

# PARAM SCIENCE MAGAZINE

August 2023

## Exploring the Extremes of Earth & Beyond

“Exploration is curiosity  
put into action”

— Don Walsh

### September Birthdays:

10 September 1922 - Yelavarthy Nayudamma

12 September 1966 - Madhu Sudan

16 September 1931 - E.C.George Sudharshan

15 September 1860 - Sir Mokshagundam Visvesvaraya

### Science Days:

September 1-7 : National Nutrition Week

September 8 : Eye Donation Day

September 16 : World Ozone Day





# Preface

Embark on a thrilling odyssey beyond the ordinary! Brace yourself as we unveil nature's most daring frontiers – the extreme environments that redefine survival. Prepare to venture into the frozen mysteries of polar worlds, the enigmatic depths of oceans, the fiery drama of volcanoes, the scorching heat of deserts, and the cosmic enigmas of outer space.

What makes these places so extraordinary? Imagine facing scorching suns and bone-chilling cold, grappling with scant water and thin air. Yet, driven by human curiosity, we've triumphed against all odds. This Magazine delves deep into exploration, where cutting-edge technology and mind-bending discoveries reshape our worldview.

Join us on an exciting journey where challenges turn into triumphs. Dive into these pages and uncover extreme environments' secrets like never before!



# Discover Harsh Conditions Defining Earth's Toughest Regions

## **POLAR REGIONS:**..... 3-4

Arctic & Antarctica.

## **OCEANS:**..... 5-6

Pacific, Atlantic, and Indian Ocean.

## **VOLCANOES:**..... 7-8

Pacific Belt-The Ring of Fire, Mid Continental Belt, Mid Atlantic Belt.

## **DESERTS:**..... 9-10

Sahara, Australian Desert, Arabian Desert.

## **OUTER SPACE:**..... 11-12

Beyond Earth's Atmosphere.



# Polar Region

## Tech Conquering Extremes

**Ice-Breaking Ships:** Designed to crush and run over pack ice.



**Modern Gear:** Customized outdoor research equipment - masks, jackets, boots, and more.



**Polar Satellites:** Spy, forecast weather, capture earth's images from space.



**Multi-UWB Radar:** Probe snow depth, measure altitude in frozen realms.



## Research Triumphant Extremes

**Frozen kingdom:** The lost world under Antarctica's ice:

- Discovering a secret ecosystem 1,600 feet below the surface.
- Revealing a mysterious underground world with lakes, rivers, and volcanoes.
- Swarms of tiny shrimplike creatures found in a dark and jagged cavern.
- Satellite photos and drilling reveal a subsurface river in Antarctica.





## Quests Defying Extremes

### Resilience amidst challenges

- William Ziegler sponsored the Fiala-Ziegler expedition to the North Pole in 1903.
- Attempt failed but stunning motion picture footage captured.
- In 1903, Fiala and his team reached Rudolf Island.
- Pack ice destroyed their ship, stranding them on Rudolf Island for two years.
- They survived by eating polar bears, walruses, and burning coal.
- Rescued in 1905 by the Terra Nova ship, with minimal casualties.



## Secrets of Extremes

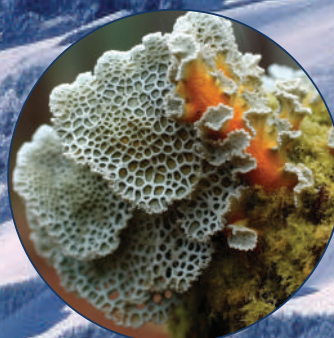
- Antarctica is the only continent without reptiles.
- Arctic is known as Land of The Midnight Sun.

## Survival in Extremes

Confronting polar extremes, animals boast fur, camouflage, and hibernate. With cold resistance and rapid growth, plants resiliently flourish in these icy environs.



Penguin



Perforated ruffle lichen



Polar bear



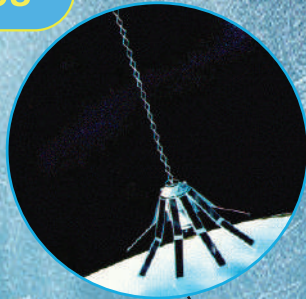
Lichens



# OCEANS

## Tech Conquering Extremes

**Geosat Radar:** Declassifies data, transforms global seafloor mapping.



**Remotely Operated Vehicles (ROV):** Tethered underwater robots, explore mysteries remotely.



**Autonomous Underwater Vehicle (AUV):** Uncrewed vehicles adapt, collect data, and reveal deep-sea wonders.



**Deep Sea Robots:** Venture into dangerous deep seas, mapping, rescuing, and more.



## Research Triumphant Extremes

**Advancing medicine through ocean exploration:**

- Deep-sea research helps biotech and medicine with special compounds.
- Helpful in drug discovery and antibiotics from marine organisms.
- These compounds improve treatments and healing.
- Advances regenerative medicine and genetic research.

