2nd International Indian Ocean Expedition 2015-2025

Newsletter

(A basin-wide research program co-sponsored by IOC-UNESCO, SCOR and IOGOOS)

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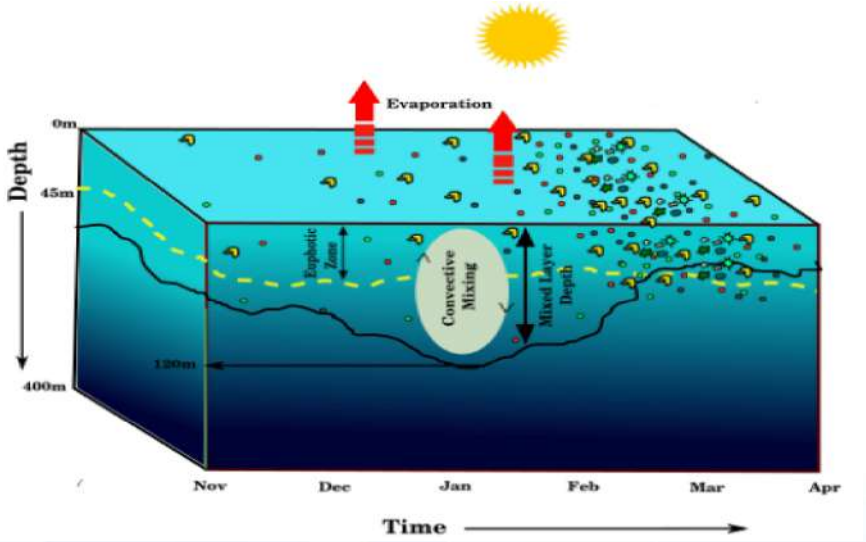
To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.

Another step towards unraveling the mysteries behind Northern Arabian Sea's periodic algal bloom

The Arabian Sea is considered to be one of the highest productive regions of the world ocean. Since the 2000s, mixed algal bloom episodes of diatom and mixotrophic dinflagellate and green Noctiluca during winter, are a regular phenomena in the northern Arabian Sea. These high-biomass and intensifying blooms are susceptible to disorient the flow of the classical food chain. Winter convective mixing fertilizing the water column has been proved to be the major player behind the recurring algal blooms. However, no observational studies have yet conclusively addressed the rationale for the evolution and spreading of green Noctiluca in conjunction with diatom. To unravel the conducive factors making an ideal bed for bloom, a team of researchers from INCOIS led by Dr. Satya Prakash undertook an expedition during the winter monsoon in the northern Arabian Sea onboard FORV Sagar Sampada. The studies carried out present new insights into understanding the physicochemical forcing on the bloom dynamics. The results suggest the Sverdrup critical depth limitation in the northern Arabian Sea as playing a crucial factor for bloom formation despite the availability of enough nutrients in the ambient medium. The team has ascertained this from the observation of shallower euphotic depth than from the mixed layer.

Source: Lakshmi, R.S., Prakash, S., Lotliker, A.A., Baliarsingh, S.K., Samanta, A., Mathew, T., Chatterjee, A., Sahu, B.K. and Balakrishnan Nair, T.M. (2021). Physicochemical controls on the initiation of phytoplankton bloom during the winter monsoon in the Arabian Sea. Sci Rep 11, 13448 https://doi.org/10.1038/s41598-021-92897-3



Schematic showing the interplay between mixed layer depth and euphotic depth on the initiation of phytoplankton blooms in the northern Arabian Sea.

[Report Courtesy: R. S. Lakshmi, R.S., Sanjiba K. Baliarsingh & Aneesh A. Lotliker, E-mail: aneesh@incois.gov.in]

