Antarctic Odyssey

A Journey Beyond the Frozen Horizon

DR. SAURABH BARUA

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ANTARCTIC ODYSSEY

In the unforgiving realm of Antarctica, each dawn brought with it a fresh challenge—a challenge to adapt, to survive, and to conquer. The freezing, bone-chilling cold, the unending solitude, and the isolating vastness would deter many from venturing into this harsh domain. Yet, in the face of these daunting conditions, the pursuit of knowledge remained an irresistible beacon, drawing researchers to its icy embrace.

by

Dr. Saurabh Barua
Winter Member
18th Indian Scientific Expedition to Antarctica

Dedicated to Parents

Foreword

Participating in the Indian Scientific Expedition to Antarctica, with the vision of researching into the mysteries of Antarctic Science, seemed like a mission on the brink of impossibility. I embarked on this journey, aware of the formidable challenges that lay ahead in an age dominated by automation. However, little did I know that the 15-month odyssey that awaited me would be a revelation—a test of not only my mettle but also of human endurance. Antarctica, often described as a world within our own planet, proved to be a relentless adversary, demanding adaptability and resilience at every turn, from the treacherous voyage to our first footsteps on its icy shores.

In the unforgiving realm of Antarctica, each dawn brought with it a fresh challenge—a challenge to adapt, to survive, and to conquer. The freezing, bone-chilling cold, the unending solitude, and the isolating vastness would deter many from venturing into this harsh domain. Yet, in the face of these daunting conditions, the pursuit of knowledge remained an irresistible beacon, drawing researchers like myself to its icy embrace.

I shared my experiences on numerous platforms, from Schools and Colleges to Universities, Research Organizations, and even the Children's Science Congress in India. At the end of these lectures, a single question echoed persistently, "Why haven't you published your remarkable Antarctic adventure for a wider audience?". Although the idea had always lingered in the recesses of my mind, the demands of other pressing assignments took precedence.

Over the years, I painstakingly laid the foundation, brick by brick, until it finally materialized into this book that you now hold in your hands. My aspiration for this book was clear—it had to be a fusion of adventure and Antarctic science, primarily aimed at benefiting students. Moreover, it is my fervent hope that this book will serve as an inspiration, particularly to students, demonstrating how unwavering determination, dedication, and discipline can surmount even the most formidable challenges. Antarctica, with its icy grip, tested our limits, but it also revealed the boundless potential of the human spirit in the face of adversity.

I delivered a lecture on the "Indian Scientific Expedition to Antarctica (ISEA)" consistently for twelve years as part of the CPYLS (CSIR Programme on Youth for Leadership in Science) program, which my organization RRL, now CSIR NEIST, has been

organizing. The primary goal of this program was to captivate the interest of young students in fields such as Physics, Chemistry, Mathematics, Geology, Geophysics, Zoology, Botany, Microbiology, Genetics, and Environmental science during their undergraduate studies. I may not be certain of the extent to which I motivated them, but this book is intended to accomplish the same objective. It covers all these subjects simultaneously, drawing insights from researchers from various organizations involved in the ISEA, contributing to Antarctic science.

Furthermore, this book aims to inspire readers by demonstrating how to prepare themselves and navigate through even the most challenging situations with unwavering determination, dedication, and discipline, regardless of the enormity of the challenges they face.

At the outset, I acknowledge Council of Scientific and Industrial Research (CSIR) for the remarkable contribution extended to research on Antarctic Science. Numbers of people are associated with this expedition directly or indirectly. Among them, some are special. I acknowledge Dr. Harsh K Gupta, the then Director, CSIR NGRI-Hyderabad, Sir Indra Mohan, Principal Investigator of Antarctic project, Dr. Shikar Chandra Jain, Co-ordinator of Antarctic Projects, Indian Embassy, Mauritius and Johannesburg, Secretary, Department of Ocean Development, M&SI-Auli, Antarctic Science Centre-Goa, Ajay Dhar, Leader & Expedition members-18ISEA, Pawan Hans helicopter personnel, Indian Army, Indian Navy, Assam Science Society, Dr. J S Sandhu, Director, RRL Jorhat, Director-NCPOR-Goa , Prof. Pradip K Bhuyan, Dept. of Physics, Dibrugarh University, my buddy Y V V S N Murty, Prem Kishore, I. P Raju, NGRI Hyderabad, Dr. E. C. Malaimani, Head-GPS group NGRI and Dr. Santanu Tamuly and Editor-Mouchak.

I profoundly acknowledge the astounding encouragement and the help rendered by my sister Subhra, brothers Sanat and Subash besides Tulika, Magdaleena and Maitreyadeepta.

Saurabh Barua

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Introduction

"Papa, why am I named Magdaleena?"

My daughter asked me this when she was just six years old.

I smiled and replied, "Dear, it was His wish. The ship that brought me back to India was named the *M.V. Magdalena Oldendorff*."

"That's interesting," she said, "but why did they name the ship that?"

"Well, ships often have meaningful names," I explained. "The *Magdalena Oldendorff* was named after someone significant, just as we named you, hoping that you would grow up to be remarkable."

As she grew older, her curiosity deepened. One day, out of the blue, she asked, "How do you justify your scientific contribution in Antarctica?"

My breath caught. It was a question I had never asked myself. In a realm where basic survival was the paramount concern, could I truly quantify the value of what I had done?

Recovering my composure, I replied, "That's a profound question, Magdaleena. While I may not hold every answer about the lasting impact of my work, I did publish a research paper titled *Rare Earthquakes in Antarctica*. It was featured in the 2001 special issue of *Current Science*—a permanent record of my time on the ice."

"That sounds important," she said softly. "But is that all?"

"Antarctica is like another planet within Earth," I replied. "Merely conducting research in such an isolated, volatile environment is a massive feat. More importantly, data gathered in Antarctica serves as the primary baseline for predicting weather, oceanic patterns, and atmospheric shifts across the rest of the globe."

"I see," she said. "It must have been quite an experience. But are you truly satisfied with what you accomplished there?"

I paused for a moment. "You know, Magdaleena, it isn't simply about personal satisfaction. It's about expanding humanity's understanding of an extraordinary frontier and realizing how urgently we must preserve it. The work is grueling, but it is vital for the future of our planet."

She smiled. "It must have been an incredible adventure."

"It was," I said, "and a chapter of my life I will always cherish. If you'd like, I can tell you what it's really like down there."

Her eyes lit up with quiet satisfaction. The book you are holding is the answer to her curiosity—and perhaps to yours.

Look at the globe, you will find one of the continents is placed right at the bottom of our mother earth. This is known as island continent Antarctica. Can anyone imagine about a piece of land like this staying in other continents? Antarctica is the coldest, windiest, driest, highest, farthest and most mysterious of all the continents. Neither polar bear nor Eskimos are the habitat at this southern extremity of the earth.

Antarctica expedition is an adventure of a lifetime where one gets to explore the last unspoiled natural wilderness on earth. The journey to this frozen continent entails crossing the rough waters, observing magnificent wildlife, and navigating through treacherous icy terrains. From walking with penguins to hiking on glaciers, serving Antarctic science, every moment on this expedition is incredible. The Antarctic Peninsula is a popular destination where travelers can witness enormous chunks of ice breaking off the glaciers and forming immense icebergs. The mesmerizing beauty of this opaque terrain, the surreal landscapes, and the quietness in this isolated realm is awe-inspiring. It takes a lot of preparation to embark on such an expedition, but the experience of witnessing the world's most extreme habitats and the serenity of the frozen wilderness is unparalleled.

The sounds of your footsteps crunching through the snow, the crunch of the ice as it gives way beneath you, and the occasional splashing of water of a seal while diving down the sea water from floating ice in the distance are the only sounds, you'll hear for miles around.

It's hard to believe that life can exist in such a harsh environment, but the birds that soar above you and the occasional Penguins that skirts your path are a reminder that even the harshest places can be home to resilient species. Penguins are the most starved animal in the world.

As you trek further into this frozen wasteland, you can't help but feel a sense of humility and reverence for this vast and unforgiving environment. You feel like you're on a journey of self-discovery, trying to uncover the secrets of this harsh and mysterious world. What you uncover is survival strategies during polar night and polar day for a maximum duration of six months.

But as you push through the challenges and obstacles that come with exploring such a remote and unforgiving place, you're rewarded with moments of sheer beauty and wonder that will stay with you forever. One such event can be wonderful auroral display in night sky.

It's not just the breath-taking vistas that leave you spellbound, but the sense of accomplishment and connection to nature that comes with pushing yourself to your limits and experiencing the world in a way that few others ever will.

It’s a different planet within the earth where everything is extreme harsh and treacherous. This is the reason why no human habitat is found in Antarctica except a few hundreds of Scientist explorers who ventures this pristine land for scientific investigations and try to explore the unexplored dynamics of this extreme condition be it either in land or in atmosphere.

From the majestic glaciers and icebergs to the stunning displays of southern lights, the Antarctica has a way of humbling even the most seasoned expedition member. It's a place where you can disconnect from the noise and distractions of everyday life and reconnect with the raw power of nature.

As you set out on your journey, you'll be faced with new challenges and obstacles at every turn. The harsh weather conditions and unforgiving terrain will test your physical and mental limits, but the rewards of overcoming these challenges are immeasurable.

You'll gain a newfound appreciation for the fragility and resilience of the natural world, and your sense of wonder and awe will be renewed with every new discovery of science beyond nature. Albeit entire journey will lead you to be a very sober and strong within as you encounter nature’s fury almost every moment where one is only tiny pie in front of a giant force.

THE HOME OF BLIZZARD

Alright, let's dive into the captivating world of Antarctica, often called 'The Home of the Blizzard.' This frozen continent is a treasure trove of incredible facts and figures that will leave you in awe.

First of all, picture this: Antarctica is a land of relentless winds known as katabatic winds.

Only 2 % is exposed as rocky terrain while 98%. is continetal ice of varying depth ranging from 5 to 50 km

These icy gusts behave like a frigid river of ice descending from the continent's interior. They're so bone-chilling and powerful that they can freeze even the bravest explorers' faces! Along the coast, these winds team up with low-pressure systems to create frequent blizzards.

Now, let's talk about its geography. Antarctica is the world's fifth-largest continent, surrounded by the vast Southern Ocean, keeping it splendidly isolated from all other land masses. The closest neighbors are South America, about 965 kilometers away, followed by Australia and South Africa at much greater distances of 2,500 and 4,000 kilometers, respectively.

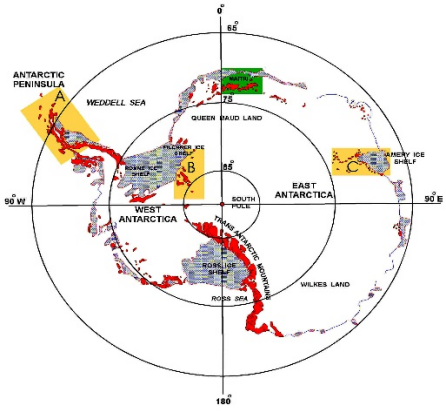
Vast icy expanse of continental ice in Antarctica : a serene beauty

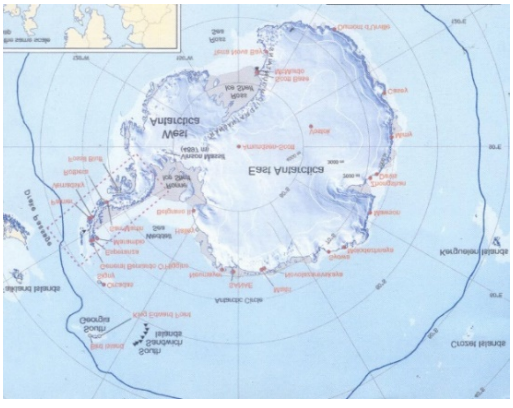
Formation of curves on ice near rock mass due to high wind speed or blizzard

Intense blizzard continued in icy terrain of Antarctica, visibility is lessened

Blizzard with moderate snowfall. Wind flag indicates wind direction

This massive land is five times the size of India and double the size of Australia, but here's the kicker: a whopping 98% of it is covered in ice, leaving only 2% ice-free.





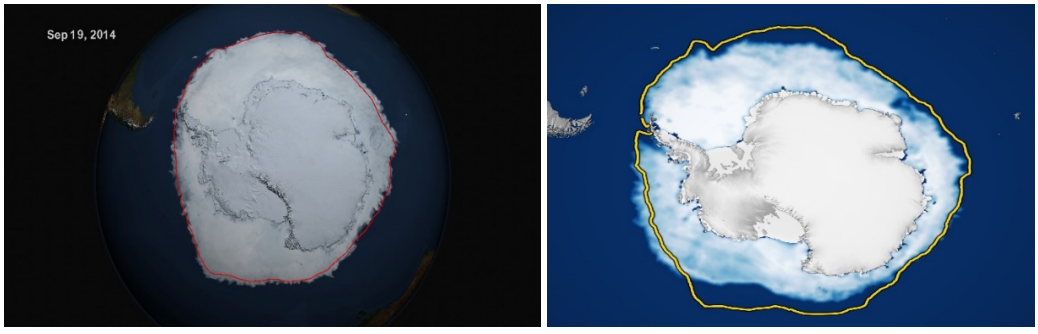
The Antarctica: driest, windiest, highest elevated and coldest territory

The geological history of Antarctica is a real page-turner. Around 50 million years ago, this icy expanse was a haven with temperate climates, lush evergreen forests, and a bustling diversity of fauna. However, as time went on, a colossal ice cap gradually formed, wiping out most of these species. Today, only a handful of tenacious survivors manage to eke out a year-round existence on the continent, some likely remnants from an earlier, warmer era, clinging to mountain peaks that have never been completely swallowed by ice.

Tectonic history : Deeply frozen and embrossed in Antarctic rock mass

Antarctica is not just a frozen desert; it's also a massive reservoir of freshwater. Over half of the world's freshwater supply is stored here! The continent boasts the world's largest ice sheet, covering a jaw-dropping 98% of its expansive 14 million square kilometers, which is equivalent to 5.4 million square miles. Within this colossal ice sheet

lies an astonishing 30 million cubic kilometers (that's 7.2 million cubic miles) of ice. That's a staggering 90% of Earth's total ice and a remarkable 68% of its freshwater resources!



Antarctica : the pulsating continent during winter 2014(left) and 2023(right). Certainly there is reduction in formation of ice in 2023 (Courtesy : NASA)

Now, let's talk altitude. It is the highest elevated continent. Antarctica stands high and mighty with an average elevation of 2,300 meters, which is around 7,500 feet – quite a contrast to North America's average elevation of just 720 meters (2,362 feet). In the East Mountains, the ice can soar to impressive heights of 4,100 meters, or about 13,450 feet. And if you're seeking the tallest rock formation, look no further than the Vinson Massif in West Antarctica's Sentinel Range, which reaches a jaw-dropping 5,140 meters (that's 16,859 feet) into the sky!

Let's not forget the climate. Antarctica holds the crown for being the coldest and driest continent on Earth. Temperatures range from a bone-chilling -89.2°C (-128.6°F) at Vostok Station to a relatively balmy 18.3°C (64.9°F) at Esperanza Base. Unlike the Arctic, which is mostly an ocean surrounded by land, Antarctica is a landmass blanketed by ice that rarely melts. The inner regions see temperatures plummet to a bone-numbing -40°C to -70°C during the coldest months (from March to October), and even in the brief summer months (from November to February), it only warms up to a comparatively less frigid -15°C to -30°C. What's more, the relative humidity in Antarctica is even lower than that of the Sahara Desert!

TERRA AUSTRALIS

So far, the historical exploration of Antarctica, it's a riveting tale! The concept of "Terra australis," or the southern land, dates back to ancient Greek philosophers like Pythagoras and Aristotle. They argued that the Earth was spherical and believed there must be a southern land to balance the known northern world. However, this idea faced challenges in medieval Europe, where the prevailing belief was in a flat Earth. It wasn't

until the fifteenth century that European exploration expanded beyond known boundaries, confirming the Earth's roundness. Maps once again depicted a vast southern land. But here's the twist: the myth of Terra Australis persisted, with numerous expeditions setting sail in search of this legendary land.

The earliest Antarctic explorer was James Cook, on his ship HMS Resolution. His reports disproved the myth of a rich and temperate Terra Australis(left). The French Antarctic expedition, led by Dumont d'Urville, landed on an iceberg from the two ships Astrolabe and Zélée(right) (Courtesy : British Geological Survey)

French explorers in the 18th century discovered subantarctic islands, strengthening the belief in a southern continent. However, it was James Cook who, during his 1772-76 voyage, dispelled this myth by encountering only ice south of the Antarctic Circle, leading him to conclude that if any landmass existed, it lay well beyond the pack ice and held no practical value.

And finally, the geological history of Antarctica is closely linked to the supercontinent Gondwanaland, formed during the Pan-African event around 600 to 500 million years ago. India, a part of Gondwana land, shares a special connection with Antarctica. India initiated geoscientific studies in East Antarctica's Central Droning Maud Land region in the 1981-1982 austral session, and these expeditions have continued uninterrupted, making significant contributions to Antarctic science across various domains.

So, there you have it – Antarctica, a land of extremes, mysteries, and incredible discoveries waiting to be made. It's a place that beckons the adventurous spirit in all of us and offers a glimpse into the Earth's remarkable past and future.

PASSION FOR EXPLORATION AND APPETITE FOR THE EXTRAORDINARY

Many a times, students ask me, "What made me so attracted to becoming a member of an Antarctic expedition?" Well, my immediate response is, "It all boils down to a deep passion for exploration and an appetite for the extraordinary."

You see, Antarctica is like the final frontier on our planet, a place where very few have dared to tread. The idea of venturing into uncharted territory, braving extreme conditions, and pushing the limits of human capability, well, that's what truly inspired me, and it's something that might resonate with your adventurous spirit.

I've always been fascinated by extreme environments, and the thought of experiencing one of the most remote and challenging landscapes on Earth was an irresistible draw. Antarctica's bone-chilling temperatures, relentless winds, and its stark, breathtaking beauty became a source of aspiration for me, a place where I yearned to thrive amidst the most challenging conditions.

But it's not just about the thrill of adventure; Antarctica is also a treasure trove of scientific discovery. It serves as a living laboratory for scientists from various fields, like atmospheric science, earth sciences, and biosciences etc. As an expedition member, I was eager to contribute to our understanding of seismic activity in Antarctica, among other scientific pursuits.

Then, there's the incredible wildlife. Antarctica is home to a unique and resilient ecosystem, with penguins, seals, and seabirds that have adapted to survive in one of the harshest environments on Earth. My love for wildlife and conservation made the opportunity to witness and protect these incredible species in their natural habitat a driving force behind my decision.

But there's also a sense of history that drew me in. Antarctica has a rich exploration history, with famous expeditions led by courageous pioneers like Shackleton and Scott. I felt a deep connection to this history and a desire to follow in the footsteps of these legendary explorers, and that's what truly made my Antarctic expedition feel like a dream come true.

Finally, Antarctica holds crucial information about our planet's past and future. The chance to contribute to global knowledge and understanding of seismic activity, crustal geodynamics, climate change, sea-level rise, and more was a compelling reason for me to join the expedition.

In the end, becoming a member of an Antarctic expedition is a decision that reflects a combination of personal passion, a sense of purpose, and a profound respect for the natural world.

It's a journey that offers both challenges and rewards, providing the opportunity to make a lasting impact on our understanding of this pristine and awe-inspiring continent.

SCALING HEIGHTS: EXPLORING THE HIMALAYAN MOUNTAINEERING INSTITUTE IN DARJEELING

One of the most cherished memories from my school days revolves around a journey to the breathtaking destination of Darjeeling, nestled in the majestic Himalayas. This trip was nothing short of transformative for me. Darjeeling had a lot to offer, but one place that truly captivated my heart was the Himalayan Mountaineering Institute, nestled within a picturesque flower garden atop a hill.

Here, I came face to face with the very equipment that had propelled legendary figures like Sir Tenzin Norgay and Sir Edmund Hillary to conquer the world's highest peak, Mount Everest. These iconic climbers had been my heroes for as long as I could remember, and seeing their gear up close was awe-inspiring.

Himalayan Mountaineering Institute, Darjeeling

What added to the magic of this place were the instructors I had the privilege of meeting. These were individuals who had undertaken extraordinary adventures in the challenging terrain of the Trans-Himalayan region. They regaled me with stories of their audacious exploits, tales of courage and determination in the face of danger and adversity. As they spoke, I felt transported to the very mountains they had conquered, experiencing both the thrill and the serenity of those heights.

Their passion for climbing was palpable, and I couldn't help but ask one of them why they pursued this perilous path. His reply, "Because it is there," echoed in my mind long after our conversation ended. It was a response that resonated with me deeply and left me profoundly inspired.

During this memorable trip, I also acquired a few books that would shape my future interests. Among them was "World's Greatest Adventure," a captivating read that delved into the epic Antarctic expeditions led by luminaries like Captain Cook and Amundsen Scott. The tales within its pages opened my eyes to the remarkable world of Antarctic exploration.

Antarctica, I learned, is an immense continent encircled by vast oceans, including the Indian Ocean, the Pacific Ocean, and the Atlantic Ocean. To reach this frozen wilderness, one must cross these formidable bodies of water. Most of its expanse is shrouded beneath layers of ice and snow, ranging from 5 feet to a staggering 5 kilometers in thickness. Only slivers of land peek through this icy blanket. Its climate is equally intriguing, with six months of perpetual darkness followed by six months of continuous daylight.

My fascination with Antarctic activities grew with every word I read and every image I saw. I stumbled upon books and magazine articles that detailed the astonishing adventures in this far-flung region. Little did I know that, years later, the first Indian Antarctic expedition would take place from 1981 to 1982, further fueling my curiosity and passion for polar exploration. Antarctica, a land of extremes, had captured my imagination, and my journey of discovery had only just begun.

SETTING SAIL: THE PIONEERING VOYAGE BEFORE THE ANTARCTIC EXPEDITION

On a rainy day, July 25th, I was on a captivating journey to Aalong, a picturesque destination in Arunachal Pradesh. Accompanied by a technical person and a driver, the adventure of reaching Aalong from Jorhat was thrilling.

We traveled up to Sonari Ghat(river port) in Dibrugarh using an official Gypsy vehicle, witnessing the mighty Brahmaputra in its full fury. The river's vastness resembled an ocean, with its other embankment entirely out of sight, hidden by black clouds. Boarding our vehicle onto one of the ferry boats anchored at the embankment, we set off towards Pasighat in Arunachal Pradesh, sailing against the flow of the Brahmaputra. The slow pace of the boat allowed us to observe numerous floodplains and submerged habitats along the way. After seven hours of battling against the Brahmaputra river's strong currents, we reached Uriumghat, port adjacent to the bank of river.

Tributary of Brahmaputra near foothills of Arunachal Pradesh

This experience marked the longest water journey I had undertaken before my Antarctic expedition.

Riverside port of ferry boat in tributary of Brahmaputra river during winter

Siang river covering huge floodplain in Assam and Arunachal Pradesh flowing out of Tsangpo in Tibet

From Pasighat, we continued our journey along the banks of the river Siang, known as the Tsangpo river in China, until we reached Aalong. Our main task was to select a

suitable site and install a seismograph station, and with the gracious permission of the Honorable Maharaj of Ramakrishna Mission, we set up the station in their compound.

Siang river the largest tributaries to Brahmaputra while entering Pasighat, Arunachal Pradesh

During the installation, I received an exciting fax from the Director of Regional Research Laboratoty(RRL) Jorhat, indicating that the National Geophysical Research Institute-Hyderabad was interested in my work experience in earthquake seismology for the upcoming Antarctica expedition. This news filled me with joy and anticipation.

Within the following two days, I promptly sent my resume, showcasing my relevant work experiences, back to Dr. Harsh Kumar Gupta, the esteemed Director of NGRI-Hyderabad and Leader of the Third Indian expedition to Antarctica. In parallel, I also forwarded a copy of the fax to Sir Indra Mohan, the Principal Investigator responsible for overseeing all projects conducted in Antarctica. Eager to learn more about the details, I had a lengthy telephone conversation with Sir Indra Mohan, during which he not only acknowledged my work and experience but also dedicated almost half an hour to discuss my recent research activities. His support and guidance were instrumental in boosting my confidence, and I owe him an immense debt of gratitude for his crucial role in my participation. The selection committee was set to convene on the 5th of August, aiming to identify a few winters over members for the Indian Scientific Expedition to Antarctica, which would span an impressive duration of 16 months. While the final selection was yet to be made, the encouragement and association with Sir Indra Mohan had already given me the courage and conviction to pursue this incredible opportunity wholeheartedly.

HEALTH ASSESSMENT AT AIIMS, NEW DELHI: BALANCING THE PHYSICAL AND PSYCHOLOGICAL

SEPTEMBER 8

I received a fax from the Department of Ocean Development, New Delhi, informing me that I had to undergo medical and psychological tests at All India Institute of Medical Sciences (AIIMS), New Delhi, from 16 to 18 September. This would be followed by Pre-Antarctic Acclimatization training at ITBP High Altitude Training Centre, Auli, and Badrinath from 21 to 28 September. After completing both the procedures, the final selection would be made. I learned that a scientist from NGRI-Hyderabad was selected as a backup in case I failed. I felt nervous. I decided to face the situation bravely. To check my physical condition, I consulted Dr. Thaneswar Borah, the Medical Officer of our Institute. He performed and suggested all possible tests and declared me physically fit. I felt more confident about my health. The expedition required a lot of stamina. So I started practicing "Yoga" and "Jogging" to increase my stamina. I had known "Yoga" since childhood and it helped me in this effort.

On 15th September, I arrived at the CSIR guest, New Delhi house by 10:00 PM and met the other 15 winter over members who would join me for the Antarctic expedition. The next morning, we left for AIIMS Delhi, where we underwent a series of medical tests to ensure our fitness for the harsh conditions. We had to do X-ray, ECG, pathological tests, ENT test, blood pressure and general check-up, as well as psychological check-up. The medical board would review our reports and give us the final clearance. I did not know most of the people in the group, but I knew we had to work as a team for the next 16 months in that isolated island. As we moved from one department to another, I got to know some of them better. There was one person who seemed to be in charge of everything. He was tall, muscular and busy. He did not introduce himself until lunch time. He was Ajay Dhar, the Leader of our expedition and a Scientist from Indian Institute of Geomagnetism, Mumbai. He welcomed us all and briefed us about the expedition. We still had some more tests to do in the afternoon.

We met two new ladies who had arrived from AIIMS-Delhi. They introduced themselves as Dr Manju Mehta, a psychiatrist, and Dr. Kusum Kapila, the Head of the Department of Pathology. They came to help us with our investigations. They also told us that another lady scientist from the Indian Institute of Geomagnetism, Mumbai, would join us soon. The next morning, we gathered for more medical tests. I remembered the third expedition, when two geologists, Dr. Sudipta Sengupta and Dr. Aditi Panth, did their research for three months in the summer.

We lost sight of Leader Ajay Dhar for a while. We felt anxious as we still had some tests to go through. Madam Kapila sensed our nervousness and assisted us in the remaining exams. We had to move across different floors of AIIMS, where various departments were located. The lift was not working, so we had to use the stairs many times. We finished all the exams by afternoon. Then we had to wait for the results. We were all a bit worried because some of the summer members had been disqualified for the Antarctica expedition. Would we make it?

We convened a brief session to formally introduce the members of our team. Mr. Bilas Shinde and Mr. Rajendra Pandkar are scientists from R&D Engineers, Pune, who will work on developing a novel method for constructing houses in cold terrain. Mr. R. P Lal is from Indian Meteorological Division, Delhi and will join us for the second wintering period.

HIGH ALTITUDE PERFORMANCE: TRAINING AT AULI'S MOUNTAINEERING & SKIING INSTITUTE (M&SI)

SEPTEMBER 11

The Medical test reports would be available the next morning, and those who pass would proceed to the Indo Tibetan Border Police (ITBP) Mountaineering and Skiing Institute (MSI) in Auli for High Altitude Training, where we were scheduled to stay for a week.

On September 11, at 6:45 AM, we gathered at Mahasagar Bhawan. Mr. P S Singh from the Department of Ocean Development was in charge of our trip. Two buses had been arranged in advance, and Mr. Ajay Dhar was already present. At the venue, we also met the fourteen-member Indian Army team responsible for managing the logistics of the expedition, and they were fellow winter over members like me. The Army team was led by Major V. V. Kadam, with whom I crossed paths with Captain Venkatesh. By 9 AM, we departed from Mahasagar Bhawan, slowly navigating through the humid summer and traffic jams of Delhi. Our journey continued, and we stopped at a roadside Dhaba in Meerut for breakfast. Around 2:00 PM, we passed through Roorkee University, reminiscent of a visit I had made a year ago to attend a seminar where I presented a research paper. Little did I know that I would be traveling the same route a year later.

We had lunch at the Rajputana hotel near Roorkee, and as we crossed Rishikesh, we entered the mesmerizing curvy hilly terrain. The enchanting sight of River Ganga flowing alongside the road caught my eye. Its waters danced and collided with the rocks along the

way, reminiscent of a similar journey I once had between Tezpur and Bomdila. At 4:30 PM, our bus arrived at Devprayag and paused near a roadside motel for evening tea. The place was abuzz with boys and girls gathered for rafting, and we noticed the colorful flags fluttering at a nearby rafting camp. It seemed to be the perfect time and place for rafting adventures.

As dusk descended upon the hilly terrain, the lights along the road passed by as our journey continued. Despite the darkness due to load shedding, we managed to cross Devprayag, where the historical rivers Bagirathi and Alkananda meet and flow down as the mighty Ganga.

The confluence of Bhagirathi river (left) and Alakananda (right) river in Debaprayag, Uttarakhand

Situated at a height of 10,000 ft, the Mountaineering and Skiing Institute (M & S I) in Auli welcomed us with freezing temperatures of around 2-3 degrees Celsius. Undeterred by the cold, our training commenced in this chilly weather. The Institute was inaugurated on 20th March 1976 by the then President, Mr. B. D. Jatti, and until 1990, ITBP managed its affairs. Later, it became an autonomous body, providing training in Mountaineering & Skiing to the members of the Air Force, Army, and Navy. Additionally, they conducted basic and advanced courses for the general public.

Snow laden Mountaineering and Skiing Institute(M&SI),
Auli, under Indo Tibetan Border Police (ITBP)

Major Rakesh Choudhury was our training in-charge, a lively and active individual despite having lost his right hand's fingers due to frostbite. After a brief introduction, he presented the preliminary program to kickstart our training.

21 September - Lecture on cold injury and display of documentary

22 September - Demonstration of Rock climbing

23-24 September - Survival training on a Glacier in Badrinath

25-27 September - Trekking and visit to Valley of Flowers

28 September - Demonstration of Firefighting and Camp fire in the evening

On the morning of 21st September, we gathered at the ITBP Winter Craft School at 10 AM. From the portico of the school campus, the entire M&SI campus came into view.

The place bore some resemblance to the terrain of Shillong. The weather was slightly overcast, and a light drizzle added to the atmosphere. The Chief Medical Officer, Dr. A.

K. Dhawan, commenced the first lecture on "Effects of Cold and its Prevention". His captivating presentation kept us engrossed, and by the time he finished, it was already noon. Without taking any breaks, he spoke for almost two hours, enlightening us about the potential diseases we might encounter in temperatures ranging from -20 degrees to -40 degrees Celsius. He emphasized the importance of protecting ourselves from Frostbite and Trench foot disease, providing us with valuable recommendations such as: Here are some of the recommendations that Dr. Dhawan emphasized during the lecture:

a. Always ensure your head and face are properly covered.
b. Wear waterproof shoes consistently.
c. Opt for Gumboot and Snow boot whenever possible.
d. Maintain meticulous foot hygiene.
e. Apply vaseline on your feet before sleeping.
f. Avoid touching metallic surfaces with bare hands.
g. Keep from remaining stationary in one place for too long.
h. Take regular breaks in a tent if you're working outdoors.
i. Incorporate mild to moderate exercise into your routine.
j. Consume high-caloric value foods.
k. Protect your eyes with UV-protected snow goggles to prevent snow blindness.

As Dr. Dhawan's lecture came to a close, he earnestly cautioned us to faithfully adhere to these recommendations, as failing to do so could potentially have dire consequences. I felt a slight shiver within me upon realizing the gravity of the situation. Following this impactful session, we transitioned to the next lecture by Dr. Bhaskar Rao, an experienced Antarctican and the Director of Logistics at the National Center for Ocean and Antarctic Research (NCAOR) in Goa. With the aid of slides and video clips, he detailed the potential challenges one might encounter during their stay in Antarctica.

In the midst of absorbing this information, a single question echoed in my mind: "Is the expedition solely defined by its challenges?" It struck me that Dr. Rao's presentation was predominantly centered on the problems we could face. This realization illuminated why Antarctic expeditions are renowned for their adventurous and demanding nature.

After a moderate lunch, our attention shifted to a rock climbing instructor. This role was taken up by Mr. Dawa Shering, a middle-aged individual hailing from Darjeeling, skillfully capable of guiding us through the intricacies of rock climbing.

BLESSINGS AMIDST THE MOUNTAINS: A JOURNEY TO BADRINATH, UTTARAKHAND

The progress of the work was notably slow. Although our departure was intended for early morning, we encountered a delay due to technical issues with the bus. Equipped with our backpacks and belongings, we eventually boarded the bus. However, this delay meant we had to return to Joshimath. The bus set off, heading north of Joshimath along a narrow road. The altitude of the terrain gradually increased. Portions of this road exhibited rugged engineering, making the journey extremely challenging. The road's narrowness allowed for only one vehicle to pass at a time, requiring one to yield for the other to proceed. On one side, there were Rocky Mountains, while on the other, an alarming sight awaited—a 55-meter drop to the gorge below, where the silvery thread of River Alakananda flowed. The treacherous nature of this road was known, with one or two bus mishaps being an annual occurrence, indicative of the area's way of life.

Amidst the rain, with its varying intensity, we continued. An hour into the journey, we crossed Gobinda Ghat (Gobinda Prayag), an important pilgrimage site for Sikh followers due to its association with Guru Gobinda Singh Ji.

Soon, our progress was halted as we approached a landslide site. A massive debris pile, stretching nearly half a kilometer, resulted from a hillside rupture. The Border Road Organization (BRO) was tirelessly working to clear the debris, a task expected to take another two to three days. However, our schedule couldn't accommodate such a wait, prompting a decision to cross the landslide area on foot. Accompanied by our ITBP Instructor, we embarked on this journey, navigating the terrain in persistent rain. The ITBP porters carried our luggage, while we shouldered our Rucksacks. Major Kadam and Som Prakash, the communication engineer, joined me.

The challenge that lay ahead was considerable—an ascent of around 1000 ft with a 20kg load on our backs. This was a novel experience for me, despite my extensive fieldwork in the North Eastern Himalayas of India. Initially, a hint of nervousness coursed through me. The path was muddied and slippery from the rain, yet I was fortunate to have chosen trekking shoes. Reaching the summit, we then descended along the debris, employing a thread wrapped around our waists for added security. The descent was successful, granting us safe passage back to the road. The site, now crowded with tourists, buses, and cars, showcased a scene of post-landslide disruption. Local traders take advantage of the situation by setting up tea stalls, as taking a moment to sip tea within the vehicles while admiring the Himalayan beauty was the most appealing way to pass the time.

This particular experience, marked by inclement weather and the challenges of traversing the landslide zone, was certainly far from pleasant in the lead-up to the commencement of our training.

Mighty Badrinath temple in Uttarakhand : Snow Clad Mountain behind

The porters relied on donkeys to transport our luggage. To accommodate us, a hired bus was arranged, extending the entire episode's duration. As the evening slowly turned into dusk, our clothing remained damp from the freezing cold. The Alakananda River roared, its waters flowing in rowdy waves. Around 8:00 PM, we finally arrived at Badrinath.

The surroundings displayed a calm and serene atmosphere. The dim light of halogen lamps struggled to penetrate the dense fog that enveloped the town. At an elevation of 13,300 feet, Badrinath seemed to slumber under the influence of the cold weather. As no dinner had been arranged at the camp, the three of us ventured out after changing into dry clothes in search of food. The town of Badrinath was entirely new to me. Temples and Dharamsala’s spread the town's landscape. Notably, a significant number of the temple priests were from Karnataka. Amid the darkness, we noticed an elderly priest making his way through a narrow road. We politely halted him and inquired about a restaurant. In response, he humbly said, "Brother, you're headed in the wrong direction." Sensing that we were newcomers, he kindly guided us towards the restaurants instead of pursuing his own destination. His personal assistance filled us with delight—an unique reflection of the divine essence that permeates this sacred land.

September 23, brought a delightful morning scene as I awoke. Snow-clad peaks encircled the Badrinath town, creating a heavenly panorama. The sunlight's reflection enhanced their allure and divinity. In the distance, the pinnacle of the Badrinath temple emerged. According to Hindu religious beliefs, visiting four spiritual places—Gangotri, Yamunotri, Kedarnath, and Badrinath—bestows full Mukti or liberation. Among these, only Badrinath is accessible by road; the others require trekking.

Amidst this, camp kitchen operations commenced. During breakfast, Dawa Sherring appeared and conveyed, "The glacier training has been canceled due to continuous rain over the glacier and nearby regions." Occasional rainfall also affected us. I asked Dawa, "What should we do now?" His immediate response was, "Barinath me ghumiye - Roam around the Badrinath town." We understood that this was the perfect opportunity to explore Badrinath.

Indian mythology associates the area with precious herbs, collectively known as Badriban, which led to the temple's name, Badrinath. The divine Badrinath temple was constructed at the confluence of Rivers Laxman Ganga and Alakananda. Indian saints perceive this Himalayan location as a dwelling of divine entities, where the very air resonates with spiritual tranquility and wisdom. Legend has it that the great sage Adi Sankaracharya placed the Badrinath idol here, bringing it from Naradakund. The significance of this effort echoes through temples located at India's four corners—Rameshwaram, Dwarka, Jagannath Puri, and Badrinath. In ancient texts, this pilgrimage is referred to as Badri Bishal or Bishalpuri, owing to the poignant saga of King Bishal's defeat by his own army's commander, who embarked on a spiritual retreat deep within the Himalayan forests near the “Gandhamadan” mountain.

Pleased with his devoted meditation, Bhagawan Narayan appeared and bestowed his blessings upon King Bishal, asking, "I am greatly content with your prayer; you may request a boon." In response, King Bishal said, "Prabhu, if you are pleased with my prayer, kindly restore my Kingdom so that both myself and my disciple can spend the rest of our lives in peaceful harmony." Bhagawan Narayan gently advised him that after enduring such rigorous meditation, he shouldn't have sought the Kingdom, but assured King Bishal that his disciple would live a tranquil life through the grace of his meditation. Following this revelation, King Bishal comprehended the profound philosophy and wholeheartedly surrendered his desires to Bhagawan Narayan. Since that moment, Badrinath has been referred to as Badri Bishal.

The Sri Badrinath temple consists of two sections. The first section, near the main entrance, houses the divine figures of Bhagawan Garur, Hanuman, and Devi Lakshmi (the goddess of wealth). The second section holds the idol of Bhagawan Badri Bishal, alongside Bhagawan Vishnu. The primary platform is situated here, and the image of the Sentry stands before the gate. Badrinath, perched at a high altitude, becomes blanketed in snow and experiences intense cold during winter. In the peak winter months, lasting for five months, the entire temple relocates to a lower elevation in Joshimath. My visit to the sacred pilgrimage site of Badrinath brought immense joy and a sense of divine connection.

EXPLORING THE LAST VILLAGE: MANA AND THE MAJESTIC BASUNDHARA FALLS ON THE INDO-TIBETAN BORDER

SEPTEMBER 24

While drizzling rain persisted in Badrinath, the number of tourists was relatively low due to the challenging road conditions and unfavorable weather. Suddenly, Dawa Shering emerged and organized us into two groups, each consisting of 12 members. In this arrangement, every individual had a partner known as a "Buddy." My Buddy was Havildar Mechanical Team (HMT) Sitaram from the Indian Army —an individual with a polite, well-mannered, and pleasant conduct. He informed us, "We will now trek to Basundhara Falls on the Indo-Tibetan border." The falls were situated at an elevation of 12,500 feet, approximately 8 kilometers away from Badrinath. After journeying around 5 kilometers north of Badrinath, we reached Mana village—the last Indian village before the Tibet border. Vehicles could only reach up to Mana village; beyond that, a trekking route was the only passage.

Rocky Bhimpul(bridge), a monolith, over Alakananda river
on the way to Mana Village near Indo-Tibetan border

After crossing the village, the landscape transformed into hilly terrain, offering a narrow trekking path. It accommodated one person at a time. Along the way, we encountered the cave of Saint Vyas, where Maharishi Vedavyas composed the mythological classic "Veda" and other renowned texts. During the time of the Mahabharata, the Pandava brothers attempted to reach "Paradise." Their journey led them to the origin of the Alakananda River. We crossed this river by walking on a substantial monolith—a rock mass acting as a bridge. Beneath the monolith, the river surged vigorously. This rectangular rock, known as "Bhimpul," was placed by the powerful Bhim to aid the Pandavas in their crossing. At this juncture, the Saraswati River merged with the Alakananda.

Mana Village - the last village near Indo-Tibetan border surrounded by snow clad mountains

As rain, wind, and cold grew more intense, rocky hills dominated the landscape, devoid of vegetation. Mr. Lal from the IMD compared this place to Schirmacher Oasis in Antarctica, having visited both areas. We noticed some members who had abandoned the trek and were returning to the Badrinath base. Despite exhaustion, my Buddy and I persevered, determined not to give up. Pushing forward, we continued along the trekking route. After a final effort, Basundhara Falls came into view—a slender thread of water cascading down from a height of 175 meters atop Mana Peak.

Upon reaching the falls, I was struck by the piercing coldness of the water, particularly as I was already soaked, including my trekking shoes. The gusty wind discouraged lingering near the falls, prompting me to seek shelter in a nearby cave. Inside, two Sanyasis (priests) were meditating. These solitary figures had been dwelling within the cave for an extended period. Occasionally, the villagers of Mana would send them fruits for sustenance. During our visit, they were the sole inhabitants of this remote part.

Mighty Basundhara water fall near Mana village-last village in India-Tibet border

By three in the afternoon, we retraced our steps to the base. Most members had returned earlier, while a few were still on their way back. Fatigue gripped my entire body. After consuming some food, I sought refuge in my sleeping bag. By evening, around 6 o'clock, I found myself engulfed by fever and sought assistance from the ITBP doctor. He prescribed paracetamol tablets, which I took after dinner before retiring. These last two days had imposed significant strain on my body, with the added anticipation of glacier training the following day.

HIGH ALTITUDE ADVENTURE: TRAINING ON BRAMHANI GLACIER AT 14,000 FEET

SEPTEMBER 25

No traces of fever remained, and I felt considerably refreshed and strengthened; both tablets had proven effective. Equipped with snow boots, ice axes, and crampons, we were prepared for our glacier training. The thought of encountering a glacier—an icy river—filled me with excitement. Any psychological fatigue had dissipated. We set off for the glacier, heading north behind the Badrinath temple. HMT Sitaram, my buddy, accompanied me. After a three-hour ascent, we arrived at the edge of the flowing ice river—the Bramhani Glacier. A vast stretch of ice crept slowly between snow-draped peaks, surrounded by several other glaciers. Melted water gurgled from the glacier's tongue. Rakesh Chowdhuri, Dawa Shering, additional trainers, and ITBP porters were already on the glacier upon our arrival, having set up a temporary camp. This glacier, known as Bramhani Glacier, originated at an altitude of nearly 17,000 feet, while our training site was situated at 14,000 feet.

High altitude Training on Brahmani glacier supported by ITBP Experts in grey attire(left),the Author with red head band sitting on the extent of Brahmani glacier(right)

Walking on the glacier's surface was a daunting effort, as its ice was incredibly slippery. Despite attaching crampons to my snow boots, maintaining stable footing was still a challenge. This was a common struggle for all of us. The glacier had a 30-degree incline, which required us to proceed with caution while gripping our ice axes firmly. I was connected with a rope, acting as a lifeline, and a carabiner; should I slip, the lifeline

would arrest my fall and prevent me from descending into the icy river below. There was no room for hesitation; a slip could result in a swift descent. Our instructor taught us how to walk on ice and demonstrated rescuing techniques for members who might fall into crevasses.