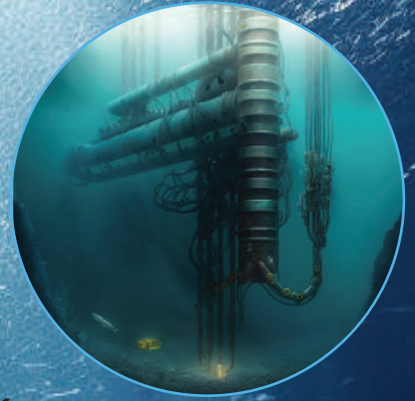




## Quests Defying Extremes

Sometimes there's success in failure

- In 1960, scientists drilled deep into the ocean floor to reach the Moho and understand earth's inner workings.
- The Moho (Mohorovičić discontinuity) marks the transition from earth's crust to mantle.
- The mission didn't reach the Moho and the project was criticized as a boondoggle and a waste of money.
- Despite setbacks, the project led to the foundation for modern ocean exploration.



## Secrets of Extremes

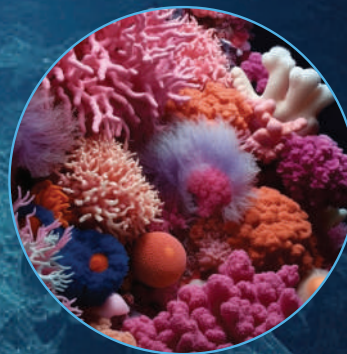
- The ocean floor is moving.
- Less than 5% of the planet's oceans have been explored.

## Survival in Extremes

Facing deep-sea pressures, many marine animals have large, light-sensitive eyes. With fur, feathers, scales, and camouflage, they thrive in their environments.



Squat lobster, Sponge, and Coral



Wall bubblegum coral



A brisingid sea star



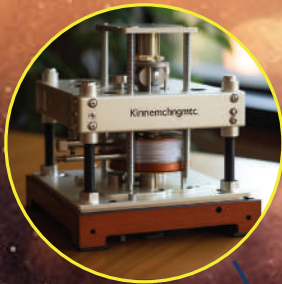
Unidentified anemone



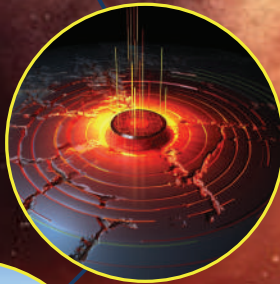
# Volcanoes

## Tech Conquering Extremes

**Kinematic Seismograph:**  
Captures ground motion as weight counteracts movement.



**Broadband Seismoscope:**  
Records earth tremors during earthquakes.



**GPS:** Monitors volcanic deformation with precision.



**Modern Aircraft:** Carries In SAR radar for advanced satellite observations.



## Research Triumphant Extremes

- Specialist extremophiles found in Costa Rica's Poás volcano, one of earth's harshest habitats.
- Water in this crater spans from comfortable temperatures up to near boiling point, posing challenges for any life forms.
- Similar hot springs may have existed on Mars when the planet had running liquid water.





## Quests Defying Extremes

- On January 15, 2022, the Hunga Tonga-Hunga Ha'apai volcano erupted, predicted to be the largest volcanic eruption of the 21st century.
- The eruption sent atmospheric shock waves, sonic booms, and tsunami waves worldwide.
- Volcano's effects reached space, causing hurricane-speed winds and unusual ionosphere currents.
- The equatorial electrojet, a natural electric current in the ionosphere, surged five times stronger and changed direction, flowing westward.
- Spacecraft observed Tonga volcano's ionosphere disturbance over South America, revealing nature's impact on weather patterns in space.



## Secrets of Extremes

- Volcanoes are priceless natural resources.
- World has 1350 active volcanoes, 500 erupted historically.

## Survival in Extremes

Amidst volcanic threats, animals sense and flee impending eruptions. With volcanoes altering terrains, resilient flora pioneer recovery, revitalizing ecosystems.



