

Researchers explored deepest and largest underwater sinkholes in the world

By the Royal Netherlands Institute for Sea Research (NIOZ)

From 5 to 20 December 2019, the Royal Netherlands Institute for Sea Research (NIOZ) and Wageningen Marine Research organized an expedition to the Saba Bank, close to the Dutch island of Saba in the Caribbean region. Experts on board the research vessel Pelagia gathered data to acquire more knowledge about the sinkholes and the hundreds of recently discovered strange calcareous algae turrets.

Saba Bank has the deepest and largest marine sinkholes in the world

In 2018, during the NICO research expedition at the Luymes Bank and part of the Saba Bank, the current expedition leaders Fleur van Duyl (NIOZ) and Erik Meesters (Wageningen Marine Research) discovered more than 20 enormous holes ranging from 10 to 375 metres in depth and with diameters varying between 70 to 1100 metres. The floor of the Saba Bank consists of a limestone deposition one to two kilometres thick. When the bank lay above water during the ice ages and the sea level was 120 m lower than it is now, flowing freshwater dissolved the limestone and created large holes. This first led to the formation of caves, which subsequently collapsed. These sinkholes that developed on land were subsequently submerged after the last ice age (20,000 years ago), when the sea level rose again.

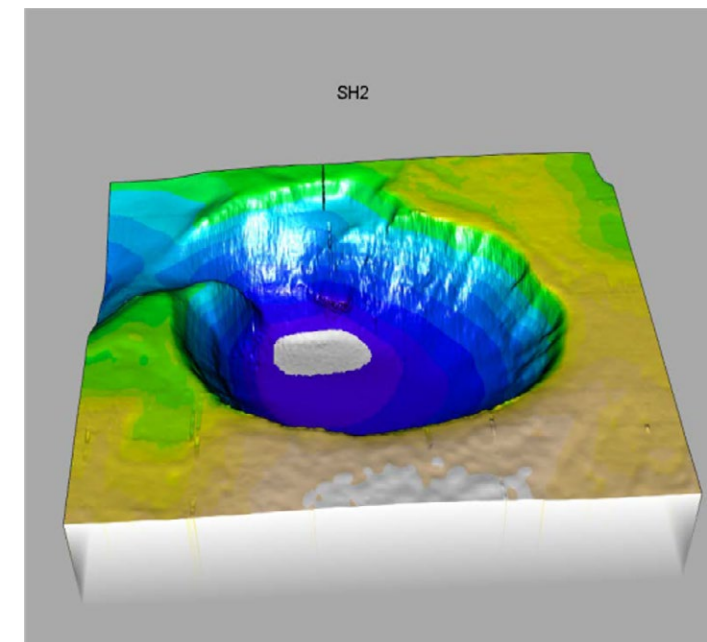
A well-known marine sinkhole is the "Great Blue Hole" off the coast of Belize in the Caribbean Sea. This hole is visible from space because it lies close to the surface and it looks like a sort of dark eye in a light blue sea. China claims

the deepest described sinkhole, the "Dragon Hole" in the South China Sea, with a depth of 308 metres. However, the floor of the deepest sinkhole on the Saba Bank is certainly 375 metres deep and is therefore deeper and larger than the "Dragon Hole". So far, no other area has been found with so many sinkholes - more than 20 - at such a short distance from each other.

