Lodz (Poland), the University of Gothenburg (Sweden) and Oregon State University (US).

Five articles have been published in prominent international journals so far on this subject.

A sixth article, published in the South African Journal of Science, has called on the government to protect these areas with special legislation, as is done in Australia.

“If we can prove that these structures are similar to the most ancient forms of life that have appeared on this planet, we have a bit of the ‘origins of life’ story right here.”

Perissinotto is also involved in a number of other research projects, the main one focusing on iSimangaliso Wetland Park, which includes Africa’s largest estuarine system (Lake St Lucia).

His research there is contributing to the removal of a “dredge spoil” island, which were man-made from the 1960s to the 1990s to prevent the Mfolozi River from running into the St Lucia Estuary.

Over 100 species of marine fish utilise St Lucia for breeding – these have decreased dramatically because St Lucia is currently a closed estuary (it does not flow into the sea).

“Through the Mfolozi connection, there will be more recruitment. This is one of the most important (fish) recruitment areas on the African continent. We are also discovering new species of invertebrates there all the time.”

Perissinotto is also conducting research on the biodiversity of surface and groundwater in the Karoo, as part of a natural baseline study by NMMU’s Africa Earth Observatory Network-Earth Stewardship Science Research Institute (AEON-ESSRI), which is being undertaken in anticipation of shale gas exploration in this area.

“We are mapping 30 to 40 systems, ranging from large dams to small streams to temporary depressions. We need to put their biodiversity on record before shale gas mining begins, so that we are able to monitor any significant changes that may occur.”

Perissinotto said he had been surprised at the “incredible number of organisms” living in the waters of this semi-arid environment – which has included the identification of at least four new species of aquatic insects and scores of new distribution records.

“We have found buckets of shrimps. It is likely that they developed special adaptations to survive in this harsh environment.”

Perissinotto is also part of a team, led by the SA Institute of Aquatic Biodiversity, which is studying coastal micro-inlets (minor estuaries), which could possibly dry up in the next decade. “Forecasts predict that water demand will exceed supply by 2025. We do not know the biodiversity of these inlets or the role they play in relation to the bigger estuaries.”

Fifteen postgraduate and postdoctoral students are carrying out marine-related research in each of these areas.