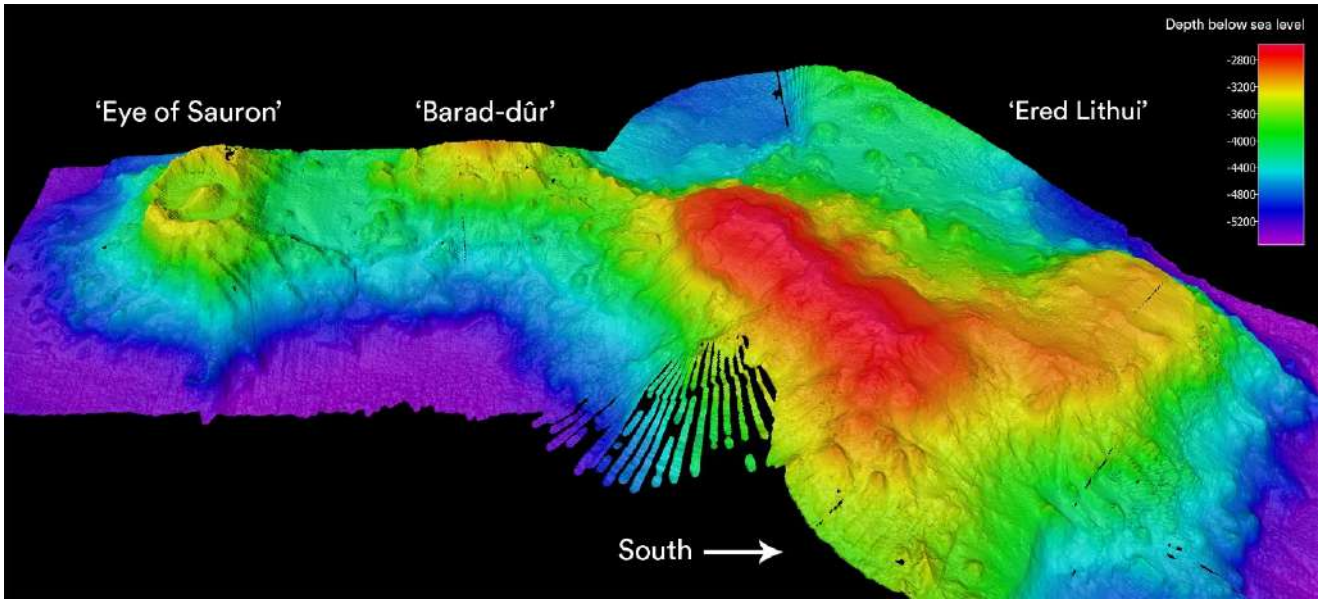
We've discovered an undersea volcano near Christmas Island that looks like the Eye of Sauron

[Report by Tim O'Hara, Senior Curator of Marine Invertebrates, Museums Victoria; Email: tohara@museum.vic.gov.au]

Published originally in "The Conversation" on 22 July 2021:
https://theconversation.com/weve-discovered-an-undersea-volcano-near-christmas-island-that-looks-like-the-eye-of-sauron-164855#comment_2566006

Looking like the Eye of Sauron from the Lord of the Rings Trilogy, an ancient undersea volcano was slowly revealed by multibeam sonar 3,100 metres below our vessel RV Investigator, 280 kilometres southeast of Christmas Island. This was on day 12 of our voyage of exploration to Australia's Indian Ocean Territories, aboard CSIRO's dedicated ocean research vessel, the RV Investigator, as part of a IIOE-2 endorsed project[IIOE2-EP40]

Previously unknown and unimagined, this volcano emerged from our screens as a giant oval-shaped depression called a caldera, 6.2km by 4.8km across. It is surrounded by a 300m-high rim (resembling Sauron's eyelids), and has a 300 m high cone-shaped peak at its centre (the "pupil").



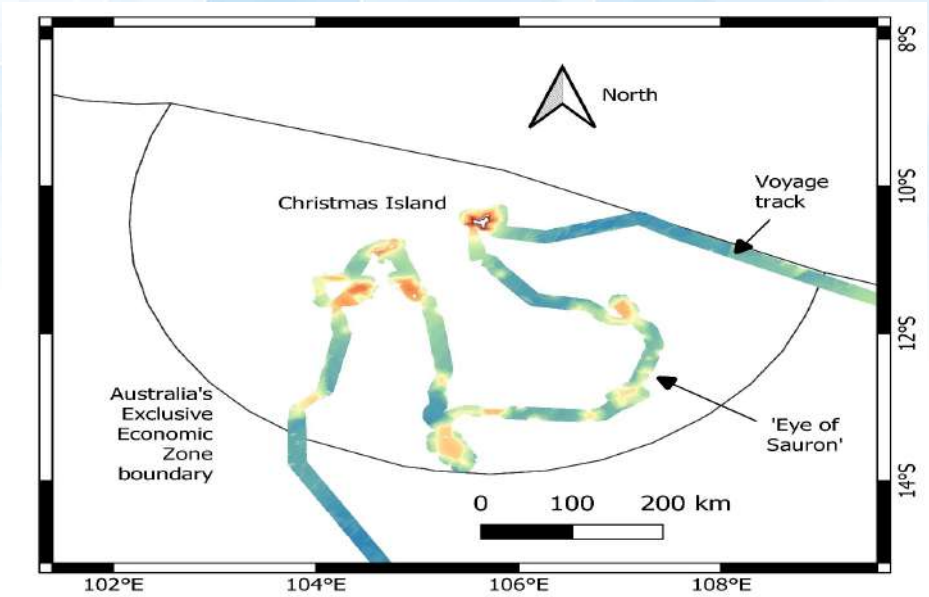
Sonar image of the 'Eye of Sauron' volcano and nearby seamounts on the sea bed south-west of Christmas Island. Phil Vandenbossche & Nelson Kuna/CSIRO