During a tea break, we relished hot tea provided from the temporary camp while basking in the sunlight, seated on the glacier. From this vantage point, the road connecting Joshimath to Badrinath appeared as a distant white thread. The second phase of training commenced after the break. Six ice axes were secured across the glacier at intervals, each attached to a 20-foot nylon rope hanging inside a crevasse. Under Mr. Rakesh's guidance, two instructors descended into the crevasse, and we watched as the trainers on the glacier executed a rapid rescue operation using the “prusiking” technique. The precision and speed of the rescue were truly impressive. This scene reminded me of Edmund Hillary and Tenzing Norgay's Everest expedition, particularly how Tenzing Norgay had rescued Hillary from crevasses on numerous occasions. We were then shown additional rescue techniques and given the opportunity to practice them. While initially challenging, I found these techniques both enjoyable and enlightening, knowing they would prove invaluable during our Antarctic expedition.

Amidst the icy stretch of the Bramhani Glacier, I found myself standing bewildered, caught in a moment that would forever alter the course of my life. Mr. Rakesh's abrupt command had sliced through the biting cold, pulling me from the focus of our training. "Let's conclude the training and move to the side," he instructed urgently. Confusion clouded my mind as I struggled to make sense of the urgency.

As if sensing my confusion, the instructor stepped closer, his voice steady despite the urgency. "Exit the glacier and take refuge on the rocky hillside," he clarified, his gaze fixed on the distant rocky terrain just 20 feet away. With a mix of fear and determination, our group of trainees managed to crawl and then sprint, our breaths visible in the frigid air, until we reached the safety of the rocky ground.

It was as if fate itself had guided us to safety, for as we turned to face the glacier, a deafening roar shattered the icy silence. Our hearts pounded in rhythm with the earth beneath us as we watched in awe and terror. An avalanche, a monstrous force of nature, was unfurling before our eyes. From the lofty heights of the hilltop, an unstoppable torrent of snow, ice, stones, and debris came hurtling down with a furious might, obliterating everything in its path.

For what felt like an eternity, we stood rooted to the rocky hillside, witnesses to the awesome and terrifying power of nature. Time seemed to stand still as the avalanche raged on, an unstoppable force that cared not for the lives or creations of man. It was in that heart-stopping moment that I realized the fragility of our existence in the face of such elemental power.

Mr. Rakesh's vigilance had been our saving grace, his quick thinking and decisive action sparing us from the devastating wrath of the avalanche. As we watched, the place where we had been training mere minutes ago was swallowed by the cascading sea of snow. Our tools and equipment were buried beneath the icy surge, lost to the wildness of the avalanche's embrace.

I couldn't help but think about the regularity of such events in this region. The knowledge that a quarter of India lay beneath a shroud of snow, vulnerable to the whims of avalanches, weighed heavily on my mind. Lives and livelihoods were at stake, and it became evident that more needed to be done to mitigate these risks.

In the aftermath of the avalanche, our perspectives shifted. Dr. Praveen Srivastava, a member of our team from SASE in Manali, emerged as a beacon of hope. His resolve to further his research in Antarctica, with the goal of better understanding and forecasting avalanches in the Himalayan region, took on a new urgency.

As the snow settled and the world around us regained its icy serenity, I knew that this experience would forever bind us. We were no longer just a group of trainees; we were survivors, witnesses to the awesome might of nature. And as we left the glacier behind, our steps heavy with the weight of newfound purpose, I couldn't help but feel that our journey had only just begun. The glacier training concluded successfully, leaving us with a newfound confidence. We were now equipped to navigate crevasses in the event of an accidental entrapment. Beyond physical competence, the development of psychological resilience and self-assurance were crucial attributes for confronting such challenges.

With the training phase wrapping up, only trekking and rock climbing remained on our agenda. I was astounded to learn about the trekking destinations: the "Valley of Flowers" at 16,688 feet and "Hemkund Sahib" at 17,900 feet. The preceding days of intense training had left me exhausted. While some participants opted out of these treks, a few of us remained enthusiastic about exploring these sites. Despite our weariness, we were determined to undertake the journey. Later, I would understand the reasons behind those who chose not to join us on these treks.

HARMONY IN NUMBERS: MY NIGHT AT GURDWARA GHAGRIA WITH 300 SOULS

SEPTEMBER 26

In silent reverence, I expressed my gratitude to Badri Bhagawan (God). Having spent these days in the area, I had developed an emotional attachment to the place, which left me feeling a bit melancholic. Departing from Badrinath at 8 AM, we encountered the remaining landslide, which we crossed with greater ease this time. By 11 AM, we reached Gobindaghat at an elevation of 5487 feet. Leaving behind twelve members of us, the bus set off for the Auli camp.

At Gobindaghat, we entered a beautiful Punjabi Gurdwara. One of our group members, Mr. Jaswinder, who was Sikh, communicated with the Gurdwara representatives and arranged for our lunch to be provided for free. The prasad (blessed food) served was truly delicious. Following a brief half-hour break, we embarked on a trek to "Ghagria," situated approximately 18 km away. The path was an inclined plane composed of small rocks and pebbles, measuring only 3 feet in width. Trekking enthusiasts of all ages, including children and the elderly, were traversing this road. Many of them were Sikh Punjabis, united by the common destination of Hemkund Darbar.

After an hour of hiking, we reached an elevation of 6,000 ft. Feeling a bit fatigued, I decided to rest near a small tea stall. Meanwhile, Mr. Som Prakash expressed his desire for tea, to which Major Kadam promptly responded that we should continue without delay. A playful argument ensued, but ultimately, we set off after a quick tea break to avoid further delay. Along the way, we crossed “Bhundhar” village, taking in the breathtaking beauty of the surroundings. The vistas in the higher Himalayan terrain were nothing short of captivating and defied adequate description.

A panoramic view of Gobindaghat in Uttarakhand from where trekking starts for Ghagria and Valley of Flowers

Upon arriving at Ghagria, we sought refuge in the Sikh Dharamsala. Having walked a continuous 14 km, fatigue had set in. I lay down on a floor bed after dinner. Spending the night inside the Gurdwara's Dharamsala, which accommodated over 300 pilgrims, was an unforgettable experience. Ghagria, located at an elevation of 9,147 ft, was quite chilly in September. To combat the cold, everyone was provided with four quilts. It's a memory I hold; resting among hundreds of pilgrims within a vast hall. Later, we learned that all this hospitality was extended without charge, in keeping with the great tradition of Sikhism.

BLOSSOMING BEAUTY: A JOURNEY TO THE ENCHANTING VALLEY OF FLOWERS

SEPTEMBER 27

Setting out at 7:00 AM, we embarked on our journey to the "Valley of Flowers." Within the first kilometer, we encountered numerous small shops lining both sides of the trekking route. The appealing beauty of the valley has been attracting visitors for a long time, offering a sense of eternal tranquility. A mesmerizing panorama of flowers stretches for miles in every direction.

According to Hindu mythology, during the age of "Dapar Yug," this place was known as the "Nandan Kanan" or "Eternal Garden." It also held names like Alka, Gandha Madhab, Baikuntha, Pushpa Vali, and Pushpa Rasa. References to it can even be found in the Mahabharata epic. Once, while Draupadi was bathing at the confluence of Gobindaghat, she noticed a beautiful flower petal drifting in the water. Urgently, she beseeched Bhim to retrieve the flower. Responding to her plea, Bhim followed the course of the “Pushpa Ganga” river and arrived at the valley of flowers, where he collected flowers resembling the petal. Even Hanuman fetched the "Gadha Madan Parbat" from this very place to Sri Lanka to source the Sanjivani herb seeds.

The valley's thriving flora and fauna owe their vitality to the pure, unpolluted air from the Himalayan tributaries and the abundant sunlight at higher altitudes. This interplay creates a lush and fresh environment, exemplified by the valley of flowers.

Magnificent view of Higher Himalaya along the trek route

In 1939, a British mountaineering expedition stumbled upon this divine wonder. While attempting to trace the origins of the two Ganges river sources, Mr. Frank S. Smythe, the leader of the Kamet peak exploration team, journeyed into the Garhwal Himalayas. After scaling Bhundhar peak at 16,688 feet, they reached a region of continuous snowfall and biting cold wind. Among this icy environment, their senses were astounded. Flowers, in countless varieties, blossomed everywhere their eyes could see. It was as if the flowers radiated an astral vibrancy. Smythe exclaimed with delight, "Oh! This must be the valley of flowers." The pristine beauty held him in admiration, and he further recorded, "Of everything that I have seen or experienced over the years, Bhundhar

or the Valley of Flowers is the most extraordinary... I have not taken a single flower, petal, or crushed a plant underfoot." Beyond the colorful variety of flowers, the fragrance was equally astonishing. A diverse array of flowers, including Jungle Geranium, Fraz clinging to foothill rocks, alimony ulephoniamat, bilace, jungle roses, and Bramhakamal, could be witnessed in various shapes and sizes.

Vast expanse of Valley of flowers : a Devine gift of Nature

Smythe developed an enduring connection with the Valley of Flowers. In 1937, he revisited the valley and collected 2500 medicinal herb plants along with 250 flower varieties, which he brought to England. One of his most notable works is the book titled "Valley of Flowers".

Brahmakamal - flower mentioned in devine Mahabharata
(Sassurea obvallata-the scientific name) available in Valley of Flower

In 1939, the "Royal Botanical Garden" dispatched an expedition led by Madam Margarete to meticulously document medicinal herbs. She was rendered speechless by the beauty she encountered. While gathering herbs one day, she tragically slipped from a hilltop cliff and lost her life. This foreign woman became a martyr to her dedication in exploring this stunning piece of land within the universe.

During the winter season, the "Valley of Flowers" is blanketed in a thick layer of snow. Spring arrives in the month of July, and with it, the entire valley bursts into a mesmerizing display of flowers. Every inch of land is adorned with blooms, creating an enchanting sight. The optimal time to explore the valley is between July and the first half of September.

RETURN TO M&SI-AULI

SEPTEMBER 27

Due to our extended time in the Valley of Flowers, we couldn't manage to visit "Hemkund Sahib" on the same day. Those who ventured to "Hemkund Sahib" couldn't explore the "Valley of Flowers" due to time constraints. Around 11 AM, we left "Ghagria" for Auli. My legs were in agony and nearly numb. The pain was intense, as if my legs were bound by heavy stones. I had developed several large boils near my heel and thirteen on my left leg. Walking in this condition was difficult; it felt as if my legs were encased in concrete. At one point, I contemplated riding a horse to complete the rest of the trek to Gobindaghat. Some members supported this idea. However, I disregarded their advice and

chose to complete the remaining journey barefoot by removing my trekking shoes. Throughout the route, Som Prakash, a communication engineer from DRDO-DEAL Dehradun, stood by me. Being from the Garhwal Himalayas, he was accustomed to traveling in hilly terrains. I managed to reach “Phulna” village with several breaks in between. I took a seat at a roadside tea shop, unable to bend my leg due to the unbearable pain. Only two kilometers remained, having already covered 16 kilometers. Walking these last two kilometers seemed nearly impossible, so I requested Som Prakash to arrange a horse for me. He hesitated to ride, so he didn't. I might have been the sole member to complete the stretch from Gobindaghat on horseback. Upon seeing the condition of my leg, the other members were quite concerned upon our arrival. We headed to Auli by bus and arrived around 6 PM in the evening.

On September 28, the day was slated for rock climbing training followed by a campfire. Due to the intense pain, I couldn't sleep well, and thus, I visited the medical unit of M&S I, Auli, early in the morning. After inspecting the boils, the medical staff recommended an operation and inquired about my choice of socks inside the trekking shoe. I informed them that I had worn a pair of new socks. They appeared displeased with this choice and explained that wearing new socks during trekking had led to this situation. They also mentioned with a smile that they hadn't explicitly communicated this point during their lecture. The boils were treated through an operation, and I was prescribed antibiotics and painkillers. The affected area of my leg was then bandaged and covered with plastering tape. I recall wearing Hawaii sandals despite the cold temperatures. I couldn't help but reflect that this situation might have been avoided had I skipped the visit to the "Valley of Flowers" and the trek in the higher Himalayas.

MOUNTING HEIGHTS: THE ART AND ADVENTURE OF ROCK-CLIMBING TRAINING

The preparations for the rock-climbing training were underway, and everyone was geared up for the session. The training location was situated around two kilometers away. Seeing my physical state, Major Rakesh suggested that I use the car while the rest of the members set out on foot. The rock-climbing instructors were already stationed at the site. Upon our assembly, three seasoned climbing experts descended using ropes along the slope from the summits of three out of five naturally formed rock masses, each equivalent in height to a four or five-storied building. They began demonstrating various climbing techniques, and I sat among the spectators, initially content to watch. However, the training turned out to be so intriguing and challenging that I couldn't remain idle in the audience.

Rock climbing training in M&SI, Auli by ITBP expert (Courtesy: ITBP)

With the help of a walking stick, I slowly made my way to the summit of one of the rock masses, wearing a helmet and securing the rope and carabiner around my waist. I successfully traversed from one hill to another using the hanging rope, conquering the technique that had initially discouraged me from participating actively. This accomplishment eased my regret for not having learned the other techniques.

Reaching peak to peak using rope in M&SI, Auli by ITBP expert(Courtesy: ITBP)

As tomorrow marked our early departure from Auli to Delhi, a sense of melancholy permeated among most of us. The valedictory function concluded, and during the campfire, emotions flowed as we anticipated the risks our instructors had taken to teach us the crucial techniques necessary for our Antarctic venture. The commitment and

training offered by the ITBP team were characterized by dedication and an enduring connection, strengthening our mental strength. A salute to "M&SI." With my leg encased in plaster, I boarded the bus bound for Delhi. The instructors, including Major Rakesh, waved us goodbye, their figures gradually disappearing from view within an hour as the towering peaks receded. Truly, the Himalayas are a golden treasure.

Upon arriving in Jorhat from Delhi, I underwent a full recovery after resting for seven days. While my physical condition was somewhat diminished, my mental resilience had increased significantly. I recognized that the rigorous training and consistent lessons on survival imparted at M&SI, Auli, had played a pivotal role in boosting my confidence. In the meantime, the next phase of training was arranged, taking me to a different setting. This time, it wasn't in the midst of forests or atop hills. The forthcoming training program was scheduled at the National Geophysical Research Institute (NGRI) in Hyderabad. The training encompassed the maintenance of scientific instruments, data collection, and processing, all essential for our upcoming mission in Antarctica. Over these days, I received numerous well-wishes and messages of encouragement from friends, colleagues, and the Scientific Workers Association (SWA) of our institution. This outpouring of support further boosted my morale. With my selection from this laboratory for the expedition, I drag the weight of ensuring its successful execution.

TRAINING AT NATIONAL GEOPHYSICAL RESEARCH INSTITUTE-HYDERABAD

OCTOBER 25

I boarded flight IC 702 from Mohan Bari Airport, Dibrugarh, at 11 AM with the destination of Hyderabad via Kolkata. However, the flight experienced a one-hour delay, and it was around 1 PM when we finally touched down in Kolkata. The original departure time for the flight to Hyderabad was 5 PM. While waiting in the lounge after completing all the necessary formalities, it became apparent that there was a situation of unrest in Kolkata city. This led to the delay as many passengers were stuck in transit to the airport. The flight eventually took off around 9 PM, arriving in Hyderabad at 12:40 AM, midnight. Despite the late hour, rigorous training was set to commence the following day.

Both Northeast Institute of Science and Technology (NEIST) [formerly Regional Research Laboratory (RRL)] and National Geophysical Research Institute (NGRI) in Hyderabad holds a distinguished reputation globally and operates under the aegis of the Council of Scientific and Industrial Research (CSIR). In NGRI, nearly 400 scientists

engaged in various research projects spanning geophysics, geology, and earthquake seismology, the institute's endeavors are guided by three fundamental aspects:

1. Knowledge: Understanding the Earth's internal composition and dynamics.
2. Economy: Extracting energy sources and exploring minerals.
3. Societal Need: Mitigating disasters, addressing climate change, and assessing its impact on society.

Logo of Northeast Institute of Science and Technology(NEIST)-Jorhat and National Geophysical Research Institute(NGRI)-Hyderabad under Council of Scientific and Industrial Research(CSIR)

These two institutes do research focused on earthquake, landslide, flood, drought, and more. The scientists are experts in their respective domains, and I was thrilled to have the opportunity to work with some of these exceptional minds. My association with NGRI had been ongoing since the inception of my research on earthquake seismology. However, this time was special; I had been assigned two projects on behalf of NGRI for implementation in Antarctica. The project objectives were as follows:

1. To discern the seismicity patterns of Antarctica and its surroundings.
2. To study the crustal geodynamics of Antarctica using the Global Positioning System (GPS).

The next morning, I readied myself for training after breakfast in the guest house. Arriving at the institute a bit early, I waited for a while and then met the person I had been looking forward to meeting – Sir Indra Mohan. He was not only one of the senior-most scientists at NGRI but also the project leader for the two Antarctica projects mentioned earlier. His contribution to my Antarctica expedition was invaluable. As a seasoned seismologist, he had been associated with the Regional Research Laboratory, Jorhat, for a

long time. Since the 1970s, he had been at the forefront of seismological studies and the establishment of seismograph stations in Northeast India.

Although I was familiar with Sir Indra Mohan, the other members of his research group were new to me. I had the opportunity to get introduced to them, and each one seemed dedicated and earnest in their research pursuits. Given my relatively limited knowledge about the technical and scientific aspects of the second project, I expressed my interest in delving deeper into the details of GPS studies. Sir Indra Mohan suggested that I accompany him to meet Dr. E. C. Malaimani, the Principal Investigator of the GPS project. We were warmly welcomed into her room, where scholars were engrossed in their research work, peering at computer screens. Aware of the purpose of my visit, Dr. Malaimani elaborated on the training plan and provided literature related to GPS satellite receivers, their operations, and data processing techniques. The GPS project aimed to estimate the crustal geodynamics of the Antarctic plate by receiving signals from GPS satellites. This process would provide insights into the rate of movement and direction of the Antarctic plate.

On the third day of my visit, I had the privilege of meeting Dr. Shikhar Chandra Jain, an Antarctician who was the coordinator of all Antarctica-related projects on behalf of NGRI-Hyderabad. In our brief meeting, he emphasized the substantial responsibility that had been entrusted to me among numerous scientists. He highlighted that these missions were among NGRI's most prestigious endeavors in Antarctica. He extended an invitation to dinner at his home, where he showcased a documentary, he had filmed during his own visit to Antarctica. The documentary showcased the mesmerizing expanse of the white icy terrain.

The Pioneer: First Indian Scientific Expedition Members in front of Polar Circle in Antarctica

He shared stories of challenging moments he had faced during his journey. Dr. S. Z. Qasim had led the first Indian Antarctic Expedition, the preparations for which were conducted in secrecy. The primary objective was to assess the feasibility of Indian scientists conducting research in Antarctica.

Postal stamp published to commemorate the first ISEA

After completing the initial training and necessary preparations, I returned to Jorhat. It was imperative to reach Hyderabad with all my belongings within the next 25 days. The training had been successfully accomplished, without any time wasted. Upon my return, I discovered that an official clearance letter from CSIR headquarters was still pending, without which my journey wouldn't be possible. I waited anxiously for this crucial letter. Time was ticking away swiftly. My days were consumed with last-minute reviews of the intricacies of both projects. I understood that I would be the sole guardian of these projects, with no one else to assist me if I encountered issues with the instruments and their functionality. Consequently, I was engrossed in arranging logistics and finalizing the procurement of essential items for the next sixteen months, following the list provided by M&SI, Auli.

As time flew by, my departure was imminent within the next three to four days. I was about to embark on my studies in the coldest and driest place on Earth, where day and night stretched for up to six months, amidst frequent blizzards and snowfalls. With all the training and preparations, I had gained confidence. I was wholeheartedly dedicated to my assignments, filled with enthusiasm. However, a dormant pain resided within me – the ache of leaving loved ones behind. I was heading towards a harsh environment, with a fifty-fifty probability of return.

In the midst of this, my colleagues from the Geoscience Division arranged a lunch party to bid me farewell. The time had come to depart. I left Jorhat and arrived home in Dibrugarh. It brought me joy to know that my mother and elder brother would accompany me to Goa for a farewell before my journey. The shopping for the remaining items was in full swing, making the last four days truly hectic. I bid farewell to friends and relatives, though it was unfortunate that my mother fell ill and couldn't join. Thus, they stayed back in Dibrugarh.

ANTARCTICA BOUND: THE JOURNEY FROM DIBRUGARH, LEAVING FAMILY BEHIND

NOVEMBER 29

The day of departure had finally dawned, marking my leaving from Dibrugarh. There was a slight tension lingering in my mind. The flight was scheduled for 1:30 PM from Mohan Bari Airport. We arrived at Mohan Bari almost half an hour ahead of time. My family, including my mother and two-year-old niece, along with a few friends, had gathered to bid me farewell. Carrying three large bags containing supplies for the next 16 months, I found myself needing to pay for the excess luggage weight. As the departure

time neared, I tightly held onto my mother's hand for the last time. Her eyes were shining with pride, devoid of tears. I couldn't help but feel proud of my mother. She had been my sole source of inspiration for embarking on this Antarctic expedition. It was her unwavering support that gave me the confidence to pursue this journey without hesitation.

ARRIVAL IN GOA

DECEMBER 12

As soon as I had arrived at the hotel in Goa, I had received the news that our icebreaker class ship MV Polar Bird had reached Murmagaon port from Norway. An icebreaker class ship is a special-purpose vessel designed to navigate through ice-covered waters and provide safe waterways for other ships. I had been overjoyed by the news, as it had meant that our expedition was about to begin. All of us had been given entry passes to access the Murmagaon port, where the final preparations had been underway.

Logo of National Centre for Polar and Ocean Research(NCPOR), Goa (formerly Antarctic Science Centre)

We arrived at the port arena after a meticulous inspection. It seemed unnecessary to scrutinize the Antarctic expedition members so closely. But they did their duty. We saw the MV polar bird waiting for us, a huge ship that would take us to Antarctica. There were many shipping containers in front of the ship. They were steel boxes of rectangular shape, where all our equipment and supplies for the next sixteen months would be stored in order. There was a lot of activity going on. I spotted our leader Ajay, with sunglasses on, who was very busy. Captain Venkatesh and some other senior members were helping him. They also assigned some tasks to the rest of us. When I approached them, they told me what I had to do. I was in charge of arranging all the scientific instruments according to

priority and putting them in the container safely and neatly. I felt a bit frustrated. What a way to start the expedition. Why did they give me such a big task? But I had no choice but to follow the order. Since it was a challenging work, I asked for assistance from three other members and held a brief meeting to plan how to do it. I listened to their suggestions.

We had a meeting with the summer members to discuss their instrument needs for the voyage and Maitri. Based on their input, we made a priority list and arranged the instruments accordingly. The ones needed for the ship-based research were placed near the door for easy access, while the others were stored behind. The winter-over members had a separate container, so they did not need a priority list. This was a crucial step to prevent any mishaps or mismanagement during the shipboard investigations. We secured the instruments with plastic straps and hooks to the container to avoid any displacement. I were happy to complete the task with the help of others.

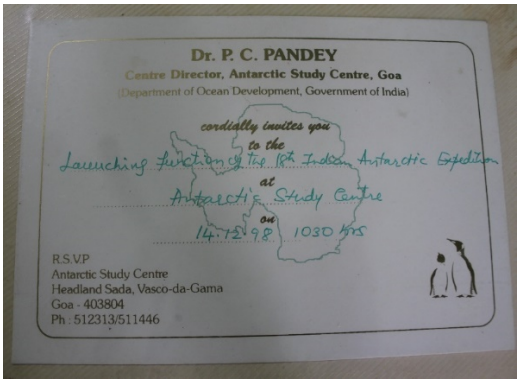
I was thrilled to see how much work was going on for our expedition. Two Pawan Hans helicopters flew in and landed on the Polar Bird's deck with a loud noise. They brought so many things that we needed for this amazing adventure. We loaded 600 tons of aviation turbine fuel (ATF) from oil tankers that came from Mumbai. We also packed 400 gas cylinders and a lot of food items like frozen vegetables, fish, meat, and processed food. They were all stored in a deep freezer container on the ship. We also had five new toilet modules that we would be installed in Maitri for the summer members. They were already made and ready to go. Major Kadam and his team were busy organizing them. We hoped to finish everything by tomorrow evening. The sun set over the port, but we didn't stop working. Later, we went to a farewell party at the tourist hotel where we stayed. The Director of the Antarctic Science Centre, Goa, had arranged it for us. It was a fun night at the Nanu resort, with a Goanese music band and many guests. In the middle of the night, we heard that the ship would leave tomorrow evening. I felt a mix of excitement and nervousness.

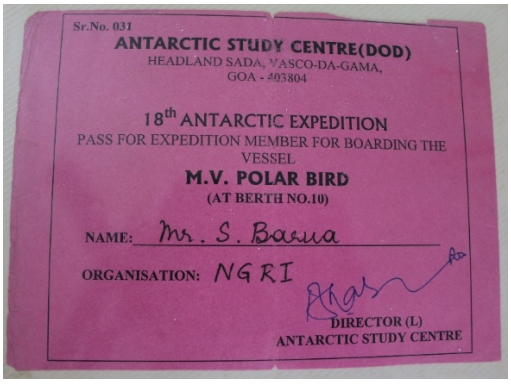
BON VOYAGE WITH MR. LUIZINHO FALEIRO: A MEMORABLE MEETING WITH THE CHIEF MINISTER OF GOA

DECEMBER 14

I couldn't believe I woke up early in the morning and saw the sky a bit cloudy in Goa. It was a wonderful day for our Bon voyage meeting at ASC. The meeting was honored by Mr. Luizinho Faleiro, the Honorable Chief Minister of Goa, who was joined by former Admirals of Indian Army and Navy. He warmly welcomed everyone and met the family members who were also there. He delivered a powerful speech about how we were

representing 100 crores Indians in our mission to serve Antarctic Science with safety. He also mentioned the great explorers like James Cook, Scott and Amundsen who set an example for us. Our Leader Ajay Dhar also acknowledged the participation of three-woman scientists as summer team members in the last expedition of this century. The meeting wrapped up by 11:30 AM and I felt inspired and honored to be part of this incredible team.





Invitation card for launching function of 18th ISEA

STEERING CUSTOMS AND IMMIGRATION: MURMAGAON PORT, GOA

We were a bit excited to leave the hotel and head to the ship by 2 PM in the afternoon. We packed our bags with everything we needed for our Antarctic adventure. A mini-truck came to take our luggage to the port, where we faced a lot of custom and immigration officers. They checked every item in our bags, as if they suspected us of smuggling gold or diamonds to the frozen continent. We had to give them a list of our belongings. For me, it included clothes, two cameras, one binocular, a Walkman and a laptop. We also had to sign a form that said we would bring them back after 16 months. It took a long time to finish these formalities, but finally we got on the ship. Some of the members had their families with them, but I was alone. They went to explore the ship, but I went back to the port to see what was happening on the deck of Polar Bird. They were loading a Pawan Hans helicopter into the hold with a huge crane. The Navy band was playing some inspiring songs to cheer us up. Mr. Prem Kishore from NGRI Hyderabad had come to see off Mr. Y V V S N Murthy and me. I was glad to have someone to say goodbye to. There were many banners and posters from different organizations wishing us a happy and successful stay in Antarctica. I had made one banner for Regional Research Laboratory,

Jorhat in Goa and displayed it on the side of the ship. It looked bright and beautiful among the other banners.

SAIL OFF MEETING: SETTING COURSE AT MURMAGAON PORT

It was with great anticipation that we embarked on this expedition to Antarctica. We had been very busy with the preparations for this journey. I observed many of the expedition members on the deck, displaying a mixture of enthusiasm and apprehension. I recalled the courageous explorers who navigated these waters before us, some of whom got perished in their attempt. They encountered numerous perils and difficulties, but they persevered their mission to uncover the secrets of the icy continent. We possessed the same drive and passion for discovery. I experienced a sensation of awe and wonder as I envisioned what lay ahead of us at the end of this vast ocean, the land that Ptolemy named "Antarcticos".

The entire expedition received extensive coverage on national television, with journalists and photographers fully engrossed in their assignments. All members were asked to gather on the port side of the ship, where the Indian and Norwegian national flags proudly waved on Polar Bird. The ship's five massive chimneys continuously released white smoke, indicating its readiness for the expedition. At 6:45 PM, the "Sail off" ceremony commenced. Mr. Premkishore and other acquaintances bid their farewells, and Dr. Mutthunayagam, the Director of ASC, delivered a brief speech.

Welcome by Dr. Mutthunayagam, Secretary, Department of Ocean Development(DoD) just before embarking the ship(left) ; Banner on behalf of Regional Research Laboratory and National Geophysical Research Institute hoisted(Right)

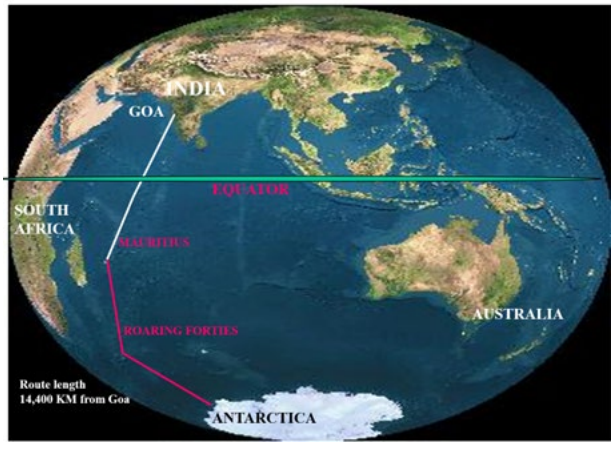
As the ceremony progressed, we were lined up in a queue, one by one having our names announced before boarding the ship and signing the register to confirm our voluntary participation in the expedition. Cheers and excitement filled the air when the

Leader's name was called, but a poignant moment ensued as his young son clung to him, reluctant to let him go. Tears welled up in many eyes under the neon lights, particularly when Major Kadam's wife, holding their two adorable children, couldn't hold back her emotions.

We all stood together on the ship's port side as the wooden stairway connecting land and ship was slowly pulled back on board. The anticipation was palpable; the ship was about to set sail. In that moment, I couldn't help but think of my Mom. Though she couldn't be present, she had been the sole inspiration behind my decision to join this Antarctic expedition. Her absence made me realize how emotional this moment truly was.

EMBARKING ON A NEW ADVENTURE: DEPARTURE FROM GOA MARKS THE BEGINNING OF THE VOYAGE

At 9:42 PM, amidst numerous delays and challenges, the long-awaited moment arrived as Polar Bird finally set sail for Antarctica from Murmagaon port. Given the navigator's unfamiliarity with the region's hydrography, a pilot boat accompanied them into the deep sea. The sky transformed rapidly, displaying a mesmerizing array of colors that stirred a mix of emotions among the crew, who were fully aware of the historical significance of their expedition. A profound sense of pride and patriotism enveloped everyone's heart as they contemplated the daunting research mission ahead in this unforgiving land.



Our route of oceanic travel to reach Antarctica from Goa crossing equator.
The red coloured route was extremely difficult journey

Confidence and determination radiated from their faces, while some members waved fond farewells to their loved ones standing on the shore. The air echoed with the resounding chants of "Vande Mataram; Bharat Mata Ki Jai," adding to the fervor of the moment. As Polar Bird ventured westward in the Arabian sea, the luminous neon lights of Murmagaon port gradually receded, resembling distant stars in the night sky. Within half an hour, they found themselves in the vastness of the deep sea, accompanied only by the twinkling stars that adorned the darkness. The pilot boat bid them farewell, wishing them luck on their extraordinary journey.

GLIMPSING NATURE'S WONDERS: WATCHING FLYING FISH OVER THE ARABIAN SEA

DECEMBER 16

Everything is normal, we found ourselves immersed in an excellent weather. The surroundings were dominated by vast expanses of water, as far as the eye could see. However, the sea surface was not tranquil but rather characterized by heavy swelling. Above, a clear sky boasted a scattering of fluffy white clouds, while a gentle breeze barely whispered its presence. The radiant sun beamed with full intensity, casting a sparkling glow upon the undulating waves. On a calm morning aboard the M.V. Polar Bird, as it sailed through the cerulean expanse of the Bay of Bengal, a group of curious members gathered at the ship's railing, their eyes fixed on the endless horizon. The sun hung low in the sky, casting a warm golden glow over the tranquil waters. As we gazed out over the sea, our anticipation was marked with the excitement of the unknown.

Suddenly, as if nature itself had orchestrated this breathtaking display for us, an astonishing sight unfolded before our eyes. From the depths of the water, a shimmering silver school of flying fish burst forth, their sleek bodies gleaming in the morning sunlight. With a graceful leap, they soared into the open air, their delicate fins outstretched like wings.

In a seamless symphony of motion, the flying fish glided above the water's surface, catching the wind beneath their fins and propelling themselves into the sky. It was as if time had slowed, and the laws of physics bent to accommodate these remarkable creatures. With each leap, they covered distances that defied reason—30, 40, even 50 feet in a single glide. Their shimmering scales caught the sunlight, scattering fragments of color like a trail of stardust.

The spectacle before us was beyond comprehension, defying the limits of our imagination. We watched in awe as the flying fish executed their breathtaking acrobatics, a testament to the beauty and ingenuity of life beneath the waves. The sea and the sky seemed to merge in a dance of nature's creation, and for a moment, we felt like privileged guests in a realm not meant for our terrestrial existence.

As the flying fish continued their aerial ballet, a sense of wonder and humility settled over us. How had these creatures evolved to navigate two distinct worlds with such finesse? Their bodies, perfectly adapted to both water and air, held the secrets of survival in an environment that demanded constant adaptation.

Cameras clicked and whirred as we attempted to capture the magic before us, but the true essence of the experience couldn't be contained within a photograph. It was etched into our memories—a memory of nature's grandeur that would remain vivid even as the years rolled on.

Eventually, as the sun climbed higher in the sky and the flying fish gradually receded back into the depths, we were left with a profound sense of gratitude. Witnessing these enchanting creatures had been a gift, a reminder that there were still mysteries in the world waiting to be discovered, even in an age where technology seemed to have unraveled every secret.

As the M.V. Polar Bird continued its journey through the Arabian sea, our hearts were lighter, our spirits lifted by the memory of those flying fish. We carried their image with us, a symbol of the boundless wonders that awaited those who dared to gaze out over the open sea with a heart full of curiosity.

OPTIMIZING CHARGE DISTRIBUTION STRATEGIES: ONBOARD MANAGEMENT

We were all full of energy and joy as we embarked on this expedition. Among us, there were three women who joined us for the summer: Dr. Girija Rajaram from IIG Mumbai, who was in charge of the academic program; Dr. Kusum Kapila, a medical doctor from AIIMS; and Dr. Manju Mehta, a psychiatrist from AIIMS. Dr. Kapila and Dr. Mehta helped Dr. Kanagamani, a surgeon, and Dr. Nag, a medicine specialist from Indian Railway, to set up the MI room of the ship. Everyone had a role to play: Dr. Saran from NIO Goa and Dr. Kapila took care of the kitchenettes; Dr. M.P Gaur from GSI, Faridabad and Dr. S. Dutta from SASE, Manali handled the galley duty; Captain Venkatesh and I managed the books library; and Dr. Praveen Kumar Srivastava from SASE, Manali looked

after the video library. Dr. Srivastava had a hearing problem in his left ear, so we had to speak louder or face his right ear when we talked to him. Lieutenant Commodore Puttur from Indian Navy suffered from a toothache that could not be treated, as we had no dentist with us. Some of us also experienced sea sickness and stayed in bed with frequent vomiting and ORS intake. Dr. Nag was the worst affected, as he could not keep anything in stomach. I also felt sea sickness, but not as much as him. I had no appetite and felt nauseous with a tendency to vomit.

CHARTING UNCHARTED WATERS: A VOYAGE TOWARD THE UNKNOWN DESTINATION

What a thrilling sight it was to witness two ships sailing past our M/V Polar Bird in the evening! One of them was so huge that it dwarfed our vessel by four times. The control room informed us that it was cruising at a speed of 20 knots, while we were moving at a modest 9 knots. I was lucky to have a binocular that my second elder brother had gifted me, but I shared it with others who were eager to see the ships more closely. We gathered on the C-Deck and enjoyed the splendid view of the front and the sides of our ship. As one of the ships came nearer, I joined Dr. Krishnamurthy from IMD, Pune at the bow and we engaged in a philosophical conversation about the origin and meaning of life. The ship was clearly visible from a distance of 2-3 km and we could see its details. The sun was setting fast in the west and we bid farewell to the ship as it headed to its unknown destination.

Logo of IMD for the expedition

SAILING INTO KNOWLEDGE: INAUGURATING THE ONBOARD LIBRARY

DECEMBER 17

I was so excited to watch a movie after lunch with Kh Gajanand and Mr. Bhaskar. My roommates, Mr. Lal and Mr. Krishnamurthy, decided to take a nap instead. They missed out on the thrilling action of Mission Impossible starring Tom Cruise. It was such a fun way to spend the afternoon. But the best part was yet to come. Captain Venkatesh announced that the library was ready to be inaugurated at 4:30pm. I had helped Mr. Bhaskar prepare the list of books and journals for the library, so I was eager to see the result of our hard work. We had brought hundreds of new books for the Maitri station. Everyone gathered for the inauguration ceremony. Prof. Girija Rajaram was the one who cut the ribbon and opened the library. She praised our effort and encouraged everyone to make use of the library as much as possible. I felt proud and happy to be part of this project.

ACADEMIA LECTURES - HYDROGRAPHY BY LIEUTENANT COMMANDER J. J. PUTTUR INDIAN NAVY

The lecture on hydrography, delivered by Lieutenant Commander J. J. Puttur, proved to be an eye-opening experience that left an indelible mark on me. As I sat among fellow expedition members, I boarded on a journey into the fascinating world of hydrography, a domain that was previously a mystery to me.

Lt. Commander Puttur began by emphasizing the paramount importance of hydrography in a multitude of fields. He skillfully unveiled the challenges hydrographers face while endeavoring to map the intricate and enigmatic ocean floor. Through captivating visuals and clear explanations, he elucidated the various sounding methods employed to uncover the secrets hidden beneath the ocean's surface.

One of the most enlightening moments of the lecture was when Lt. Commander Puttur explored into the art of interpreting hydrographic charts. He revealed how these meticulously crafted charts, filled with intricate details, were essential tools for mariners, scientists, and policymakers alike.

The lecture continued to captivate as Lt. Commander Puttur shared the remarkable work of his dedicated team members. He showcased contour maps that his team had painstakingly created, showcasing the intricate measurements of various sea parameters such as current patterns, depths and temperatures all obtained during their voyages across the vast ocean.

As the lecture concluded, I couldn't help but feel a profound sense of admiration for the hydrographers and their vital contributions to our understanding of the world beneath the waves.

The M/V Polar bird was stranded on the equator at 1:15 a.m. local standard time. The night was pitch-black, except for the light from the ship that reflected on the sea waves. The ship was rocking and swaying, but not too much to interfere with the experiment. Dr. Saran from NIO Goa and Captain Mani from Indian Navy were ready to measure the sea surface temperature. They asked a crew member to lower a rope with their measuring instrument attached to it. I was there with Mr. Dutta, Pawan Hans Engineers, and Mr. Kamal Sharma from Survey of India, watching their progress. The instrument had a transmitter that sent data to a laptop on board. As it descended to the ocean floor, 500 meters below, we could see the graph of depth versus temperature on the laptop screen. The data was also stored in the computer hard disk.

STARRY HORIZONS: OBSERVING THE NIGHT SKY FROM THE SHIP'S DECK

The ship was rolling and pitching with wave of the sea. We were in the middle of the night, surrounded by the dark and mysterious water. The sky was clear and I could see the Orion constellation shining above us. Suddenly, I heard a voice from the bridge. It was the navigation officer, calling for Dr. Saran. He wanted to know how his experiment was going. The crew members were standing by the roller, ready to pull up the instrument. They were waiting for Dr. Saran's signal. The front of the ship was dimly lit. Dr. Saran was having trouble locating and retrieving the instrument. Mr. Kamal Sharma saw his struggle and decided to help. He climbed up the side wall of the ship and leaned over the water. He told me to hold his feet firmly so he wouldn't fall. I grabbed his feet and pushed them down with all my strength. I wanted to make sure he was safe. Later, when I thought about that night, I realized how risky our action was. We could have jeopardized the whole expedition. I stayed outside until 3:00am that night.

BREAKING NEWS AT SEA: ONBOARD COMMUNICATION FACILITY REPORTS U.S. INVASION OF IRAQ

As we sat down for breakfast, Dr. Girija Rajaram told us that the US and its allies had invaded Iraq and toppled Saddam Hussein's regime. His daughter, who lived in Bahrain, was very worried about her and our journey. She had heard about the sea mines that had been planted under the Indian Ocean basin and the possible threat to our ship. The communication system on board was fast and efficient. The ship was connected with GPS

and was being tracked by it. The route was predetermined. Only one navigation officer was in charge of the whole control room at the bridge. The GPS module showed the exact position of the ship with latitude, longitude and altitude. The ship had satellite fax, satellite phone and HF communication modules. Anyone on board could use these facilities to communicate with anywhere in the world. If something went wrong with the ship, it could be immediately reported to the rest of the world. There were two radars in the control room that could detect any object around the ship within a radius of 20 km. The bridge was like a control tower of an airport. Big glass windows covered the front, left and right sides. From the control room we could see the exact location of the ship, its speed, how much distance it had covered in total, the meteorological parameters and the hydrography chart. Mr. Krishnamurty collected daily routine meteorological data from here.

NAVIGATING THE FROZEN FRONTIER: INSIDE THE BRIDGE OF THE M V POLAR BIRD, AN ICEBREAKER CLASS SHIP

The M V Polar Bird had a diverse crew from different countries, but only a few Norwegians. The captain, two navigation officers and a sailor were the only ones from Norway. The rest came from Malaysia, Turkey, Bolivia, Sri Lanka and India. One of them was Mr. Vinod, an Indian engineer who worked tirelessly on the ship's engine. He was always quiet and composed, but also confident. We didn't get to know him well, unlike the others who shared their stories and experiences of the sea with us. They had a profound wisdom that matched the great philosophers. The crew members had to work in shifts of 12 hours each, taking care of various aspects of the ship such as the generator, the engine, the piston ballast, the satellite terminal, the radar, the communication system and the central warning system. These were all monitored from the bridge, the control room of the ship. Any lapse in attention could lead to a serious disaster in the middle of the ocean. I became friends with Thura, one of the navigation officers, who liked to play table tennis with us. I often spent time with him in the bridge when he was on duty.

The ship's passage, hydrography, and cyclone alerts were constantly tracked by various advanced instruments. One of them was the global positioning system or GPS. This device gave us the exact coordinates of the ship's location with six decimal places. GPS made the ship's navigation easier and safer. The officer could pre-program the route and the ship would follow it automatically. If a cyclone was detected, the officer could alter the course to avoid it.

The availability of instruments associated to the bridge were as follows: -

Instruments and its capability

1. GPS – To estimate the location of the ship
2. Radar - To determine the location of cyclone and iceberg along with its velocity
3. Sonar Scanner – To measure depth of the sea through sounding
4. Barometer – to measure the atmospheric pressure
5. Humidity meter – to measure relative humidity
6. Thermometer – to measure the ambient temperature of sea
7. Hydrography chart – a detailed description of depth of seabed, direction of flow of water and it velocity.
8. Speedometer – to determine the velocity of the ship 1 knot=1.82km per hour
9. Manoeuvring wheel - to change the direction of the wheel
10. Fax machine
11. Telex machine
12. Genset status meter – to monitor the workability of generator
13. Anemometer – to measure the velocity of the wind and direction

The Bridge was equipped with various computer screens of different sizes, showing important information for navigation. Two large Radar screens constantly scanned the surroundings within a range of 8 kilometres, alerting the Navigation Officer of any potential hazards such as icebergs or tornados. The speed and direction of these threats could be calculated from the Radar data and used to adjust the ship's course accordingly. The Bridge also received weather charts every four hours via fax, indicating the areas of low and high pressure. The ship was a hive of activity, with everyone working on their assigned tasks. Some of our members even started their projects during the voyage. It was the third day since we left Goa.

M V Polar Bird was a part of Indian Scientific Expedition to Antarctica three times till our expedition. It was a ice breaker class ship which had the capability to break five feet high span of ice layer. The ship was equipped with four lifting cranes each weigh 20 tons. Ground clearance on the deck was sufficient enough for accommodating landing of two helicopters at a time. It had 57 numbers of cabins having a length of 112 meters and width of 20meters. Apart from Antarctica, its movement was restricted to Arctic and Greenland only. It had an 18 cylinders single engine with a horsepower of 8000. The average speed of the ship was around 9 knot ie. 16km per hour. In last 24 hours it had crossed almost 348 kilometers which is around three and half degree latitudes (1 degree =111km). Eight Piston ballast were fitted in both the sides which controlled the balance of the ship.