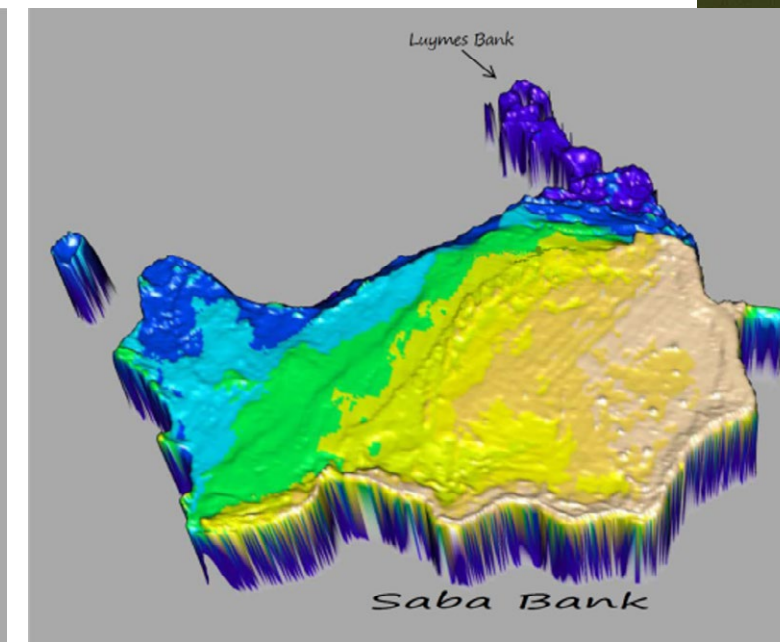
Knowledge about the Saba Bank still far from complete

From a scientific perspective, little is known about the ecological functioning of the Saba Bank. And there are even many blanks on the map. "During the NICO expedition in 2018, we discovered a unique and spectacular biological community in one of the sinkholes on the Saba Bank at a depth of about 110 metres", says expedition leader Fleur van Duyl from NIOZ. *"On the seafloor we found hundreds of calciferous algae turrets with diameters of 40 to 60 cm. These pink-purple turrets consist of layers of crustose calcareous algae and reminded us of the Chinese terracotta army."*

According to Erik Meesters, expedition leader of Wageningen Marine Research, these calcareous algae probably grow very slowly at that depth because there is very little light. *"They might be able to tell us more about the history of the Saba Bank and the conditions under which the sinkholes were formed."* What made this year's expedition so special for Meesters is that they did not know what they would find; *"Most of the sinkholes on the Saba Bank have not yet been visited by anybody and that makes it particularly exciting."*



3D image of the Saba Bank with the Luymes Bank in the North East. Source: Erik Meesters



One of the sinkholes in detail. Source: Erik Meesters

First findings

The researchers extensively explored all 21 sinkholes on the Saba Bank. The aim was to find out more about the nature of the calcareous algae turrets and the environmental factors that influence their growth. How does the exchange of water between the sinkholes and the flowing water above work, and which biological communities and nutrients such as bacteria are present? The collected data is taken back to the Universities where it will be analyzed. This will provide insights into why these turrets occur at some sinkholes but not others.

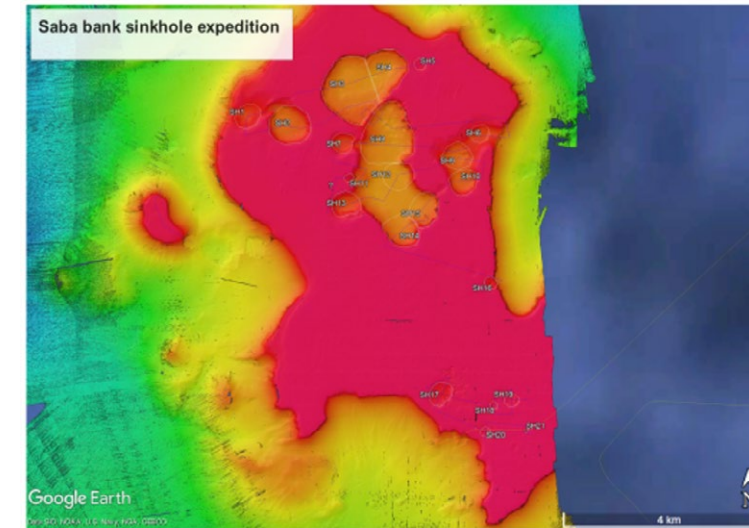
The research vessel dropped a wide range of measurement equipment and cameras to a depth of many tens of metres. These were used to collect various data about the water column, and took samples of water and seafloor life, including an effort to bring several turrets to the surface. The researchers also placed anchors with measurement equipment in the sinkholes which allowed seven days of monitoring during the expedition. All collected data is now being analyzed and the researchers are eager to find out more about the secrets of the sinkholes.