A caldera is formed when a volcano collapses. The molten magma at the base of the volcano shifts upwards, leaving empty chambers. The thin solid crust on the surface of the dome then collapses, creating a large crater-like structure. Often, a small new peak then begins to form in the centre as the volcano continues spewing magma.

One well-known caldera is the one at Krakatoa in Indonesia, which exploded in 1883, killing tens of thousands of people and leaving only bits of the mountain rim visible above the waves. By 1927, a small volcano, Anak Krakatoa ("child of Krakatoa"), had grown in its centre.

In contrast, we may not even be aware of volcanic eruptions when they happen deep under the ocean. One of the few tell-tale signs is the presence of rafts of light pumice stone floating on the sea surface after being blown out of a submarine volcano. Eventually, this pumice stone becomes waterlogged and sinks to the ocean floor.

Our volcanic "eye" was not alone. Further mapping to the south revealed a smaller sea mountain covered in numerous volcanic cones, and further still to the south was a larger, flat-topped seamount. Following our Lord of the Rings theme, we have nicknamed them Barad-dûr ("Dark Fortress") and Ered Lithui ("Ash Mountains"), respectively.



The voyage of the RV Investigator around Christmas Island. Tim O'Hara/Museums Victoria

Although author J.R.R. Tolkein's knowledge of mountain geology wasn't perfect, our names are wonderfully appropriate given the jagged nature of the first and the pumice-covered surface of the second.

The Eye of Sauron, Barad-dûr, and Ered Lithui are part of the Karma cluster of seamounts that have been previously estimated by geologists to be more than 100 million years old, and which formed next to an ancient sea ridge from a time when Australia was situated much further south, near Antarctica. The flat summit of Ered Lithui was formed by wave erosion when the seamount protruded above the sea surface, before the heavy seamount slowly sank back down into the soft ocean seafloor. The summit of Ered Lithui is now 2.6km below sea level.

But here is the geological conundrum. Our caldera looks surprisingly fresh for a structure that should be more than 100 million years old. Ered Lithui has almost 100m of sand and mud layers draped over its summit, formed by sinking dead organisms over millions of years. This sedimentation rate would have partially smothered the caldera. Instead it is possible that volcanoes have continued to sprout or new ones formed long after the original foundation. Our restless Earth is never still.

The large deep-sea predatory seastar Zoroaster. Rob French/Museums Victoria

Small batfish patrol the seamount summits. Rob French/Museums Victoria

Elasipod sea cucumbers feed on organic detritus on deep sandy seafloors. Rob French/Museums Victoria

But life adapts to these geological changes, and Ered Lithui is now covered in seafloor animals. Brittle-stars, sea-stars, crabs and worms burrow into or skate over the sandy surface. Erect black corals, fan-corals, sea-whips, sponges and barnacles grow on exposed rocks. Gelatinous cusk-eels prowl around rock gullies and boulders. Batfish lie in wait for unsuspecting prey.

Our mission is to map the seafloor and survey sea life from these ancient and secluded seascapes. The Australian government recently announced plans to create two massive marine parks across the regions. Our expedition will supply scientific data that will help Parks Australia to manage these areas into the future.

Scientists from museums, universities, CSIRO and Bush Blitz around Australia are participating in the voyage. We are close to completing part one of our journey to the Christmas Island region. Part two of our journey to the Cocos (Keeling) Island region will be scheduled in the next year or so.

No doubt many animals that we find here will be new to science and our first records of their existence will be from this region. We expect many more surprising discoveries.