EQUATORIAL CROSSING AND CORONATION: A MARITIME RITE OF PASSAGE

DECEMBER 19

As we sailed closer to the equator, the local time gradually fell behind the Indian standard time (IST) by more than half an hour. On the fourth day of our voyage, we reached the latitude of two degrees north. It was 1:15 AM local time on December 19th when we crossed the equator - the imaginary line that separates the northern and southern hemispheres. This was a proud moment for me and other sailors on board. I stayed awake to witness this event and joined some others on the deck. The wind was strong and the night was dark. Our ship, M V Polar Bird, was anchored at the hottest region of the world. Dr. Arvind Saran from NOI-Goa and Captain Mani from Indian Navy were ready to start their investigations from this point onwards, so the ship had to stop. The weather was clear but the ship was rocking and tilting slightly. I looked up and saw the Orion constellation in the clear sky. Dr. Saran and Captain Mani began their work at the front of the ship, also known as the bow area. I went with Mr. Dutta, Mr. Verma from Pawan Hans, and Mr. Kamal Sharma from Survey of India to observe their activities. They finished their work in about an hour and then we returned to our cabins. From now on, the ship would stop at every one-degree interval we crossed.

18th Indian Scientific Expedition members while crossing equator. Among them, 30 members were summer expedition members and 26 members were wintering over member.

The coronation ceremony is a rite of passage for sailors who cross the equator for the first time. It symbolizes their transition from pollywogs (novices) to shellbacks (veterans). We had to participate in this ceremony when we crossed the equator in the early morning hours of December 19th. It involved taking a holy dip into the waters of the Southern Ocean to wash away any sins committed in the northern hemisphere. We were not aware of this event until it happened.

Back in the day, when sailors from the north crossed the equator, they thought they were hot stuff. They had to face the wrath of King Neptune, who ruled the south with an iron fist. He would hold a kangaroo court on the ship, where he would accuse the newbies of all kinds of crimes and dish out hilarious punishments. The idea was to make them squeaky clean and ready for the southern adventure. One fine morning, we got a royal invitation to join the party at 11AM on the deck. We had no clue what was going on. We showed up at the deck with butterflies in our stomachs and saw Mr. Gaur from the Rock Squad dressed up as King Neptune, with a fake beard and a tin foil crown. He had Dr. Saran as his sidekick, who looked like a clown. Dr. Gupta was the bouncer, who had taken off his shirt and was waving a big stick around. He whacked us lightly and told us to sit in a line on the deck. We didn't dare to argue. We also spotted a tiny pool on the deck, filled with water from the south pole.

One by one, we bowed before King Neptune as we crossed the equator. The ritual required us to kneel and hold our ears while he interrogated us. He asked us various questions about our lives, our goals, and our sins in the northern hemisphere. We had to answer truthfully or face his wrath. He also gave us some advice on how to behave in the southern hemisphere. His final question was always the same: "Have you any sin in the northern hemisphere?" He did not wait for our reply, but ordered us to plunge into the pool. Some of us jumped willingly, others hesitated and were pushed.

The climax came when a group of us grabbed our leader Ajay and dragged him into the water. He was not amused. We watched the scene from a distance, but soon we were caught by Dr. Gupta and his accomplices. They roped us and brought us back to King Neptune. Our punishment was doubled for trying to escape. We had no choice but to dive again. Under the bright sun, on the vast expanse of the Indian Ocean, King Neptune crowned us all as his loyal subjects. He had forgiven us for all our sins in the northern hemisphere and welcomed us to the southern hemisphere. It was a wonderful feeling that filled us with joy. In the evening, the captain of the ship threw a party for us and gave us a certificate in French to commemorate our equator crossing.

The English translation of the same was as follows: -

We Neptune ruler of all Oceans, Lakes and Rivers, Ponds and Water holes, hereby declare that the honorable:

Name Dr. S. Barua

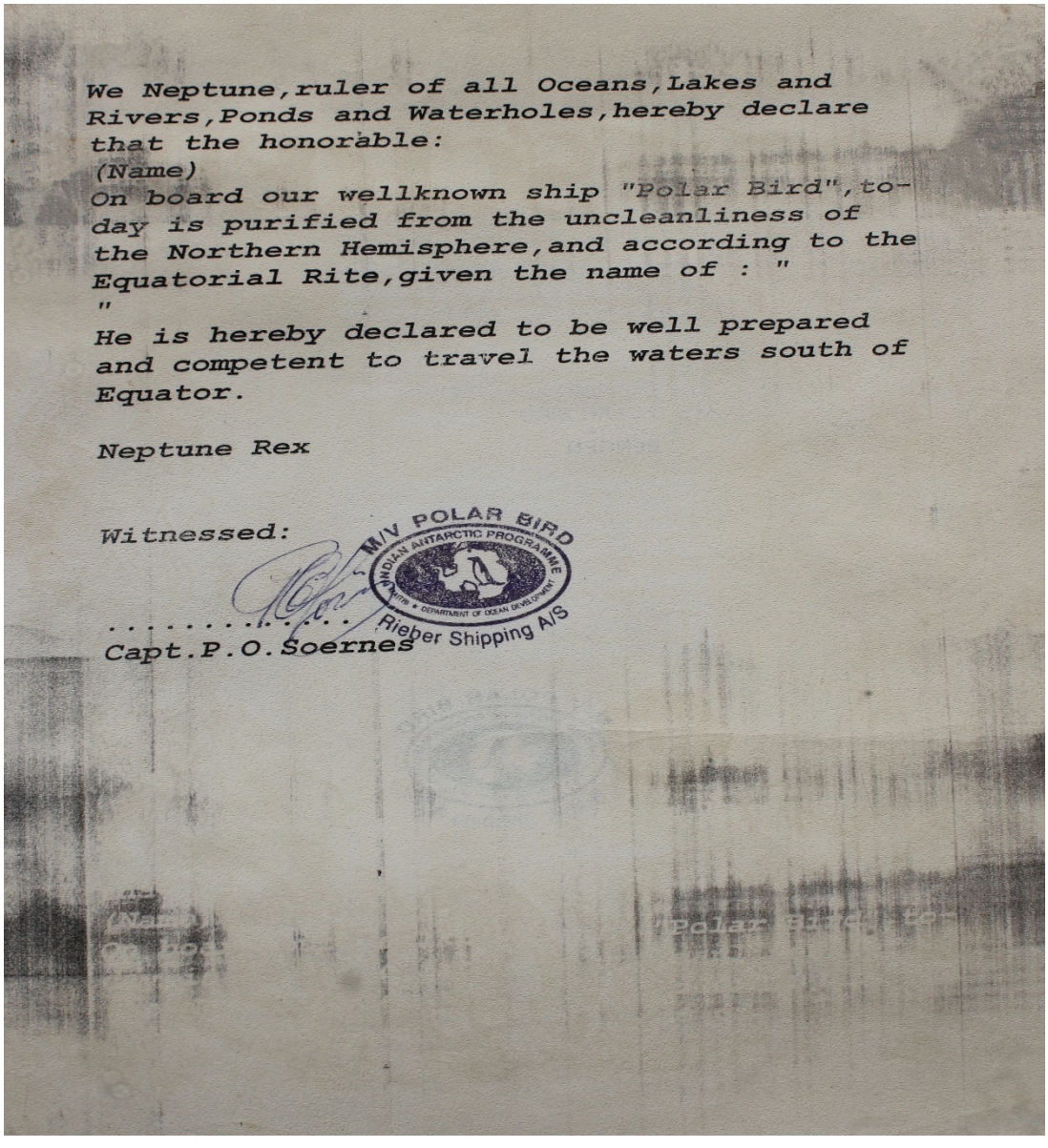
On board our well-known ship "Polar Bird" today is purified from the uncleanliness of the Northern Hemisphere and according to the Equatorial Rite, given the name of "Blue Whale". He is hereby declared to be well prepared and competent to travel the waters south of equator.

Neptune Rex
Witnessed
Capt. P. O. Seeones
M/V Polar Bird
Rieber Shipping Agency, Norway

The party was a lively affair, with each member assigned a name based on an oceanic fish or animal. The buffet table offered a variety of European dishes and beverages, catering to different tastes and preferences. The captain of M V Polar Bird gave a short speech, highlighting the ship's role in the Indian Antarctic Expedition. He expressed his hope for a successful outcome of the mission and thanked everyone for their participation. The festivities continued until midnight, as the members enjoyed themselves in the middle of the sea, forgetting the hardships and loneliness of their journey.

Certificate of equator crossing offered by Captain, M/V Polar Bird

We were the only ship in this oceanic world, exploring the horizon where no one else dared to go. I left the party in the lounge and stepped out to the star boat side, where the night sky was clear and bright. The ship's light cast a glow on the huge waves around us.



The English version of the Certificate

Dr. Baburaj, a researcher from Defense Institute for Physiology and Allied Science (DIPAS), had a very busy schedule during the expedition. He wanted to collect the physiological data of each member of the team. We became his subjects for the experiment. He attached many probes to our bodies, from head to toe, in a clinical room where we had to lie down on a bed. He measured various parameters such as body

temperature, heartbeat, pressure, and so on. The whole process took about an hour for each person. He told us that he would repeat this data collection in Maitri as well.

We sailed to the south of the Indian Ocean, where we saw no change between the waters above and below. They seemed identical to us, but the researchers told us that there was a huge difference between these two oceans. The Circumpolar wind and current started from here, influencing the oceanic water near Antarctica. The wind forced the water to go east, making a powerful east-west flow. This also made the cold water near Antarctica blend with the hot water of the southern hemisphere in the center of the ocean. The outcome was a rough and wavy ocean that tested our sailing abilities. We had lost sight of land for days, and we felt dull and impatient on board. The same schedule and work setting made us annoyed. How many times could we admire the sunrise and sunset on the horizon?

EXPLORING THE DEEP: DR. SARAN'S ONBOARD ACADEMIC LECTURE FROM NIO GOA

DECEMBER 22

Dr. Saran, a distinguished marine biologist hailing from the prestigious CSIR National Institute of Oceanography (NIO) in Goa, graced our academic gathering with his profound knowledge and expertise.

During his enchanting lecture, Dr. Saran explored into the intricate world of oceanography, specifically focusing on the variation of sea temperature at different depths. He skillfully guided us through the process of creating a contour map, illustrating how this invaluable tool helps scientists understand the complexities of oceanic temperature distribution.

As the lecture continued, Dr. Saran expanded our horizons by explaining the profound impact of temperature and hydrostatic pressure on sound propagation underwater.

To measure these critical variables, Dr. Saran introduced us to the world of Eco-sounding, a technique that has revolutionized underwater research. With eloquence and precision, he described how this technology enables scientists to collect crucial data about our oceans, unlocking the secrets hidden beneath the waves.

Dr. Saran's lecture left us in admiration of the vastness of marine science and humbled by the depth of his knowledge. As he concluded his presentation, the room erupted in

enthusiastic applause, a fitting tribute to the brilliant mind and inspiring educator who had just illuminated our understanding of the world beneath the surface of the sea.

UNDER THE STARLIT SKY: ARRIVAL IN PORT LOUIS, MAURITIUS AT 2 AM

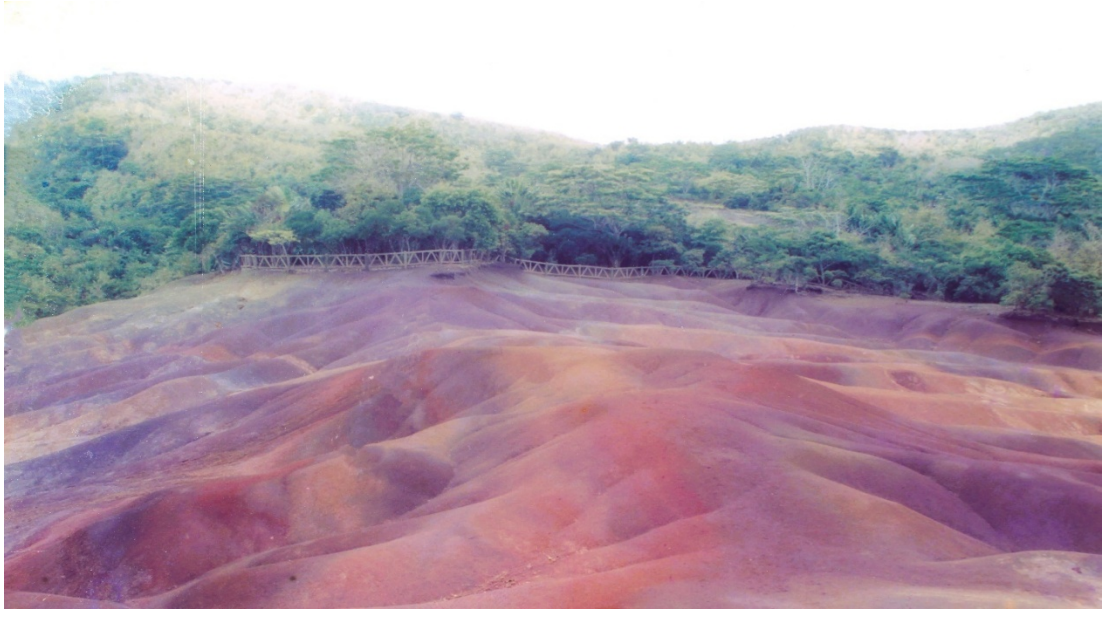
DECEMBER 23

At 2:00 AM, we finally arrived in Mauritius. Our ship had to wait outside the port of Port Louis, as there was no space for us to dock. We had been sailing for 10 days without seeing land, so we were eager to catch a glimpse of the city. We went to the C-deck of the ship and admired the neon lights that illuminated the night. We returned to our cabin by 3:00 AM, feeling excited and tired.

I woke up at 6:00AM and quickly washed my face before heading to C-deck. I could see the scenic mountains and the port of Mauritius clearly. A small boat was approaching our ship. It was a "Pilot boat" that would guide our ship to the port to anchor. We finally reached Port Louis, a new and free port built by a Korean company. Many ships from Europe, South Africa and Asia visit this port for refuelling and provisioning, as there is no tax for entry. To the east of Port Louis, there was another port that charged tax for entry.

Mauritius is an island that originated from the Ho Volcano. It covers an area of about 1002.5 square kilometres and has a population of around one million people. More than half of the population is of Indian origin. The port was bustling with activity when the ship arrived. Various cars came to pick up the crew members who quickly dispersed. The cranes began to upload and unload the items that were procured for the expedition. Among them were two Chetak helicopters that the Indian Navy had sent to the Mauritius government. The helicopters were lifted from the hold and carefully placed on the port. The pilots were already waiting and they flew away with the helicopters as soon as possible.

Mauritius is a stunning country with well-planned infrastructure and diverse attractions. Geologists will find many places of interest, such as volcanic formations, coral reefs and mineral deposits. Tourism is the main source of income for the country, followed by sugar cane farming.

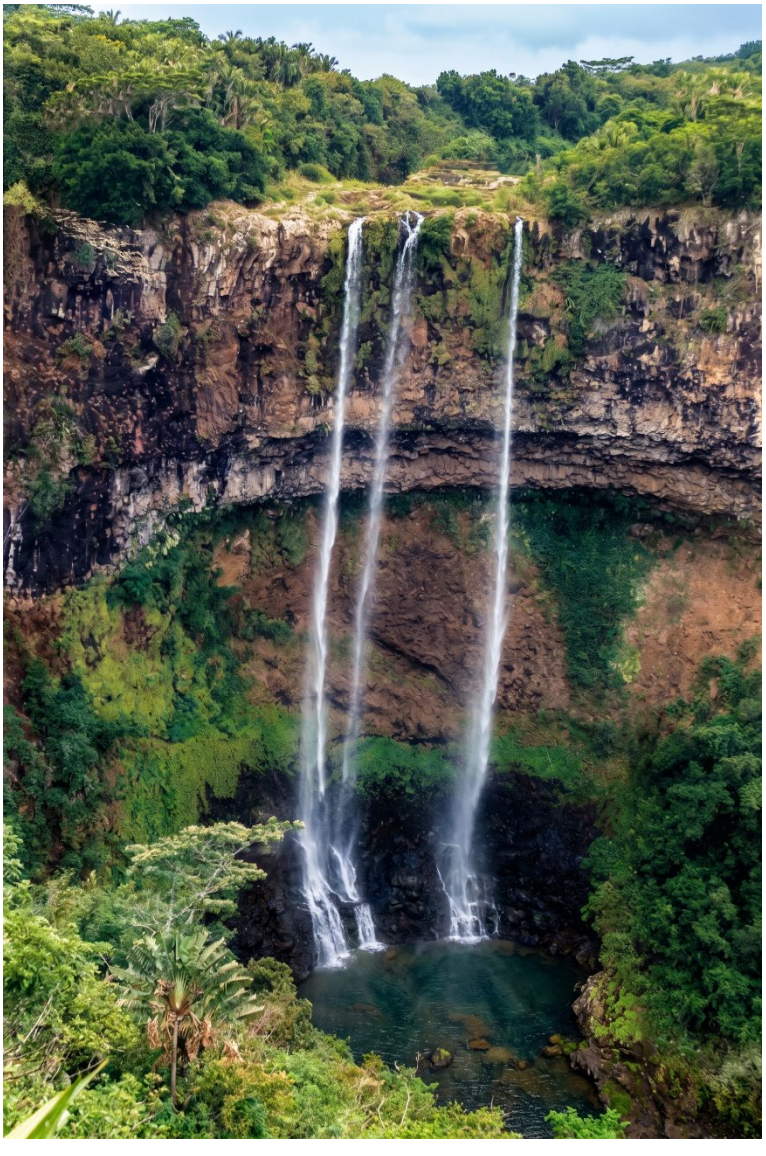


The seven Colored Earths are a geological formation and prominent tourist attraction found in the Chamarel plain of the Rivière Noire District in south-western Mauritius. It is a relatively small area of sand dunes comprising sand of seven distinct colors.

Many of the sugar cane farmers are of Indian origin, descendants of indentured labourers who came from Bihar, Uttar Pradesh, Bengal and Tamil Nadu during the colonial era. After Mauritius gained independence from Britain, they became landowners and entrepreneurs. They have a deep respect for Indian culture and most of them speak Hindi. The official languages are French, English and Creole. The physical appearance of most Mauritians resembles that of Goans. I met a crane operator and tried to strike a conversation with him. He greeted me in Hindi and I felt pleasantly surprised and at home. He told me that he used to speak French at home and that his ancestors came from Chandigarh, Punjab. He said that Mauritius had a high per capita income and a prosperous economy.

I had a wonderful time exploring Port Louis, the capital city of Mauritius, thanks to the Indian Embassy. They arranged two buses for us to visit different places in the afternoon. I quickly got on one of the buses and found a seat in the back. Our first stop was the Bank of Mauritius, where I exchanged some dollars for Mauritian rupees. Then we headed to a large shopping mall with many shops and products from different parts of the world. It was very festive and lively, as many tourists were buying gifts and souvenirs for Christmas. I saw some beautiful showpieces made of glass and light, but I did not buy

anything. Instead, I decided to use my money to call my mom and tell her about my trip. She was happy to hear from me and asked me to enjoy myself. After that, we went to the waterfront, where we saw many yachts sailing to other scenic places like Quepep, Rosehill and Victoria. I wished I could go there too, but I was already very satisfied with what I had seen and experienced.



Chamarel Waterfall, located in the southwest reaches of the Mauritiaus, is the nation's highest waterfall. Its thundering waters plunge some 300 feet (100 meters) into crystal clear pools,

A LEADER'S SPECIAL DAY: BIRTHDAY CELEBRATION AND BEYOND

DECEMBER 25

We visited many attractions in Mauritius.We saw the Botanical Garden, where the giant lily was impressive. We also went to a dormant volcano crater that was filled with green plants. We enjoyed the underwater walking experience at a beach. We returned to the port by 7:30PM and celebrated our leader Ajay's birthday. He cut a huge multi-layered cake on the deck of Polar Bird, surrounded by sixty members. We cheered for him under the starry sky of Port Louis. The ship looked beautiful with lights.

JOURNEY TO THE FROZEN CONTINENT: M V POLAR BIRD SETS COURSE FOR ANTARCTICA THROUGH NO RESCUE ZONE

DECEMBER 26

We stocked up on fresh vegetables, food items, fish and meat and stored them in deep freezers. One of them broke down due to overloading, causing anxiety among Captain, Leader and others. We urgently called for a mechanic and waited for 10 hours to fix it. Some people used this time to explore and shop around. Our departure from Mauritius was postponed by more than half a day. Leader Dhar announced that we would leave at 10:30PM and start our final leg of the journey to Antarctica. The ship sailed into the dark sea around 11:00PM, leaving behind the port lights. The familiar rolling and pitching resumed - nothing new for us. Nobody was on deck. I felt irritated in my sleep. I had mixed feelings of pain and joy, as I was going to spend almost 14 months in that unfamiliar continent. In two weeks, I would reach the snowy ice desert, where I had to face extreme cold, blizzards, six-month nights and six-month days, and conduct research for Antarctic science. It was a big challenge ahead of me. I don't know when I fell asleep. When I woke up, I saw the same scenery: water, water and water only. The ship was heading towards an unknown territory. I felt a slight psychological strain, wondering if I could adapt to human civilization again after sixteen months.

We had two peaceful days on the Southern Ocean, with calm and normal conditions. Most of the members enjoyed their meals in the dining hall, while some of us gathered on the deck after dinner. We had lively conversations on various topics, from politics and science to future plans. The stars shone brightly in the dark sky. Dr. Pradip Kumar, a biologist from Roorkee University, had a keen interest in astrophysics. He pointed out the southern cross, the morning star, and other celestial objects. We were surrounded by water,

endless amounts of oceanic water, as the Polar bird sailed towards an unknown destination. No other ships crossed our path. We were alone on our journey. The lights from the cabins and the bridge reflected on the huge waves that crashed against the ship with a loud noise and splashed away. It was a mesmerizing sight to watch for a long time.

We encountered no other vessel after departing from Mauritius. At latitude 37 degrees south, we spotted a distant ship on our course. The navigator hailed the ship and exchanged polite greetings. The ship was a cargo vessel travelling from South Africa to Sri Lanka. Few ships take this route because of the swell waves. We had no choice but to brave those waves. We wanted to take the shortest possible route. The ocean grew more violent as we sailed on. The ship was rocked by the massive swell waves. The seawater splashed over the deck. It was hard to keep our balance. The bottles on the dining tables swung back and forth like pendulums. The kitchen was in chaos. The soup that was prepared for the crew spilled from the pot on the hotplate and flooded the floor. I asked Thura how bad it was, he answered with a grim face "It will get worse ahead". We were approaching the roaring forties.

The ship M V Polar Bird was in a no rescue zone, where no one would help us if we faced any trouble. Only expeditioners like us dared to venture this way, and now we knew why. The crew members were busy securing the containers on the deck with chains, making sure they were fastened at all four corners. They had to tighten the chains that had become loose. They wanted to finish everything before we reached the roaring forties, where the winds and waves were fierce. No one was allowed to go outside except for the crew who had to do regular maintenance. The Bridge kept announcing safety precautions for us to follow in our cabins. Some of us were suffering from sea sickness, especially Dr. Nag and Pandkar. But we did not stop our routine activities, such as attending on-board lectures and conducting investigations. Meanwhile, the radar detected a large depression that signaled a possible cyclone. The captain of the ship looked worried. He decided to change the course of the ship after a lot of deliberation. The navigation officer steered the ship away from the cyclone, avoiding the danger by travelling almost 200 kilometres away.

The roaring forties were getting closer, as we could tell from the dimension of swell wave. A few of us, who had a bit of a wild streak, sneaked to the Bridge to get a better view of the waves. The Captain was not happy about this and told the Leader to sort us out. The Leader called us all together and gave us a stern lecture about the rules. The Bridge was forbidden to anyone but the Leader and the Iceberg observer until we got to sixty degrees south latitude. We also had to stay off the deck, so we were stuck in our

cabins most of the time. To make things more fun, the Leader set up a table tennis and badminton competition in the hold. It was a nice way to cheer us up and keep us fit during this kind of risky expedition.

NAVIGATING THE TEMPEST: A JOURNEY THROUGH TURMOIL IN THE SOUTHERN OCEAN

DECEMBER 31

Polar Bird was sailing through the middle section of its journey towards the roaring forties. The main cause of the roughness in this part of the Southern Ocean was the strong wind. The equatorial region had a high temperature, which created a low-pressure zone that stretched up to forty degrees south latitude. In contrast, the air in the southern hemisphere was cold and dense, forming a high-pressure area. The pressure difference made the air flow from the equator to the Antarctic region. As a result, the atmosphere was mostly turbulent, generating huge waves. The warm equatorial air mixed with the cold Antarctic air between forty- and sixty-degrees south latitude. This explained why this specific region had rain, storms and unpredictable weather all year round. That was why the routes in the southern latitude were called the roaring forty, furious fifty and screaming sixty.

In the afternoon, I saw some crew members working on the deck. The ship was rocking and rolling violently. Despite that, they were securing wire fences around the deck, carefully attaching them to fixed iron masts. All these were preparations for the New Year's Eve celebration.

SAILING THROUGH THE ROARING FORTIES: A MARITIME ADVENTURE

JANUARY 1

We celebrated the New Year's Eve with great joy and enthusiasm. The next morning, we crossed the 40th parallel south, also known as the roaring forties, around 6:00 AM. We were too tired to get up early, but we had a special surprise waiting for us. Two of our R & D Engineers had designed a T-Shirt to commemorate our Antarctic expedition. We were thrilled to receive this gift and decided to take a group photo wearing it. We gathered on the deck, holding hands and smiling, while the ship was rocking and rolling. It was a memorable moment for all of us.

Interaction with Category II wave expanse of Indian Ocean. Huge swell waves are seen.

By evening, the sea became rough and stormy. We were caught in a deep depression that covered the whole region. The sky was dark and ominous, and the rain poured down with thunder and lightning. It seemed like the ocean was angry at us. The navigation officer said we were in a very dangerous situation, facing the third-degree status of the sea. I saw the front of the ship, or the bow, plunging into the huge waves and emerging with water splashing over it. It was a terrible struggle between the ship and the sea. I heard the captain yelling something, but I couldn't make out what he said. The dining hall was deserted, as no one could stand upright without holding on to something. I guessed they had received some warning that I missed. I hurried to my cabin and found Mr Lal and Mr Krishnamurthy in bed, strapped with safety belts to prevent them from falling. I told them what I saw outside, but they didn't say anything. We stayed awake for a long time, feeling the ship rocking and rolling. It was the most frightening experience of my life.

SAILING ROUTE OF 18TH INDIAN ANTARCTICA EXPEDITION

Name of the ship (Icebreaker class): M.V Polar Birds

Position of Route, Goa to Antarctica

Date (Time) /UTC	Latitude	Longitude		Date (UTC)	Lat.	Long.
14.12.98(1920IST)	15°22' N	73°44' E		28.12.98 (00)	27°07' S	53°20' E
15.12.98 (00UTC)	13°46' N	72°57' E		-------II----- (03) -------II----- (12)	27°24' S 29°15' S	53°06' E 52°07' E
-------II----(12UTC)	12°00' N	72°21' E		29.12.98 (00)	29°23' S	52°02' E
16.12.98 (00)	11°00' N	71°34' E		-------II----- (03) -------II----- (12)	29°23' S 30°00' S	52°02' E 51°24' E
-------II----- (12)	01°00' N	71°04' E		30.12.98 (00)	32°09' S	50°21' E
17.12.98 (00)	07°06' N	69°18' E		-------II----- (03) -------II----- (12)	32°42' S 33°24' S	50°00' E 49°24' E
-------II------ (12)	05°12' N	68°24' E		31.12.98 (00)	35°18' S	48°23' E
18.12.98 (00)	03°12' N	67°27' E		-------II----- (03) -------II----- (12)	35°06' S 36°54' S	48°06' E 47°18' E
-------II-----(12)	01°18' N	67°06' E				
18.12.98(21.30 UTC) 19.12.98(0200 IST)	00°00' N Equator cross	66°28' E		1.1.1999 (00)	38°54' S	45°48' E
19.12.98 (00)	00°31' S	66°15' E		-------II----- (03) -------II----- (12)	39°30' S 40°48' S	45°18' E 44°06' E
-------II-------(12)	02°18' S	65°20' E		2.1.99 (00)	42°44' S	42°15' E
20.12.98 (00)	04°31' S	64°27' E		-------II----- (03) -------II----- (12)	43°10' S 44°18' S	41°49' E 40°42' E
-------II-------(12)	06°06' S	63°33' E		3.1.99 (00)	46°00' S	38°54' E
21.12.98 (00)	08°12' S	62°32' E		-------II----- (03) -------II----- (12)	46°24' S 47°30' S	38°36' E 37°36' E
-------II-------(12)	10°06' S	61°12' E		4.1.98 (00)	49°06' S	36°12' E
22.12.98 (00~~Z~~)	12°12' S	60°45' E		-------II----- (03) -------II----- (12)	49°30' S 50°42' S	35°48' E 34°42' E

-------II-------(12)	14°24' S	59°48' E				
23.12.98 (00)	16°30' S	58°50' E				
-------II-------(03) -------II-------(12)	16°54' S 18°24' S	58°48' E 58°12' E				
Stay at Mauritius 24.12.98 to 25.12.98						
26.12.98 (09)	20°24' S	57°00' E				
-------II-------(12)	21°24' S	55°42' E				
27.12.98 (00)	23°35' S	55°30' E				
-------II-------(03) -------II-------(12)	24°00' S 25°38' S	55°15' E 54°17' E				

JANUARY 1

Happy New Year to everyone who reads this write up. I want to share with you my experience of celebrating the new year on a ship in the Indian Ocean. We had an excellent new year eve yesterday on the deck of the MV Polar Bird. The sky was somewhat cloudy and a heavy wind breeze sustained. The deck was enlightened by two search lights, while the darkness surrounded us on all sides. The MV Polar Bird and its crew members, along with we expeditionar, were sailing along this challenging path of the ocean. During the celebration, the crew members also joined with us. I did not adjust my clock to the local time, so I was still following the Indian standard time. I wondered what my family and friends were doing in India. I missed them a lot, especially my mother. The sky cleared up later and we could see the full moon shining on the water surface. It looked like a silvery coating on the waves that were tossing up and down. The deck was more cheerful with the rhythm of Daler Mehendi's song. All of us danced and enjoyed ourselves. I had a cocktail of Coca Cola and Champagne, which was offered by the ship captain. I stayed on deck until around 1 AM local time, when it was around 4 AM in India.

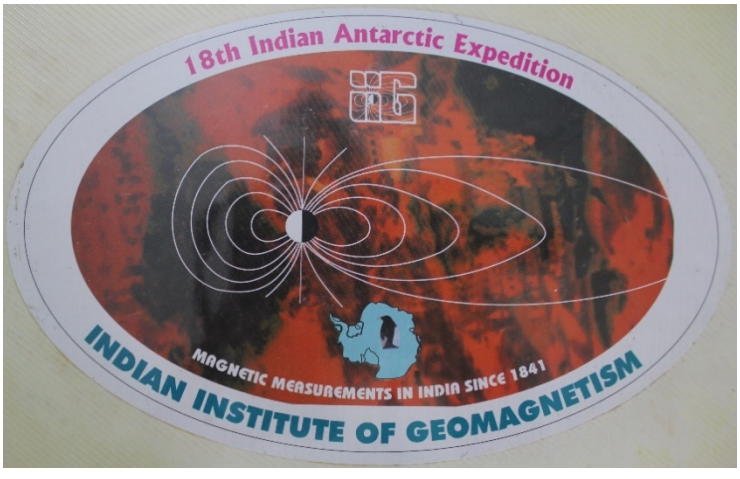
EXPLORING THE EARTH'S MAGNETIC FIELD: A TALK BY PROF. GIRIJA FROM IIG MUMBAI

JANUARY 2

Today's lecture was a spellbinding journey into the world of geomagnetic research, as delivered by the renowned Prof. Girija Rajaram from the esteemed Indian Institute of

Geomagnetism (IIG) in Mumbai. The lecture hall buzzed with anticipation as eager expedition members gathered to absorb the wealth of knowledge she was about to share.

As Prof. Rajaram began her presentation, it became evident that her expertise in geomagnetism was unparalleled. She effortlessly explained the intricate physics behind this field of study, unraveling the mysteries of Earth's magnetic forces that have fascinated scientists for generations.



Logo of IIG-Mumbai

A highlight of her lecture was the revelation of IIG's groundbreaking projects in Antarctica. Prof. Rajaram, accompanied by our esteemed Expedition Leader, Mr. Ajay Dhar, shed light on the fascinating endeavors they had undertaken in the frozen expanse of the southernmost continent.

What struck me most was Prof. Rajaram's unwavering dedication and passion for her work. Despite the constant motion of the ship we were on, she delivered her talk with remarkable confidence and enthusiasm, captivating us with every word. After the lecture concluded, the room erupted in applause, a testament to the profound impact Prof. Rajaram's insights had on all of us.

UNVEILING THE MYSTERIES OF THE INDIAN OCEAN'S LOW-PRESSURE ZONE AND MASSIVE SWELL WAVES

We had an amazing adventure as we sailed through a low-pressure zone. The ship was rocking and rolling so much that it was hard to do anything. The night was dark and mysterious, with only the water and the huge waves around us. Some brave birds were still

flying and following our ship, M V Polar Bird. There were two seagulls and some small black birds that glided with the wind, while others rested on the water. I was curious about the names of the birds, so I asked Dr. Z. Hussain Saab, a Zoologist from Zoological Survey of India. He was very kind and explained to me not only the names but also the zoological details of the birds. I learned so much from him. Then I went to my cabin and lay down on my bed. Suddenly, I heard a knock on my door. I got up and opened it, and saw Major Kadam of Indian Army. He invited me to join him on the deck. I quickly got ready and followed him. He was in charge of the logistics operations of the expedition. We wanted to see the rough sea more closely and how the ship handled it. We tried to go to the front part of the ship, but it was too dangerous, so we went to the bridge instead.

I was terrified as I approached the bridge. The ship was rocking violently, and I could see the bow plunging into the water and then rising up again. The waves were crashing over the deck, soaking everything in sight. The sky was dark and stormy, and the only light came from the flashes of lightning that illuminated the ship for a brief moment. It looked like a ghost ship, haunted by some ancient curse. The navigator was shouting orders, trying to steer the ship through the chaos. He looked panicked and angry, as if he blamed himself for our predicament. The sea was roaring like a beast, but I could still hear the cries of the birds that circled around us. They were albatrosses, fulmars, petrels and prions, gliding effortlessly through the rain and wind. They seemed to mock us with their freedom and grace. I wondered why I had ever agreed to join this expedition to Antarctica. Major Kadam was silent, staring at the horizon with a blank expression. The others were whispering nervously, holding on to whatever they could find. We went back to the dining hall after an hour of torture. The situation was no better there. We couldn't sit still, and our food and drinks kept sliding off the table. I laughed nervously, trying to hide my fear. I felt a surge of anxiety in my chest. Anything could happen now.

CAPTIVATING VIEWS: EDWARD ISLAND AND MARINE ISLAND THROUGH THE CABIN WINDOW

JANUARY 3

It was indeed a thrilling moment to witness the beauty of two remote islands in the Indian Ocean on 3 January. We were sailing from 45° South latitude to 48° South latitude when we spotted Edward Island and Marine Island on our right side. They were only about 8-10 km away from our vessel. Edward Island is named after Prince Edward, Duke of Kent and Strathearn, while Marine Island is named after Marc-Joseph Marion du Fresne,

a French explorer. Both islands are part of the Prince Edward Islands, a special nature reserve and a marine protection area of South Africa.

I had been sleeping when my cabin mate, Mr. R. P. Lal, a scientist from IMD Delhi, woke me up and told me to look through the window. I grabbed my camera and rushed outside to capture the moment. Many other expedition members were already there, admiring the view. The islands were partly covered by clouds, but I could see some meteorological observatories on Marine Island through my binoculars. Dr. Lal told me that they were maintained by the South African government. There was no human habitation on these islands.

The outside temperature was around 8-9 degrees centigrade, but the wind chill made it feel much colder. I could not stay outside for long and had to go back to the cabin for warmer clothes. The albatrosses and other small birds like fulmars and petrels were still following us. I wondered how they could travel such long distances with us and where they rested at night. They seemed to glide effortlessly with the wind, conserving their energy. It was amazing to watch them fly. I felt lucky to have this opportunity to see these islands that few people ever visit. It was a memorable experience that I will never forget.

Marion and Prince Edward Islands are two uninhabited subantarctic islands that belong to South Africa. They are the remnants of an ancient volcano that rises from the Indian Ocean. Prince Edward Island, the smaller and northeastern one, covers an area of 47 square kilometers; Marion Island, the larger and southwestern one, covers an area of 290 square kilometers and has a peak elevation of 1,230 meters at Mascarin Peak. The islands were first sighted by the French explorer Marc-Joseph Marion du Fresne in January 1772 and named after him and Prince Edward, the fourth son of King George III. South Africa claimed the islands in 1947 and established a permanent meteorological and biological research station on Marion Island in 1948. The islands are designated as Special Nature Reserves and Marine Protected Areas to conserve their unique biodiversity and ecosystems.

SURVIVING THE TEMPEST: THREE DAYS OF CHAOS AT SEA AND A GLIMPSE OF TRANQUILITY

The last three days aboard the ship had been a relentless onslaught of chaos and discomfort. The relentless rolling and pitching of the vessel made even the simplest tasks feel like monumental challenges. It was impossible to hold anything without losing your grip, and standing up straight was a distant dream. The crew and expedition members alike felt as if they were constantly battling the whims of a tempestuous ocean.

Polar Bird bravely facing huge swell wave during tempest in Indian ocean

Nights were the worst. Sleeping had become a nightmare. The incessant rocking and swaying turned every bunk into a treacherous adventure. It was not uncommon for someone to wake up in the middle of the night, falling from their bed with a surprised yelp. In nervousness, many had resorted to using their belts as makeshift restraints, tying themselves to their narrow berths to avoid being flung across the room like rag dolls.

During those tumultuous days, the ship tilted at alarming angles, reaching up to 20 degrees on both sides. members clung to railings and furniture as they navigated the narrow hallways. Meals in the dining hall became a comical spectacle as plates and cutlery danced their way across tables, often ending up on the floor. The crew, despite their experience, struggled to maintain their footing as they went about their duties.

Tensions among the members ran high, and conversations were limited to exchanging eye contact. The ship's constant motion left no room for any other thoughts, as everyone clung to whatever they could find, hoping for the torment to end.

But today was different. As the sun broke the horizon, casting a golden glow across the now tranquil sea, a collective sigh of relief washed over the ship. The ocean had finally relented, offering a brief respite from its relentless continuous assault. The waves, once towering monsters, had subsided to gentle swells, and the ship sailed smoothly through the calm waters.

For the first time in what felt like an eternity, members could stand without clinging to railings or furniture. They could move about freely without the fear of being thrown off balance. The dining hall was filled with laughter and solidarity as people enjoyed their meals without the constant threat of airborne dishes.

As the ship sailed onward through the newfound calm, a sense of gratitude washed over everyone on board. They knew that the sea could be fickle, and rough waters might return, but for now, they cherished this moment of respite, grateful for the opportunity to relax and recover from the relentless turmoil of the past three days.

GRACEFUL GUARDIANS OF THE WAVES: ALBATROSS, FULMAR, PATRAL, AND PRION IN THE WAKE OF THE SHIP

The Albatross, Fullmar and Petral were still following us. Around evening hours, the Vessel suddenly stopped moving. I was curious why it stopped.

Albatross – a trustworthy companion of our journey

Upon enquiry, I learned that Dr. Saran from National Institute of Oceanography (NIO), Goa had started his experiment of measuring the sea temperature at depth. This would continue now onwards every day at certain hours. I came out and went to the dining hall of the vessel where a good arrangement for preparation of tea, coffee and snacks was available. I prepared a cup of tea and toast with chicken sausage. I moved towards the starboard side. No one was available on that side. Fullmar birds were gliding in plenty nearby. Soon I was throwing some pieces of toast I prepared, and ten birds were diving to

pick them up. However, I noticed that they were interested in only chicken sausage, leaving bread pieces floating. Although the Albatrosses were with us, they kept on flying at a distance of around 80 to 100 feet, while the small birds were flying quite near to us at a distance of around 10 to 20 feet. The Fulmar was grey-colored while the Albatross was white-colored with longer fins.

It is to be noted that the Antarctic region is home to a diverse and rich marine wildlife, including various species of seabirds and marine mammals. However, there is a relative paucity of information on the occurrence and distribution of these animals in the Indian Ocean Sector, which covers a large area between 34 to 71°S and 10 to 52°E. During the expedition, we observed 13 species of seabirds and five species of marine mammals between the subtropical convergence and the Antarctic landmass. These observations were carried out by visual examination, using a field binocular whenever necessary. The area includes different biotopes, such as open ocean, pack ice, floating ice, icy sea shelf, land mass and the environs of a large number of islands. Our Zoologist recorded data on the abundance, zoogeographic distribution and behaviour of these animals, which are important indicators of the health and productivity of the Southern Ocean ecosystem.

BUNDLING UP: WINTER CLOTHING DISTRIBUTION IN THE FREEZING WEATHER

The weather was freezing, so we needed proper winter gear. We got various items like Jackets, Overalls, Pullovers, Balaclavas, Gloves, Goggles, and Shoes. They were all designed for extreme cold. I got one of them to keep me warm. Those were brought from came from countries with harsh winters. The quality was excellent. The shoes were for walking on ice and rocks. The overalls were from Haley Hansen, a German brand. The jackets were Annapurna jackets, used by Everest climbers.

Around 4:30 pm, Captain Venkatesh invited some expedition members to play handball on the deck. Handball is a game where you have to throw the ball into the opponent's goal without entering the goal area or breaking any other rules. We divided into two teams, one with our leader Mr. Dhar, Major Kadam, Mr. Angal, Mr. Dutta and others, and the other with me, Mr. Som, Mr. Praveen, Captain Venkatesh and others. The weather was calm and pleasant, and the ship was sailing smoothly on the ocean. We had a lot of fun playing handball in the middle of the Indian Ocean. It was a great way to relax and enjoy the evening. The game also made us feel more energetic and motivated for our expedition.

EXPLORING THE FROZEN FRONTIER: MR. GAUR'S LECTURE ON THE GEOLOGICAL SURVEY OF INDIA'S ACTIVITIES IN ANTARCTICA AND SIGHT OF ICEBERG

*JANUARY **5***

The Academia session was in progress. Dr. M. P Gaur, a geologist from Geological Survey of India, Faridabad, was delivering a lecture on his work in Antarctica. Suddenly, Mr. Hemant Gaur, a communication engineer from DEAL Dehradun, announced from the navigation control room that an iceberg had been spotted. Dr. Girija Rajaram, the coordinator of the session, was excited and quickly suspended the lecture, inviting everyone to go outside and see the iceberg from the port side. Everyone rushed to the port side, eager to catch a glimpse of the iceberg.

However, Dr. M. P Gaur soon learned that the iceberg was too far away to be seen, about 44 km from the ship's position.

Exposed Geological Stratigraphy in Schirmacher Oasis, in Queen Maud Land in Antarctica

He informed everyone and resumed his lecture, explaining the objective of Geological Survey of India in this expedition: to conduct geological survey and mineral mapping in Antarctica. Dr. Gaur was a senior expedition member and a friendly person, who had visited Antarctica three times before as a summer expeditioner. He had also done many

geological surveys in northeastern India, covering states like Nagaland, Manipur, Mizoram and Assam.

PAWAN HANS HELICOPTER LTD. SECURES EXPEDITION LIFELINE: WINNING THE FLYING CONTRACT FOR ANTARCTICA

The 18th ISEA was a prestigious event for the Indian Scientific expedition to Antarctica. Pawan Hans Ltd, a government enterprise, provided helicopter services to Antarctica for the expedition. They won the contract over many international competitors. The crew consisted of five members: three pilots and two engineers. Captain Kahlon, Captain Saxena and Captain Singh were the pilots while Captain Soni and Captain Verma were the engineers. Captain Soni and Captain Saxena had previous experience in Antarctica. They were all professional, friendly and respectful. Captain Verma was always cheerful and smiling. Captain Saxena practiced prayer and meditation every day. Captain Kahlon looked like the captain of Titanic with his white beard and confident expression. I once told him about the resemblance and he calmly replied, "Yes, everyone says!".

CLOSE CALL: AVERTING A MAJOR ACCIDENT ONBOARD

Amidst the vast stretch of the Southern Ocean, the M.V. Polar Bird sailed on, its decks glistening with a thin layer of rain and snow. The weather had taken a turn for the worse, with a mix of rain and snow falling lightly from the sky. The once-steady ship now rocked more violently, as if challenged by the elements themselves.