Sinkhole seems to seep gas

The Saba Bank revealed a surprise. Via the Saba Conservation Foundation the researchers got coordinates of a purported hotspring (found by fishermen) in one of the sinkholes. At ca 280m depth a plume was detected with the multibeam, maybe a methane seep? The CTD profiles showed an amazing steep gradient in among others oxygen in the sinkhole.

Saba Bank

The Saba Bank, several kilometres to the south of the island of Saba, covers more than 2400 km² and is therefore the largest protected nature area in the Netherlands. The bank lies completely underwater and is important from both a biological and economic perspective. The submarine mountain rises from the seafloor at a depth of 1000 metres to on average 30 to 40 metres below the sea surface. Large parts of the edges of the bank consist of extensive, healthy coral reefs. This region in the Caribbean Netherlands is also part of the shark and sea mammal nature reserve Yarari designated by the Dutch state. The importance of the biodiversity of the Caribbean Netherlands is internationally recognised by a designation of the Saba Bank as an Ecologically or Biologically Significant Marine Area (EBSA) under the Biodiversity Treaty.



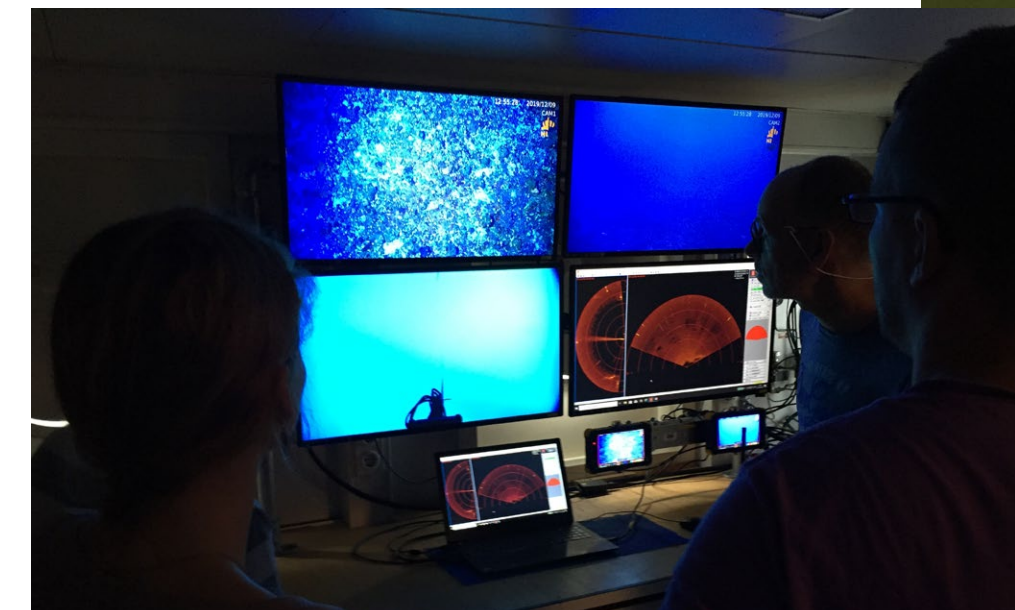
Close-up photo of the Luymes Bank and the various sinkholes. Source: Erik Meesters



A CCA pillar from a sinkhole. Credit: Fleur van Duyl, NIOZ



Close up of one of the calcium carbonate pillars researchers managed to get on board during the expedition. Credit: NIOZ/WUR, Erik Meesters



Researchers watching live footage from the bottom of the first Saba Bank sinkholes. Credit: Matthew Humphreys (NIOZ)

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