Flamingoes



Metrosideros  
polymorpha



Archipelago



Limpets



# Deserts

## Tech Conquering Extremes

**Camels:** Arid-adapted, endure 8-day waterless stretches, body temp adjusts for sweating.



**Four-Wheeled Go-Carts:** Equipped with track tires for optimal grip on slippery slopes.



**Drones:** Gather data, images, and videos; measure temp, humidity, air pressure.



## Research Triumphant Extremes

**Mystery of the honeycomb patterns of salt deserts**

- Salt deserts, extreme and unique, draw tourists with strange shapes.
- Mystery unlocked: Honeycomb salt patterns origin revealed by swirling water.
- Underground salty water movements create cool hexagonal designs.
- Many convection rolls create hexagonal, raised humps in unique patterns.





## Quests Defying Extremes

- In deserts, "Mirage Miracles" happen due to bending light caused by temperature changes.
- These illusions make objects seem closer or distorted, like water on hot sand.
- Distant objects can appear raised or inverted due to this bending light.
- This phenomenon is common and confuses even scientists, revealing the magic of light and air.



## Secrets of Extremes

- Dust storms in deserts can span 100+ miles.
- Atacama Desert, rainless for 500 years, saw rare event in 2015.

## Survival in Extremes

Facing desert challenges, animals sport large ears and nocturnal behaviors. With water-storing leaves and deep roots, plants too thrive in such aridity.



The Golden barrel cactus



The Inland taipan



Joshua trees



African wild dog



# Outer Space

## Tech Conquering Extremes

**Compton Observatory:** Detects high-energy photons across the electromagnetic spectrum.



**International Space Station:** Hosts diverse daily scientific experiments in space.



**Satellites:** Capture data, images from distant bodies and environments.



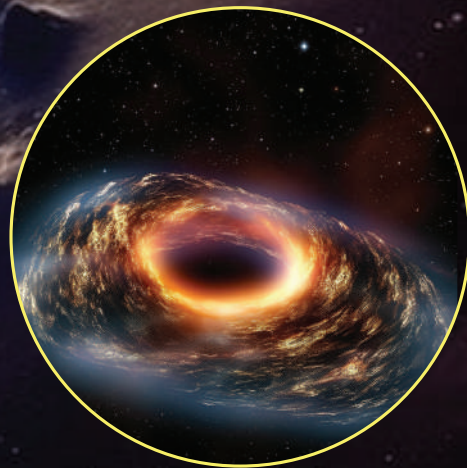
**Spacesuits:** Enable survival, providing oxygen and water for spacewalks.



## Research Triumphant Extremes

Astronomers using NASA's Hubble Space Telescope observed a fascinating event in the universe:

- A star, located about 300 million light years away from a black hole, was being twisted into the shape of a doughnut by the black hole.
- This incredible phenomenon, where a star transforms into a massive doughnut before getting swallowed up by the black hole, is extremely rare.
- It only happens a few times in 100,000 years in galaxies with dormant black holes at their cores.
- The researchers were able to witness the star's final moments in detail as it was gobbled up by the black hole.





## Quests Defying Extremes

- In June 1971, the Soviet Union established the first experimental space station in earth's orbit, known as Salyut 1.
- On 7th June 1971, the crew of Soyuz 11 became the first to board the Salyut 1 space station.
- During their mission, which lasted over three weeks, the cosmonauts conducted various experiments in space.
- Tragedy struck when the crew capsule depressurized during preparations for re-entry, resulting in the deaths of the three-man crew.
- The crew of Soyuz 11 remains the only humans to have died in space.



## Secrets of Extremes

- Moon footprints last 100 million years.
- Over 500,000 space junk pieces clutter our orbits today.

## Survival in Extremes

Facing space's vast challenges, the void poses pressure, temperature, and radiation risks. With commercial spacecraft, hopes of cosmic civilizations emerge.