As sunshine had started glittering, in spite the slippery deck, the members and crew aboard the M.V. Polar Bird had gathered on the deck for their routine handball game. Laughter and companionship had echoed across the ship as they engaged in friendly competition. However, the weather had other plans. The slippery and unstable deck made even the simplest movements treacherous, turning the game into a dangerous endeavor.

As the players struggled to keep their balance on the slippery surface, a series of unfortunate events began to unfold. One by one, they fell victim to the unpredictable deck. The deck had become a hazard, and the game turned into a battleground against the unforgiving weather.

Rolling and Pitching of M/V Polar Bird in High Seas,
one has to take other's help to stand firm on the deck

Major Kadam, Mr. Sitaram and Mr. Som prominent figures among the players, also experienced the deck's hostility. The ship's increased rocking had turned their attempts at movement into a losing battle. Helpless against the powerful forces at play, they slid towards the side of the deck, their eyes wide with a mix of fear and disbelief. For a moment that felt like an eternity, the cliff of the ship's edge loomed before them.

But fate had other plans. Just as disaster seemed inevitable, a fence materialized as a last line of defense. The fence stood firm, halting the three men's dangerous slide towards the open sea. It was a fraction of a second, a fleeting moment of relief, that saved them from a potential tragedy.

With hearts pounding and adrenaline coursing through their veins, the group made a swift decision. The once-enjoyable handball game transformed into a risky gamble, and the risk was far too great. They abandoned the game, retreating to the safety of the ship's interior.

The incident left an indelible mark on their memories, a testament to the thin line between adventure and danger that comes with venturing into the heart of nature's fury.

RAPID RESPONSE: URGENT MEETING CONVENED

Mr. Ajay Dhar, the leader of the 18th ISEA, convened an urgent meeting with all the members to address some issues. The main issue was the lack of snow goggles, woolen inners, and polar shocks at Mauritius. These items were supposed to be provided by Mauritius for our team. We all realized the gravity of the situation and discussed it. The question was how to cope with the harsh Antarctic conditions without these essential items. Some members voiced their dissatisfaction with the management of the National Centre for Antarctic and Ocean Research, Goa and the Department of Ocean Development, New Delhi, who were responsible for the logistics of the expedition. Mr. Dhar tried to calm down the members and said that there might be some old stock available at Maitri, Antarctica, which would be distributed upon our arrival there. He also said, "I know this is not ideal, but we have to make the best of what we have. We are here for a noble cause and we have to overcome this challenge together." We understood that we had to make do with the old stock only. We had no choice but to move forward. But it was hard to comprehend how such a mistake could occur when the expedition was so important and difficult.

I was ecstatic to witness a rare and spectacular phenomenon in the middle of the dark night. It was 11:45 PM Local Standard Time and 2:15 AM in India, but the sun had not set yet. It was like a glowing jewel in the sky, defying the laws of nature. The sky was covered with thick and gloomy clouds that looked like a heavy blanket over the earth. The air was freezing cold at 2°C, biting my skin like a thousand needles. The pressure was dropping rapidly and the difference was around 55 millibars. Such a low and unstable pressure usually creates violent cyclones in the Southern Ocean. As expected, the sea became rough and turbulent and the waves reached level four. They were like angry beasts, roaring and crashing against the ship. I could see some massive icebergs floating in the far distance, like silent giants guarding their territory. The ship was rocking and rolling like crazy, tossing me from side to side. I couldn't sleep at all.

MAJESTIC ENCOUNTERS: WITNESSING LARGE WHALES BY THE STARBOARD SIDE

JANUARY 7

What a exciting morning it was! Right after we finished our breakfast, we heard an announcement from the Bridge that few huge whales were spotted on the starboard side of the ship. We rushed out of our cabin and saw them, about 100 meters away, leaping out

of the water and diving back in. It was an amazing sight to see the bubbles and fountains spraying from their bodies. I will never forget that moment.

Whales observed alongside our route in disciplined row formation

The whales stayed with us for a while, then vanished into the waves and the horizon. We saw them exactly at 60 degrees south latitude, where the ship stopped for Dr. Saran's routine experiment. This is where the Antarctic waters begin, according to the Antarctic Treaty. This means that from now on, we have to follow certain rules and regulations to protect the environment, as all the expedition members and the ship's crew are bound by the treaty.

NAVIGATING THE FROZEN MAZE: PASSAGE THROUGH ICEBERGS

Certainly, it was an amazing sight of so many icebergs in the distance, scattered across the horizon. Two of them were very close to our ship, and I could see their intricate shapes and colors. I joined the other expedition members who were taking photos from the starboard side, using various cameras with big zoom lenses. I had a Nikon SLR camera, and I snapped away until I ran out of film. It was a wonderful experience and a rare opportunity to see such giant icebergs up close.

First view of iceberg at 57 degrees south latitude in rough seas and dark cloud ahead

Icebergs of different shape and sizes observed on our passage,
one ninth is visible and rest is under water

Beautiful iceberg surrounded by blue colored oceanic water - a kilometer away from our ship

In the evening, we saw more icebergs near the port side of the ship. Some of them were small and bobbing up and down in the waves, splashing water over their surfaces.

Partially Melted Iceberg floating: near the path of our ship

Iceberg broken away from Shelf ice in Antarctica and flown away into deep ocean

One of them looked like a king-sized rhinoceros, with a horn-shaped outcrop. I wondered how old it was, and how much it had shrunk since it broke off from a glacier or an ice shelf.

Iceberg just broken away from Shelf ice in Antarctic water

This process is called calving, and it can be caused by several factors, such as ocean currents, tides, waves, or melting. Some of the icebergs were dome-shaped and blue-white in color, like frozen islands. Others had green patches of zoo plankton underneath them, adding some contrast to the scene. I learned that icebergs are made of freshwater ice, and that they have a core temperature of about -20 degrees Celsius. I was fascinated by these natural wonders, and I wanted to learn more about them.

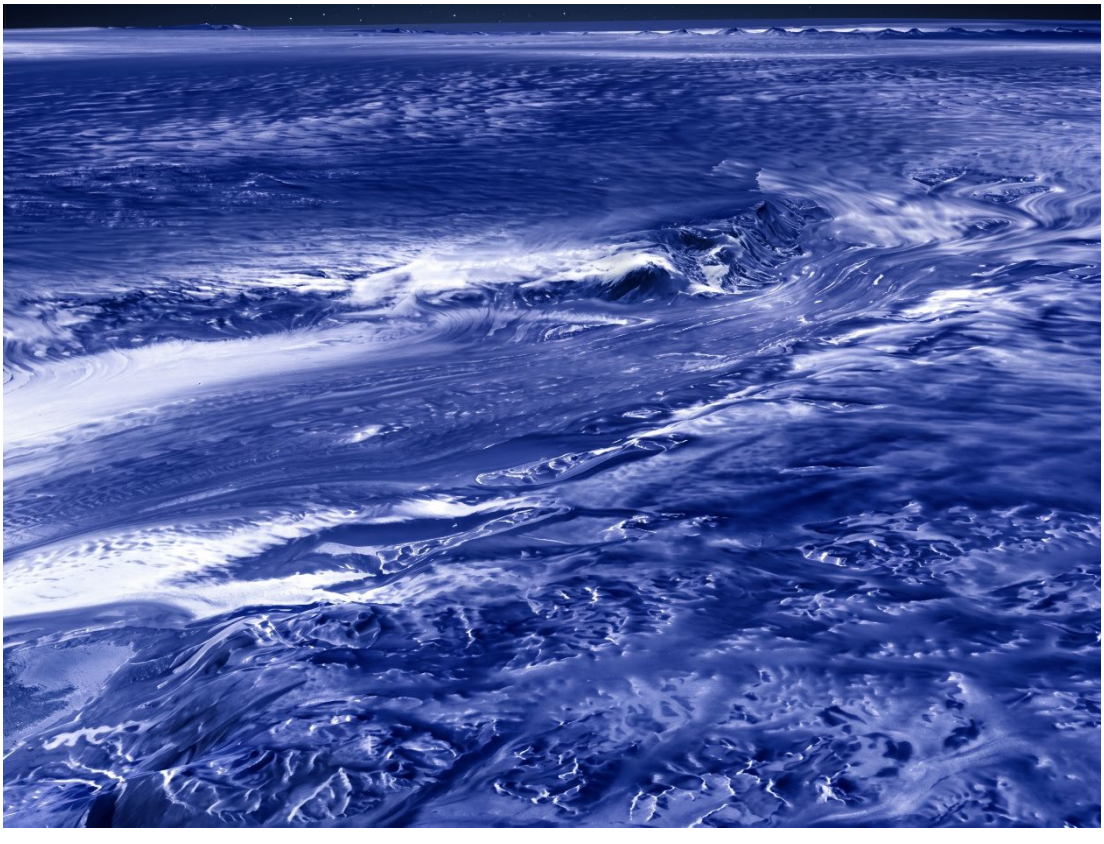
Another form of Iceberg : a subject of study for the expedition member from SASE, Manali

Only a small number of Antarctic glaciers find their terminus on land, notably in regions like the dry valleys, where wind's dual action erodes and melts the ice. The prevailing trend for most glaciers is to flow either into ice shelves or directly into the ocean. In these zones, they often generate a floating extension recognized as a glacier tongue, from which icebergs disengage. Glaciers manifest a broad spectrum in size, ranging from a few kilometers in length and a couple of hundred meters in width to colossal giants stretching across hundreds of kilometers. A prominent instance is the

Beardmore Glacier, which historically served as the entryway to the elevated polar plateau for early adventurers. This glacier spans 200 kilometers (124 miles) in length, 23 kilometers (14 miles) in width, and maintains a pace of approximately one meter (39 inches) per day. The title of Antarctica's swiftest measured glacier is claimed by the Shirase Glacier in eastern Queen Maud Land, boasting a velocity of two kilometers (1.2 miles) per year.

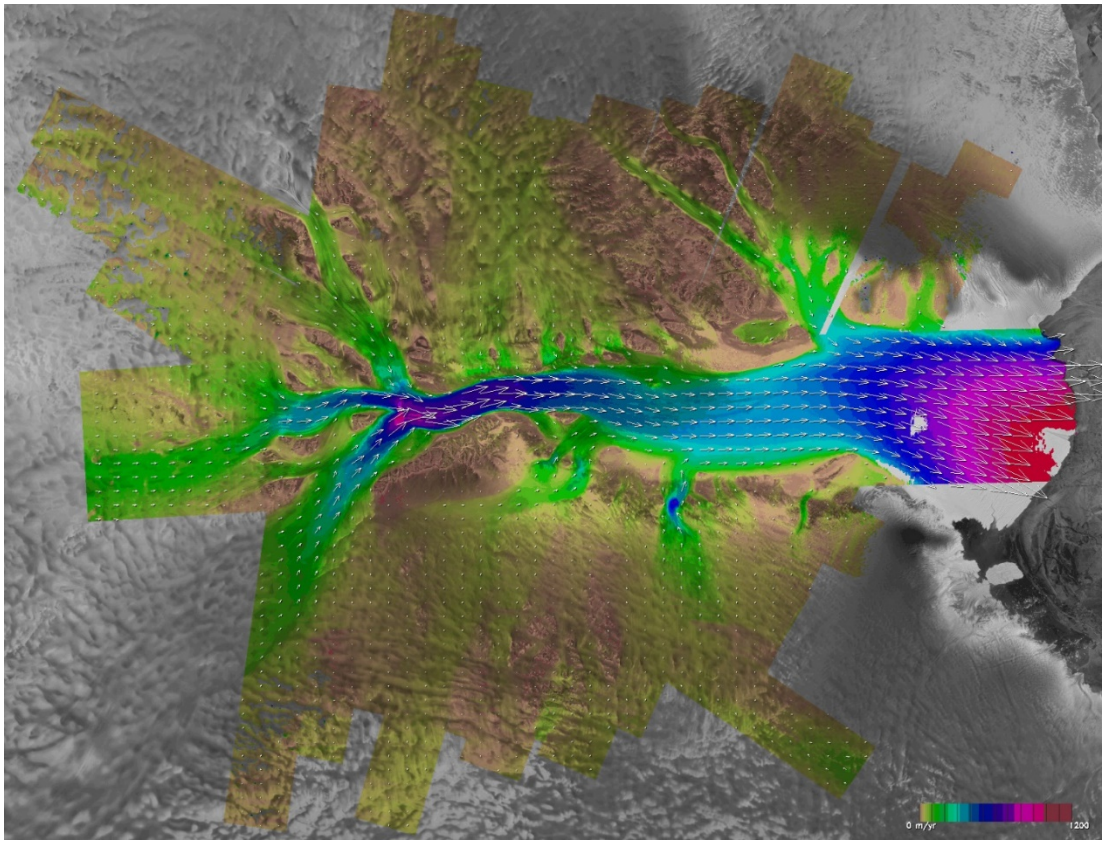
LARGEST GLACIER

The globe's largest glacier, the Lambert Glacier, is positioned in Antarctica. With a width extending 40 kilometers (25 miles) and a length surpassing 400 kilometers (248 miles) traversing the Prince Charles Mountains, it blankets a drainage territory of one million square kilometers (386,000 square miles) within East Antarctica. As it progresses to lower elevations, the Lambert



An angled view of Lambert Glacier looking towards the source (https://svs.gsfc.nasa.gov/992)

Glacier merges with the floating Amery Ice Shelf and persists for an additional 300 kilometers (186 miles) toward the oceanic boundary. Its speed measures 230 meters (754 feet) annually at its entry into the mountains and nearly one kilometer (3,270 feet) each year at the ice shelf front, where it broadens to approximately 200 kilometers (124 miles).



This image shows the movement of the Lambert Glacier. The ice velocity vectors were obtained by using RADARSAT Synthetic Aperture Radar (SAR) imagery from the 2000 Antarctic Mapping Mission. Yellow represents the areas of no motion, which are either exposed land or stationary ice. The smaller confluent glaciers have generally low velocities, shown in green, of 100-300 meters (330-980 feet) per year, which gradually increase as they flow down the rapidly changing continental slope into the upper reaches of the faster flowing Lambert Glacier. (https://eoimages.gsfc.nasa.gov/images/imagerecords/1000/1199/velocity_lambert_lrg.jpg)

ICE FORMS OF THE POLAR WORLD: FLOATING ICE, PACKED ICE, FAST ICE AND POLYNYAS

As we approached, we encountered a calm and tranquil ocean surface, devoid of the previous turbulence, with slightly denser, clear water. Continuing further, we were greeted

by a breathtaking sight—a multitude of floating ice arranged in parallel lines, spread with water. As we ventured farther south, we encountered densely packed ice, replacing the scattered growler or floating ice. Our icebreaker-class ship encountered significant challenges in maneuvering through this packed ice. Eventually, our vessel came to a complete halt, becoming firmly grounded in fast ice—a thick and extensive icy expanse atop the ocean's surface. Number of attempts to break the fast ice into fragments for safe passage proved unsuccessful. We became dependent on tidal waves to reach us, as they held the potential to break the fast ice, clearing a pathway to the Indian Bay, where we aimed to navigate.

Floating ice or Growler in calm and quite Antarctic water : a pristine view

Packed ice in Antarctic water : 3 to 5 ft in thickness

The frozen expanse of Antarctica's ocean, marked by perilous icebergs and extensive sea ice, wields a pivotal influence on shaping the circulation within the Southern Ocean. Furthermore, it shapes the dynamic interplay between the ocean and the atmosphere, thereby casting a profound impact on the broader climate and weather patterns of the southern hemisphere.

As temperatures drop at the close of March, following a brief summer stint, the Antarctic shoreline undergoes encasement in frigid sea ice, merging into pack ice. This pack ice proliferates until it attains its zenith of about 19 million square kilometers (7.3 million square miles) around September or October, effectively doubling the spatial extent of Antarctica. With the advent of warmer conditions, the pack ice gradually wanes and fragments, its diffusion composed by wind and ultimate dissolution. By late February, the pack ice's coverage hits a nadir, a modest remnant area of approximately 3 million square kilometers (1.6 million square miles) persisting along the continent's periphery.

Various forms of ice including Pancake ice seen as we move towards Indian bay

The floating pack ice's presence catalyzes a notable effect on heat exchange between the atmosphere and the ocean. While the open ocean merely reflects a fraction of incoming radiation, snow-clad pack ice reflects over 80 percent.

Given that the pack ice doesn't achieve maximum expansion until the intensification of the sun's radiation in September or October, its presence defers the conventional warming process, preserving Antarctica's air in a cold state.

Pancake ice as observed from the Ship

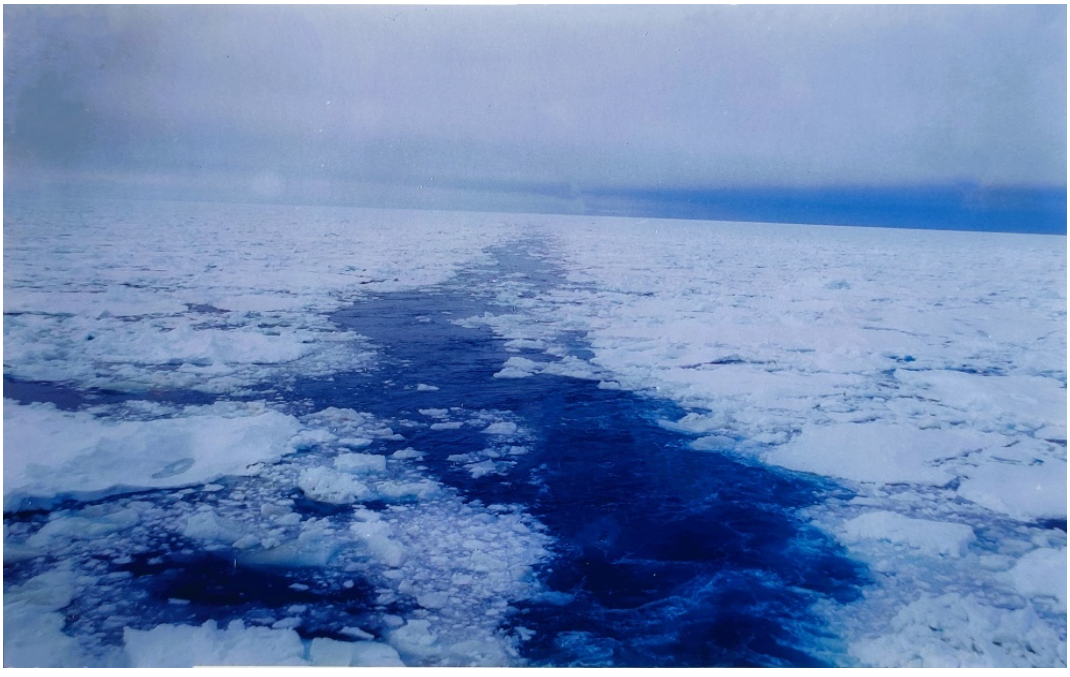
The extent and distribution of pack ice surrounding Antarctica display annual fluctuations. On average, it stretches as far north as 61°S, but specific locales like South Georgia encounter it at 52°S.

M/V Polar Bird stranded in front of vast expanse of Fast ice

The ice belt's breadth ranges from 600 kilometers (370 miles) off the coast of East Antarctica to nearly 3000 kilometers (1850 miles) in the Weddell Sea.

Vast sheets of packed ice create a mesmerizing mosaic across the Antarctic Ocean, an icy testament to the raw, breathtaking beauty of the world's southernmost water

Throughout most of the year, this ice belt operates as a barrier, impeding ship access to the Antarctic coast. Within the pack ice zone, a fusion of floating ice and open water emerges. Periodically, extensive areas of open water, designated as polynyas, form amidst the ice cover. The temperature contrast between the icy atmosphere and the warmer ocean along the pack's edges and within polynyas plays a pivotal role in shaping Antarctica's atmospheric conditions.



Charting a course through nature's frozen maze -
The Ship breaks through packed ice, forging its path amidst the adventure.

Captured amidst an endless sea of fast ice, the M/V Polar
Bird stands as a resilient symbol against the icy expanse

Fragmented fast ice formations, shattered by the force of tidal waves, illustrate the powerful impact of nature's relentless forces in polar regions

Comprising an mixture of ice and open water, the pack ice exhibits mobility under the guidance of ocean currents and winds. Offshore winds tend to disperse the ice, while potent storm winds induce convergence, particularly along wind-facing coastlines. This mobility poses navigational challenges for ships maneuvering through the pack, as it can ensnare and crush vessels.

IN THE HEART OF THE NO RESCUE ZONE: FACING THE UNKNOWN

The sun was about to set, adding more colors to the scene. The icebergs looked amazing in the light, sparkling and shining like jewels. I couldn't take my eyes off them.

Rapid dissolution: Witness the swift meltdown of an iceberg in the frigid waters of Antarctica, a stark reminder of the accelerating pace of ice loss in our changing climate.

It was a breathtaking sight that left me speechless. The sky was covered with thin clouds that let some sunlight through. The temperature was around 2^{o}C, but I didn't mind the cold. We were so close to our destination! Only a distance of 5^{o} more and we would see the Antarctic shelf. We hadn't seen any other ship on our way. This was a no rescue zone, where no one would help us if something went wrong. But we were not afraid. We were excited and curious about what awaited us in Antarctica. After 21 days of sailing through the lonely sea, we finally reached 65^{o} South latitude. I was thrilled. The sea was calm and quiet, and I slept well last night without much rocking or tossing.

RALLYING IN THE HOLD: THE THRILLING TABLE TENNIS MATCHES BELOW DECK

We felt a surge of joy when we realized that we were a few hundred miles away from the shelf. The next part of our journey would be the most challenging and risky, as the icebergs had increased dramatically. They were everywhere, looming and drifting in the water. We had to be alert at all times to avoid crashing into them. The bridge was off-limits to most of the expedition members, except for our leader Mr. Dhar, Major Kadam, and the two communication engineers. The ship's captain was very anxious, as he had to

ensure the safety of everyone on board. He knew that he would be held accountable by the Department of Ocean Development, Govt. of India, if anything went wrong. He had three more navigating officers to assist him, working in shifts of eight hours each. They had to be extremely careful to prevent any mishap, especially a collision. That would be disastrous. The captain did not want to gamble with our lives. He had heard of many cases where ships had been smashed and shattered in this part of the voyage. One of them was my good friend Thomas, who was a navigating officer.

He was a tall and handsome guy, my partner in table tennis. We used to play the sport in the hold, a huge hollow space under the deck of the ship. It was surrounded by curved iron plates on both sides and covered with an iron sheet on top. The space was almost as big as half a football field. In the hold, there was a sauna bath and a small swimming pool. There were also two helicopters from Panwan Hans Ltd, tied with nylon ropes. They were used for transporting expedition members and logistic items from the shelf ice to Maitri, Antarctica.

An imposing triangular iceberg majestically adrift in the vast depths of the ocean

The hold of M/V Polar Bird was half empty, even after loading several items for the two-year expedition. Among them were a big Mantis Crane, a Pisten Bully, food items, rations and bottled water in an iron shipping container. All the items were secured with plastic ropes in the four corners. The ship's authority had also installed a fixed Table Tennis board in the hold. Whenever the sea was calm and quiet, they played table tennis

to stay fit and alert. I felt the vastness of the ocean water around us in the hold. We were on the 22nd day of our voyage, and most of the crew members were either sick or gone crazy. The leader suggested a table tennis tournament to lift the spirits of the expedition members. Many of us joined the tournament. I was out in the second round of singles and in the semifinal of doubles with Thomas as my partner. Some of the crew members were very skilled at table tennis. The whole event boosted our morale and psyche. I often wondered what it would be like to reach Antarctica. How different would it be from the hold of the ship? How cold would it be? How beautiful would it be? I was excited to find out, but I also knew I would miss playing table tennis with Thomas in the hold.

ANTARCTIC ODYSSEY: NAVIGATING THE FROZEN WATERS TO DOCK AT INDIAN BAY

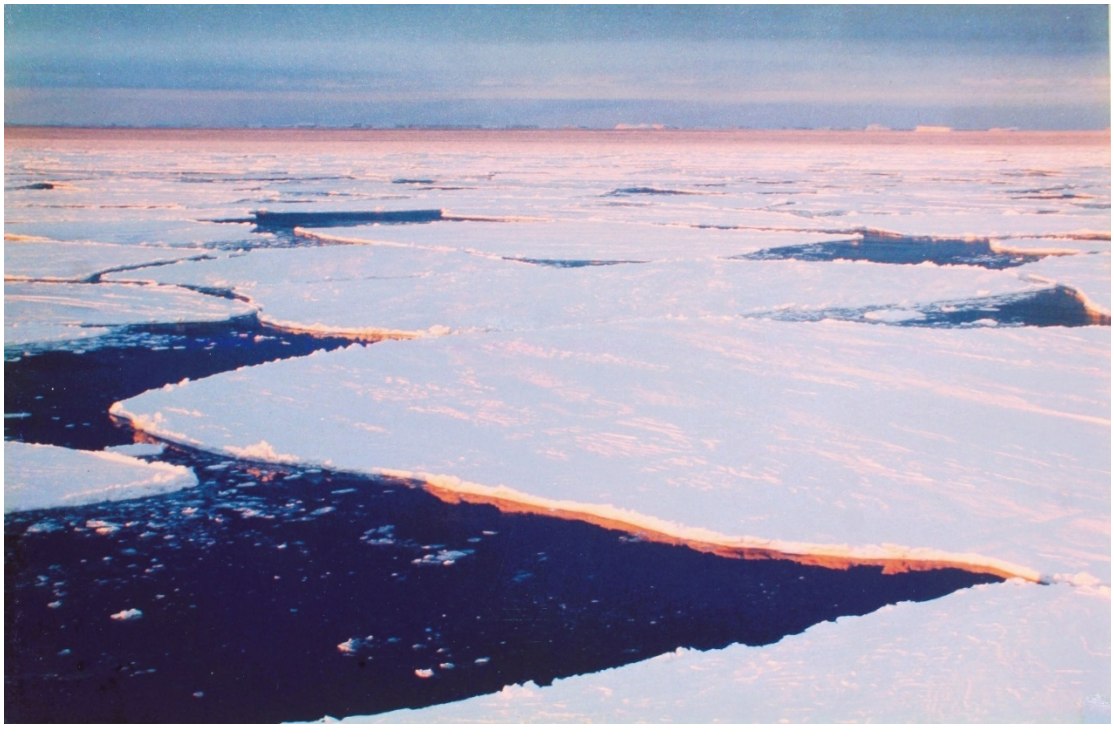
JANUARY 9

It was 8 o'clock in the morning and we were sailing in the Antarctic Ocean. As we crossed the Antarctic Circle, we entered the GMT time zone. I was still in bed, about to get up and I glanced

Isolated beauty: A tabletop iceberg caught amidst a huge spread of packed ice

through the window. Near and far, I saw patches of growlers (small pieces of floating ice) in the sea water. Growlers are one of the types of floating ice that form in the Antarctic waters. In the distance, some larger icebergs were visible. The M/V Polar Bird was moving

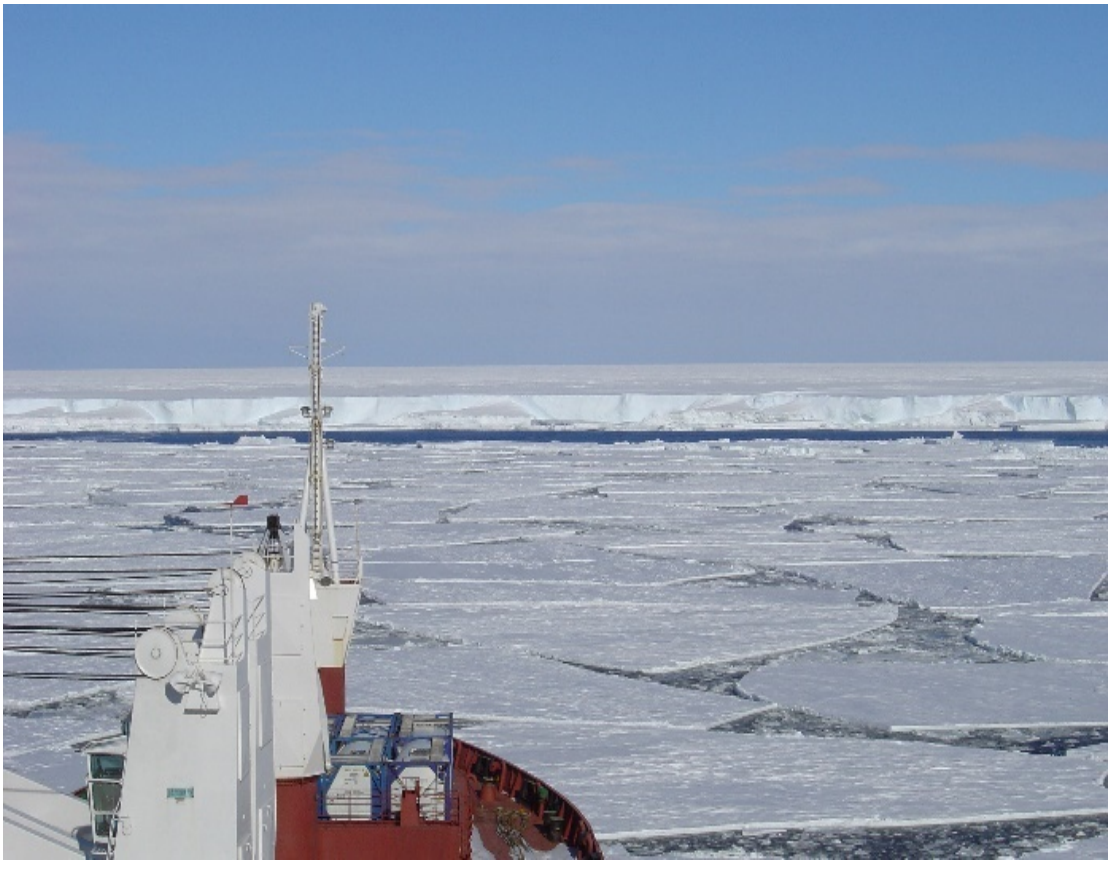
at 12 knots, heading towards Indian Bay - a huge section of the ice-shelf that belongs to India. After breakfast, when I came out of the dining room, I was amazed by the sight around me. It was a scene beyond words. No more growlers were floating around. I was speechless. The ship was completely surrounded by pack ice. Pack ice is another type of iceberg that occurs before polynyas. The ship was pushing the pack ice slowly, creating a passage through it. The collision between the ship and the pack ice made a lot of noise. It was an ocean of broken ice pieces. The entire pack ice was sparkling under the sunlight as the sky was clear and blue.



Nature's Splintered Art: Tidal Waves Transform Fast Ice into Glittering Wrecks under Sunlight's Gaze

We were sailing on the M/V Polar at a steady speed, surrounded by packed ice of various sizes and shapes. Some were as small as a few feet, while others were as large as 200 square feet. The packed ice was floating on the water, separated by narrow gaps. Beyond them, we could see the fast ice, a flat sheet of ice that covered a large area. The packed ice came from the fast ice, breaking off and drifting away. As we approached the shelf ice, the packed ice became denser and thicker. The temperature was around 8 degrees centigrade, and there was no wind at all. We had to wear UV protected anti-glare spectacles to protect our eyes from the reflection of the sun on the ice. It was too bright to

look outside for a long time without them. We spotted some wildlife on our way. There were small white birds called prions flying in the sky. They looked like sparrows, but with pure white feathers. There were also seals resting on the packed ice, some of them very close to our ship. Some of them ran away and jumped into the water when they saw us, while others stayed still and ignored us. Some of them showed signs of fear and aggression, opening their mouths wide and making loud noises. One seal was right in front of our ship's path, and it barely escaped from being hit by diving into the sea at the last moment. We watched them with curiosity and wonder, amazed by the beauty and diversity of life in this frozen land.



The ship bravely navigates towards a Polynia as triangular-shaped icebergs float in the deep ocean, witnessing the dramatic break-up of fast ice along the shelf-ice seen ahead

We were all on the deck with our cameras, eager to witness the nature. In the distance, we spotted two King penguins that quickly plunged into the water when they saw us. The sound of the camera shutter was incessant as we tried to capture the moment. I was no

exception. I used up two film rolls in an hour. It was an Nikon SLR camera. Then I realized that I had to be careful with my supplies, as I only had a few more rolls for the next 16 months. A good digital camera was too pricey for me to afford. Oh well, I decided to stop taking pictures. The ice around us was getting thicker and larger. As far as we could see, there was nothing but ice everywhere. The sky was overcast. It looked like a sea of milk "Apurba!".

An aerial view unveiling the stunning Indian Bay, flanked by Shelf ice adjacent to the extensive Polynia region

The atmosphere was completely different. It was 2:00 AM local standard time (GMT), but the sky was bright and clear. The Sun was just above the horizon, shining over the frozen sea. I was on the third-floor balcony of the cabin, one level below the bridge. Two Russians and one Iranian, who had joined us in Mauritius, were standing at the bow. I could also see some Indians among them. After an hour of struggle, the ship had crossed the packed ice and reached the polynya, an area of open water surrounded by ice. Our ship was sailing through the polynya water, heading towards the fast ice. The fast ice was a smooth surface without any cracks, like a huge ice rink. Around the fast ice, there were giant icebergs floating in the Antarctic Ocean. We had to avoid them carefully, so we kept

sailing through the polynya. One of our members, Mr. Angal from R &DE, Pune, counted 36 icebergs around us. Meanwhile, the ship started to break the fast ice by ramming it head-on, creating a safe passage for us. The ship moved back and forth for a long distance, maybe more than two kilometers, and stopped for a few moments.

The vessel resumed its journey towards the fast ice, gaining speed and momentum. It collided with the thick layer of ice, creating a large crack that spread over a wide area.

MV Polar Bird patiently anchored in front of the fast ice,
anticipating the arrival of the tides amidst an icy landscape

A group of penguins that were basking in the sun far away heard the loud noise and fled from the ship. The vessel managed to sail through the crack for a while, but then it got stuck in the fast ice. It could not move any further and had to wait for the tide to come. The tide would widen the crack and allow the vessel to reach the shelf ice.

Nature's Puzzle: Tide's Dance Breaks Fast Ice into Beautiful Pieces

MV Polar Bird pioneers through the formidable fast ice,
carving a passage towards uncharted horizons

We were hoping for the tide to arrive soon. There were no icebergs nearby, so we were not in immediate danger.

MV Polar Bird reaches Indian Bay, unveiling a breathtaking view of shelf ice and Polynia from above

WELCOME BY PENGUINS: SURVIVORS OF THE FROZEN REALM

Approaching the shelf ice, a group of inquisitive penguins hurried towards our ship, acknowledging the arrival of something unfamiliar in their territory. They extended warm welcome to our arrival. It was so charming view of group of penguins starring at us. Most of the time, one penguin was found aloof standing away from the group just like sentry which was unique.

Penguins gracefully ushering in the ship amidst the serene beauty of the shelf ice

Penguins, the most charismatic inhabitants of Antarctica, surpass seals, skuas, and petrels in liveliness and charm. They can be found across various latitudes in the southern hemisphere, primarily residing between 45° and 55°S. They are the most starved animal on the planet because of pulsating nature of Antarctic continent.

Regal king penguins gracefully inhabit the frigid Shelf Ice near Polynia

King penguins engaging in a lively discussion amid the stunning beauty of the Shelf Ice

Penguins, with a lineage dating back approximately 60 million years, evolved as seabirds in temperate zones during the early-to-mid Tertiary period. Their adaptations to colder waters eventually made them perfectly suited for the frigid lands of Antarctica as the circumpolar region gradually cooled, enabling penguins to diversify and thrive.

King penguins gather in a rookery near the Antarctic waters, showcasing their majestic presence amidst the icy landscape

These resilient birds have developed several remarkable adaptations to endure the cold. Their dense plumage, which overlaps like tiles, acts as insulation against the harsh elements of the Antarctic environment, including cold air, biting winds, and icy waters. A layer of woolly down further enhances their insulation and warmth retention. Additionally, penguins possess a substantial layer of fat that functions as insulation between their skin and muscles, serving as an energy reserve.

In their natural habitat, penguins excel as swimmers, utilizing their feet and stubby tails as rudders, while their flippers serve as powerful propellers. Most penguin species feed near the water's surface, consuming small fish and shrimp-like creatures from the plankton. Some larger species, like gentoos and emperors, dive to significant depths,

exceeding 100 meters. Penguins demonstrate impressive swimming speeds, reaching 10 to 15 km/h (6-9 mph), considering their size.

For Adelie penguins, wintering in the pack ice provides relatively warmer conditions compared to the brutal Antarctic mainland. During early spring, they embark on a southward journey towards their colonies, guided by the sun. Males arrive first, refurbishing nest sites, with females joining them later. After egg-laying, females return to the sea, leaving males to incubate the eggs. As the sea ice disperses, food becomes more accessible, allowing parents to take turns feeding the chicks with fish and plankton. Chinstrap and gentoo penguins are two other species venturing south of the Antarctic Convergence, breeding slightly later and often on rockier terrain. These smaller penguins complete their breeding cycles within the polar summer.

The most significant challenge for penguins lies in the far south, where summers are brief, and food availability is restricted by sea ice. Adelie penguins on mainland Antarctica barely complete their breeding cycle before inshore ice disperses, releasing their chicks before they reach full maturity. Emperor penguins face an even greater challenge due to their size and the prolonged period needed for chick-rearing. They gather in the autumn as new sea ice forms, enduring the coldest months to incubate their eggs. Only the males incubate, huddling together in scrums to keep the eggs warm. By mid-summer, as sea ice breaks, the chicks are ready for the sea but not yet fully grown, embarking on their own journey to fend for themselves.

King Penguin colony gathers around a mother, cradling her adorable chick amidst the icy embrace

Emperor penguins are approximately 1 meter (33 inches) tall and weigh around 30 kg (66 lb), featuring distinctive black caps, blue-grey necks, brilliant orange ear patches, and lemon-yellow breasts. Adelie penguins stand at about 71 cm (28 inches) tall, weighing around 5.5 kg (12 lb), characterized by black caps and chins, black-tipped blue backs, and grey-pink feet. Gentoo penguins, the largest among pygoscelid penguins, measure around 76 cm (30 inches) tall and weigh approximately 7 kg (13 lb). They are recognized by white breasts, black bodies with white triangular flashes on their foreheads, and red bills with black plates. Chinstrap penguins, also 76 cm (30 inches) tall, weigh about 4 kg (8.8 lb), featuring black heads, backs, and eye-rings, white cheeks, and narrow bands of black-tipped feathers under their chins.

An expansive bird's-eye view capturing the bustling penguin rookery, alive with activity and community

These remarkable penguins communicate through various vocalizations, from braying and cooing to crackling, barking, and trumpeting. Each species exhibits unique breeding behaviors, including nest building, egg incubation, and chick rearing, adding layers of complexity to the intriguing world of Antarctic penguins. The sight of rookery was extraordinary.

THE MARVELOUS CYCLE OF LIFE: THE PHYTOPLANKTON, KRILL, AND WHALE FOOD CHAIN

Let us know what is cycle all about. The Southern Ocean, a vast stretch of frigid waters surrounding Antarctica, hides within its depths a complex mystery of life. Here, two distinct ecosystems flourish, shaped by the relentless forces of wind and ice. One, nestled in the west-wind-drift region, relies solely on phytoplankton as its lifeblood, while the other, in the east-wind-drift region, draws resources from a richer palette of marine

flora and fauna. These ecosystems are intertwined in a delicate dance of survival, where each species plays a crucial role.

Phytoplankton the main feed of Antarctic krill (Ref. National Geographic)

Krill species is a small, swimming crustacean that lives in swarms

Baleen whale (Ref: Australian Antarctic Program ; Whale breaching Photo: Dave and Fiona Harvey)

A swarm of adult and larval krill, feeding on algae which grows underneath the sea ice. (Photo: Alfred Wegener Institute; Ulrich Freier)

In the west-wind-drift ecosystem, where icy winds sweep across the open ocean, phytoplankton take center stage. These microscopic plants harness the meager sunlight that pierces through the cold depths, forming the foundation of the food chain. Minute

crustaceans within the plankton community, known as copepods and amphipods, graze upon the phytoplankton, transforming sunlight into sustenance. These tiny crustaceans, in turn, become a vital food source for small fish, continuing the cycle of life. But the story doesn't end here. The small fish become prey for hungry squid, and the squid, in a remarkable turn of fate, become food for the majestic sperm whales that roam these icy waters.

In stark contrast, the east-wind-drift ecosystem boasts higher productivity and a more diverse menu. Here, life flourishes not only in the open water but also within the confines of the pack ice. This icy stretch harbors algae, a unique resource that contributes to the ecosystem's richness. But the true stars of the show in this part of the Southern Ocean are the Antarctic krill (Euphausia superba). These small, shrimp-like creatures are the most abundant animal species on the planet and are far from being passive drifters, as previously believed.

Recent revelations have uncovered the astonishing journey of krill. After the pack ice disperses during the summer, they embark on a southward migration towards Antarctica, a behavior once thought to be exclusive to fish. This migration makes them a critical link in the food chain.

Interestingly, Krill, in turn, become the primary food for a host of Antarctic creatures. Baleen whales, renowned for their grandeur, rely heavily on krill for their survival. But they are not alone. Crabeater seals, with their specialized diet, and Adelie Penguins, with their untiring appetite, have now become significant consumers of krill.

The Southern Ocean, with its two distinct ecosystems, continues to reveal its mysteries and adapt to changing conditions. It is a testament to the resilience and adaptability of life in one of the harshest environments on Earth.

TAKING FLIGHT OVER ANTARCTICA: HELICOPTER TEST RUN FROM THE SHIP

It was a bright and sunny afternoon in Antarctica. The snow was dazzling under the clear sky, and we had to wear special glasses or goggles to protect our eyes from the ultraviolet (UV) rays. We were all wearing warm clothes designed for the extreme cold. We had been working hard since morning to unload the two helicopters from the ship's hold with the help of two large cranes. The helicopters were now on the deck, ready for a test flight over the Dakshin Gangotri. The engineers from Pawan Hans Ltd., Mr. Soni and

Mr. Verma, had checked and prepared the helicopters for the pilots. The pilots strapped themselves in and started the rotors.

"Nature's Blanket: Snowfall drapes the deck of
the Polar Bird in the vast spread of the Antarctic Ocean

First flight: Pawan Hans Helicopter ventures over the Antarctic horizon

Second Pawan Hans Helicopter from the 18th Expedition embarking on its trial flight

We watched from the balcony of the second and third floors, eager to see the historic moment. The helicopters took off and flew over Dakshin Gangotri for an hour, then returned safely to the deck. We were all happy and congratulated the Pawan Hans team for their courageous feat.

LAUNCHING ROUTINE HELICOPTER SORTIES: AN ANTARCTIC EXPEDITION MILESTONE

JANUARY 12

The first mission of our helicopter missions to Maitri, the Indian Antarctic Base, was a courtesy visit. We brought fresh fruits, letters from home, food items and our warm greetings. Mr. Dhar, our leader, was joined by Dr. Khare, Observer from Department of Ocean Development, New Delhi/NCAOR, Goa, Major Kadam, Dr. Mehta and Mr. Gaur. We were excited to start our missions from today, as the weather was clear and sunny, perfect for flying. Everyone was up and ready by 8:00 am, bustling with excitement on the deck. We worked together to ensure everything was in order. Captain Venkatesh was in charge of the logistics, and I assisted him along with Mr. Pandkar from R & DE, Pune. We also had a brief meeting to discuss our plan of action for the logistics.

Commencing routine helicopter sorties on board Polar Bird,
exploring the vast and pristine landscapes

The first one to start his research in Maitri was Mr. M. Perumal from IIG-Mumbai, who flew to the Indian research station in Antarctica with his luggage and instruments. He was the pioneer among us to begin his experiments as soon as possible. The other scientists from SASE-Manali, IMD-Delhi and IIG-Mumbai also unloaded their equipment and instruments from the ship's container with the help of the Maitri team. The expedition members in Maitri had not seen any other Indians for almost a year since the last team left. They must have felt lonely and isolated in the harsh environment. It was a delightful moment for them when they arrived at Maitri. The Maitri team welcomed them warmly and sent them a delicious cake with creamy frosting.

The summer team members had priority to visit the station first. They had to start and finish their experiments quickly. The winter team members, like me, would go later. That was the plan. But I couldn't wait to see Maitri with my own eyes. For 25 long days, we had been sailing across the Indian and Antarctic oceans, longing for solid land. I knew I had to be patient.

The previous day, there was a wide area of clear water behind our vessel. But now, it had disappeared. The water was filled with packed ice and some icebergs.