Obituary
Dr. Satya Prakash (1979-2021)

We are deeply grieved to convey to the IIOE-2 community that our JPO INDIA IIOE-2 Coordinator Dr. Satya Prakash passed away in the early hours of 22 July, 2021 due to a brief illness. He was healthy and working towards the upcoming IIOSC-2020 (now scheduled for March, 2022) till a few hours before his tragic demise. He has been a dear friend, wonderful colleague, excellent scientist and above all a great human being, to anyone and everyone around him- family, classmates, coworkers and neighbours. Satya is survived by his wife and a twelve-year old daughter.

Dr. Satya Prakash was born on 22 September, 1979 in a small town of Darbhanga district in the Bihar state of northern India. After his schooling in Kendriya Vidyalaya (Central School) and graduation (Geology Honours) from St. Xavier's College, Ranchi University, he pursued M.Sc. (Applied Geology) from Indian Institute of Technology (Roorkee) during 2001-2003. Soon after that, with enrollment for PhD at the Physical Research Laboratory (Dept. of Space, Ahmedabad), his career led to the path of professional accomplishments and laurels. Satya's work as a doctoral student and subsequently as a post-doctoral fellow (2003-2008) on the biogeochemistry (esp. new production and Nitrogen cycle) of the Arabian Sea and Southern Ocean utilising isotopes is considered one of his notable contributions in the field. He was one of the pioneers in the deployment and validation of new-generation Argo-floats with biogeochemical sensors in the Indian Ocean. He collaborated in over 40 research papers published in peer-review journals. Satya had a vision to develop a system for seamless monitoring and forecasting of water quality of the Indian seas, with an apt title for his dream project – Marine Observation System along (the) Indian Coast or MOSAIC. As a culmination of Satya's relentless efforts and in fulfilling his dreams, INCOIS intends to deploy in the near future the first-of- its- kind water quality monitoring buoys in the Indian Ocean.

Satya played a key role in planning various activities leading to the formal launching of the Second International Indian Ocean Expedition (IIOE-2) from Goa. He also participated in the first research cruise under IIOE-2 (Goa-Mauritius). Since then, he had served as the JPO coordinator for the India node of IIOE-2 and had been actively involved in numerous activities related to the IIOE-2 including being a part of the Editorial Team of the IIOE-2 newsletter and the Indian Ocean Bubble, as well as facilitating the hosting of the fourth meeting of the Steering Committee of the IIOE-2 in virtual space from the 12-15 of April, 2021. As the spirit of IIOE-2 transcends into the UN Decade of Ocean Science for Sustainable Development (2021-2030), Satya's scientific contributions will guide us in adding new chapters to the Indian Ocean sciences, as his legacy.

IIOSC-2020 Conference rescheduled to 14-18 March, 2022

In view of the continuing concerns related to the pandemic, the International Indian Ocean Science Conference (IIOSC)-2020 has now been rescheduled to 14-18 March 2022.

More details on the Conference are available at the website https://iiosc2020.incois.gov.in/

Endorse your projects in IIOE-2

Don't miss the opportunity to network, collaborate, flesh out your research project and participate in IIOE-2 cruises!!

The endorsement of your scientific proposal or a scientific activity focusing on the Indian Ocean region is a recognition of the proposal's or activity's alignment with the mission and objectives of IIOE-2, of its potential for contributing to an increased multi-disciplinary understanding of the dynamics of the Indian Ocean, and of its contribution to the achievement of societal objectives within the Indian Ocean region. Over 45 international, multi-disciplinary scientific projects have already been endorsed to date by the IIOE-2. Yours could be the next one!

Visit https://iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp for further details and for projects already endorsed by IIOE-2 https://iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp.

CLIVAR July 2021 Bulletin is available online

The International CLIVAR Project Office distributes a monthly bulletin with announcements, funding opportunities, meeting notifications relevant to the ocean/climate science community.

The latest CLIVAR Bulletin July, 2021 is available at:

https://mailchi.mp/clivar.org/clivar-july-2021-bulletin

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (August-end) issue of the IIOE-2 Newsletter. Contributions referring IIOE-2 endorsed projects, cruises, conferences, workshops, "plain language summary" of published papers focused on the Indian Ocean etc. are welcome. Articles may be up to 500 words in length (Word files) accompanied by suitable figures, photos.(separate.jpg files).

Deadline: **25 August, 2021**

The Indian Ocean Bubble-2

Access the latest issue of Indian Ocean Bubble-2

https://iioe-2.incois.gov.in/IIOE-2/Bubble.jsp

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