Commercial Space Station



Space Astronaut



Intraterrestrial Object



Space Flight



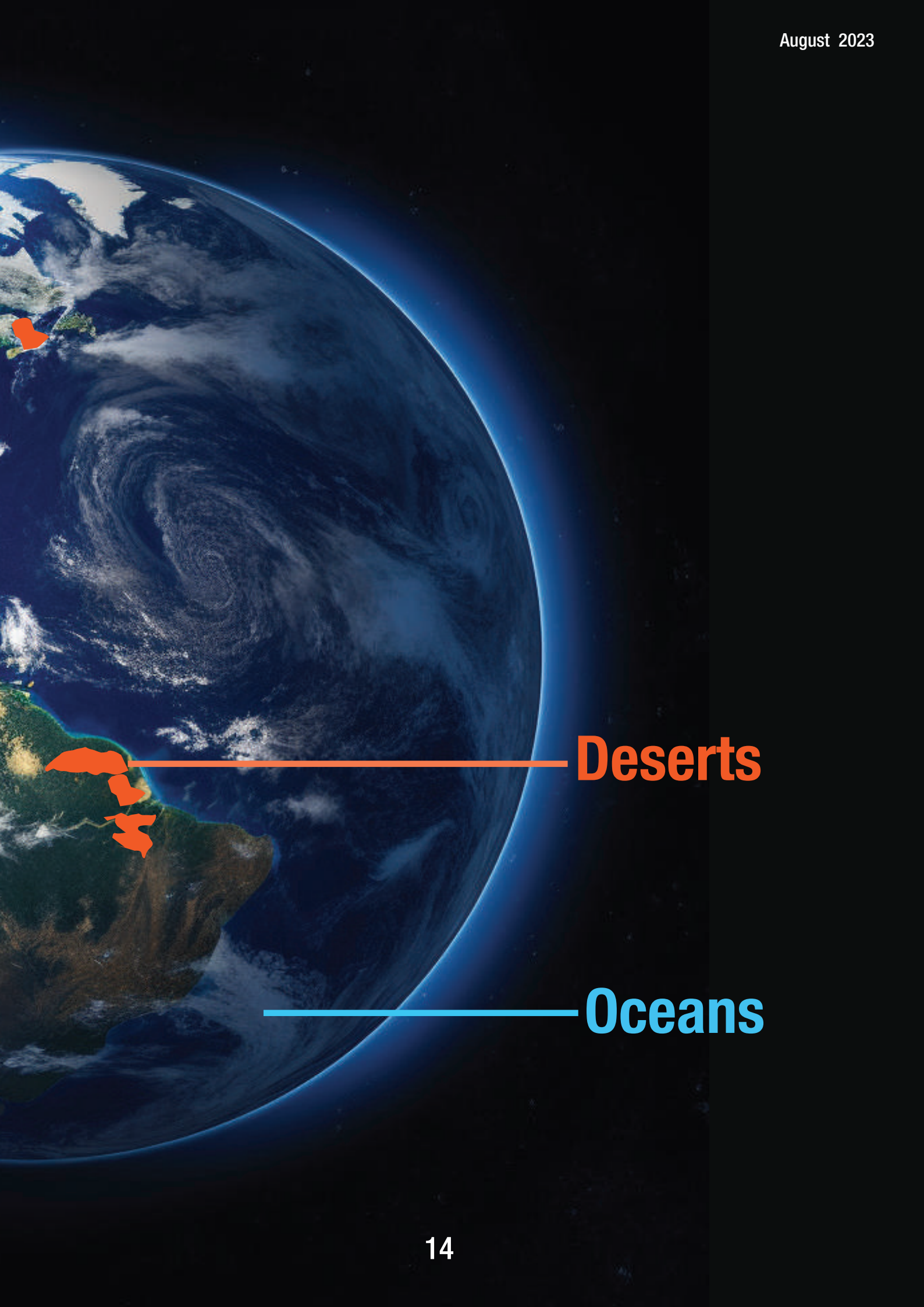
# Extreme Regions

**Polar Region** —————

**Volcanoes** —————







**Deserts**

**Oceans**



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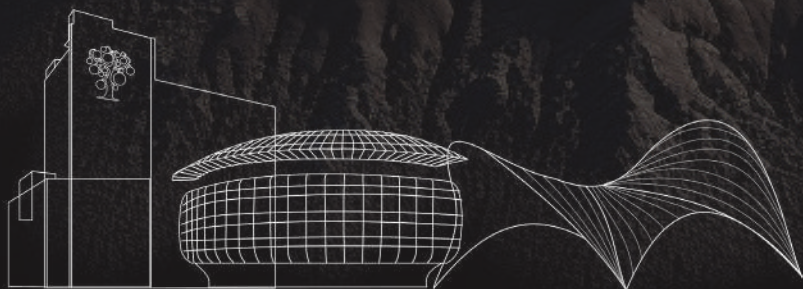
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