Endless spread of pristine ice fields seen from the deck of Polar Bird

The wind had shifted overnight, blowing violently and moving the icebergs around. It was a simple reminder of how volatile and hazardous this environment was. I observed some Penguins on the icy terrain. They exhibited a curious behavior: in every group, one Penguin would remain upright while the rest reclined. This arrangement was consistent among all the groups, as though they had designated a Guard to alert them of danger. We were stuck in the Fast Ice, with no way to move our vessel.

SEAS OF SURPRISES: RECEIVING A FAX FROM MOUCHAK MAMA

I was puzzled and frightened, thinking I had made a mistake. Major Kadam and Dr. Kusum Kapila stormed into my room and commanded me to come with them. They took me to the hallway and instructed me to kneel down and extend my arms. I complied with them anxiously. They handed over me a fax. It was a letter from Dr. P. C. Tamuly, the then Head of Department, Research Planning and Business Division (RPBD) of RRL. It was the first ever letter I got in Antarctica. I felt a wave of joy and appreciation. I thanked

Dr. P. C. Tamuly for his kind act. This occurred when I was in the office of Mr. Hemant Gaur, our communication engineer and winter member from DEAL-Dehradun.

The day had been busy with total four sorties to Maitri, the Indian research base in Antarctica. Each round trip took about two hours, flying over the icy landscape. The last sortie ended at 8:00 PM, but the sun was still shining brightly. It was summer in Antarctica, and the sun never set. The only way to tell the time was by looking at the clock or the situation around. There was no fixed schedule for sleeping. People slept when they felt tired and sleepy. Three members of the team, Mr. Rup Kumar Das and Mr. Kamal Sharma from Survey of India and Mr. R. P Lal from IMD, were transferred to Maitri with their luggage. The helicopter carried their belongings in a net that hung below it. It was a risky way to transport the items, as they could swing in any direction in the wind. I was confirmed and reminded myself "We need to take every step cautiously; any mishap can happen any time here".

DAKSHIN GANGOTRI - THE FROZEN MARVEL: INDIA'S FIRST WINTERING RESEARCH BASE IN ANTARCTICA

Let us dive into the past. What a tremendous challenge that was. In the unforgiving realm of Antarctica, a remarkable feat of human engineering and resilience took shape during the Antarctic summer of 1983-1984. This monumental achievement marked the birth of India's first wintering research base in the frozen wilderness of Antarctica, christened Dakshin Gangotri. Built on a 620-square-meter raft foundation nestled a staggering 1.5 kilometers beneath the icy surface, Dakshin Gangotri emerged as a symbol of India's dedication to scientific exploration in one of the harshest environments on Earth.

Monumental achievement: Dakshin Gangotri, India's inaugural Antarctic Base, standing strong on the ice shelf, marking the success of the 3rd expedition

Dakshin Gangotri, the first Indian Antarctic Base,
standing resilient on the vast shelf ice during the 3rd expedition

The station's construction was an extraordinary endeavor, with every aspect carefully designed to withstand the treacherous conditions of the Antarctic. Comprising two double-storied blocks of prefabricated timber structures, Dakshin Gangotri was a testament to human ingenuity and determination. The top block featured a sloping roof that doubled as a loft for storage, and the two blocks were interconnected by a single-story corridor.

One of the key features that set Dakshin Gangotri apart was its innovative use of prefabricated load-bearing panels. These panels were primarily composed of wood, consisting of two 9mm-thick plywood sheets attached to the sides of a load-bearing timber frame. The space between the two sides was filled with thermally insulating material. To protect the structure from the harsh Antarctic elements, the outer face was clad with a 25mm-thick insulation material, onto which metallic sheets were bolted.

Inside, each room had a unique finishing, tailored to its purpose. The radio room boasted acoustic tiles to ensure clear communication, while the generator and boiler room were lined with asbestos for safety. The bathrooms and kitchen featured melamine-faced plywood for durability, while other rooms had hardboard finishes.

Perhaps the most awe-inspiring aspect of Dakshin Gangotri's story was the speed at which it was constructed. Despite facing the harsh Antarctic conditions, the entire base was completed in a mere 30 days, thanks to the unwavering dedication and resilience of the Indian expedition members, led by the visionary Dr. Harsh K. Gupta.

For five years, Dakshin Gangotri served as a beacon of scientific exploration in Antarctica. It was a hub of research and discovery, where brave individuals pushed the boundaries of human endurance to expand our understanding of this remote and hostile continent. However, as nature would have it, the accumulation of snow gradually covered the station, and it was soon buried under 50 feet of snow.

Dakshin Gangotri remains a symbol of India's commitment to the relentless pursuit of scientific discovery in the most extreme environments on Earth, and a source of inspiration for future Antarctic missions.

BATTLING THE ELEMENTS: SASE-MANALI TEAM'S ORDEAL IN A BLIZZARD AND WHITEOUT

JANUARY 13

The sky was overcast again and the IMD staff warned that the weather would deteriorate quickly. The situation was as if the misfortune did not stop following us. Meanwhile, two scientists, Dr. Praveen and Dr. Dutta, embarked on a daring mission to unravel the mysteries of the icy continent. They were part of a team from the Snow and Avalanche Study Establishment (SASE) based in Manali, India, tasked with conducting ALBEDO studies to understand the reflection of solar radiation on the ice. Their journey led them to the remote Indian scientific base, Dakshin Gangotri (DG).

As expected, the whiteout condition began to set in. The scheduled trip to Maitri was called off for the day from the ship. The weather was completely closed in. A blizzard started, our first encounter with such a phenomenon. Snowfall, a bit of rain and strong winds persisted. No one ventured outside. It was absolutely a dreadful situation; we were isolated from any outside help. If anything went wrong, we would have to deal with it ourselves. We had no choice but to face the situation. Nothing was visible, except the

terrible noise of the wind. Maitri was about 70 km away from us. Apart from the crew and expedition members, none of us were accustomed to this region. Many questions crossed my mind. For the next 15 months, we would have to face this situation often, as I knew how unpredictable the Antarctic weather was. The navigating officer at the bridge was extremely vigilant. They were keeping a close eye on the icebergs and their movement. At any moment, an iceberg could collide with our ship because of the blizzard and the wind.

Complete Antarctic Attire: Essential gear including overalls, snow boots, balaclavas, snow goggles, and gloves for extreme cold conditions, complemented by thermal inner wear (top) for optimal protection (including hand gloves, missing here).

The helicopter that had ferried Dr. Praveen and Dr. Dutta to the DG base descended amidst swirling snowflakes, placing the two researchers and their equipment on the frigid ground. The air was so cold it felt as if every breath might freeze in their lungs. The sun, though low on the horizon, cast an otherworldly glow on the snow-covered landscape, bathing everything in a surreal, pale light.

Leading Companies Providing Essential Antarctic Gear: A Compilation of Logos

Excitement and determination fueled their actions as they began setting up their instruments. The wind bit at their faces, but the urgency of their mission pushed them forward. They worked with skillful precision, securing sensors, calibrating equipment, and establishing communication lines. But as they went about their tasks, the weather began to take a treacherous turn.

Without warning, the blizzard descended upon them, a furious tempest of wind and snow that engulfed the landscape in a swirling vortex of white. Visibility rapidly deteriorated, reducing their surroundings to an ethereal blur. Driven by a blinding

whiteout, they realized they were in grave danger. The icy gusts howled like an ancient force determined to reclaim the land from any intruders.

Realization set in that they were stranded. The helicopter that had brought them had departed, and now they were alone in the heart of the storm. Survival instincts kicked in, and they sought shelter within the walls of the scientific base. The biting cold penetrated even the thickest layers of clothing, and they huddled together, their bodies trembling from both the cold and the uncertainty of their situation.

For hours that felt like an eternity, they remained trapped within the base, unable to gauge the passage of time. Fear and doubt gnawed at their resolve. Were they forgotten? Would anyone come to their rescue?

After what seemed like an infinity, the storm began to relent. The wind's fury subsided, and the snowfall lessened. Dr. Praveen and Dr. Dutta dared to look outside and were greeted by a scene of eerie calmness. The snow-covered landscape stretched before them, as if untouched by the tempest that had held them captive.

Vast and formidable, the periphery of Antarctic reveals its extreme shelf ice

There were many incidents of shipwreck from the collision of Iceberg during Blizzard. Incidentally, Blizzard used to blow from South to North. So the Ship was not static, it kept on moving at slowest speed maintaining a safe distance with Iceberg. The

speed of wind was around 50-60 knots (1 knot =1.82 Km) per hour while wind gust was much more severe. Ship had attained a harmonic motion due to wind. The helicopter blades were jumping terribly even though tied with a nylon rope. There was accumulation of snow on the deck including most part of the ship. The ship was completely covered with snow after a few hours. Even railings, rods and window panes were fully covered with snow. The furious activity of nature continued throughout the day. Communication between DG and Ship got disrupted due to Blizzard.

We were worried about Mr. Srivastava and Mr. Dutta who were left alone at DG. Almighty only knew about their well-being. I was just praying for their safe return. In DG they were staying in a portacabin where they had sufficient food item for 15 days. We all were worried about their survival. I remembered the training in ITBP, Auli towards Antarctic survival. Although they had ration , sleeping bags, small generator but they were totally cut off from all direction , even communication. It was mankind’s endurance to nature's fury. In evening the Blizzard was much more intense with full roar.

The blizzard lasted until the following day, creating a complete whiteout condition that persisted until the morning. However, the situation was slowly improving as the wind speed dropped by 30 knots. The Pawan Hans helicopter engineers were instructed to prepare the helicopter for a possible rescue mission if the weather conditions allowed them to locate and retrieve the members from DG.

With the weather finally showing signs of improvement, the researchers knew they had to act swiftly. They sent out a distress signal, praying that it would reach their team at the base camp. To their immense relief, the signal was received, and a rescue operation was launched. A helicopter was dispatched, braving the lingering winds to reach the stranded scientists.

As the helicopter emerged from the snowy horizon, it was a beacon of hope in the deserted landscape. With skilled precision, it descended, its blades stirring the snowflakes into a whirlwind. Dr. Praveen and Dr. Dutta clambered aboard from DG base, their hearts full of gratitude and awe for the daring rescue.

Back at the ship, they recounted their harrowing experience to us. Their story was one of survival against the odds, of human determination and the indomitable spirit of exploration. The ALBEDO studies could wait, for the true lesson they had learned was the unpredictable power of Antarctica's weather.

They understood what they had gone through. They were immediately moved to the MI room of the ship and conducted a thorough physical examination. They had signs of frostbite on their faces.

UNDERSTANDING THE ELEMENTS: DEFINING BLIZZARD, WHITEOUT, AND WIND CHILL INDEX

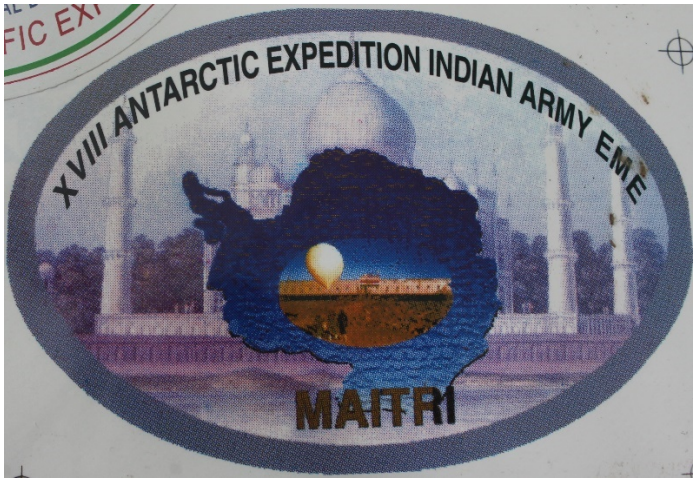
Blizzards stand as the most severe weather occurrences in Antarctica, arising from forceful winds propelling falling or drifting snow along the ground. Persisting for days, they drastically diminish visibility to near zero. In the face of blizzards, expeditioners must remain sheltered within tents or caravans. Coastal blizzards often stem from low-pressure systems that amplify local Katabatic winds. Wind velocities can escalate to 150 km/h (92 mph), accompanied by gusts surpassing 190 km/h (129 mph).

On the other hand, *Whiteout*, a phenomenon prevailing in snowy landscapes, arises when depth and distance visual cues vanish. This phenomenon manifests when both the sky and ground share equivalent brightness and color, yielding a homogenous expanse of white that obscures the horizon and landmarks.

The *windchill index* quantifies the cold sensation on the skin by considering temperature and wind speed's cumulative impact. Computed through a formula that adjusts based on locale and underlying assumptions, the windchill index signifies heightened risk of frostbite and hypothermia with lower values. As an illustration, at -20°C coupled with a wind speed of 14 km/h, the windchill index reaches about -32°C. This indicates that exposed skin can freeze within a mere 10 minutes or less.

SALUTING OUR HEROES: INDIAN ARMY DAY CELEBRATION

Today was a special day for us as we celebrated Indian Army Day with the 16-member Army team that was on board our ship.



Logo of Indian Army EME team on the occasion of 18th ISEA

The team, which included officers of Major and Captain rank as well as Havildars, was responsible for the logistics of our expedition. The celebration was intended to honor their service and courage. Mr. Srivastava and Mr. Dutta too joined the celebration. We were glad to have them with us. The celebration was full of fun and excitement, with various events and activities. The theme of the celebration was "Jab Nikal Pare Safarpe to Keya Murke Dekhna", which means "Why to look back when you are on voyage". It was a fitting motto for our adventurous journey and our brave companions.

UNPREDICTED CHALLENGES: A MISHAP DURING A HELICOPTER SORTIE TO MAITRI

JANUARY 16

The weather was clear enough to fly for Maitri, base. Two helicopters were ready to transport the expedition members and their equipment. The snow on the deck had been cleared, but there was still plenty of snow around.

Lost Cargo: Helicopter mishap leads to items floating in Antarctic waters

The helicopters were carrying people, machines, materials and rations. Most of the items were carried by under slung because the ship had not reached the shelf ice yet. The pilots of the helicopters were Captain Saxena, Captain Singh and Captain Kahlon. Captain Kahlon's helicopter had some problem during takeoff. The expedition members inside his helicopter were Dr. Gupta from Botanical Survey of India, Mr. Mohammad Razzak from National Marine Institute of Iran, Dr. Pradeep Kumar of IIT Roorkee and Dr. Ramtake from CSIR ITRC Lucknow.

Deployment of rescue boat via ship's crane to recover items lost in Antarctic waters

Both helicopters took off successfully. However, a moment later, we witnessed a terrible accident. One helicopter was trying to straighten the under slung by flying vertically, but it collided with the upper edge of a shipping container. The collision caused the helicopter to lose its balance and it started to plunge into the sea water. Captain Kahlon showed his remarkable skill of piloting and released the under slung from the helicopter. He managed to regain control over the helicopter and avoided a probable disaster. All the materials in the under slung were scattered over the sea surface and started to float. All the crew members rushed to the deck and lowered a small boat by crane to rescue the instruments and materials from sinking. All the expedition members watched anxiously as the rescue operation proceeded. Mr. Razzak's bag, which contained $2000 and his passport, was also floating on the water. Fortunately, his bag was recovered along with other materials. The rescue operation was led by Mr. Dyke and two other Filipino crew members.

The Bridge supervised and directed the entire rescue operation, which lasted for almost an hour. As soon as the mishap occurred, the helicopter landed. Captain Gupta and

Captain Soni, the technical team, inspected the helicopter for any technical issues. They found none and declared that the helicopter was safe and ready for the next sortie.

An aerial vista of the serene Schirmacher Oasis amid the Antarctic wilderness

Dr. Kumar and Mr Razzack had to delay their visit, while myself and Mr. Y V V S N Murthy were instructed to depart for Maitri.

Boarding the helicopter en route to Maitri station following the mishap

We boarded the same helicopter without much delay. It was a strange feeling to fly with it after the incident. The flight was very smooth, though. We flew over the Shelf ice on our way to Maitri. Shelf ice is a mass of ice that separates from a glacier and floats on the sea water with varying thickness.

As we flew over the shelf ice, we could see many crevasses that formed deep cracks on the surface. They looked like scars on the white landscape. In the distance, we could spot the Uthant hills, a group of rocky peaks that stood out from the ice. They were named after a former UN secretary-general who visited Antarctica in 1968. Our helicopter was gradually approaching the Schirmacher Hills, another range of nunataks that hosted our research base. We were eager to land and explore this fascinating region, the Schirmacher Oasis, with mix of fear and adventure.

Panoramic vista: Uthant Mountain, the majestic centerpiece of Antarctica's rugged landscape photographed from helicopter

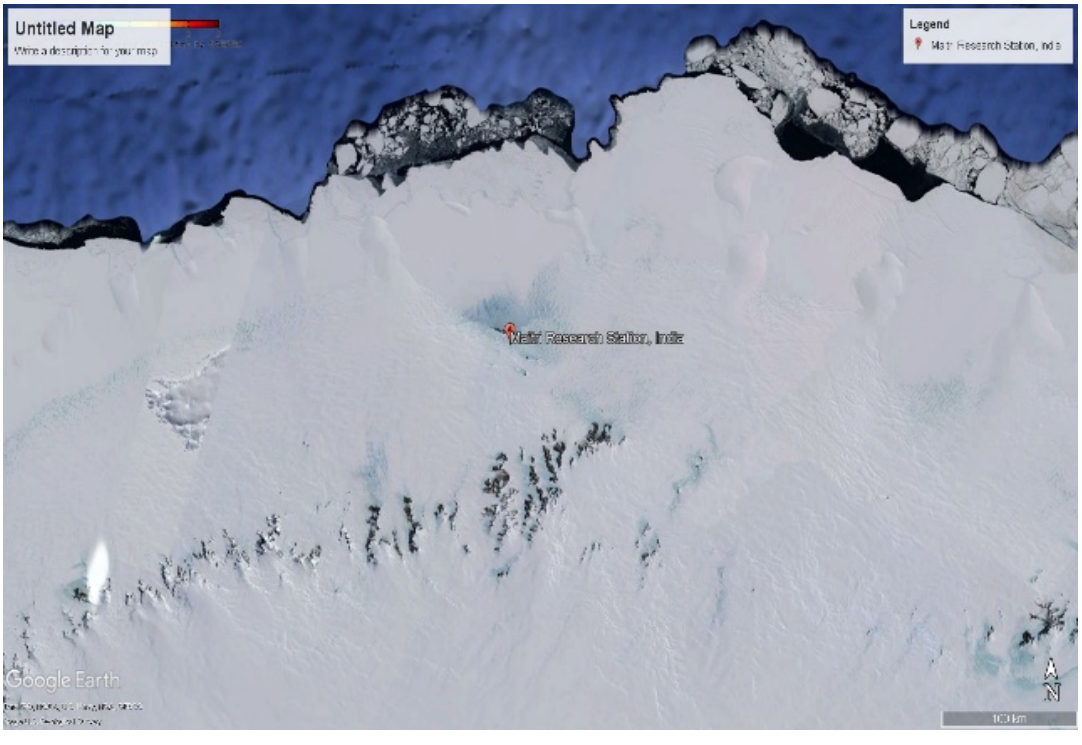
THE SMALLEST OASIS IN ANTARCTICA: SCHIRMACHER OASIS

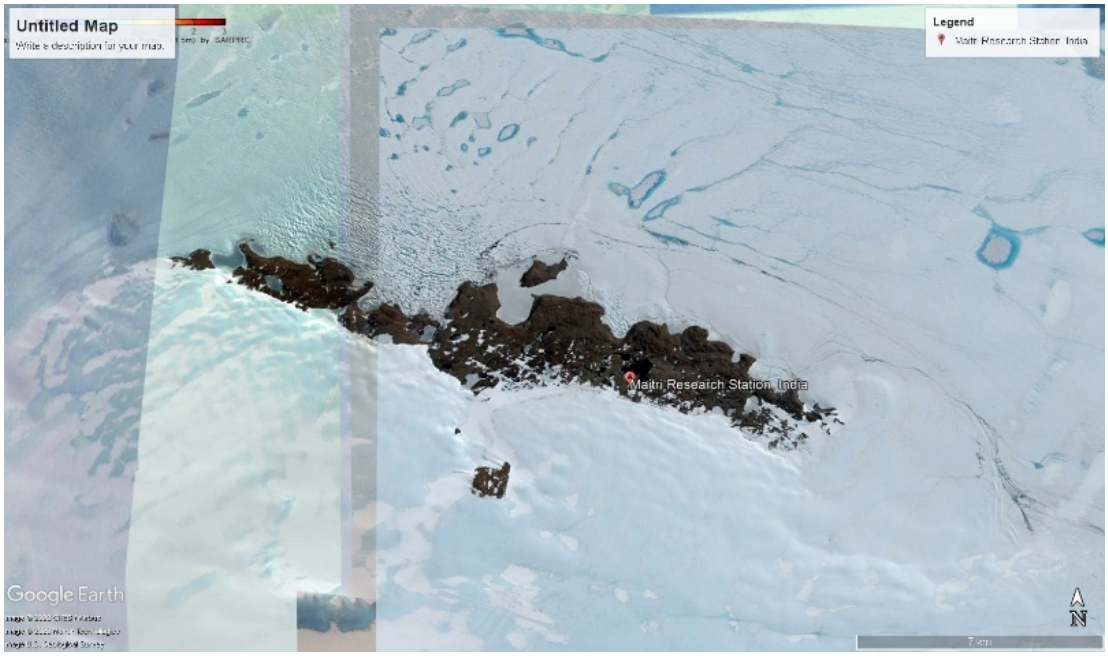
The Schirmacher Oasis is a 25 km (16 miles) long and up to 3 km (1.9 miles) wide ice-free plateau with more than 100 freshwater lakes. It is situated in the Schirmacher Hills on the Princess Astrid Coast in Queen Maud Land in East Antarctica and is, on average, 100 m (330 ft) above sea level. With an area of 34 km^2 (13 sq mi), the Schirmacher Oasis ranks among the smallest Antarctic oases and is a typical polar desert.

The oasis is located between the edge of the Antarctic Ice Sheet and the *Novolazarevskaya Nivl Ice Shelf*. The approximately 100 m (330 ft) high plateau of the Schirmacher Oasis is a barrier to the northwards-running ice stream. On the northern edge of the oasis are so-called epishelf lakes, bays separated from the ocean which are connected with the ocean underneath the surface of the ice. Thus, tidal effects can be observed in the lakes. The epishelf lakes can contain either mere freshwater or saltwater which is overlaid by freshwater. The Antarctic Ice Sheet, southwards of the Schirmacher Oasis, reaches heights of 1,500 m (4,900 ft). The

nunataks *Skaly Instituta Geologii Arktiki (Skaly IGA)* and *Basisny-Kit* protrude from the ice sheet. Between the offshore ice sheet and the Wegener Ice Sheet Plateau are the Wohlthat Mountains.

The highest part of the Schirmacher Oasis is Mount Rebristaya/Vetaiha peak, with a height of 228 m (748 ft). At a depth of 34.5 m (113 ft), Lake Glubokoye is the deepest inland lake of the oasis. Spatially, the largest lake within the oasis is Lake Sub, with an area of 0.5 km^2 (0.19 sq mi). The formation of this oasis is a scientific wonder.





Location of Schirmechar oasis(top) and Maitri(below) from Google sattelite image, surrounded by vast spread of ice

Expansive view of the Eastern extent of Schirmacher oasis, far numbers of mountains are visible

A number of theories exist about the formation of the oasis that include geothermal heating, intense insolation, or the hypothesis that the ice flow is blocked by a geological feature such as a mountain. Our geologist were exploring the wonder.

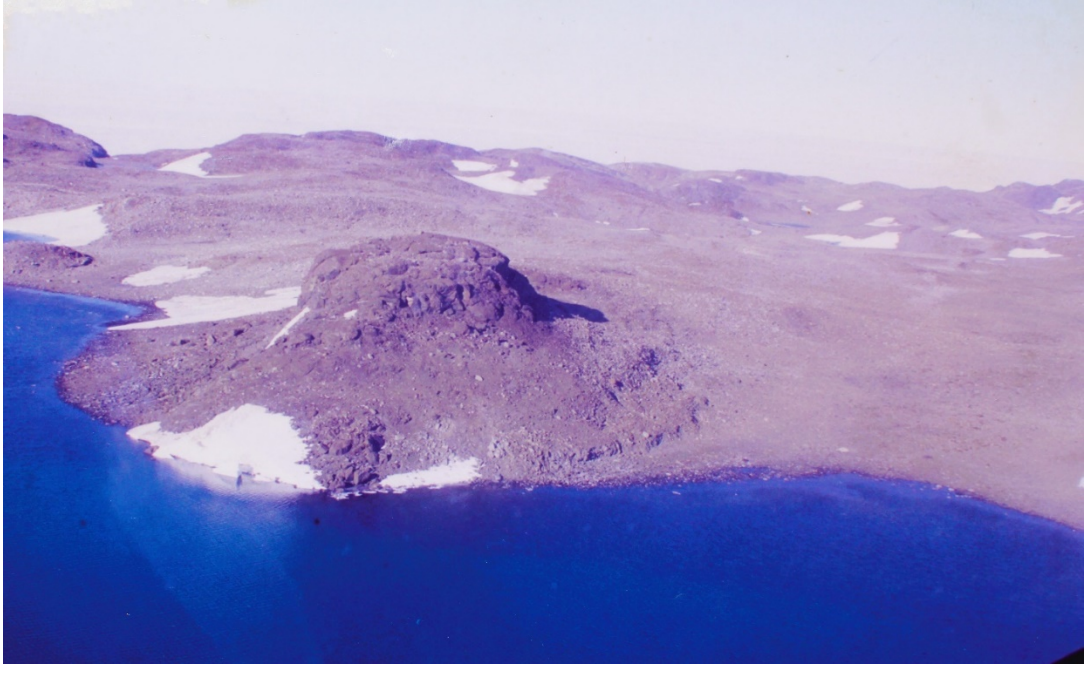
Northern extent of Schirmacher oasis among vast span of ice where melting is visible

An aerial glimpse of the serene Schirmacher oasis captured from helicopter

The climate of the Schirmacher Oasis is relatively mild for Antarctic conditions. The annual average temperature is −10.4°C (13.3°F) (ranging from 0.9°C (33.6°F) in summer to −22.0°C (−7.6°F) in winter), the annual average wind speed is 9.7 m/s (22 mph ; 18.9 kn), the annual average precipitation is 264.5 mm (10.41 in), and there are 350 hours of sunshine per month. Because of the positive radiation balance, the Schirmacher Oasis is regionally classified as a "coastal climate zone".

The rocky soil at the Oasis allows growth only for a limited amount of undemanding plants like mosses and lichens. Animals are also rare at the Oasis. Exceptions are the Antarctic skua, the Antarctic petrel, the snow petrel, and the Wilson's storm petrel. Occasionally, Adélie penguins can be seen at the oasis.

At the beginning of 1939 Germany launched an expedition under the command of captain Alfred Ritscher to explore an uncharted area of the Antarctic. They surveyed an area between latitudes 69°10’ S and 76°30’ S and longitudes 11°30 W and 20°00’ E, totaling 600 000 km² and called it Neuschwabenland, or New Swabia. The area was surveyed by two Dornier hydroplanes, *Boreas* and *Passat*. One was piloted by Richardheinrich Schirmacher, who, on 3 February 1939, spotted both the oasis and the lake at its centre. Schirmacher named both after himself (ref. Wiki).



Bird’s eye view of hills and lake in Scirmacher osasis snapped from helicopter

TOUCHING DOWN AT MAITRI: MY NEW HOME IN ANTARCTICA

JANUARY 16

In the meantime, after flying half an hour, we had a clear view of Maitri, the second Indian Antarctic Base, from a distance. It looked like a small hut in the vast white landscape. As our chopper approached the ground, we could see the whole complex of Maitri. Antarctica is a no-pollution zone, so the visibility was perfect. We could see various facilities such as summer huts, water pump, satellite communication dome, the aluminum antenna for high frequency communication, the generator set compound, and the main two-storied structure of Maitri. This was where we would stay for the next 15 months. There were also two iron-made helicopter landing grounds near Lake Priyadarshini. The lake was named after late Prime Minister Indira Gandhi, who had suggested the name Maitri for the station. The chopper landed smoothly on one of the landing grounds. We had a close call earlier, but we were safe now. As soon as we touched down, we heard a welcome announcement on the microphone that echoed in the premises. I realized that things would not be easy here. But I was ready for an extreme adventure and to contribute to Antarctic science. The complex looked lonely and bleak, surrounded by an ocean of ice and rocky mountains. The air was extremely dry. We had to stay inside the chopper until the rotor stopped completely. Then we stepped out of the chopper and entered our new home.

The author at the entrance of Maitri, Indian Antarctic station

Scenic view from Maitri, the second Indian Antarctic Base at Schirmacher Oasis, showcasing the sprawling retreating glacier and Pawan Hans helicopters lined up on the helipads

Wooden milestone displaying the distances of major Indian cities from Maitri, Antarctica

It was a cold day with no wind at Maitri. The temperature outside was around -3.0°C. Some of the winter members came to welcome and assist us. They took us to the lounge inside Maitri, where we felt the warmth of hospitality and friendship. As we walked through the corridor, we saw the metallic plaque that commemorated the achievements and contributions of the previous expedition members who had explored the Antarctic science. We also learned about the tragic deaths of four Indian researchers who had sacrificed their lives during field experiments from the information attached in wall. It was a stark reminder. We exchanged introductions and received some essential advice for our stay. Then we moved to Tirumala summer hut, our temporary home for the next two months. It was a wooden structure with dimensions of 14 x 12 x 9 feet. It had four pillars that were secured with strong plastic ropes to prevent it from being blown away by blizzards. Tirumala hut housed a seismic and geophysical observatory at the base, and we used to sleep on the rooftop of the observatory in sleeping bags, climbing up and down a wooden ladder. Prof. Pradeep Kumar and Mohammad Razzak were already there.

Visible in the image are the effects of overnight snowfall in Schirmacher Oasis, Tirumala, Dodabeta Hut, and a 22-meter mast equipped with wind energy assessment sensors standing tall

LIFE IN THE SUMMER HUT: RESUMING GALLEY DUTY

JANUARY 17

New assignment bestowed upon arrival as Galley duty member. Galley duty was one of the responsibilities that we had to fulfill during our stay in the summer huts and around the Maitri complex in Antarctica. It involved maintaining the cleanliness and orderliness of the facilities, as well as ensuring the availability of hot water and proper sanitation for the expedition members. It was a challenging but essential part of our Antarctic survival. Our day would start at 6:00 AM, when we had to heat up cold or frozen water using an ATF burner and place it near the toilet and bathroom module for others to use until 11:00 AM. Then we had to fill two large water tank modules with a capacity of 500 liters each from Lake Priyadarshini, which was about 300 meters away. We used a small pipe and pump to draw water from the lake, but we had to be careful not to leave any water inside the pipe after filling the tanks. Otherwise, the water would freeze overnight and cause problems for the next day. This was a temporary arrangement for the summer huts, so we had to manually lift and shift the pipe to drain out every drop of water. In contrast, the water filling in the Maitri complex was automatic and pneumatic.

View of Pawan Hans Helicopter stationed by Maitri,
showcasing pilots and expedition members. Visible in the frame are ATF barrels

Summer expedition shelters at Summers Hut, featuring visible INMARSAT terminals used by expedition members

Another important task that we had to do was to burn the human secretion into ash using a different ATF burner fitted within the toilet module. This was done after the members in the summer huts had used the module until 11:00 AM. Burning the waste was necessary to prevent environmental contamination and reduce the volume of waste that had to be transported back to India.

Galley duty was not only a physical but also a mental challenge. We had to cope with extreme weather conditions, rough terrain, limited resources, and isolation. We also had to work as a team and support each other in times of difficulty. Galley duty taught us valuable lessons about endurance, discipline and adventure that we will never forget.

Scenic freshwater lake adjacent to Maitri amidst the Schirmacher oasis

SECOND MISHAP CHRONICLES: THE BURNING OF THE WOODEN MODULE

JANUARY 17

It was a typical day in Antarctica, around 11:15AM, when we had to perform our second assignment of galley duty. This involved burning the excreta into ash in both the toilet modules. We were guided by I P Raju, a veteran wintering over member from NGRI Hyderabad, who instructed us how to do it safely and efficiently. After starting the burning process, Raju and I went to Annapurna hut, just 20 ft away, and asked Bhaskar, my summer team member, to keep an eye on the modules. We were about to relax for a bit when Bhaskar came running and shouted for help. I ran back to the modules and saw that one of them was on fire with thick smoke. I yelled for help as loud as I could and sprinted towards Maitri. I also switched off the ATF burner of the other module on my way. Halfway to Maitri, I saw many of the previous expedition members rushing with fire extinguishers towards the burning module. It took them a few minutes to control the fire, but by then the module and burner were completely destroyed. Luckily, the other module was spared from the flames as the wind was blowing in the opposite direction. I felt extremely guilty about the incident as I was responsible for it along with Bhaskar. It all

happened so fast due to our lack of vigilance, even though Bhaskar was at the site. I wished we had stayed near the modules instead of leaving them unattended. After the incident, Mr. Sivan, the station commander and leader of 15th WOT, called a meeting and told the summer members not to panic or feel sorry, but to be alert and prevent such accidents. I promised myself to be attentive at all times, as we had been trained by ITBP for Antarctic survival.

EXPLORING THE MAITRI LANDSCAPE: LAKE PRIYADARSHINI AT THE FOREFRONT

Maitri is located in a desolate landscape of broken rocks and scattered ice. It faces north, overlooking Lake Priyadarshini, a large lake in the Schirmecher oasis. The lake is named after Indira Gandhi, the former prime minister of India who initiated the Antarctic expeditions. The lake freezes for most of the year, except for a brief period in summer when it shows some movement on its surface. The water from the lake is used for daily purposes at Maitri. On the left side of Maitri, there are two big hangars where Pisten bully vehicles and Mantis cranes are stored. Behind Maitri, there is a generator complex with six operational gensets and a retreating glacier that connects to the South Pole. On the right side of Maitri, there is a large high-frequency antenna and several summer huts, such as Dobabeta, Tirumala and Annapurna.

Welcoming foreign expedition members with a red carpet at Maitri, as we proudly display national flags of respective nation during a warm reception

A serene view of a freshwater lake in Schirmacher oasis, offering a glimpse of the pristine beauty of the region.

Panoramic view of the lake, showcasing the prominent 22-meter utilized for wind energy assessment by NAL, Bangalore : the author used to climb ones in week to retrieve EEPROM from wildmill

Snow blankets the surroundings near summer huts following an overnight snowfall

Snow covered landscape around Maitri, frozen lake surface except middle portion

INDIAN SEISMOLOGICAL OBSERVATORY IN MAITRI, ANTARCTICA

Antarctica stands out as one of the most geologically stable continents globally, characterized by exceptionally low seismic activity and precise modern crustal deformation. Since the International Geophysical Year (IGY) of 1957, over ten seismic stations have been established, and the reporting of seismic activity has been integrated into the worldwide seismic network, encompassing Antarctic stations. Over the past three decades, this tranquil region has experienced just ten earthquakes within the magnitude range of 4.1 to 4.9.

In an effort to monitor seismic activity within Antarctica and the Indian Ocean, a reconnaissance survey was initiated during the 16th Antarctic Expedition in January-February 1997. This survey aimed to select suitable sites and assess the feasibility of operating a seismological station in Antarctica. During the subsequent 17th Indian Antarctic expedition, a state-of-the-art Digital Seismological Station was successfully installed and fully commissioned on January 26, 1998. Its primary objective is to monitor seismic activity within Antarctica and also contribute to global teleseismic studies and monitor activity in the mid-oceanic ridge of the Indian Ocean.

To ensure the accuracy of data collected by the Broad-Band seismographs, a thermally insulated vault was meticulously designed and buried underground. Given the sensitivity of these instruments to temperature and pressure fluctuations, the vault incorporates an electronically controlled system that maintains the interior temperature at precisely 15° +/- 0.5° Celsius. Data is digitized at a rate of 50 samples per second, and continuous recording is carried out using a 24-bit digitizer. An integrated GPS system within the data acquisition system ensures accurate timestamping. Since its installation in December 1998, the station has operated continuously without interruption till date.

During my tenure, the observatory also achieved the successful continuous operation of a permanent GPS tracking station running in parallel with the seismological station.

Seismological observatory at Maitri, Antarctica, featuring analog and digital seismographs. The author demonstrates static body discharge using a wristband-the first assignment.

Data collected from the GPS permanent station at Maitri underwent rigorous processing, allowing for the estimation of Maitri's coordinates with respect to IRTF 97 stations situated across Antarctica. These calculations were made by determining the baselines between these stations. The resulting coordinates for the Maitri station, referenced to the IRTF 97 coordinate system at epoch 1998.1, are as follows:

- X Coordinate : 2063437.667 meters ; Latitude: 70° 45' 56.90245" S

- Y Coordinate : 428659.449 meters ; Longitude: 11° 44' 08.62037" E

- Z Coordinate : -5999849.162 meters ; Height: 132.242 meters

Additionally, horizontal velocity vectors were computed for Maitri (MAIT) and FOR1 (Forester German station) at a rate of 1 centimeter per year. This data holds crucial significance as it provides valuable insights into the seismic activity of the icy continent, the Indian Ocean and mainland India as well.

Moreover, the technical expertise acquired in establishing a seismic monitoring station under sub-zero conditions carries substantial importance. Beyond these considerations, the measurement of displacement and its relation to stress-strain phenomena between Antarctica and India holds the potential to advance our understanding of seismotectonic, particularly within Peninsular India and the broader Indian subcontinent. India would have missed this crucial information had we not installed these machines.

Interior of the seismological observatory showcasing the sophisticated digital setup for earthquake monitoring. An oil heater (left) maintains room temperature arourd 5°C. Heat-sensitive white chart paper captures analog seismograms, while a digitizer records and displays signals as digital seismograms on a laptop computer for further analysis

During my research period, the seismological station at Maitri, Antarctica, diligently recorded a total of 380 earthquakes, encompassing both teleseismic and regional events. The majority of these earthquakes fell into the teleseismic category. Some regional earthquakes, with their epicenters located within the Indian Ocean, were also captured, while a few very proximate shocks were recorded, originating directly from the ocean.

Notably, a solitary local earthquake event was documented at Maitri, with its epicenter situated within Antarctica itself. Preliminary analysis indicates that the epicenter

of this event is located in Queen Maud Land. The distribution of epicenters for the regional earthquakes reveals that a significant number originate from the northeast and northwest regions.

For further insights into this intriguing occurrence, you can refer to the article titled "A rare earthquake in Antarctica" Saurabh Baruah and Indra Mohan, published in CURRENT SCIENCE (Special issue of Third World Science), Vol. 81, No. 8, on October 25, 2001, spanning pages 883 to 885 and detail in Technical Report of our expedition.

STATIC ELECTRICITY'S INFLUENCE: INSIGHTS FROM A FORMER ISEA MEMBER

I was overwhelmed to learn more about the digital seismograph and GPS that we were using in Antarctica. Mr. I P Raju, existing wintering over member from NGRI, was very generous with his time and knowledge. He taught us how to operate, maintain, retrieve and process the data from these sophisticated instruments. He also warned us about the possible technical glitches that could occur and how to fix them quickly. I paid close attention to his instructions, because I knew that once he and Bhaskar left, I would be on my own. I had to be prepared for any situation that might disrupt the operation. The most crucial thing to remember was to neutralize the static charge of our bodies. Antarctica is the driest, coldest and windiest place on Earth, and it makes our bodies highly charged with static electricity. If we touch the instruments without discharging ourselves, we could damage them beyond repair. And that would be a disaster in Antarctica, where we can't get any replacements. So, before touching anything, we always had to wear a wrist band that was connected to a wire that grounded us. This way, we could protect the instruments and our mission.

EXPLORING BIODIVERSITY: INSIGHTS FROM DR. HUSSAIN AT THE ZOOLOGICAL SURVEY OF INDIA

JANUARY 19

Dr. Hussain from Zoological Survey of India, Dehradun has embarked on a research project on nematodes, a diverse group of roundworms that inhabit various environments. He was eager to explore the Antarctic region, where he joined the expedition. The weather was favorable for his work, and he wasted no time in setting up his equipment in Tirumala hut. He collected water samples from different lakes near Maitri, including Lake

Priyadarshini, and examined them under his microscope. He was delighted to find nematodes in the water of Lake Priyadarshini, as well as other microorganisms such as protozoa and bacteria. He showed me his findings and explained their significance for the ecology of the region. He continued his routine of sampling, studying, and documenting every day, with great enthusiasm and dedication. One day, I jokingly remarked that he seemed to love his old microscope more than anything else. He replied without looking up, "Old is always gold". He was completely absorbed in his work. He had a limited time to complete his project, as the summer season was short and unpredictable in Antarctica. He faced many challenges such as strong winds, blizzards, and low visibility, but he never gave up on his passion for nematodes. Dr. Hussain explained several details. Few excerpts are indicated below: -

LAND ANIMALS:

Antarctica's land animals mainly consist of moss- and soil-dwelling arthropods, including around 50 species of mites, 20 species of springtails (collembola), and two species of midges. There are also 28 species of metazoans, such as rotifers, 28 species of tardigrades, 51 species of nematodes, and various protozoa such as rhizopods and ciliates. These creatures can also be found in meltwater ponds and lakes, along with 12 species of crustaceans.

The permanent animal inhabitants of Antarctica are mostly small and can only be seen with a magnifying glass or microscope. The largest of them is a wingless midge called Belgica antarctica, reaching a maximum length of 12 mm (0.5 in). Most soil mites are barely visible, measuring only half to one-third of a millimeter (0.02 to 0.013 in). Rotifers are around one-quarter of a millimeter (0.01 in) long and become visible to the naked eye when present in large numbers, sometimes staining pools red. Tardigrades are about half the length of rotifers.

THE SOUTHERN SEALS AND WHALES

The Antarctic coast, sea ice, and subantarctic islands are home to five species of true or 'earless' seals, which lack external pinnae or flaps on their ears. These species, namely the Weddell, Ross, Leopard, and crabeater seals, are closely related to each other. Among the whales, porpoises, and dolphins, the blue whale belongs to the order Cetacea. Like all mammals, it breathes air, internally develops its young, and nurses them after birth. These characteristics distinguish cetaceans from fishes. While they possess streamlined shapes and fins for balancing and propulsion, these adaptations are secondary and beneficial for aquatic life.

A breaching Killer Whale captured on the ocean's surface.
Image credit: Dave Harvey (Australian Antarctic Program)

Weddell Seal lying on the snow surface (L. Photo: Dave Harvey(AAP))

ANTARCTIC PLANTS

Most of these simple Antarctic plants grow in compact curves, mats and small cushions. By gathering together in colonies, they are able to collect and retain more water. They also lose less by evaporation, and show a marked ability to use water rapidly whenever it becomes available.

A typical moss turf from the Antarctic Specially Protected Area near Casey station. Most of the moss shown here is the endemic Schistidiumantarctici (olive green in colour), which is the dominant moss species in the area. Photo: Sharon Robinson(Australian Antarctic Program)

These plants have also become well adapted to the almost continuous light during the long days of a polar summer. One antarctic moss, *Bryum argenteum*, produces more energy by photosynthesis in low light at 5°C (41°F) than it does at 15°C(59°F), or higher. Photosynthesis can start within a few hours of warming after prolonged period of freezing, and almost immediately following short periods.

A photograph capturing the distinctive moss turf near Maitri station. The prevalent moss species depicted is the endemic, recognizable by grayish green in colour : visible only for a month.

SURVIVING THE COLD

The adaptations of Antarctic flora and fauna to endure the severe cold are not unique; rather, they resemble strategies working in other demanding habitats globally.

Within Antarctica, both plants and animals implement two principal approaches to weather the rigorous cold. Warm-blooded creatures uphold their core temperature through insulation and behavioral and metabolic alterations. Conversely, plants and cold-blooded animals exhibit adaptations to evade or mitigate the detrimental consequences of freezing. They exhibit a preference for locales where the local climate is comparatively milder than the surrounding regions.

Layer of algae on snow surface, Photo: Kerry Steinberner (Australian Antarctic Program)

The crystallization of ice within cells and tissues emerges as the most injurious consequence of low temperatures for both plant and animal life. Ice formation has the potential to rupture the outer cell membrane, inflicting irreversible harm upon the delicate cellular machinery.

To counteract ice crystallization, numerous organisms undergo water loss as temperatures plummet, heightening the concentration of sugars, salts, and other cellular

components. Antarctic flora like lichens and mosses, along with insect eggs and larval stages, possess the ability to dehydrate and subsequently swiftly recover when temperatures ascend, a mechanism contributing to their remarkable resistance to extreme cold.

Lichens on Heard Island Photo: Roger Kirkwood Recently tipped iceberg brown with algae. Photo: Kerry Steinberner (Australian Antarctic Program)

Warm-blooded inhabitants of Antarctica, such as penguins, seabirds, seals, and whales, rely on substantial layers of blubber for insulation against the frigidity. It's heavenly so far biodiversity is concerned.

Red algae in the snow. Photo: Bob Jones (Australian Antarctic Program)

SALUTING THE TRICOLOUR: HOISTING THE NATIONAL FLAG ON REPUBLIC DAY

JANUARY 26

What a glorious day it was for me and all the other members of the expedition to celebrate the Republic Day by raising the national flag in the midst of snowfall and cold. The Indian National Tricolor was waving proudly in this corner of the world. To our delight, the Russian Expedition members and their Leader also joined us from Novolazaraveskaya - the closest Russian Antarctic base. The National flag was hoisted by Mr. K. R Sivan, Leader 17th Indian Scientific Expedition to Antarctica and we all sang the National Anthem. It was a wonderful feeling for me, I felt grateful for my parent, my family members and friends.

Many flags from different participating Institutes were displayed with full color and pride in front of Maitri. It was freezing outside. After the flag hoisting ceremony we gathered in the lounge of Maitri and the Republic day function started with the address by Mr. Sivan to the expedition members followed by speech from 43rd RAE leader in Russian. Then the English version was read out. The function went on till evening with fun and games. As, I remembered some words in Russian, so I asked the leader "Kak de la?" meaning "How are you?". He replied with a smile "Aachin Kharaso" meaning "Very Good". He was very pleased hearing Russian words from me.

Hoisting the Indian National Flag on Republic Day during 17th ISEA: a proud moment

Thereafter, we faced a severe blizzard yesterday, just a day after we celebrated the Republic Day in the midst of snowfall. The wind was howling at 40 knots (1 Knot =1.82 km), making it very difficult to walk from Tirumala hut to Maitri, which was only 250 meters away. The temperature difference was also striking: it was -3 degree centigrade outside Maitri, but +5 degree centigrade inside Tirumala hut. The windchill effect lowered the temperature to -25 degree centigrade, and we felt the gusts pushing us back. The lake water, which was usually calm and quiet, was now choppy and wavy. Tirumala hut was also shaking and creaking due to the east-west wind. The blizzard showed no signs of stopping, and we had to brave it to go for dinner in Maitri.

Hoisting the Indian National Flag on Republic Day during 18th ISEA

HONORING EXCELLENCE: MAJOR GAUTAM NARAYAN RECEIVES THE VISHISTA SEVA MEDAL

JANUARY 28

I woke up late in the morning, feeling exhausted by the surroundings. Bhaskar barged into my room, shook me awake and asked "Did you see the flashgun of my camera?". I unsteadily opened my eyes and tried to make sense of his words. I said "Yes, it is with me". He asked "Where is it?". I said "I put it in my camera bag". He grabbed the flashgun and ran out like a bolt of lightning towards Maitri complex. I was puzzled by his haste. Later I learned that there was a ceremony to honour Major Gautam Narayan of 17th ISEA who received the Vishista Seva Medal award for his heroic act. The award was announced on Republic Day. Mr. Sivan, the leader, got the message at 7 AM and called for a meeting to celebrate the glorious occasion. The VSM was given to Major Narayan for saving the lives of six Russian members of the Russian Antarctic Expedition(RAE). It was a harsh winter night when the MI-8 Russian helicopter with eight expedition members crashed on the shelf ice, which was almost 150 km away from Maitri. The RAE sent an SoS to the Indian Team Maitri for rescuing the members. A rescue mission was planned without delay.

A seven-member team led by Major G Narayan drove to the spot on a convoy over the shelf ice, covering 150 km distance over an unmarked path full of crevasses. The accident happened during the peak winter, in the month of July, in the darkness of polar night. I wondered how they located the crash site. It was found out later that the GPS of the helicopter was luckily remained intact. The Inmarsat satellite phone was also working fine. So the RAE team from the crash site could contact Maitri for help. If there was no communication, the rescue would have been impossible. The bravery of the entire rescue team was commendable. All eight members were safely rescued by the Indian team.

The rescue effort in Antarctica was a courageous act, as it was carried out in a hostile and dangerous environment. The members of the Russian Antarctic Expedition and several Leaders praised this performance, which showed remarkable skill and determination by Indians.

UNFORESEEN CHALLENGES: HELICOPTER ENGINEER'S ACCIDENT DURING FIELD WORK

In the meantime we heard of another accident. There was a call from Dr. Nag, our Physician, from the ship stranded at the Indian Bay of Shelf Ice at Maitri informing the ill

health of Mr. Verma, Engineer from Pawan Hans. Dr. Nag asked for help from the ship and requested doctors here in Maitri to visit to the Ship. The weather was a bit clear and the Chopper could come to Maitri to receive the Doctors. Dr. S. K. Sarma, the Physician of 17th ISEA and Dr. Kusum Kapila rushed to the ship along with the leader Mr. Ajay Dhar, 18th ISEA. There was a field visit by Geological Survey of India almost 200km away. The GSI team was escorted by Mr. Verma in case any technical snag occurs. On the halfway, we had one refueling logistics hub set Indian Army expedition members. Mr. Verma wanted to get down to the same place in order to upkeep the hub. The hub consisted of a four to five ATF filled barrels, two filling pumps and tools in wooden box without any housing. Accordingly, he was dropped to the site. From the hub to Geological field site, the duration of to and fro journey was around 3 hours including field investigation.

Field survey team conducting research amidst the striking terrain of Uthant mountain

He wanted to spend these three hours towards the maintenance of the hub. So, the GSI team in spite of knowing the risk of leaving him alone near hub left him with a view to pick Mr. Verma while returning from field. The field investigation by GSI went well. After wrapping up the team while returning could not land to the site near hub as the weather was totally got packed suddenly. Neither the Chopper could identify the location

of hub nor Mr. Verma. Total white out condition prevailed. So, they moved away to a safer place where they could at least land and waited for the whiteout condition to be over. Almost after interval of five hours, the weather got clear and they could reach near the site. Upon searching they could trace Mr. Verma almost frozen but subconscious. Immediately, he was rushed to the ship. Faces of all the expedition member got pale. Our winter survival yet to start. We prayed for his early recovery.

SURVIVAL STRATEGIES UNVEILED: AN ANTARCTIC SURVIVAL VIDEO SHOW

Meanwhile the summer team at Maitri, had to cancel most of their activities due to bad weather conditions. The only exception was the work near the station, which is located in the Schirmacher Oasis. To cope with the harsh environment, the 16 members of the ISEA wintering over team(WOT) team watched a video show that depicted the environmental challenges and the beauty of Antarctica. The video included scenes of the blizzard, the convoy with pisten bully, and the amazing display of Aurora Australis. It also showed how they dealt with ice accumulation inside the generator room and cleared snow during zero visibility condition and heavy blizzard. The video was meant to educate them about Antarctic survival and share their experiences at Maitri. We enjoyed the video clip, despite the outside temperature dropping to -38 degree centigrade and the blizzard lasting for four days.

LAKESIDE WONDERS: THE FASCINATING FORMATION OF PANCAKE ICE

JANUARY 28

On the fourth day, the blizzard had subsided significantly. I was in my laboratory at Tirumala hut, working with Praveen Srivastava, snow scientist from SASE-Manali. Some of our team members ventured outside and continued their tasks near the lake. Two of them, Mohammad Razzak and Pradip Kumar, returned to Tirumala after collecting water samples from Lake Priyadarshini amidst packed weather. Dr. Kumar told us excitedly, "There is pancake ice forming near the pump house in the lake. You both should go and see it."

Transformation captured: Ice melting and the mesmerizing formation of icicles

Praveen and I said "Yes Sir! We will go right away". We hurried to the location in spite of packed weather. Praveen was thrilled to see the pancake ice because it was related to his research topic. It was a stunning sight. He shouted “This is the one I am looking for since long”. The round pieces of ice looked like pancakes. They had raised edges from bumping into each other. They formed from wave action on slush or ice rind. They sparkled like crystals in the water. I was just gazing speechless.

Natural process capturing the gradual crystallization preceding the ice formation on the lake's surface

As the ocean undergoes its cooling process, the appearance of frazil ice crystals gives the surface an oily appearance. Rising to the uppermost layer, these crystals create a mixture of ice spicules and plates, known as grease ice. As temperatures continue to drop, the surface ice solidifies into a continuous layer.

Initial stages of crystalline formation: A few water molecules transform into ice over the lake bed, initiating the growth of tiny ice crystals throughout the liquid.

Affected by the ocean's swells and waves, this layer fractures into irregularly shaped discs, each with an approximate diameter of 500 mm (19.5 in). These discs mingle together, giving rise to what we call pancake ice.

Enhanced hexagonal symmetry in crystal ice formation due to slower growth in colder, drier atmospheres

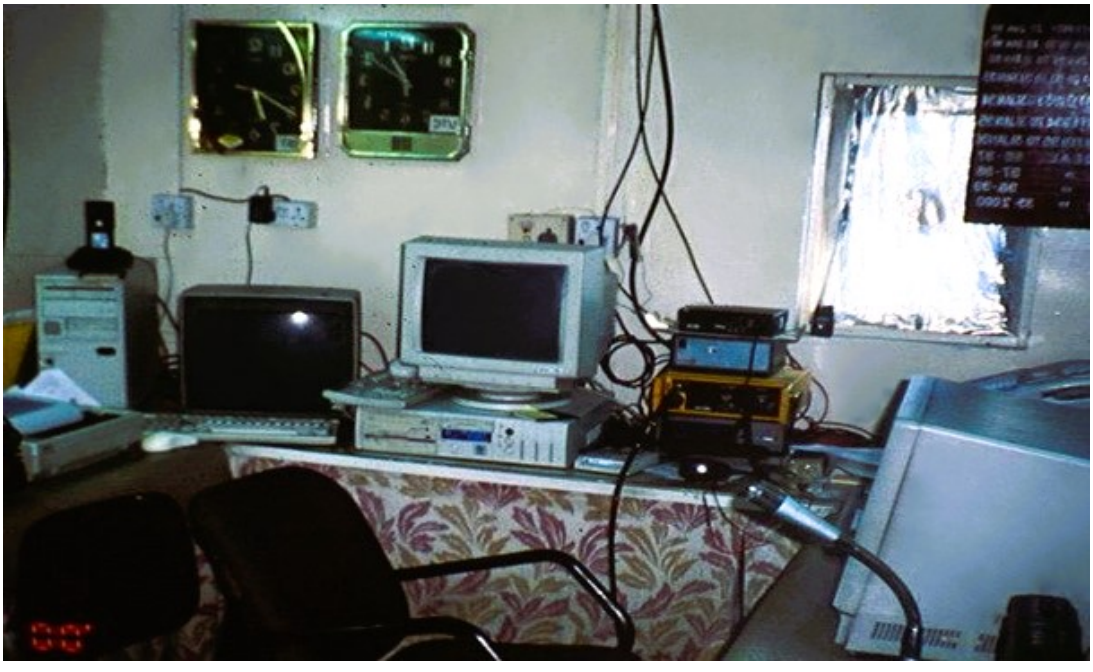
This sequence of pancakes may repeatedly combine and break apart before forming a cohesive ice cover. The ice's thickness increases through a combination of freezing at the water's base, the addition of frazil ice, and the accumulation of surface snow, which serves as a thermal insulating layer. However, we observed this features in lake water.

In the meantime, packing of weather was over. Incidentally, wind and snow fall almost slowed down. Towards the south of Maitri, the sun was about to set. But it was never during polar day. It kept on moving circularly over the horizon. It was 1:00 AM in the night. Southern sky was a bit clear as peeped. Patches of cloud were seen in the sky shaded by different colors. Since it was polar day, plenty of day light still existed. I could not restrict myself and went out leaving sleeping bag. Just clicked a few snaps and went on watching. Stunningly attractive and seemingly beautiful clouds with the blue background there over. In addition, reflection of light from glacier added a different dimension to the portrait. One would just like to watch. Outside temperature was so chilling that I could not stay more outside which was around -25 degree centigrade. Just got entered inside Tirumala and dived into the sleeping bag. Everyone one was sleeping peacefully and I entered just quietly.

THE SATELLITE COMMUNICATION SYSTEM AT MAITRI BASE

One may be wondering how we used to get communicated with outside world. In fact, Maitri Antarctic base had a very good communication system. Internet and telephone systems were exceptionally good to communicate with the outside world. Simply one had to type the email ID and include the message and send. Unlike communication in mainland, this particular communication was costly. NCAOR-Goa, provided the best communication facility ever through two SATCOM terminals under BSNL.

All the expedition were extremely busy in writing mails and me too utilized the facility for first few weeks. Gradually it had reduced when engrossed with Antarctic survival. Still, I remember that my first three email were sent to Sir Indra Mohan, Ma and Tulika. Situation here was so horrendous, members used to wait for some information from near and dear once from other parts of the continent.



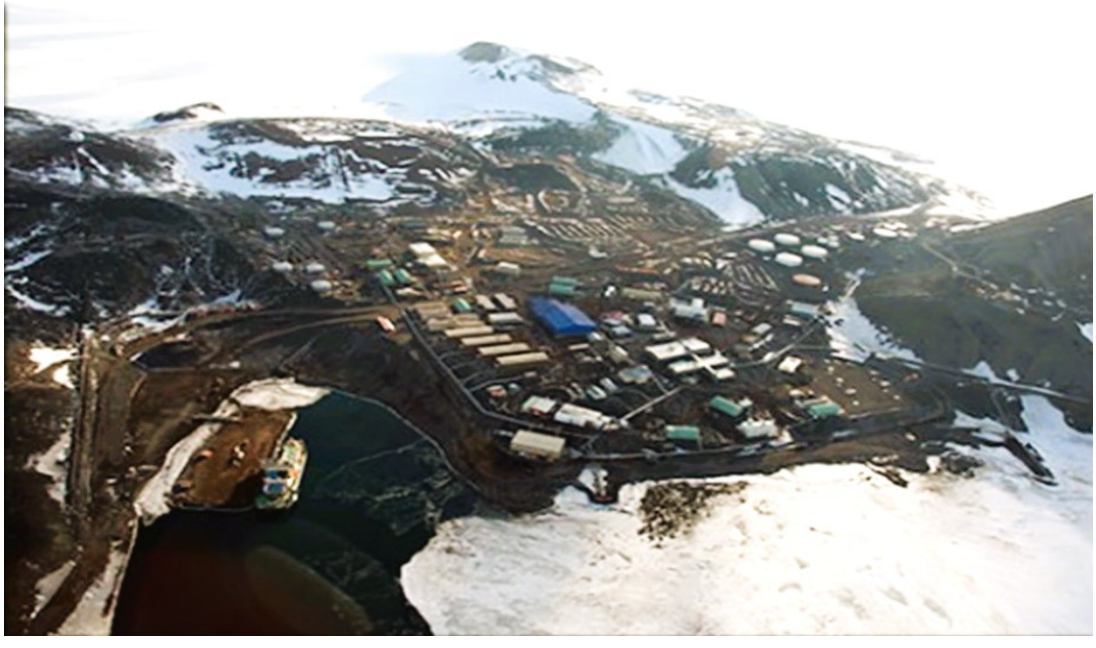
Communication hub at Maitri Station, featuring a range of equipment including satellite phones, HF communication, loudspeaker and a FAX machine. The clock displays the time difference between Antarctica and India.

CRITICAL CONDITION OF HELICOPTER ENGINEER - MR. VERMA FLOWN TO CHRIST CHURCH

JANUARY 30

Morning 8:47 AM, I was inside sleeping bag. It was so cold and still I was coping with the environment. Acclimatization was the prime requirement of Antarctic survival. Dr. Pradeep Kumar came running to Tirumala and told "You all get up soon, a meeting has been arranged at 9:00 AM by Mr. Sivan, he has asked all to participate". Without much word I just rushed to the lounge. Most of the members were present. Mr Sivan informed us about the condition of Mr. Verma. Although his condition was stable but it was decided to send him out of Antarctic territory. Eventually, he informed that Mr. Verma had a mild stroke causing paralysis to one side and our ship Polar Bird moved to 0-degree east which was around 200km away from the present position of the ship. We all were standing grim faced and was looking for some ray of hope.

Various contingency plans were drawn for evacuation of Mr. Verma and contact was made various Antarctic stations for necessary help in evacuating him. Immediate response was received from McMurdo Sound station-USA, Sanae IV station-South Africa, NuMayer station-Germany and British Antarctic Centre-UK. McMurdo station had plane leaving in two days of time for Christ Church, New Zealand and they asked Mr. Verma to be shifted to NuMayer station.



McMurdo Sound station, operated by the USA's National Science Foundation (NSF) in Antarctica

NuMayer Station, a German scientific base in
Antarctica operated by the Alfred Wegener Institute, Germany

Sanae IV station offered help in shifting Mr. Verma from Sanae IV station to NuMayer station by their Helicopter. British Antarctic Survey offered to send a plane in the next ten days and evacuate. After thorough discussion with our Doctors and these stations, it was decided to shift Mr. Verma to NuMayer station via Sanae IV and airlift him to Christ Church with the help of the plane Arriving from McMurdo station. Every move was going on as planned as we did not want waste a single moment in vain. Instant Polar Bird-the ship was diverted from 11 degrees East towards 2 degrees West longitude to reach within flying distance of Sanae IV station. Meanwhile the remaining distance of nearly 200km was covered by our Helicopters and Mr. Verma was safely transferred to Sanae IV station. They in turn had their Helicopter waiting and immediately transferred Mr. Verma to NuMayer station and was boarded on the plane under unconsciousness stage. The entire process could be successfully completed in spite of harsh weather.

In the meantime, it was diagnosed that during the whiteout moment he had the mild heart attack. We were happy that here at this point he would get some kind of treatment even though nothing was available for this fatal situation.

Exploring the Sanae IV Station in Antarctica: A glimpse into the South African research base within the icy continent. Learn more at www.sanap.ac.za

PASSING THE PULSE: HANDING OVER SEISMIC INSTRUMENTS IN TIRUMALA

Mr. I. P. Raju had handed over all the instruments to my disposal to upkeep the same by teaching me bit by bit. I was very obedient student to him since I had to be lone warrior for the instrument after his departure along with Bhaskar. Lots of questions were hovering in my mind, whether would I be able to perform to the expectation since here I had not only to serve as a Scientist but also to act as an Instrument technician. Failure of single electronic component would lead to a disaster. So I was pretty cautious and instinctive but of course with low level of confidence.

My Ashtech GPS receiver was showing lots of problem, sometimes it hanged up otherwise it used to worked perfectly. Rest of the instruments ie. broadband digital seismograph and analog seismograph were running well. In addition, I was looking after the 26 meter mast anemometer for wind energy assessment as established by National Aerospace Laboratory, Bangalore for designing the wind turbine. Right from its operation, daily maintenance, data retrieval, subsequent data processing and analysis from these instrument kept me very busy throughout the day. My most important desire was not to miss a single day without operation of these instruments. So I took utmost precaution while operating the instrument and was very careful while handling the software. The main objective of the project was to know the Antarctic plate motion and seismicity in and around Antarctica.

PUMP HOUSE IN PRIYADARSHINI LAKE-AN ENGINEERING MARVEL

I just freaked out near lake side in the evening. Water in lake had started to get frozen due to wind chill effect. Towards NW of Maitri there was a pump set housed inside wooden hut. Mostly it was used to pump out the water from the frozen lake throughout the year. Incidentally, the engineering part of the laying out of the pipe was interesting. Length of the pipe from pump house to Maitri complex was around 250 meters.

The Pumphouse situated in Priyadarshini Lake, serving as the water source for the Maitri complex

Pipeline conduit carrying water from the pump house to the Maitri complex

Flowing of water in freezing cold throughout the pipe needed some engineering marvelous so that water did not get frozen during the passage. Laying of pipe was made on some wooden column and the entire pipe was wrapped up with heating coil covered several layers of thermoform. If somehow heating measures fails flow of water would be disrupted. Plenty of snow accumulated around each of the column and most of the time of the year it remained covered with snow only. Formation of crystal shaped ice on lake shore was amazing. Wave of water was splashing over it making the sight more beautiful. Several hours I spent unknowingly looking at different formation of ice. It was so amazing to look at this formation. Very rapidly the temperature had started decreasing with simultaneous freezing and accumulation of ice. Since morning the wind blow was 30knot and the temperature remains at 0ºC. Most of the activities of summer people had been stopped by order of the Leader. Even than the Iranian member was collecting the water sample.

A HEARTFELT FAREWELL: REMEMBERING THE SAD DEMISE OF MR. VERMA, AN EXPEDITION MEMBER

In the meantime, Mr. Verma was flown to Sane - the South African Antarctic Research Base and from there he was taken to Mc Murdo Sound – the American Antarctic Base. There was an airstrip for aircraft landing on icecap. From there he was shifted by aircraft to Christchurch, New Zealand. He was admitted to a Hospital in Christchurch where he had his last breadth on 2nd February. We were shocked totally. The expedition had not begun yet but we had to loss one member. We were sad, terrified and numb. I had no words to console the other members of Pawan Han's Ltd. Our team leader, DoD observer Dr. Khare, Dr. Nag , Medical Officer tried their best to save him but failed. I remembered the interaction with Mr. Verma on 26th January during the celebration of Republic Day. I greeted with him. He was very charming and nice person always in jolly mood. Even during blizzard and extremely cold condition, when people try to stay indoors, he looked after the two choppers which was the backbone of the expedition. Still, I cherish my conversation with him regarding Pawan Hans. I enquired how they had achieved the bidding to serve the Antarctic expedition after beating the international competitors. He replied "Of course we were the lowest bidder besides charging very little pie out of our investment. We did not want foreign competitors to take away the Indian currency". A condolence held in the lounge of Maitri in presence of both the Leaders Mr K. R. Sivan(17ISEA) and Mr. Ajay Dhar(18ISEA) along with other members.

NOBODY CAN BRING ME HERE … RATHER I HAVE COME OF MY OWN

FEBRUARY 5

In worst-to-worst situation, we remember always one person foremost. Remembering Mother very intense. No communication till last few days. Morning was bit different in nature. I was inside sleeping bag on first floor. I woke up around 6 O clock hearing the shouting of Mr. Sharma of SOI (Survey of India). He could see huge snow accumulation inside the hut in the first floor. Somebody might have opened the window and forgot to close which resulted the situation during the blizzard outside. Immediately I came out of my sleeping bag came down holding the staircase and could see the nature outside. It was so fascinating and frightening: all the hills and plane land around Maitri were covered with heavy snow amidst blizzard continued. I took so many snaps outside. But it was too freezing cold outside I could hardly stay few moments. There was lots of snow accumulation in the entry gate of Tirumala hut as well. I decided to clean the accumulation

as my instruments are under operation nearby. If snow melts it would affect the instruments.

Last wintering over team was preparing to wrap up their belongings to proceed to ship. Mr. Arun Choudhury from SASE Manali was to collect some old AWS instruments from Vettaiya peak and Sivling. He asked me to join him. I just agreed and got into Pisten bully. Sivling is a rocky outgrowth of 50 meters from snowy base.

Panoramic view of Shivinga from Vettaiya peak

At the base of Shivlinga-the rocky outgrowth

One side of this place was a stiff gourge. The colour of ice was just blue. The other members were Mr. Mores , The Piten Bully driver, Mr. A Chaudhury, Mr. Ramtake from CSIR-ITRC-Lucknow, Dr. Nadkarni from CSIR-NPL, Delhi, Dr. Sushil Kumar and Dr. Pradeep Kumar from Banaras Hindu University, Dr. Hussain from ZSI, Dr. M. P Gaur and Mr. Dharpadhkar from GSI, Mr. Mohammad from Iran, Mr. S. Dutta from SASE & Dr. Kusum Kapila from AIIMS-Delhi.

The Vettaiya peak was a bit an excellent place although fully snow covered. Some rock mass was visible amidst snow. It was a peak in Schirmecher oasis. One can have a 360-degree view around Schirmecher oasis in the vast ocean of ice. In between we saw SASE camp fitted with automatic whether system (AWS). We did not wait much time. It had also witnessed heavy snowfall last night. On the way back Mr. Arun stopped the Pisten Bully beside a lakeside for Dr. Pradeep Kumar to collect water sample from the lake. What color of ice, perfectly serene blue. Surrounds of lake was fully frozen except middle of it. White snowflakes were visible on top of ice. Some of these were also flowing with wind blow. Reaching middle was a daunting task and risky. So, we started digging ice to make a hole up to water below. We failed to dig it out so no water sample could be collected.

Till now weather was packed without any sunshine. Suddenly sunshine clicked in tearing the cloud. Far ahead, the snow laden tip of Shelf ice was glittering. It was such awesome frame, we all got speechless for a moment. I was trying to reach the gorge of Sivling , Madam Kapila shouted and stopped me going that side. We all returned back by evening 7 O clock safe and sound.

Today the event of handing over of Maitri base was due but due to bad weather no Chopper could arrive. Thus postponed. Most of the 17ISEA members had gone to the ship. The leader Mr. Sivan, Major Narayan, Captain Rao, Arun, Sambhu, Prasad and Bisht got annoyed as they were eager to reach but could not go to the ship. As the weather was clear yesterday and chopper arrived with frozen food. Our Leader could have come yesterday itself for the event.

I was a bit tense as one of the computer monitors had gone bad. When I shared this with fellow expedition members, Dr. Sambhu Nath of CSIR-NPL came forward and informed me that he was bringing back one monitor and CPU in good condition. If we approach and get the permission from Dr. H. N. Dutta, Senior Principal Scientist & Project Leader, NPL, who was in Delhi, he had no problem to keep the Monitor. According we got the permission and Dr. Nath was happy to keep the monitor with me. It was so

enchanting, I just got relieved. Now at least all the assigned work would continue perfectly without hindrance of Monitor.

Madam Girija Rajaram from IIG Mumbai, was busy in cleaning the surroundings of summer Toilet module right from bathroom. All the toilet modules were cleaned during snow fall and mild blizzard. Mr. Murthy, IMD Pune was on Galley duty. In front of Madam I asked Mr. Murthy "Are you not ashamed of engaging Prof Rajaram for this cleansing?". Immediately she uttered "Nobody can bring me here to help them rather I have come of my own". Absolutely generous personality. She was 56 years old summer expedition member to study geomagnetism in Antarctica. A book on Antarctic geomagnetism entitled "Geomagnetic effects in Antarctica" was written by her. Now she wanted to rewrite the same after having direct practical experience on geomagnetic activity here.

DELAY IN STATION HANDOVER: CHOPPER ARRIVAL DEFERRED BY UNPREDICTABLE WEATHER

FEBRUARY 8

Weather was packed today. Chopper could not arrive so the handing over of station was delayed again. When we first touched the ice, it was packed ice only. M V Polar Bird was waiting there since then to proceed to Shelf ice. Packed ice had melted by this time to a large extent. The ship had reached the shelf ice now and stranded. This place in shelf ice is known as "Indian Bay" which accommodates first Indian Antarctic base "Dakshin Gangotri" buried under ice at almost 50 ft depth.

Setting of sun was visible these days. When we arrived on January 16, we used to see sunlight for 24 hours. Sun never used to set. Sun used to move around Maitri throughout the day in the horizon. Gradually we had started to observe a dusk kind of situation.

No one had gone for field as the weather was packed. Everyone was stuck up inside summer huts ie. Tirumala, Nandadevi and Annapurna hut busy having their laboratory work, literature writing. Maitri was situated almost 200 meters away from Tirumala hut. Amidst shivering cold & blizzard, visiting Maitri base from Tirumala was a daunting task really explains why Antarctic survival was different from all other places on the earth.

VISIT TO DAKSHIN GANGOTRI (DG) SNOUT

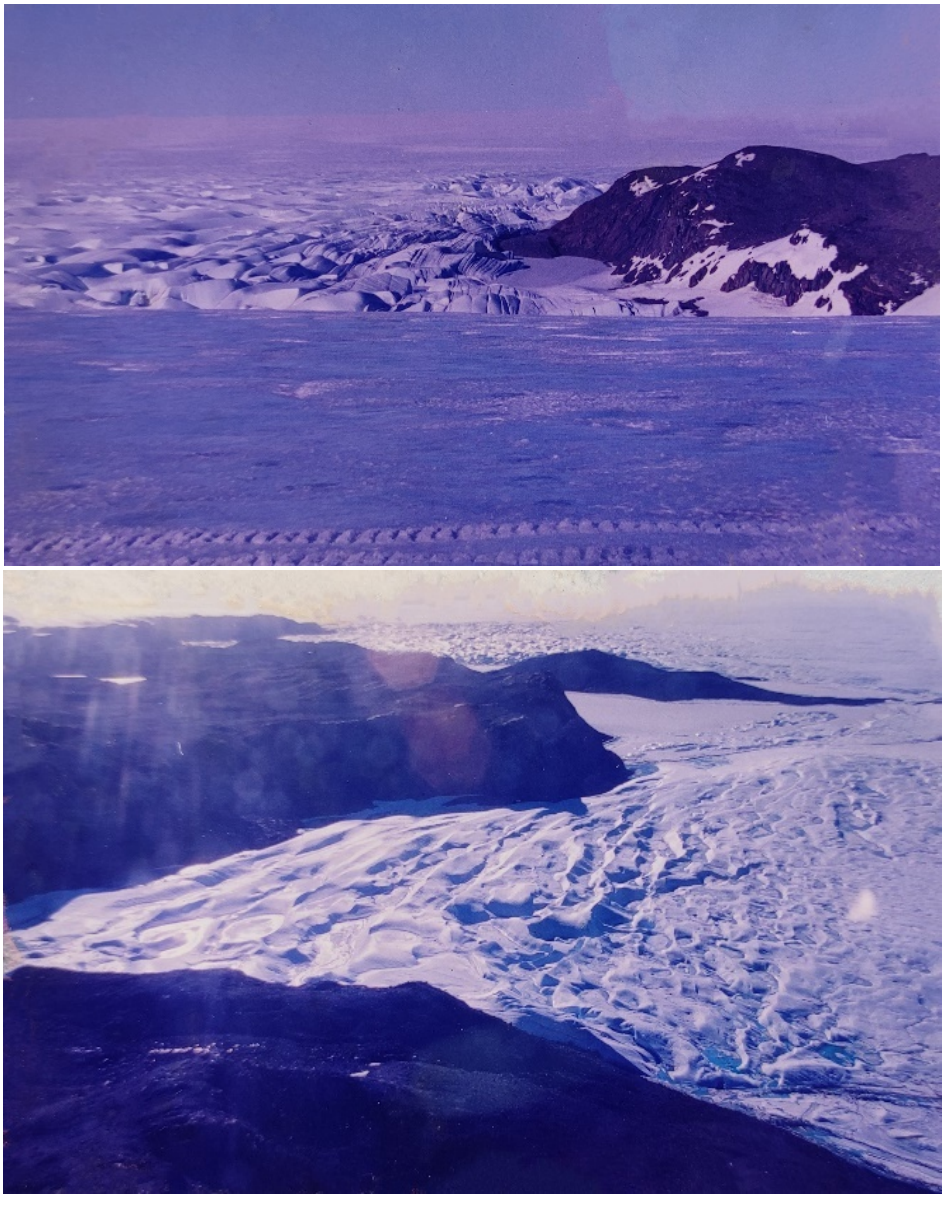
FEBRUARY 25

Visited DG snout - a beautiful place a bit far from Maitri. Few summer team members wanted to carry forward their respective studies. They wished me to accompany – I nodded. The team comprises the Leader Ajay Dhar, Madam Kusum Kapila, Dr. Pradeep Kumar, Dr. Mahommad Sokri from Iran and Mr. Y. Bhaskar from CSIR NGRI - Hyderabad and myself. We started around 3'O clock noon. We were dropped by Mr. T Singh by Helicopter just beneath the DG snout – just 15 minutes ride. The area was beautiful and splendid one. A lake was seen surrounded by hillocks. This was one of the most beautiful lakes ever I saw in Schirmecher oasis. DG snout was a glacier receding by few inches every year. It was just a narrow portion of ice coming out of continental ice on the Schirmecher oasis and at this point it is the narrowest. Rest of the areas were covered by rocky stones and a lake. The gap between continental and shelf ice was of the order of 100 meters.

View of the Dakshin Gangotri glacier snout, a section contributing to the vast expanse of the East Antarctica ice sheet (EAIS)

Aerial perspective of the Schirmecher Oasis blanketed in snow, situated within an icy landmass

Towards the north of DG snout, there was a lake. The water was being accumulated continuously from the glacier through numbers of natural canals. After getting down from chopper I could not stop myself from clicking camera. Within few minutes I consumed two numbers of films. We travelled surrounding the lake and snout for necessary survey from different angles. Again, towards north of lake where the Shelf ice meets the Oasis was a point of observation with awesome display of icy terrain. The shelf ice was completely wavey and numbers of up and down on the surface. This pattern evolves due to tremendous amount of pressure, generated by surficial sea waves and under current, released on the shelf ice which was again obstructed by the Oasis. The shelf ice floating on water cannot move further due to oasis. As a result, over the large period of time the surface had become undulating and blistered.



North of the Schirmacher Oasis: Aerial view capturing shelf ice formations with distinct pressure ridges, illustrating the Oasis' encasement

We had tried to approach that terrain. Myself and Mr. Mohammad were far ahead of others.

Aerial view showcasing pressure ridges on the northern shelf ice near Schirmacher Oasis, depicting the obstruction of the oasis by ice formations

We wanted have break but leader said “No”. There was high hillock ahead. Sun was about to set. He advised to take rest after we cross the hillock.

Natural erosion phenomena within Schirmacher Oasis: Rock weathering attributed to a blend of wind, ice, and temperature fluctuations

We reached a point from where there was no turn around. At this point, we had to move ahead only. If we wanted to go back, we had to travel more than hour following the same track back. So, we had no other option to climb the hill as rock climber. I remember the training at AULI - the ITBP training institute.

Crevasses alongside the frozen lake in Schirmecher oasis

The hill acted as a wall surrounding the lake. The hill was in pressure zone. So many wavey intruded rocks were visible on the side wall. In spite of all odds, we started climbing. Leader was ahead of us now finding the path. I was the second person following him. If my leg had slipped for a moment on loose pebbles on the ground, I simply would have fallen down to the lake water from 100meters height or more. All of us were really annoyed with this effort and was very cautiously stepping ahead. Somehow, we managed the rock climbing without any walkie talkie, ropes, gaiti etc. Leader and Mr. Mohammad were very expert in this respect. We had nice taste of Rock climbing. Thanks a lot, to Leader. I would have never dared to climbed that particular hill if I was alone. After four hours of walking over snow, ice, hills and rocky pebbles we reached Maitri at around 8'O clock in the evening when fading sunlight still existed on the western part of Maitri.

CRACKS IN THE ICE: UNDERSTANDING THE PERILS OF ANTARCTICA'S HIDDEN CREVASSES

Crevasses are deep, often hidden, and treacherous features commonly found in Antarctica and other glaciated regions around the world. They are essentially cracks or fractures in a glacier's surface ice, formed as a result of the glacier's movement over rugged

terrain. While they might appear harmless on the surface, crevasses can be extremely dangerous and pose significant risks to anyone traveling or working in polar regions.

Crevassess on ice shelf: *Crevasses resulted from the movement and resulting stress associated with the shear stress generated*

The wheel of Pisten Bully stuck up in Crevasses accidentally

Cracked crevasses in near Maitri and imminent dangers

Crevasses typically form when the glacier flows over uneven topography or encounters obstacles like steep slopes, icefalls, or rock outcrops. As the glacier deforms and moves, it stretches and cracks, creating these deep openings. They can vary in size, from small cracks that are easily stepped over to enormous chasms that can be hundreds of feet deep.

A big crevasse near Maitri as identified by Convoy members

Snow bridges are thin layers of snow that form over crevasses. They may look solid, but they can be fragile and give way suddenly. Snow bridges can be especially treacherous when covered by fresh snowfall or obscured by blowing snow, as they become almost impossible to detect.

Often-hidden nature of crevasses creates most significant associated dangers : our snow covered vehicle trapped in during blizzard

In Antarctica, where conditions are extreme and help may be far away, crevasses represent one of the most serious natural hazards. Understanding their formation, recognizing their hidden dangers, and taking appropriate safety measures are crucial for ensuring the safety of those who work and explore in this challenging environment.

FROZEN ARCHIVES: UNVEILING THE GEOLOGICAL TALES OF GLACIAL MORAINES

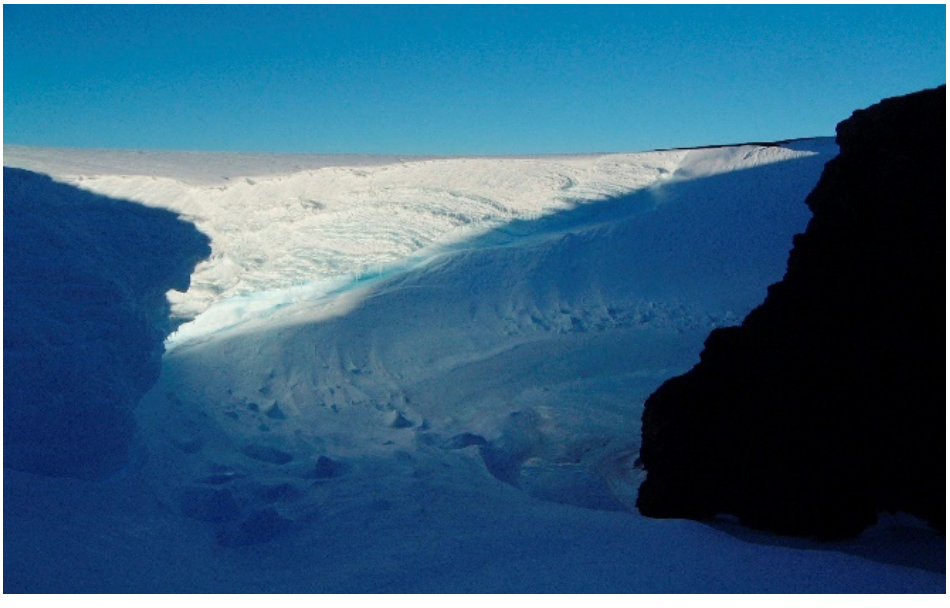
Moraines in Antarctica, like in other glaciated regions of the world, are significant geological features shaped by the actions of glaciers. Moraines are accumulations of rock, sediment, and debris carried and deposited by glaciers as they advance, retreat, or remain stationary. These moraines provide valuable insights into the past behaviour and dynamics of Antarctica's ice sheets.

Geological field trips in pristine continent

Fresh snowfall on moraines in Schirmechar oasis

The study of moraines in Antarctica is particularly important in the context of climate change. The behavior of ice sheets and glaciers in response to changing environmental conditions can be monitored by examining the formation and distribution of moraines. This data contributes to our understanding of how Antarctica's ice masses are responding to ongoing global warming.

Scientists in Antarctica often use techniques such as remote sensing, ground-penetrating radar, and field surveys to identify and study moraines. These studies help researchers refine climate models and make more accurate predictions about the future behavior of the continent's ice sheets.



Low-relief moraine ridges on the fore field of the retreating glacier in Antarctica. The moraines mark former ice extent and mirror the shape of the glacier terminus at the time of formation

In summary, moraines in Antarctica play a crucial role in understanding the complex history and dynamics of the continent's ice sheets. They provide valuable evidence of past glacial movements, helping scientists make informed predictions about the impact of climate change on Antarctica's ice masses and, by extension, on global sea levels.

The Queen Maud Mountains is a large region of the Transantarctic Mountains and is comprised of many different ranges, mountains and features such as glaciers, hills, bluffs, moraines and spurs

FACING THE ANTARCTIC SOLITUDE: THE DEPARTURE OF SUMMER COLLEAGUES AND GROWING UNCERTAINTY

FEBRUARY 28

The Maitri complex was getting emptier as the summer people departed. Only a few of us remained behind. I felt a growing psychological strain. I was plagued by uncertainty and insecurity about my future. My summer colleague Mr. Y. V. S. S. N. Murthy from CSIR NGRI-Hyderabad had already gone to the ship with Dr. Pradeep Kumar of Roorkee University. They were very sad when they left us. They knew how hard it would be for us to survive the harsh Antarctic conditions.

Equipped with wide tracks, the Pisten Bully has good traction in soft drifting snow and thus has the pulling power for heavy loads of 45-50 tons with the best climbing ability in steep terrain. Its power and maneuverability also make the Pisten Bully an ideal helper in dangerous situations

The convoy's first trip was scheduled for today, with four pisten bully vehicles. The main objective of convoy was to bring the frozen food, medicine, fuel and logistic items from Indian Bay to Maitri. These items were left at Indian Bay by the ship that got stranded there. The convoy would make regular trips to Indian Bay to retrieve the items. We got up early to get ready, though I was not part of the convoy. The expedition members from the Indian army were the ones who handled these tasks. Mr. Krishnamurthy of IMD Pune performed many prayers and rituals. He applied a tilak mark on the forehead of each convoy member, as we all stood in a line in the lounge.

The convoy departed at 7 A.M. with two people in each pisten bully. We welcomed three new members from 17ISEA to our team. The previous team consisted of Major Gautam Narayan, Mr. Mors Ben and Mr. Reddy. The new team included Major V. V. Kadam, Subedar Sharma, Subedar Soreng and Bishnoi. Before the convoy started, we did

a preliminary survey by helicopter to check the route. The route was about 200 km long and crossed both continental ice and shelf ice. The continental ice was thick and stable, but the shelf ice was thin and fragile in some places. We had to be careful not to drive over any cracks or crevasses that could collapse under the weight of the pisten bullies. We used GPS coordinates to mark the route on a map and placed some milestones at each location with flags and filled ATF containers. The convoy followed these milestones, but sometimes they were hard to see from the ground because of the uneven terrain. We relied on GPS tracking most of the time, but there were also instances when the GPS module failed due to the cold weather draining the battery. After 14 hours of non-stop driving, we reached our destination safely. Everyone was happy and energetic. All four pisten bullies were in good shape thanks to the proper maintenance of the previous team, which was a key factor for the success of the expedition.

MARCH 1

I was very happy to receive a gift from Dr. Kusum Kapila Madam from AIIMS Delhi which I still possess. It was a woolen Monkey Cap and I gave her a Pond's cold cream as a return gift.

SURGE OF ANXIETY AS WE WERE LEFT BEHIND IN ANTARCTICA

MARCH 2

No more summer member remained at Maitri base. The final ones to leave were Dr. Khare, the DoD representative, and Mr. Angal, the official photographer. They joined the ship today after both helicopters reached Maitri to ferry them. Hence, our wintering over in Antarctica formally started. The Pawan Hans personnel did an excellent job despite the difficulties. Before, only foreign helicopter services had handled this tough assignment. But this time, Pawan Hans became the first Indian helicopter service to assist the Indian Scientific Expedition to Antarctica. Dr Niloy Khare was a pleasant and energetic person who not only coordinated the entire expedition smoothly but also showed his proficiency.

The Transantarctic Mountains are a large and extensive system of mountain ranges that contains many notable mountains and impressive peaks

16th Wintering Over Members during December 1998 to March 2000

As the ship prepared to sail away from Indian bay towards India, we felt a surge of anxiety among us. Now onwards, we were the winter over members who would stay behind in Antarctica for more than a year. We hugged the summer members goodbye, one by one, with tears in our eyes.

It was a heartbreaking and memorable moment as expedition members left Maitri fully. We did not know what challenges and dangers awaited us in the long Antarctic survival. We only knew that we would face endless polar nights, fierce blizzards and extreme cold. We also knew that we would be isolated from the rest of the world, with no visitors until the next expedition. If we wanted to leave, we could not. If anyone from the mainland wanted to reach us, they could not. We would be the only inhabitants of this part of the continent, along with 17 Russian expedition members from the nearby Novolazaraveskaya station, 5 km away. The departure was very painful for everyone, regardless of their rank or role. All the members of 17 ISEA were longing to see their loved ones again. Only those who have been to Antarctica and endured its harsh conditions can understand how we felt. I still remember how I embraced Mr. R. P. Lal, who had already wintered over once before, and saw him crying as he bid farewell to Mr. Angal.

FAREWELL TO POLAR BIRD: A FINAL VISIT

MARCH 3

The M. V. Polar Bird was about to leave in a day or two. All logistic preparations were almost over. They were doing everything properly and timely as the sea surface was getting frozen at fastest rate. Within a day formation of grease ice occurred which had farther converted into fast ice within two more days. They would have to stay back for next summer season if Polynea near Indian bay got frozen. So, the ship crew members downloaded all the items from the ship and simultaneously uploaded the empty ATF barrel & tanks, broken pisten bully, nonfunctioning generators, all malfunctioned items used by earlier expedition members from bay before time. All the four cranes were working day and night.

During dinner, Mr. Ajay Dhar, Leader asked four of us to get ready for a trip to the ship. Half-heartedly I agreed.

MARCH 4

I woke up early in the morning, feeling excited for the trip to the ship. I was accompanied by four other people: Mr. R. P Lal from IMD, who was in charge of the meteorological observations; Surgent Surajit Nandel, the station electrician, who would

ensure the smooth functioning of the power supply; Dr. Kanagamani, the station surgeon, who would take care of any medical emergencies; and Mr. Pandkar from R & D E, Pune, who was conducting some research on fuel cells.

Logo on behalf of R & D E, Pune for 18th ISEA

The Chopper was piloted by Capt. Kahlon and Capt. T. Singh. They brought us safely to the ship. It was the first time I landed on the ship since I departed for Maitri on January 16. I had to stay with my experiments. I did not want to leave them unattended even for a moment, although a summer member was present and was taking care of the daily activities of the project diligently. We received a warm welcome from all the expedition members on board. They cheered for us. The 15 WOT members and especially 18ISEA summer members were very kind to us. They served us hot tea and coffee. It was a touching moment when we met such a wonderful group of people on board. Some of the members who were in their cabins came out quickly to greet and chat with us.

We had a sudden change of plans as we were about to leave the ship that was anchored to Indian Bay on the shelf ice. The deck was covered with snow and the crew members were busy clearing it. The sky was partly cloudy and sunny, but we could see many icebergs floating around in the distance. We were told that the chopper was ready to take us back to Maitri, and we had to hurry to get on board. We said goodbye to everyone who came out to see us off. The chopper took off, but soon we realized that the weather had turned into a white-out. We could barely see the ship fading away as we flew over the

shelf ice. Captain T. Singh noticed that the visibility was too low and decided to turn back to the ship. He informed the ship about our situation and asked for arrangements. It was a wise decision, as the weather got worse and worse. We landed safely on the ship and spent the night there. I shared a room with Mr. Reddy, who was a member of the 15WOT team.

MARCH 5

Incidentally, we returned to Maitri around 10 am, after a challenging journey in the white out condition. The wind speed had decreased significantly and we could see clearly. We were relieved to land safely in Maitri. On our way back to Maitri, we noticed the DG snout standing out in its natural color and shape.

Meanwhile, another convoy was preparing to depart from Indian bay to Maitri, where the ship was anchoring.

After we got off, Ajay and the others flew back to Maitri for a final farewell. They came back with the last flight, piloted by Capt. T. Singh and Capt. Saxena, who left Maitri empty-handed. We wished them good luck and a safe trip to India.

SETTING SAIL FOR HOME: FAREWELL TO THE 15TH WINTERING OVER TEAM

MARCH 6

On this day, M. V. Polar Bird had set sail for India, leaving us behind in Antarctic Territory. The ship started exactly at 6AM from Indian bay, carrying 15WOT members and summer expedition members of 18th Indian Scientific Expedition to Antarctica.

While leaving, our Convoy team members were present for sending them off, which was a customary.

All were busy with their own assignment in Maitri. Every one of us was allotted one room, which comprised a bed, a water heater module, a tape recorder, a chair and table. I occupied the room earlier occupied by Mr. I. P. Raju.

On the other hand, our army team members were trying to make as many convoys as possible to bring the food items, fuel etc. as fast as possible. So huge activity was going on. They did not want to take any chance in this treacherous climate.

TRAPPED BY NATURE'S FURY: CONVOY TEAM'S BLIZZARD ORDEAL AND HIGH STATIC CHARGE

MARCH 15

Nevertheless, the Convoy team of eight people, led by Major Kadam and Captain Venkatesh, returned to Maitri station safely at 8 PM after being trapped in a severe blizzard and snow drift since March 12th. A deep depression in the Antarctic Ocean caused heavy snowfall and strong winds for several days, making it impossible to move. The team was stranded at the 37th barrel pillar and had to stay inside the Banzara, a mobile shelter equipped with all the amenities such as kitchen, bathroom, toilets and beds. It also had an ATF generator to provide power.

The convoy of pisten bulley vehicles going together to the ice shelf on the shore. These vehicles have trailers on which the containers and oil tankers are mounted. The road distance is 160km. It takes 13 hours for convoy to travel from the Maitri station to the ice shelf if the weather is supportive

The convoy carries a living module called 'Banjara', and a fuel generator named 'Jeevan Jyoti' with fuel tank with 5KL. Banjara is heated from inside and is equipped with a small kitchen and bio-toilet.

Simultaneously, we maintained hourly communication with them through high frequency walkie talkies to monitor their situation. In the midst of the harsh weather and poor visibility, our brave explorers had to keep their spirits high and survive the suffering - which was part of the Antarctic adventure. `

Here in Tirumala hut, the blizzard had caused a high static charge on my body, which interfered with my instruments. My GPS datalogger could not recognize the external hard disks, and the GPS that provided the time signal to the Portacorder (analog seismograph) had stopped working. I was baffled and returned to Maitri. I talked to Ajay, who advised me to wait for a few days. He said there was a strong geomagnetic storm in addition to the blizzard. That made sense to me as a physics student, and I felt calmer and more curious. I also realized that this would happen more often as we approached the polar night and the harsh Antarctic winter. I was dressed in full Antarctic gear: thermal woolen innerwear, overall, balacova, UV-protected snow goggles, thermal gloves and snow boots. For

extreme cold (below -40 degrees), I also wore an Annapurna jacket made of fine feathers. I didn't touch any instruments instead decided to visit later.

I arrived at Tirumala hut around 6 PM when darkness had fallen. The hut was quiet and peaceful inside. No more sound disturbed me. The hut had been the home for 16 summer expedition members for last two months, suddenly became soundproof. I enjoyed the conversations and discussions I had with them. They were all experts in their fields with degrees from various prestigious Indian universities. I came to check the condition of the instrument but it was useless. The problem remained unsolved. The leader and other members went to drazer point behind Maitri complex to welcome the convoy staff with snacks and hot coffee. As I returned from Tirumala hut, I saw the lights from the convoy that reminded me of sanje-linze on Indian roads. The convoy group was greeted with Arti and Joy. We celebrated their safe arrival with a drink. They brought lots of fresh food, frozen food and ATF fuel. Today, Mr. Gajananda from CSIR NPL Delhi and I were assigned the galley duty.

ICY TRANSFORMATION: THE FROZEN LAKE BEHIND TIRUMALA

MARCH 16

This time, when I went to Tirumala, I saw a different scene. A huge pile of snow had blocked the door. It took me half an hour to clear it before I could enter the hut. The lake behind Tirumala was almost completely frozen, except for a small patch of water in the middle. The Blizzard had finally stopped, but the wind was still howling outside. I had slept until noon, exhausted from my night shift in the galley. The wind was making a loud and annoying noise, but I had got used to it by now.

Antarctica as a whole has so little precipitation it is classified as a desert, but snow does fall near the coasts, and in the interior snow accumulates faster than it can melt. Polar winds blow this snow around the continent, so that any object standing proud of the flat surface quickly gains a downwind "tail" of blown snow. Snow accumulation can be seen in and around Maitri.

MARCH 17

Major Kadam's instructions were followed diligently and efficiently by the army expedition team. HMT Sitaram, HMT Soreng and Subedar Sharma were busy along with Major Kadam and Capt. Venkatesh. The weather was slightly better than before as they prepared for the next convoy.

CELEBRATING WEATHER WISDOM: WORLD METEOROLOGICAL DAY AT MAITRI

MARCH 23

We had a busy day at the Maitri station as we received a convoy of shipping containers with various supplies and equipment. Among them were some spare parts and accessories for the Mercedes Benz engine and the Pisten Bully snow vehicle that we needed to repair. The four of us, Mr. Ajay, Mr. Praveen, Mr. Gajanand and myself, unloaded about 2000 kg of materials and took them to the workshop inside a large hanger. There, HMT Sitaram and HMT Bishnoi were working hard to replace the old engine of the Pisten Bully with a new one, using a crane. They used to work from dawn to dusk,

following the Antarctic survival mantra of keeping oneself busy. We did not feel tired at all, thanks to the pure oxygen in the air.

Witnessing a rare event - ice forming and fully frozen on a most pure lake water near Maitri

Later that day, we joined Mr. Lal from IMD for a special celebration of the World Meteorological Day. He gave us an informative presentation about the history and activities of the Indian Meteorological Department and its various branches. We learned a lot from his wisdom and enjoyed the occasion in the Maitri lounge.

RACING AGAINST WINTER'S GRASP: NAVIGATING THE FREEZING POLYNYA

MARCH 24

On the way to Indian bay, our convoy members faced some challenges due to the harsh weather conditions and the technical issues with the crane. The weather was better than last few days, but the temperature was decreasing rapidly. Yesterday, they had to camp on the shelf ice, a thick floating platform of ice that extends from the coast into the sea. They were supposed to reach Dakshin Gangotri (DG) point by today evening, but they could not load and unload their equipment because the crane was not working properly.

Major Kadam contacted HMT Bishnoi in Maitri, the main crane operator, several times from the shelf for his guidance. HMT Bishnoi helped him fix the problems through HF communication. The convoy members also observed that the surface of the polynya, an area of open water surrounded by sea ice, was freezing fast. The 17 ISEA were lucky that their ship had left Indian bay on March 6th, otherwise they would have been trapped by the ice until next summer. There have been many incidents in Antarctica where ships got stranded due to the freezing of ocean water. The convoy finally reached DG point from the shelf tonight and planned to travel back to Maitri by tomorrow morning.

FAREWELL FROM SCHIRMACHER OASIS: THE SKUA'S DEPARTURE

MARCH 25

Yesterday, Gajanand and myself were assigned to galley duty, which was really exhausting. The convoy had left at 6 AM and was expected to return by 12 midnight. However, they arrived at 2 AM due to a technical snag in the Pisten bully that was fixed. Repairing it was a daunting task in such a condition. The most painful part was tightening the screws, which required removing the hand gloves. In minus 40 degrees temperature, that was really troublesome. Our member had to use a portable heater nearby and warm their fingers periodically. If there was a blizzard, the situation would be even more vulnerable. I was waiting for them, got up from lounge and greeted them. They all returned safe and sound. Don’t know why, I used to get worried when they were outside. They always had to be alert. It was an extremely difficult and dreadful assignment. Their tiredness and hardship were evident on their faces. We could hear the HF communication between Maitri and the convoy members as it was connected to an amplifier system and kept on throughout. This communication measure was provided by Defense Electronics Application Laboratory (DEAL)-Dehradun, a DRDO establishment.

In the last few days, the static charge was very high. We could not touch each other or any metal object without feeling a spark and a shock. It resulted from the combination of strong winds, extreme cold and dry air with very low humidity. Last Skua birds had departed from the oasis, following their natural rhythm that signaled the onset of winter. They used to fly around Maitri, where we sometimes gave them frozen meat and fish, even though it was against the Antarctic treaty. Skua birds preyed on Snow Petrels and penguins, showing no fear or mercy. They were like scavengers of the mainland, traveling more than 2000km to reach Antarctica from nearby lands.

*The south polar skua (*Stercorarius maccormicki*) is the most southerly bird in the world. Although they live around the coastal edges of Antarctica, they have been seen flying over the South Pole, over 850 miles (1,575 kilometers) from the coast. They are large birds, measuring approximately 21 inches (53 centimeter) in length - Skuas flying near Maitri campus*

ASSISTING ARMY TEAM MEMBERS: AN UNFORGETTABLE EXPERIENCE

MARCH 26

I had just finished my lunch when Leader Ajay approached me and said, "Saurabh, you need to go to drazer point and provide logistic support to HMT Soreng and HMT Naresh." I sensed the urgency in his voice and knew he trusted me with this kind of work. I agreed without hesitation and said, "Yes, I will do it." The night before, a convoy had brought an Oil tanker, Banzara (the moving shelter), and some shipping containers with supplies. They had to leave them at Drazer point because the road to Maitri was too high and snow-covered. The soft snow made it difficult for the pisten bully to drag the heavy oil tanker that held about 15 kiloliters. Our task was to transport those items to Maitri with more powerful pisten bullies from the hanger. We took two pisten bullies: a 270 and a 330. The 330 was stronger than the 270 and was driven by HMT Naresh, while I rode with him. The other one was driven by HMT Soreng.

Mantis crane lifting and managing the oil filled tanker brought by convoy team from shelf

A JCB followed us, driven by Mr. Jaswinder Singh. His job was to clear the snow on the road before we passed. However, he could not succeed because the snow was too deep and the JCB tilted at one point. He decided not to take any more risks and left the vehicle and joined us. We looked for another way to reach drazer and managed to get there with two pisten bullies. This route was rocky and pebbly with less snow accumulation.

We accomplished the challenging task of transporting the oil tanker and the shipping container with 270 and 330 Pisten bully to Maitri. It was a rewarding experience and I felt privileged to assist our Indian Army team members. We faced some difficulty to cross the elevated section of the route. But HMT Naresh showed his skill and drove the vehicle safely to Maitri. Later we dispatched a crane to rescue the tilted JCB from the snow. The entire operation was an eye-opener for me.

SEISMIC RIPPLES FROM A FAR: THE CHAMOLI EARTHQUAKE RECORDED AT MAITRI'S SEISMOLOGICAL OBSERVATORY IN ANTARCTICA

MARCH 28

A shocking news received. The Garhwal Himalaya region experienced a powerful earthquake on March 29, 1999 at 00:35 local time. The epicenter was near Chamoli, a district that suffered the most damage and casualties. According to official reports, about 100 people died and 300 people were injured by the quake. The magnitude and depth of the quake were disputed by different sources, but it was estimated to be around 6.6-6.8 on the Richter scale and 15-21 km deep.

I recorded the earthquake event on both digital and analog seismographs. The P-wave arrival time was 19 hours 23 minutes and 46.5 seconds. The next morning, everyone in Maitri was curious about the earthquake, especially Leader Ajay and two of our expedition members who were from Garhwal. Mr. Mohan Singh, the cook, was from Chamoli and Mr. Som Prakash, the communication officer, was from Pauri-Garhwal. They were very anxious about their families and villages. Mohan Singh, who usually ignored the news, was reading every detail he could find. He was very quiet and sad when he learned that Chamoli was the worst affected area. We were also worried for him.

We received news updates via email communication. Mr. Som Prakash printed them out and put them on the dining table before breakfast. I had a copy of one of them as headline follows: -

10. Scientists differ over magnitude of quake, Wednesday, March 31, 1999.

APRIL 1

The Convoy departed today with Leader Ajay, Major Kadam, Captain Venkatesh and others on board. They had to wait for two days due to a storm warning from Pretoria, South Africa. The weather cleared up and they set off for India bay, where they arrived at 9:30 PM.

Today was also the anniversary of the Indian Institute of Geomagnetism (IIG), Colaba, Mumbai. We celebrated this occasion with enthusiasm. Mr. Vilas Shinde of R &DE, Pune was the Acting Leader of Maitri in Leader Ajay's absence. He presided over the meeting and spoke about the achievements of IIG and R&DE, two prestigious institutions. He also highlighted the role of IIG in Antarctic research. He praised the team

spirit of all the members and acknowledged their contribution in shifting and organizing the spare parts of generators and other items brought by the previous convoys. The event concluded with a small party.

ETHEREAL BEAUTY: A GLIMPSE OF TRANQUILITY HOVERING OVER THE OASIS

APRIL 2

As predicted, the weather turned for the worse. A heavy blizzard and snowfall began, and the temperature dropped to -14.9 degrees Celsius. The convoy was forced to stop at DG Point due to the bad weather.

By evening, the wind had died down and the snowfall had stopped. I ventured outside Maitri and was amazed by the beauty of the scenery. The sky was ablaze with color at dawn, with red and pink clouds painting the horizon. In the opposite direction, the full moon hung large and bright between the peaks of Schirmecher Oasis. The moonlight reflected off the ice, creating a dreamlike landscape that made me forget all my troubles.

Summer sunset in Antarctica, panoramic colourful cloudy sky above Schirmechar oasis and continental glaciers having nature background

In the distance, I could see the HF antenna mast standing tall and proud. It was a reminder that humans are capable of great things, even in the most challenging of environments. It was a symbol of hope and resilience, and it gave me strength to face whatever challenges lay ahead.

SUDDEN GUST OF WIND: CAUSE OF AN ACCIDENT DURING ROUTINE BALLOON RELEASE EXPERIMENT AND SUBSEQUENT X-RAY INVESTIGATION

APRIL 7

Mr. R. P. Lal was no stranger to the unforgiving conditions of Antarctica. As a seasoned scientist from the Indian Meteorological Department (IMD), he had spent couple of years at the Maitri research base, dedicated to unravelling the mysteries of the Earth's upper atmosphere in one of the world's most challenging environments.

Just like other days, today morning, the frigid winds whistled through the narrow gaps of the station, reminding everyone of the formidable surroundings. Mr. Lal, equipped with his extensive experience and unwavering determination, had set out to prepare for his routine balloon release experiment. This experiment was vital for collecting data to better understand the upper atmosphere around Maitri, which played a crucial role in the station's meteorological studies.

The process involved meticulous preparations, and Mr. Lal, dressed in his cold-weather gear, was engrossed in setting up the equipment. After filling up the helium gas in the balloon, he meticulously checked the weather instruments, ensuring everything was in perfect order. The research station relied on this data for weather forecasting and climate research, making Mr. Lal's role of utmost importance.

Ballooning experiment by IMD to assess the upper atmospheric condition

As he focused on his work, a sudden gust of wind caught him off guard. The icy breeze was unrelenting, and Mr. Lal struggled to maintain his balance. In a heart-wrenching moment, his left foot twisted awkwardly, and he tumbled to the rocky ground. Pain radiated from his left knee, and he knew instantly that something went wrong. He had injured himself during this seemingly routine task.

Observing the incident, a few expedition members rushed to his side, their concern was evident. Mr. Lal, renowned for his endurance, clenched his jaw and tried to stand, but the pain was too much to bear. It was clear that his left knee had suffered a significant injury, one that would restrict his mobility.

Given the remote location of the Maitri research base and the harsh conditions, we couldn't afford to take any chances. Mr. Lal needed immediate medical attention. Dr. Nag, the station's resident physician, examined his injured knee. He suspected that it might be a fracture, but a more detailed assessment was needed.

The decision was made to transport Mr. Lal to the small medical facility on the station, which was well-equipped to handle emergencies like this. Dr. Nag carefully immobilized his injured leg to prevent further damage during the transfer.

Dr. Nag, made sure the X-ray machine was working properly by taking an X-ray of a nut bolt. He developed the film and hung it to dry. He seemed satisfied with the results, so he took an X-ray of Mr. Lal's leg. He had to take two tries, but both doctors confirmed that there was no broken bone. This was likely the first X-ray ever taken in Maitri.

The X-ray results were clear - it was a thin fracture, albeit not a severe one. Mr. Lal's knee was placed in a brace, and he was given pain medication to help manage the discomfort. He would need to rest and undergo physical therapy to regain full mobility, but the injury would not be career-ending.

Throughout his recovery, Mr. Lal continued to contribute to the research station in other ways, using his expertise to analyse data and assist his colleague Mr. Krishnamurthy remotely. His determination and dedication remained unwavering, even in the face of adversity.

In the end, Mr. Lal's injury served as a reminder of the challenges that Antarctica presented, but it also highlighted the resilience of those who called Maitri their temporary home. Antarctica demanded respect and careful preparation, but it also rewarded those who persevered with valuable insights into the Earth's upper atmosphere, thanks to scientists like Mr. R. P. Lal and the unwavering support of the Maitri research team.

Today was HMT Jaswinder Singh's birthday. He is a young man in the army who recently became a father. He kept thinking about his family throughout the day and night. In his free time, he listened to a recording of his wife and baby's voices that he had made during a restricted telephone call.

VISIT TO NOVOLAZARAVESKYA - THE RUSSIAN BASE

APRIL 9

It was a beautiful sunny day in Antarctica. The sky was a clear blue, and the sun sparkled off the ice. However, the wind was blowing fiercely. I was busy transferring data from one laptop to another and backing it up. The data transfer took about an hour and a half, and the backup process took about 20 minutes.

After I finished my work, I headed back to my dorm. On the way, I ran into Leader Ajay. He asked me if I would like to visit the Novolazarevskaya Russian Antarctic base. I was excited by the prospect, and I eagerly agreed.

Hand wooven Sticker gifted by a Russian Expedition Member

We set off at around 3:00 PM in two Pisten Bullys. One was a 170, and the other was a 270. The purpose of the visit was twofold. First, we wanted to check on the 270 Pisten Bully, which had been out of order since the previous expedition. Second, we wanted to visit the Russian base.

Souvenir from Russian expeditioner

Pisten Bully (4WD vehicles) are used for limited operational or scientific tasks in the field and shelf ice during high winds, extreme cold and extreme danger.

The Pisten Bully is built to cope with the extreme conditions of the eternal ice. It is designed for outstanding performance, long-life and low operating costs that are all priorities in the ice shelf regions

There were nine of us in total on the trip: Leader Ajay, Major Kadam, Captain Venkatesh, Dr. Nag, Mr. Shinde, Dr. Praveen, HMT Naresh, Subedar Sharma, and myself.

We drove from Maitri to Drazer point, which was a dirt road covered in rocks, stones, and pebbles. From Drazer point, we continued on to SASE point. This route was all on the continental ice. The path was steep and dangerous, as the ice was very slippery.

We stopped at SASE point, where Dr. Praveen replaced the PCMCIA data card in the AWS (Automatic Weather Station). By this time, it was almost dusk. The sun was setting over the Schirmacher Oasis. The wind was blowing so hard that it was moving the snow around on the ice, creating a beautiful and eerie scene.

We continued on our journey, following the track of the convoy. The 270 Pisten Bully was being driven by Major Kadam, with Leader Ajay in the passenger seat. Our vehicle was being driven by Captain Venkatesh, following behind the 270.

We were now at a high altitude on the continental ice. From the cabin of our vehicle, I could see much of the oasis. After half an hour of driving, we reached a place called Sankalp point. This was where the convoy had previously started its journey. However, our convoy team had decided to keep the Banjara (moving shelter) and Jivanjyoti (generator) at Sankalp point, due to the steep slope from SASE point to Drazer point.

Novolazarevskaya Station (Russian: Станция Новолазаревская) is a Russian, formerly Soviet, Antarctic research station. The station is located at Schirmacher Oasis, Queen Maud Land, 75 km (47 mi) from the Antarctic coast, from which it is separated by Lazarev Ice Shelf

The other part of Novolazarevskaya which is 3.5 kilometres (2.2 mi) east of Maitri, Indian Anatrctic Base.

During the journey, Dr. Praveen and Dr. Nag were wearing trekking shoes instead of snow boots. As a result, their fingers on both feet started to freeze. They tried rubbing their hands together to warm them up, but this didn't work. They then tried to burn paper to get some heat in the cabin, but this also didn't work.

Dr. Praveen couldn't take the cold any longer, so he asked me if he could borrow my snow boots. I told him that he should have brought his own boots, but I lent him my snow boots anyway. I put his trekking shoes. A short distance from Sankalp point, we turned left off the convoy route and headed towards the Russian base. The Russian convoy markers were black oil barrels, while the Indian markers were red oil barrels. We arrived at the Russian base when it was completely dark.

The Russian base looked like a small town in the middle of the icy continent. We went straight to the Russian leader's room. On the way, I met Mr. Alexandra Sasa, the Russian seismologist. He took us to the leader's room.

None of us spoke Russian, so we communicated with the Russians using gestures. However, we were able to understand each other. Nicolai, the communications engineer,

who spoke a little English, acted as our interpreter. The current Russian expedition leader was leaving in April, so we invited him and his team to lunch with us. We were amazed by the warm hospitality of the Russians. It was great to know that we had friends in this remote place.

On the way back, it was pitch black outside. The moon was full, and it cast a beautiful glow on the ice. We were the only two vehicles on this ocean of ice, crossing crevasses and small water channels without any traffic lights or police checkpoints. It was an unforgettable experience, and I was so glad that I had the opportunity to visit the Novolazarevskaya Russian Antarctic base.

VISIT OF RUSSIAN TEAM TO MAITRI FROM NOVO

APRIL 16

The Russian team arrived at Maitri, as we had invited them. The team consisted of the leader, second chief, meteorologist, Pisten bully driver, and one mechanical person. We celebrated their safe arrival to Saint Petersburg and their upcoming journey back home with a bon voyage party.

Envelope of Russian Post office, Novolazaraveskyay and Indian Post Office, Maitri

From morning onwards, our leader and others were busy in the kitchen preparing various food items for the guests. A variety of dishes were prepared, along with several kinds of drinks, both soft and hard. Everyone was busy in one way or another, contributing to the gaiety and festivity of the occasion.

The party was a great success. Everyone had a wonderful time, and the Russian team was very grateful for our hospitality.

Visit of Russian expedition members to Maitri

We exchanged gifts, souvenir and promised to stay in touch. It was a truly memorable evening, and we were so happy that we had the opportunity to celebrate with our Russian friends.

CONVOY ADVENTURES, TECHNICAL HURDLES, AND UNEXPECTED RUSSIAN AID

APRIL 17

I was sleeping soundly at 6:00 AM when Praveen woke me up. "Will you accompany me to barrel number 133 and to DG point?" he asked. "My instrument is having some data transfer problems, and I need your help to fix it." I agreed, but asked for a few minutes to get ready. Praveen told me that he was planning to join the convoy team, which was almost ready to depart. In addition to its main objective, the convoy also had a secondary objective: to retrieve two of our lifeline items, a trailer and an oil tanker, which had been buried under ice for many years.

A Convoy of Indian team on continental ice, convoy track and burried ATF barrel were seen

The Indian team had tried to retrieve them several times, but had been unsuccessful. This time, the logistic team would be assisted by the Russian team.

We set off from Maitri with the convoy, led by Major Kadam. There were eight Pisten bullies in the convoy, each named after all rivers in India: Sutlez, Pompa, Godavari, and Koyna. It was a unique experience to travel with the convoy.

On the way to 133 Barrel point, we faced a technical problem with the alternators of Godavari. Our crew members, Mr. Naresh, Mr. R. B Singh, Mr. M. C. Sharma and Captain Venkatesh, worked hard to fix it. We managed to reach our destination on time. Soon after, the Russian Leader and Deputy Leader arrived with two huge Pisten bully vehicles that looked like military tanks. They tried to help us pull out the Oil tanker that was stuck in the snow, but it was too deep. The weather was harsh, with strong wind and snow and a Windchill of -40 degree centigrade. We appreciated the cooperation and friendship of our Russian neighbours in this desolate land. They promised to come back with more assistance and left quickly.

Russian team refilling of aviation turbine fuel(ATF) during convoy

The convoy left us for Indian Bay, and we began our journey to SASE Point to fix the problem with the AWS data transfer. We successfully completed the necessary repairs and restored the data recording. On our way back to Maitri, we were alone in the Pisten bully on the ocean of continental ice. There was nothing but ice in every direction. However, we were in constant communication with Maitri about our location. Moving without Banzara and Generator was a highly risky endeavor, even for a short journey in Antarctica. But we took the risk.

FAREWELL TO THE 43RD RUSSIAN ANTARCTIC EXPEDITION (RAE) TEAM

APRIL 20

As planned, at 12:30 PM, I and six other people, including the Leader, Praveen, Dr. Nag, Pandkar, Sitaram, and Narayan, started for Novolazarevskaya, the nearest Russian base. We walked, as it was only 5.5 kilometers away. Generally had we take a long route over Pisten bully following the convoy route, which usually took 3 hours. On foot, it took us less than an hour. The current Russian Antarctic team was going back to Russia, so they had invited us to have lunch with them. We arrived at 1:15 PM. It was cloudy and windy, with a high wind chill.

We went straight to the common lounge, where the Russian Leader and the others were waiting. We took off our winter clothes. The station was a bit warmer inside because it was centrally heated. After a few exchanges, the Leader invited us to the dining table, where food and Russian vodka had been prepared. The Russian Leader of the 43rd RAE welcomed us in Russian, which was translated by Mr. Nicolai, the Radio Communication Officer. After his speech, our Leader Ajay gave a speech emphasizing further cooperation between the two stations.

There was a variety of food, from horse meat and fish to other boiled continental dishes. They also offered us cake prepared in Novo.

After lunch and a visit to the Russian seismological observatory, we started walking back to Maitri at dusk. On the way, we walked on frozen lakes, mountains, and snow terrain. Indeed, we felt very much at home with the Russian expedition members.

POWER OUTAGE AT MAITRI: WHEN ADITYA NO. 1 TOOK A BREAK

APRIL 21

The generator named Aditya No. 1 was running smoothly, providing continuous power to the Maitri station. Most of the members were relaxing in the lounge during the evening hours. Suddenly, all the lights went out due to a power failure in the generator.

Mr. Shinde was nearby, conducting a routine health check on the generator with his probe. He noticed some sparks and smoke coming from the generator, so he immediately went to get Subedar Dilbag Singh, the electrician who maintained the generator.

This was the first time that the power had gone out completely at Maitri for two hours during our stay. If the outage had lasted a few more hours, it could have been fatal, as the entire water, plumbing, and heating system could have been damaged.

In darkness, I rushed to the laboratory with my flashlight and turned off instruments using backup batteries. It was a chaotic and unfamiliar situation, leaving me momentarily uncertain. The thought of a complete system failure and the freezing of our sole water source, ice, filled me with fear. After nearly five hours, the generator resumed power supply, allowing the instruments to function again.

BLIZZARD'S EMBRACE: A TALE OF HEROIC RESCUE NEAR DAKSHIN GANGOTRI

APRIL 23

After spending six days at Indian Bay, in the remote stretch of Indian bay, near the earlier Indian scientific base Dakshin Gangotri, a fierce blizzard raged. The icy winds howled mercilessly, creating an impenetrable wall of snow that obscured all sense of direction. A convoy of specialized vehicles, critical for the expedition's success, was caught in this icy turbulence.

Among the convoy, two expedition members, Mr. Sharma and Mr. Singh, found themselves separated from the group. Lost and disoriented, their vehicle became stranded in a sea of white. The snowstorm was relentless, and their chances of survival seemed to diminish with every passing minute.

Meanwhile, back at the base, the news of the missing members spread like wildfire. Major Kadam, a seasoned officer with nerves of steel, and Captain Vasant, a resourceful and determined young leader, immediately geared up for a search and rescue mission. Clad in their cold-weather gear, they embarked on a treacherous journey into the heart of the blizzard.

The storm's ferocity was unlike anything they had experienced before. Visibility was reduced to mere inches, and the biting cold threatened to freeze even the bravest hearts. Armed with determination, the two rescuers pushed forward, fighting against the elements as well as their own doubts.

Blizzards are associated with winds spilling over the edge of the ice plateau where loose snow or ice on the ground is lifted and blown by strong winds. Convoy of Pisten bully (top) fierce blizzard (bottom)

For hours, they braved the blinding snow and bone-chilling cold, refusing to succumb to the adversity that surrounded them. Their communication devices were barely functional, and every step felt like a monumental effort. But the image of their lost comrades, alone and in danger, fueled their resolve.

Finally, after what seemed like an eternity, a faint glimmer of hope emerged. A faint outline of the stranded vehicle appeared through the haze. Major Kadam and Captain Vasant pressed on, their hearts pounding with a mixture of relief and anticipation.

As they approached the stranded vehicle, they could see Mr. Singh and Mr. Sharma inside lost Pisten bully, their faces pale and eyes wide with fear. The two expedition members had been huddled together for warmth; their spirits almost broken by the ordeal. Major Kadam and Captain Vasant quickly assessed the situation, offering words of reassurance and support.

The rescue team worked swiftly, using their experience and expertise to free the vehicle from the grip of the snowdrift. With every heave and push, the vehicle inched closer to liberty. At last, with a collective effort, the vehicle broke free, its engine roaring to life in response.

With the convoy vehicle now mobile, the rescuers guided it back towards the base, navigating through the relentless blizzard once again. The return journey was just as perilous, but the knowledge that they were heading to safety spurred them onward.

Hours later, the convoy vehicle rolled back into the protective confines of Dakshin Gangotri base. Mr. Singh and Mr. Sharma were greeted with cheers and embraces, their harrowing ordeal finally over. The heroic efforts of Major Kadam and Captain Vasant had saved not only the stranded expedition members but also the valuable equipment and supplies carried by the convoy.

Their story of bravery in the face of adversity spread through the base like boon, inspiring all who heard it. Major Kadam and Captain Vasant's dedication, determination, and selflessness in the midst of the blizzard showcased the true essence of heroism. As the storm outside continued to rage, the warmth of their rescue effort shone as a beacon of hope, reminding everyone that even in the harshest of environments, the human spirit could triumph over nature's fury.

This was their sixth convoy, and they brought 60KL of ATF. This leaves us with only 160KL of oil out of the 410KL we brought from India. With this current stock, the station can be powered for the next nine months, until January.

BRAVING THE BLIZZARD: MAITRI STATION'S BATTLE WITH FIERCE WINDS AND DRIFTING SNOW

APRIL 24

The blizzard was raging outside Maitri station. The wind was howling at an average speed of 40 knots (1knot=1.82km/s), with gusts reaching up to 70 knots. The snow was drifting from the south-east, creating huge piles around the buildings and reducing the visibility to less than 10 feet. It sounded like the wind was going to tear everything apart. It was caused by a large depression in the Indian Ocean, as shown by a satellite image from Pretoria.

I had to go to Tirumala hut for some routine work, but it was a struggle to walk against the wind. Sometimes, the wind would push me back or lift me off the ground. I had to make sure that no part of my body was exposed to the cold and snow. I wore a balaclava that soon became covered with snow. I followed the track carefully, hoping not to get lost in the whiteout.

Coming back from Tirumala was easier, as I had the wind behind me. I just leaned back and let the wind carry me along. I felt like I was flying over the snow. I was wearing full Antarctic gear, which protected me from the harsh conditions.

Snow fall and gloomy weather just before occurrence of blizzard: captured from front door of Maitri

During extreme blizzard wind and snow drift making the terrain hazy:
captured from front door of Maitri

The blizzard lasted for seven days, according to the weather station. It was one of the worst storms we had ever experienced. It reminded me of how powerful and unpredictable nature can be in this frozen continent.

MAY 1

The morning was a flurry of activity. Major Kadam had asked me to help with the preparation of the last convoy before the polar night began. The blizzard that had raged for days had delayed our progress, but we were determined to finish the convoy.

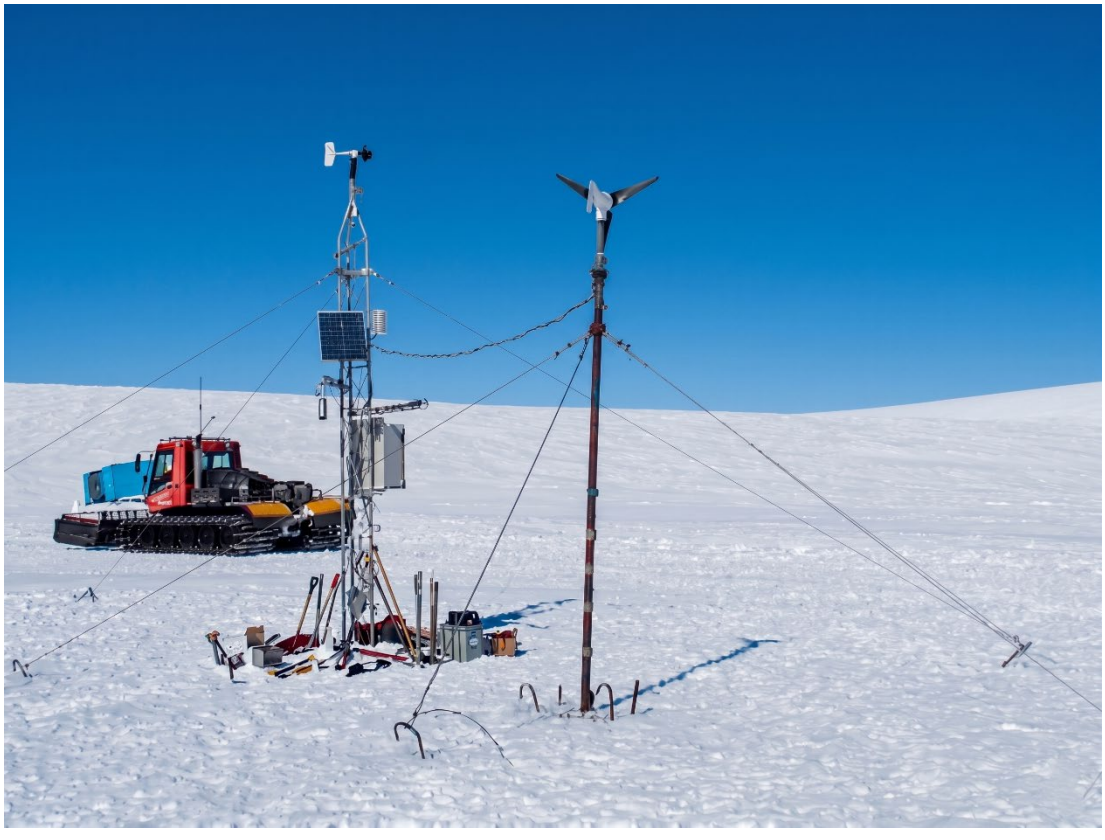
A few fuel tanks were still attached to the trailer. Major Kadam wanted them moved to the main reservoir. I would help with the loading and unloading by locking and unlocking the crane hooks. Major Kadam would operate the crane and shout instructions.

I was enthusiastic to help. I had never worked with a crane before. I knew that a small mistake could cause a major accident, so I was careful to follow Major Kadam's instructions exactly.

Together, we loaded and unloaded four tanks, each with a capacity of 20KL. The temperature outside was -9°C, but we worked quickly and efficiently. By 11am, we were finished. I returned to my laboratory to begin my regular scientific duties.

Captain Venkatesh would lead the convoy this time, as Major Kadam would be joining them by Russian MI-8 helicopter the next day. The convoy was scheduled to travel to Russian Bay to collect supplies that had been brought there by a Russian ship from Cape Town. The Russian ship had already arrived in Russian Bay, bringing with it the 44th Russian Antarctic Expedition Members. This ship would be visiting all of the Russian Antarctic Stations under the banner of the 44th RAE. For the first time, they would be visiting Novolazaraveskaya first, before visiting Maitri the next day.

The convoy departed at around 2:00 PM. As the sun began to set, they reached Drazer Point. Captain Venkatesh informed Major Kadam that the hydraulic engine on the Pisten bully named Godavari was leaking. Major Kadam instructed Captain Venkatesh to leave the Pisten bully at Drazer Point. Praveen then joined the convoy, as one of his experimental AWS at DG Point had been rendered inoperable by a power failure and needed to be repaired as soon as possible.



SASE's Albedo Research in Antarctica:
Utilizing Solar-Powered Automatic Weather Stations (AWS)and Albedometer

INTERNATIONAL COLLABORATION AT DAWN: THE 44TH RUSSIAN ANTARCTIC EXPEDITION MEETS WITH MAITRI TEAM

MAY 2

Everyone was awake early in the morning. The leader of the 44th Russian Antarctic Expedition (RAE), Mr. Leonid, along with the leader of the 43rd RAE at Novolazaraveskaya, Mr. Alexandra Kchochin, and other members of the 44th RAE, were scheduled to visit Maitri at 11:00 AM for a meeting to discuss scientific and logistic support.

In anticipation of their arrival, the Indian and Russian flags were hoisted in front of Maitri. The lounge was decorated with flowers and food items were arranged on the tables. Mohan and a few others had been busy since morning preparing for the visit.

At around 2:15 PM, an MI-8 helicopter landed on the helipad. The passengers included some of the new expedition members, the pilot, the navigator, and some of the old expedition members. Mr. Shinde and I greeted them at the helipad and brought them to the Leader's Office.

A Signed Memento from the 44th Russian Expedition Team Member

The Russian leaders were in a hurry and asked our Leader, Ajay, to get ready for a visit to the Russian ship. Everything was quickly prepared. The Russian leaders were offered black coffee and drinks.

Four Indian members, including Ajay and Major Kadam, joined the Russian leaders in the MI-8 helicopter for the visit to the ship. They returned from the ship at 4:00 PM.

The Russian expedition was different from the Indian expedition. There was one leader who was responsible for the entire 44th RAE, and there were several station leaders who were responsible for their respective stations. Being the leader of the entire expedition was a very prestigious position.

When the Russian leaders arrived in Maitri, we welcomed them warmly. The leader of the 44th RAE gave a brief speech in Russian, stating the importance of cooperation between the two stations. He also wished everyone a happy wintering and stressed the importance of Antarctic science and its importance in Russia.

His speech was translated into English by a doctor from Mirny station who was an anesthesiologist and marine biologist.

Indeed, it was a happy and historic moment for all of us present.

MAY 3

By the way, I was so encouraged by the speech of the 44th RAE Leader that it gave me a renewed sense of energy to contribute to Antarctic science. I had been feeling a bit down lately due to the harsh climate, isolation, and the monotony of eating the same food every day. But the RAE Leader's visit was a much-needed boost.

A helicopter of 43rd RAE arrived at Maitri on a mission to collect letters and greeting cards from us to be posted from Cape Town, South Africa. They were only here for a few minutes, but it was great to see some new faces after such a long time.

The helicopter crew was on their way to Mirny, another Russian Antarctic base. From there, they would travel over the continental ice to Vostok, the only station at the magnetic south pole. They would arrive after a journey of one and a half months.

I was excited to hear about their journey and to know that they would be carrying our letters and greetings with them. It was a reminder that even though we are isolated in Antarctica, we are still connected to the rest of the world.

Our convoy was located at DG point. They had to move the camp to a new location a few kilometers away. The incessant snowfall had buried half of the camp, making it uninhabitable.

One of our communication engineers, Mr. Gaur, visited the Russian research ship yesterday. He described it as a fully modernized icebreaker with 250 cabins distributed over seven stories. The ship also had an elevator, a medical room, an operating theatre, and an intensive care unit. There were many rooms dedicated to scientific experiments. The health of the generators and turbines was monitored 24/7 using computer monitors.

Various items for our expedition were brought by the Russian ship from Cape Town. These items were sent by the Department of Ocean Development (DoD), Delhi, and the Antarctic Science Centre (ASC), Goa. However, most of the items were stolen. The situation would be clear when the convoy returned. Most importantly, the new clothing that was sent for each of the members was stolen. We were worried because we were using old overalls, snow boots, goggles, gloves, and Annapurna jackets that were used by previous expedition members. The only new clothing we had were thermal innerwear.

The wind was blowing at 40 knots. The temperature was -10 degrees Celsius, but the windchill effect made it feel like -34 degrees Celsius. Sunset was scheduled for 2:00 PM GMT and sunrise was scheduled for 8:30 AM GMT. The amount of daylight was decreasing rapidly.

GENSET INTO THE FIRE: A GALLEY DUTY'S MIDNIGHT ORDEAL AT MAITRI STATION

MAY 5

Myself and Gajanand were assigned to galley duty today. Galley duty is the responsibility of keeping the kitchen and other facilities clean and functional in Maitri. I was the first galley person, which meant I had to clean the corridor, washbasin and toilet, and burn the human waste in the incinerator in the morning. In the evening, I had to check the generator, water boiler, deep freezer and other equipment every hour. Gajanand was the second galley person, whose job was to wash the dishes and utensils. My galley duty would last until 7:00 AM the next day. The smooth operation of the station depended on us. We completed the morning tasks without any trouble.

The evening shift started at 7 PM as usual. Everything was normal except for a slight increase in temperature in the vegetable’s deep freezer, which we fixed. I continued my hourly rounds and logged the readings carefully. If there was any problem that I could not solve, I had to inform the relevant person. It was 1:15 AM in the night, and I was taking the readings of the generator named Surya-2, which was running that day. I noticed a burning smell and checked for its source. I thought it might be a capacitor or a choke of a tube light, which sometimes happened. After writing down the readings in the log book in the control room, I came out and crossed the snow that had piled up from the last blizzard. Suddenly, I heard a loud explosion and saw sparks flying from the generator. The generator room was engulfed in flames and smoke. It was a terrifying moment - everyone was asleep and the generator was 30 feet behind Maitri.

I was faced with a quick decision. I rushed back to the generator room, but then changed my mind and went to wake up the other members, including Mr. Dilbag Singh from EME, who was responsible for the generators. I was in a state of panic. I thought everything was going to be destroyed because there was a large oil tank above the generator. I was so nervous that I ran back to the generator room. The fire had grown much larger by then. I grabbed a fire extinguisher and started fighting the fire. Dilbag and the other Maitrians arrived at the scene fully clothed. We all started pouring firefighting chemicals on the fire until it was under control. The generator was still running, but it was not producing any power. Smoke was coming out of the exhaust. Dilbag stopped the generator and identified the burnt cable. This caused a disruption in the power supply. In the icy continent, in the darkness of night, we were all struggling to survive in the Antarctic in the midst of severe cold and windchill.

I was thankful that I was a little late for my reading that day. This allowed me to witness the situation. It could have been much worse if I had arrived just a little earlier, at 1:00 AM. No one would have witnessed the event.

The power supply was restored after two and a half hours of effort by Dilbag and the others at 3:30 AM. I stopped my instruments to charge the backup batteries by visting Tirumala. What an event to end the day!

The standby generators were Aditya 1, 2, Bhaskara 1, and 2. After this incident, Dilbag tried to start Aditya 1, but it would not start because the fuel channel was leaking. He stopped it and then tried Bhaskara 2, which started successfully at around 3:30 AM.

MAY 6

Everyone was late for breakfast due to yesterday's event

MAY 9

Most of the members were preparing for a visit to Novolzaraveskya. The new Russian leader had invited us for lunch at 3:00 PM. Everyone was in a cheerful mood.

The members were ready by 12:00 PM. Eight people, including Leader Ajay, travelled to NOVO. They left at around 12:30 PM with the Pisten bully numbered 170.

Leader Ajay asked me to look after the station in his absence. Only eight people were left in Maitri out of twenty-six.

The convoy was returning to Maitri after finishing the 7th and last Convoy before polar night starts. All the conversations during the travel were audible to us through the VHF communication channel. The convoy commander, Major Kadam, was communicating frequently as both communication officers were traveling to NOVO. I was replying to Major over the communication set. Live and proper communication was very important during the convoy.

In the meantime, we received information from Mr. Gaur, the first communication officer, about their safe arrival at NOVO.

The convoy reached at 6:30 PM in the evening. Mr. Praveen had also reached on time along with the convoy. It was the day of his wedding anniversary. After reaching Maitri, he immediately rushed to the communication room to make a phone call to his wife.

We were glad to have successfully completed the convoy. Simultaneously, we celebrated Praveen's wedding anniversary.

SHARING THE LOAD: A SPECIAL SUNDAY TRADITION AT MAITRI STATION

MAY 16

Today onwards, we have devised a new noble rule to give Mohan ji a break from cooking every day. He has been preparing delicious meals for us since day one with a big smile. We appreciate his hard work and dedication. Therefore, we decided that every Sunday, two of our members would take turns to cook food for all of us. This way, Mohan ji can rest for a day and enjoy the food prepared by others.

Today was our turn to cook, but we got a reprieve because the Russians' visit was cancelled due to bad weather and heavy snow drifting. Mohan ji had already made breakfast, so we only had to make lunch and dinner. We chose some easy tin food items for lunch: rice, chapati, dal makhni, and sarso da sag. For dinner, we made some more elaborate dishes: motor gobi fry, mutton kima, tur dal, chicken curry, and fried ham. Tur dal was made by Mr. Pandkar from R&DE, Pune. Dr. Nag, our physician doctor from Indian Railway, helped us with the chicken curry.

We received mixed feedback from our members. Some praised our cooking skills, while others remained silent. Our leader did not comment on our food at all.

FREQUENT POWER FAILURE - A PANICKY SITUATION

MAY 17

Morning, I overslept and woke up at 8:30 AM. Suddenly, I heard someone yelling for Dilbag. I jumped out of bed and got ready, sensing that something went wrong with the generator. I was right. The generator had stopped, leaving Maitri and the surrounding area without power. I looked out the window and saw no smoke, so I ruled out a fire incident. I stepped out of my room and met Dr. Kanagamani, our surgeon and the earliest riser in Maitri, who told me about the problem with the generator. The oil inlet to the generator had frozen with ice due to snow drift and water contamination in the oil. The ice had blocked the entire pipeline.

After an hour, the power supply was restored. This generator problem has become quite common. It might be due to the lack of regular maintenance by the previous team. However, HMT Dilbag was very diligent in his duty. Above all, we had to deal with the harsh weather here. With the freezing temperature and constant snow drifting outside, anything could happen here. One had to be always alert.

When I met Leader in the morning, he informed me that all his instruments had stopped working due to a power outage. These days, I was frustrated with my instruments, which were powered by batteries connected to a charger module. I was glad to see that all the instruments were functioning well without any interruption when I visited Tirumala hut.

The duration of daylight was decreasing very quickly. The Sun rose around 10:08 AM and set by 12:10 PM by noon. The ambient temperature outside was -21.1°C at this hour i.e., 10:30 PM. The sky was clear and the stars were sparkling. Because of the absence of pollution, the stars could be seen more vividly than I used to see from Jorhat, Assam.

LAST GLIMPSE OF SOLITUDE: SCHIRMACHER OASIS AT SUNSET

MAY 18

According to the IMD forecasts, tomorrow will be the last day of sunset over Schirmacher Oasis. Today, the sun briefly appeared and then disappeared behind the clouds, although the sky was partly cloudy. From tomorrow onwards, there will be no sunlight over our region for the next three months, which will be the polar nights for us. It will be a rare and unique experience. Everyone at Maitri station was anxious and curious

about this phenomenon, although there was no discomfort around. But everyone was trying to adapt to the situation in their own way.

Maitri at 12 Noon: Embracing the Feeble Polar Light during Polar night

A Polar Night's Midday Ambiance: Blending Dawn and Dusk Tones at 12 Noon

The oil supply from the tank to the generator got blocked due to freezing at the base of the tank. The logistic team had to remove the ice by draining the oil and pouring hot water on the base of the tank. When the tank was half filled with water, they placed large immersion heaters inside the water. After half an hour, all the ice melted and drained out automatically. Then they blew out the remaining water with three high pressure blowers. The idea came from Havildar Sarjit Singh Nandel, another station electrician from EME, Pune.

TOTAL DARKNESS – POLAR NIGHT BEGINS

MAY 19

Heading towards the uncertainty associated with polar night, we were looking forward to witnessing the sunrise today morning at 10:35 AM, but we were disappointed because the sky was completely obscured by clouds due to a massive weather system passing over Maitri and its neighboring areas. The system was very evident in both the satellite recording chart and the contour map of the weather chart that we received through HF communication at 10:00AM from Pretoria, the nearest weather station.

Dim Illumination Perceptible Amidst Polar Night at 12 Noon

At that time (10:39AM), the Sun was positioned at 18 degrees North, shining brightly above the horizon. Gradually, the Sun ascended to 23 degrees North, rotating by exactly 5 degrees, when the entire region plunged into darkness due to the thick clouds that blocked its rays.

GENERATOR GONE DOWN AGAIN

MAY 21

Around 4:00AM, I woke up to some loud and frantic noise on the PA system. The generator had malfunctioned badly. I left my cozy bed and headed to the chilly corridor. The voltage and the AC frequency had fallen drastically. The load was being adjusted urgently by the galley crew. The temperatures of the pump house and the heating systems were being reported diligently by Subedar Sharma. It was a chaotic and stressful situation and I was annoyed and frustrated. Major Kadam appeared from his room, prepared and confident to take control. I trusted he would calm things down quickly. I glanced out of the window and saw nothing but pitch-black darkness. I chose to return to sleep.

The sky was clear and bright in the morning. In the north, some fluffy and colorful clouds were present, where the Sun showed up at 10:30AM. It was a brief but glorious sight. The Sun sparkled dazzling for a moment and then vanished mysteriously again. We all went outside to observe and record the moment. The light bounced off the ice-shelf and the clouds, creating a magnificent and stunning view.

The Antarctic winter had started harshly. The temperature had plummeted dramatically and it was freezing and biting cold. The wind was howling and roaring all day fiercely. It felt like -40 degrees centigrade with the wind chill factor painfully. At 11:00PM, it was +15.5 degrees centigrade inside Maitri, but -15.5 degrees centigrade outside bitterly.

THE ARRIVAL OF THE 44TH RAE TEAM: A NEW BEGINNING

MAY 23

Amidst this chilling weather and polar night, the new Russian team that visited Maitri station at our invitation. They were supposed to come last Sunday, but they rescheduled for today. The team leader of the 44th RAE was Vladimir Sergeivich and his deputy was Vladimir Ivansevisch. They were both strong and humble people. I also met my counterpart, the seismologist from the Russian station. His name was Peter Kosoy and he was a very friendly, charming and respectful person. I liked him a lot from the first

meeting. Peter Kosoy worked at the Obininisk seismological observatory, 100 km away from Moscow. He had four children aged 1, 4, 8 and 12 years old. He was very interested in visiting our seismological observatory, so we showed him around and explained our instruments and data. He was impressed by seeing our analog and digital seismographs, GPS instruments and our contributions to Antarctic science. We had a lot of technical discussions and agreed to exchange data and help each other. He spoke some English, which made communication easier for me. I used to struggle with Alexandra Sasa, the former seismologist, to discuss some issues. His way of speaking was very unique. I could tell he was taking time to translate from Russian to English in his mind. Once, I asked him how he felt about Antarctica and he said it was not a very bad place.

We also talked about some social issues and I was surprised to learn that most of them were not in favor of Leninism anymore, even though they used to be staunch followers of it. During this expedition, Peter would upgrade their seismic observatory to a fully digital one with a REFTEK 72A-08 instrument from the USA and a Russian seismometer with a period of 25 seconds.

I was delighted to hear that he knew about Buddhism and he pronounced the name of "Gautama" with great reverence. It was wonderful to hear that. He also used to practice Indian Yoga.

MAY 24

The day of last sunrise in Schirmecher oasis.

MAY 25

We were in receipt of a letter of appreciation from the Director, Antarctic Science Center (ASC) praising Major Kadam & Captain Venkatesh two of our expedition members for their bravery. Indeed it was remarkable contribution by them.

MAY 27

It was as if the sky was painted by a divine hand. The sun peeked out for a brief moment in the north, adding to the splendour of the faint sunlight that illuminated the clouds with a dazzling array of colours, from brownish - red to bright red. The contrast with the dark sky and the twinkling stars was striking.

The southern horizon also offered a beautiful spectacle. The light reflected on the continental ice near Maitri, changing its hue from pink to snow white. It was a mesmerizing display of nature's artistry.

The visibility improved and we could see clearly until 1:30 PM. The darkness vanished and the sky became fully bright at 11:00 AM. Then, the moon emerged in the west, towards Novolazaraveskaya and the sky gradually darkened again.

CRICKET FEVER ON ICE: INDIA VS. ENGLAND, COPING MONOTONY AND ISOLATION

MAY 30

The World Cup Cricket tournament was in full swing. The fate of both India and England depended on today's match, which had been postponed due to rain yesterday.

Our only source of information was the Hindi news (Indian) broadcasted by HF set in the communication room. We eagerly awaited the updates on the game, and we often speculated about the possible outcomes. This was our way of coping with the monotony and isolation of living in Antarctica due to non-availability of television and newspaper.

NO MORE VIEW OF SUN

MAY 31

The Sun was gone from our sight. Only a faint glow on the northern horizon at 9:00 AM reminded us of its existence, and only if there were some clouds to reflect its light. We had lost our source of warmth and energy, and we didn't know if it would ever return.

Polar night is a phenomenon in the southernmost regions of Earth where night lasts for more than 24 hours. Inmarsat dome and communication towers are visible. Reflection from sunlight on cloud hovering

SURVIVING THE POLAR NIGHT: MENTAL HEALTH AND CAMARADERIE

JUNE 3

I want to share with you the mental health of the expedition members as we faced the Polar night that was about to start. We had just finished the month of May and entered a new one. We had been here for almost five months. We had witnessed and experienced things that we could never imagine in the mainland. And we had to deal with the challenges of galley duty – burning human excreta, and the interpersonal relationship among 26 members. Meanwhile, we all started to count the days for the ship to come and take us back. Whenever and wherever we talked to each other, this topic was always on our minds.

Especially those members who had families and kids, they felt very lonely and missed them a lot, even though they knew they could not do anything from Antarctica. Every day, we saw the same faces – the 26 of us. No TV, no newspaper, no internet, only 16 minutes of international phone time per month through expensive Inmarsat satellite, darkness outside and similar kind of food taste that was now old and boring – all these made the environment very stressful. It was a tough and demanding stay. I was also in the same

situation and felt tired. But I kept myself motivated with one goal, the reason why I came here – “How best can I contribute to Science of Antarctica?”

It was a joyous moment for us when we heard the familiar ring of the telephone from the mainland. It meant that someone we loved was calling to check on us and to share some news from the outside world. We would gather around the PA system and listen eagerly to the voice of our family or friend. It was a rare and precious connection that lifted our spirits.

The glittering cloud in Antarctic sky under reflection of feeble sunlight is incredible during polar night

We needed those moments because life at Maitri was not easy. We had to cope with the long and dark winter, with no sunlight for months. We could not go outside much because of the extreme cold and the frequent blizzards that whipped up the snow and ice. We felt isolated and bored, with nothing to do but wait for the spring. Some of us started to lose hope and feel depressed. We wondered why we had chosen to come here and what we were missing out on. The darkness affected our mental and physical health in many ways.

The outdoor environment was perilous and required utmost vigilance. Only the army team and a few members of the scientific team, namely Leader Ajay, Mr. Lal, Mr. Krishnamurthy, Mr. Shinde, Mr. Pandkar and myself, had the privilege of venturing outside. All of our laboratory was located in separate huts about 250 meters away from

Maitri, the main station. Despite the harsh weather conditions, we had to carry on with our studies at any cost.

One of the challenges that some of the members faced was how to use their time effectively. Watching movies, playing indoor games, or studying for hours could become boring or exhausting after a while. Some members also struggled with insomnia or sleeplessness, which affected their mood and productivity.

UNEXPECTED TRAGEDY: THE CONSEQUENCES OF A SUDDEN GUST

JUNE 8

In order to keep myself active, I followed Major Kadam to the container, which was parked outside. I could find him there. He opened the right door of the container and we saw the new carpets stacked inside brought from India to replace the old existing one. They looked nice and cozy. We started to take them out one by one. Major Kadam was standing near the open door, directing some of us where to put them. The wind was blowing hard, making it difficult to carry the carpets. Suddenly, a gust of wind slammed the left door of the container open. It swung with such force that it hit Major Kadam and Dilbag on its way. Major Kadam fell to the ground, blood gushing from his head. Dilbag also collapsed, clutching his back.

We rushed to help them and called for a doctor. Dr. Kanagamani, the station surgeon, came quickly and examined them. He bandaged Major Kadam's head and gave him some painkillers. He said he had a concussion and needed to rest for at least 48 hours. He also checked Dilbag's back and said he had a bruise but nothing serious. He advised him to apply some ice and take it easy for a while.

That terrible accident that spoiled our mood and ruined Major Kadam's anniversary plans. He was supposed to celebrate with his wife tomorrow, but now he had to stay in bed with a headache. We felt sorry for him and wished him a speedy recovery.

WINTER WONDERLAND: PREPARING FOR MIDWINTER DAY CELEBRATION

JUNE 12

I was thrilled when Leader Ajay announced a meeting at 7 pm to discuss the plans for Mid-winter day, the most awaited festival of Antarctica. On June 21st, the sun would be

farthest from our continent, leaving us in complete darkness. But we would not let that dampen our spirits. We had already been invited by the SANAE station, the South African base, and we had also invited the nearby Russian expedition. It would be a grand celebration of friendship and solidarity.

In the meeting, we agreed to tidy up the inside of Maitri, our cozy home away from home. We had A-block on the ground floor, B-block on the first floor and the lounge where we could relax and have fun. We also decided to organize some indoor games tournaments to keep us entertained and competitive. We had Table Tennis, Carrom, Chess, Sweep and Scrabble to choose from. Leader Ajay also encouraged us to come up with some creative ideas for the special day.

I was looking forward to the Mid-winter day with great excitement. It was a chance to bond with my fellow expedition members and to celebrate our unique experience when we were in isolation.

TOTAL CUT OFF FROM THE REST OF THE WORLD: SNAG IN INMARSAT

JUNE 13

We faced the impact of Y2K problem. Due to a protocol change by Videsh Sanchar Nigam Limited (VSNL), the E-mail service was disrupted. We had to update the Eldora settings of the Inmarsat in our systems to match the new protocol. This required re-installing the software with the correct settings.

Unfortunately, we had no access to any emails or news from inside or outside the country. The only way we could communicate was by phone or fax through an “Inmarsat satellite connection”, which was very costly.

Thus the recovery of the device was a priority for the team. They had already communicated with the Defense Electronics Application Laboratory (DEAL) in Dehradun through a fax message, requesting their assistance in locating and retrieving the device. The fax message contained the details of the device and its last known location.

The members of Maitri had to adjust to the polar night, where the sun never rose above the horizon. We could only see a faint glow of twilight in the northern sky, but no sunlight at all. To keep ourselves busy and productive, we used to clean the lounge and the passage that led to the Boiler room periodically after our routine study. We worked together as a team and made sure everything was tidy and organized.

JUNE 14

We received a reply fax from DEAL, Dehradun with necessary instructions on how to fix the email settings. DEAL has been providing communication support for the Indian Antarctic station, MAITRI since 1995. This is a crucial activity for the nation's scientific research. Despite our best efforts, we could not reinstall the system successfully.

We were all busy with the renovation and cleaning work for the Midwinter Day celebrations. It is a special holiday for those who spend the winter in Antarctica, marking the shortest day and longest night of the year. I cleaned the window glasses of the lounge and helped others to clean the passage from the boiler room to the bathroom and lavatory. We wanted to make everything look nice and festive for the occasion. All 26 of us were busy under the guidance of the Leader.

AN ENGLISH TEACHER WAS BORN

JUNE 15

Havildar Jaswinder Singh was a soldier of the EME unit of the Indian Army, stationed at Dinjan near Dibrugarh in Assam. He had a strong passion for serving his country and learning new skills. He joined the Army at 17, against his family's wishes, and completed his class Xth education. He was married and had a baby boy who was born in October. He had to leave for an Antarctic expedition in November, but he did not let that stop him from pursuing his dream of learning spoken English. He asked me to be his English teacher and I agreed without hesitation. He was a quick and eager learner and we used every spare moment to practice his English.

Havildar Narayan and Havildar Khattri were diligently polishing the brass mementos displayed in Maitri, which were donated by various organizations from India and abroad. The mementos shone brightly and sparkled after their careful work. I was impressed by their skill and asked them, "How do you polish them so well?". They answered proudly, "We are trained in the Army." They were very happy to receive my compliment.

JUNE 20

The eve of the Mid-winter day was filled with joy and excitement. We got invitations from several Antarctic bases of different countries. The leaders of Germany, Japan, Russia and South Africa greeted us warmly and wished us well in our Maitri base. The Mid-winter day is a special occasion that celebrates the middle of the Polar night, a period of continuous darkness that lasts from two to six months depending on the location. The

central part of Antarctica experiences six months of darkness, while the coastal areas have two months. All the leaders expressed their hope that we would achieve our scientific goals successfully.

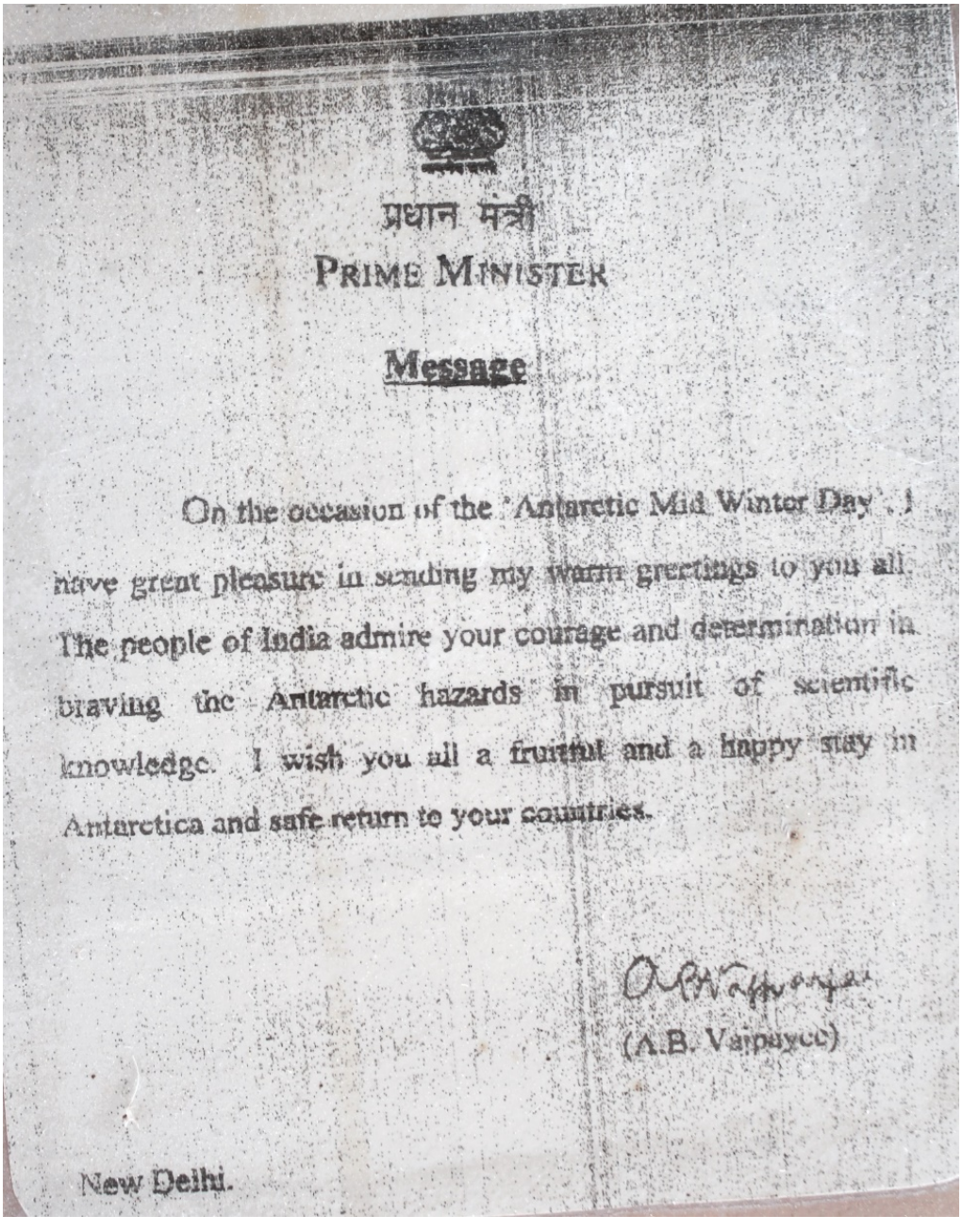
The Midwinter Day celebration is a tradition that dates back to the early expeditions in Antarctica. It is observed by the personnel who spend the winter in the continent, as well as some people around the world. It coincides with the winter solstice, the shortest and darkest day of the year, and marks the halfway point of the polar night. On this day, people enjoy festive meals, exchange gifts and cards, and decorate their stations with flags and other ornaments. At Maitri, we had been preparing for this special occasion with great enthusiasm. Many of us had practiced individual and group performances to showcase our talents on stage. Mr. Pandkar had transformed the entrance room with a new wallpaper and decorations, with the help of Mr. Narayan, Dr. Nag and Mr. Shinde. The room looks stunning and inviting. We are looking forward to celebrating Midwinter Day with our colleagues and friends.

The Antarctic night was dark and cold. The sun had dipped below the horizon at 23.5 degrees north latitude, and it would not rise again for months. The only light came from the stars and the faint glow of the aurora. The wind howled at 55 knots, whipping up snow and ice. Two generators ran constantly, providing power and heat to the Maitri base. They also produced noise and smoke, which polluted the air and disturbed the silence. Albeit, no other noise existed.

GREETINGS FROM ATAL BIHARI VAJPAYEE – THE HON. PRIME MINISTER

JUNE 21

With galore, today we celebrated Mid-Winter Day, a significant occasion for us in Maitri. It marked the end of the longest night of polar night, which lasted for more than two months. On this day, the Sun moved northward and reached 23.5 degrees latitude. This meant that from tomorrow, the darkness would gradually decrease. We Maitrians were delighted to host the 44th RAE members from Novolazaraveskya as our esteemed guests. We spared no effort unturned to make the event a success. We also received many greetings from dignitaries around the world, including Prime Minister Atal Bihari Vajpayee ji and President Bill Clinton, as well as from other Antarctic stations. These messages boosted our morale and made us feel cheerful after a long period of monotony. We could feel that we were on a great mission.



प्रधान मंत्री

PRIME MINISTER

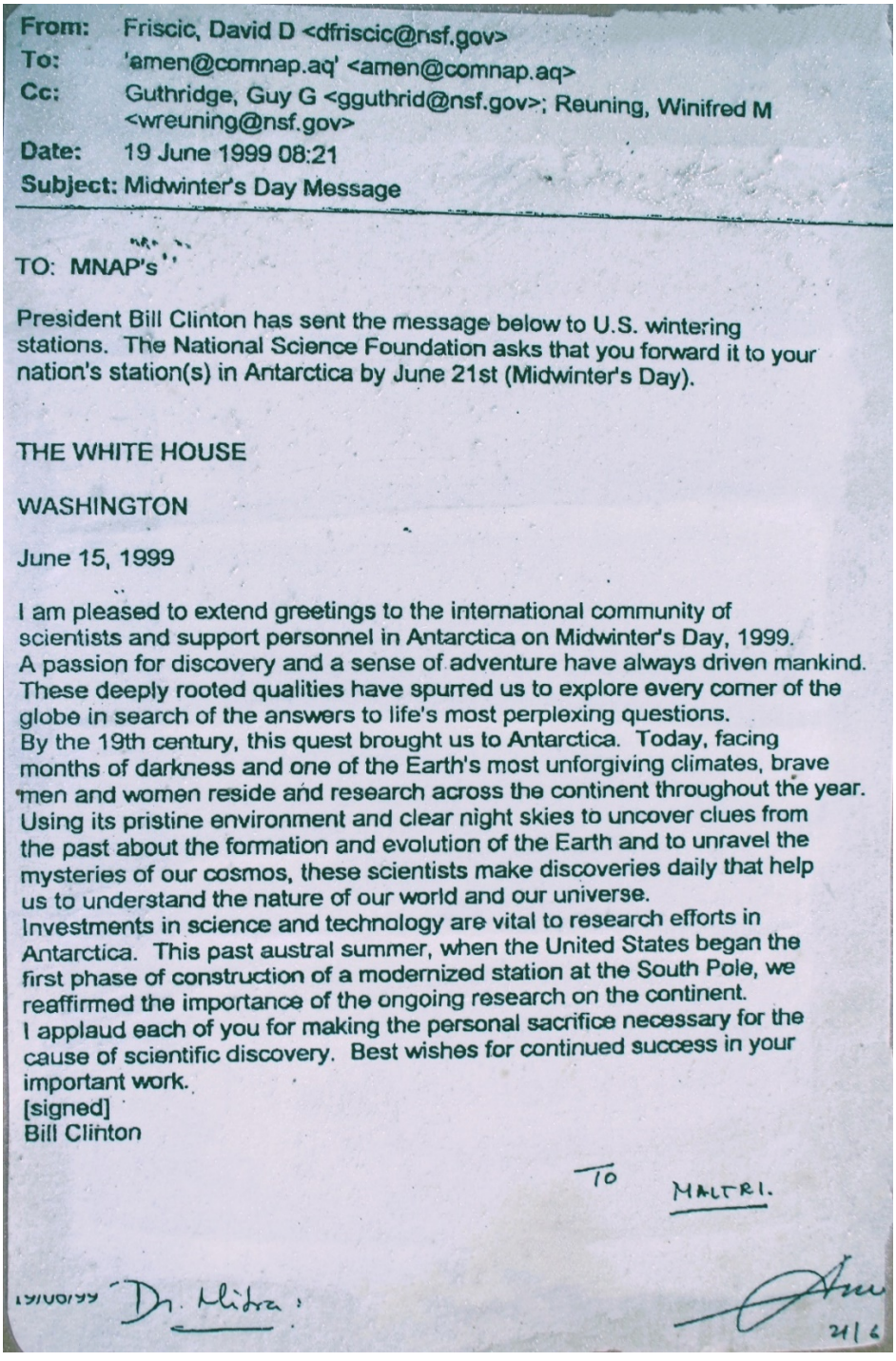
Message

On the occasion of the 'Antarctic Mid Winter Day', I have great pleasure in sending my warm greetings to you all. The people of India admire your courage and determination in braving the Antarctic hazards in pursuit of scientific knowledge. I wish you all a fruitful and a happy stay in Antarctica and safe return to your countries.

(A.B. Vajpayee)

New Delhi.

Warm Wishes from Honorable Atal Behari Vajpayee, Prime Minister of India, on the Occasion of Midwinter Day



From: Friscic, David D <dfriscic@nsf.gov>
To: 'amen@comnap.aq' <amen@comnap.aq>
Cc: Guthridge, Guy G <gguthrid@nsf.gov>; Reuning, Winifred M <wreuning@nsf.gov>
Date: 19 June 1999 08:21
Subject: Midwinter's Day Message

TO: MNAP's

President Bill Clinton has sent the message below to U.S. wintering stations. The National Science Foundation asks that you forward it to your nation's station(s) in Antarctica by June 21st (Midwinter's Day).

THE WHITE HOUSE

WASHINGTON

June 15, 1999

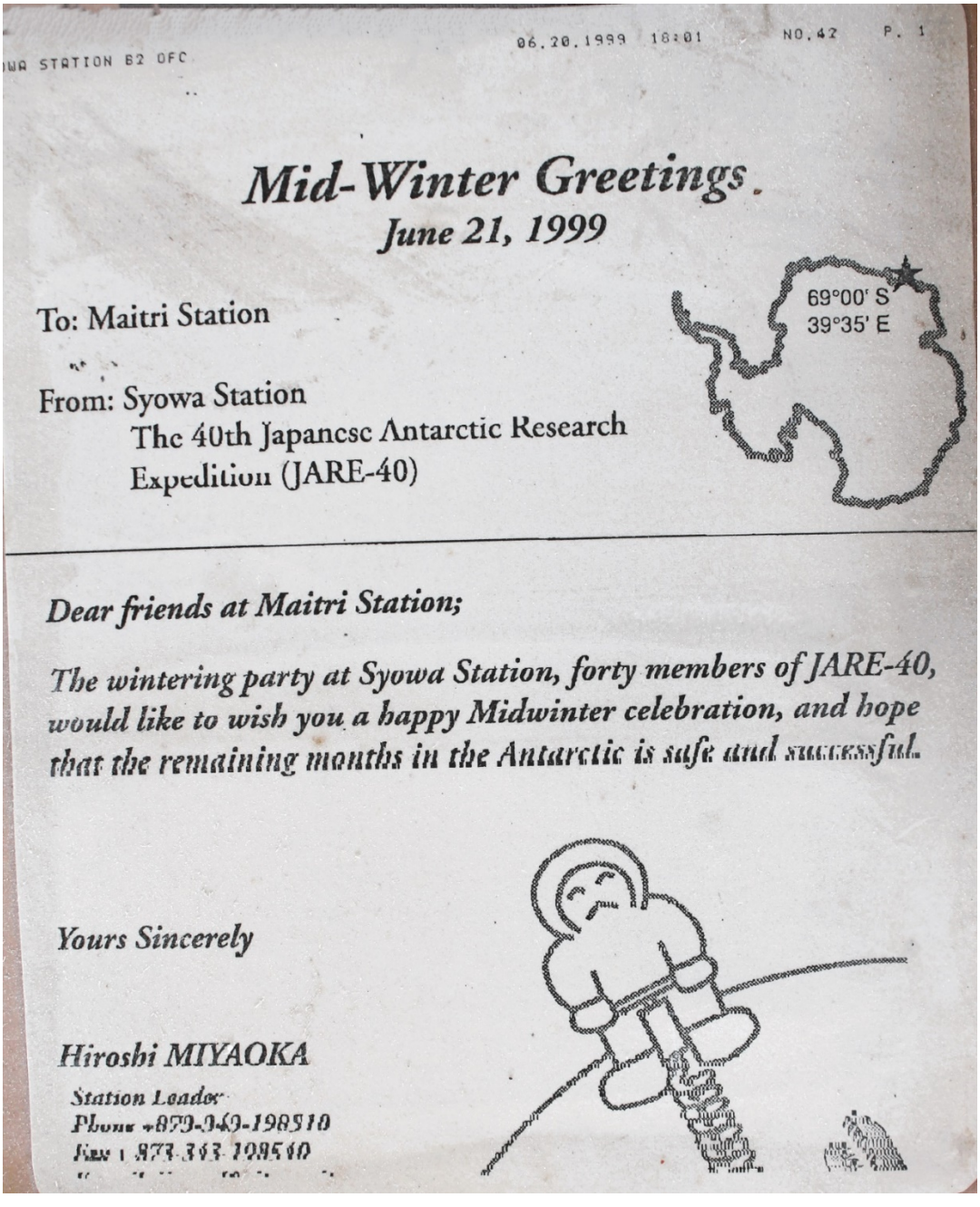
I am pleased to extend greetings to the international community of scientists and support personnel in Antarctica on Midwinter's Day, 1999.
A passion for discovery and a sense of adventure have always driven mankind. These deeply rooted qualities have spurred us to explore every corner of the globe in search of the answers to life's most perplexing questions.
By the 19th century, this quest brought us to Antarctica. Today, facing months of darkness and one of the Earth's most unforgiving climates, brave men and women reside and research across the continent throughout the year.
Using its pristine environment and clear night skies to uncover clues from the past about the formation and evolution of the Earth and to unravel the mysteries of our cosmos, these scientists make discoveries daily that help us to understand the nature of our world and our universe.
Investments in science and technology are vital to research efforts in Antarctica. This past austral summer, when the United States began the first phase of construction of a modernized station at the South Pole, we reaffirmed the importance of the ongoing research on the continent.
I applaud each of you for making the personal sacrifice necessary for the cause of scientific discovery. Best wishes for continued success in your important work.
[signed]
Bill Clinton

TO MAITRI.

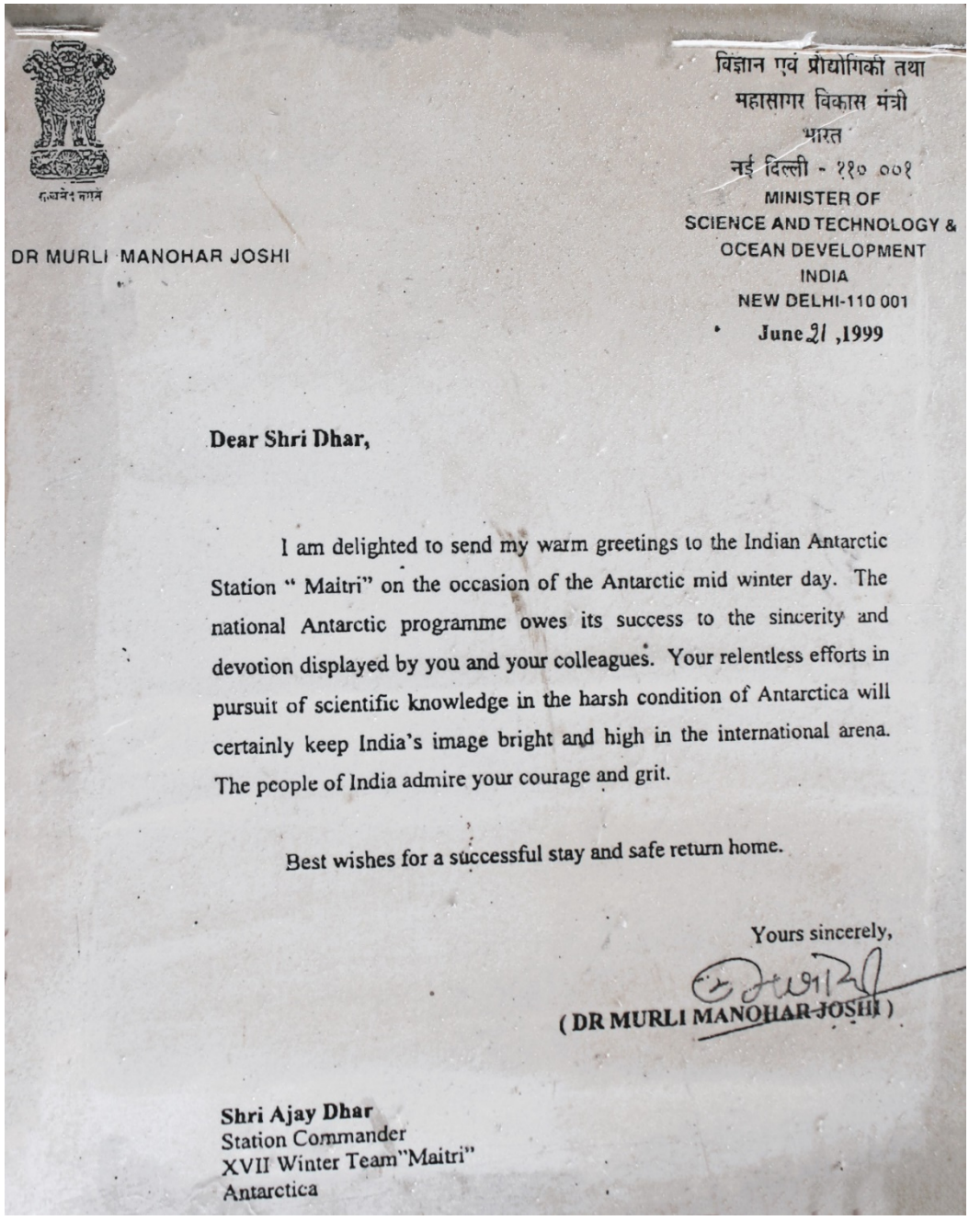
19/06/99 Dr. Mishra

21/6

Greetings from Honorable Mr. Bill Clinton, President, USA, on the occasion of mid winter day



Greetings from Honorable Dr. Hiroshi Miyaoka, Sation Leader, Syowa , Japanese station, on the occasion of mid-winter day



सत्यमेव जयते

DR MURLI MANOHAR JOSHI

विज्ञान एवं प्रौद्योगिकी तथा
महासागर विकास मंत्री
भारत
नई दिल्ली - ११० ००१
MINISTER OF
SCIENCE AND TECHNOLOGY &
OCEAN DEVELOPMENT
INDIA
NEW DELHI-110 001

June 21 ,1999

Dear Shri Dhar,

I am delighted to send my warm greetings to the Indian Antarctic Station " Maitri" on the occasion of the Antarctic mid winter day. The national Antarctic programme owes its success to the sincerity and devotion displayed by you and your colleagues. Your relentless efforts in pursuit of scientific knowledge in the harsh condition of Antarctica will certainly keep India's image bright and high in the international arena. The people of India admire your courage and grit.

Best wishes for a successful stay and safe return home.

Yours sincerely,

(DR MURLI MANOHAR JOSHI)

Shri Ajay Dhar
Station Commander
XVII Winter Team"Maitri"
Antarctica

Midwinter Day Greetings from Honorable Dr. Murali Manohar Joshi,
Esteemed Minister of Science and Technology

The Russian guests arrived at Maitri around noon and were warmly welcomed by our team with artificial flowers. They brought some souvenirs and vodka as a gesture of

friendship. Our leader Ajay gave a short speech to express our appreciation and gratitude. Then we enjoyed a feast of various dishes, both vegetarian and non-vegetarian, along with drinks. We also entertained them with a cultural program that showcased our talents and diversity. Everyone had a great time and looked forward to working together on our scientific objectives. The party ended after the Russians left at six in the evening.

EXPLORING NOVO'S RUSSIAN SEISMOLOGICAL OBSERVATORY

JUNE 22

We were honored to join the Russians in their celebration on the 22nd. They had invited us to share their joy. Our team of 18 people, headed by Leader Ajay, departed for NOVO at 10 am in four vehicles. We arrived at Novo station by noon, under the dim light of the polar night.

We arrived at the venue and were immediately ushered to the dining table. The leader gave a brief introduction and then the party began. The tables were arranged in a single row, facing each other, as if we were about to have a diplomatic meeting. The members of both teams sat across from each other. There were several bottles of vodka on the table. The party started with a toast of vodka. The food was served at a buffet counter. There was a variety of salads, fish, chicken and beef dishes. Some of our members were vegetarian. One of the salads had fresh vegetables and fish mixed together. Captain Venkatesh took that salad, thinking it was a vegetarian dish, but soon realized his mistake. He quickly swapped his plate for another one. After finishing my lunch, I went with Mr. Peter, the seismologist, to visit the Russian seismological observatory at Novolazaraveskaya. He wanted to show me the new seismographs he had brought with him.

Our first stop was the data processing room, where we saw how the networked observatory handled the digital seismograms. The room had two computers: one for networking and one for processing. The processing computer had a software that was supposed to analyze the seismograms, but Peter pointed out some errors in its output. He said that the software was faulty and that he was waiting for an updated version from Russia.

Then, we visited the seismograph observatory with seismometers and data acquisition system (DAS) from Reftek, Dallas, USA. The seismometers had a period of 25sec and were connected to the DAS in three components (XYZ) with a GPS pulse. The observatory was in a manmade cave, 30ft deep, with a 14x12 ft room and rock wall. It was very quiet

and did not record any noise from the blizzard outside. The seismometers were on the rock surface, aligned and balanced. No seismic pier was needed. This was an excellent seismograph observatory. We walked down carefully because of the ice after exchanging several queries on seismic activity in this icy continent.

Peter was reluctant to let me take a picture of the observatory. He said his Leader had forbidden it. But after some persuasion, he agreed to let me snap a quick shot. I had already faced some resistance from Mr. Alexandra Sasha, the seismologist, who did not want me to visit the place at all. I later realized why he was so secretive.

Afterwards, I had a chance to visit his room after we went to the observatory. He told me it was the same room where Mr. Alexandra Sasha used to live, and now it was occupied by Mr. Peter. I was astonished by what I saw in his room. He had cards of Gautama Buddha and Jesus Christ on the shelf, side by side, with respect and reverence. He said he had been to a Buddhist Temple in Russia and met a Bhante - a Buddhist Monk - before he came to Antarctica. He also said his hobby was Philosophy and Religion. He admired former President Gorbachev for ending militarism and bringing freedom to Russia. I disagreed with him and said, “I don't like Gorbachev because he broke up such a big powerful country into smaller pieces”. He replied, “Gorbachev did a good job for the country, even though the economy is suffering, but the people are free, which is more important”. He also told me that many of the talented people were leaving Russia and working for Saddam and Arabian countries to make weapons for them. I was very impressed by Peter, who knew so much about Indian gods and goddesses like Lord Shiva, Maa Kali and Maa Durga. We returned to Maitri with great satisfaction.

MY PHYSICAL FITNESS AT STAKE: ANEMIA DIAGNOSED

JUNE 30

I had been feeling unwell lately. My physical fitness had declined treacherously and Doctor Kanagamani diagnosed me with anemia. He checked my pulse rate and it was too high. I also felt weak but I did not know why. My heart was beating fast and hard. It started a few days ago when I exercised and it got worse. I had trouble walking quickly to my laboratory Tirumala hut. I thought it was because of the cold air affecting my lungs, but I was mistaken.

As the person in charge of the galley for the day, I had an unusual experience. I felt some mental distress that lasted all day long. Even though I performed my tasks normally and carefully, I could not stop thinking about random thoughts that popped into my mind.

I kept this condition to myself for three months, until I shared it with some other members. To my surprise, some of them had similar psychological issues as me. They comforted me and assured me that I was not alone. I was relieved that I was not completely insane, and that I could recognize my problem. The long isolation, the old food, the extreme cold, the harsh weather, the troublesome maintenance of the observatory, and above all, the darkness of the polar night took a toll on our physical and mental health. Later I understood that this was part of the challenge of surviving in Antarctica as wintering over members.

I regret hiding my mental health issues from others. If I had not shared my feelings with my team members, I would have been completely exhausted before the next mission. This experience taught me a valuable lesson: one should always communicate one's problems to someone trusted as soon as possible.

We had been assigned galley duty. Fortunately, I was the second galley person., evening 7 PM to 7AM. During night hour, I watched a movie called Deception I and II. It was about two sisters who looked alike, but had very different lives. One was married to a university professor and microbiologist, and had two kids. The other was married to a millionaire who was a drug smuggler, and had no kids. They were both bored with their lives, so they decided to switch places without telling their husbands. They enjoyed their new lives at first, but then things went wrong. The professor's real wife, who was now with the drug lord, found out about his illegal business and some secrets. He killed her for that. When the other sister heard about her death, she confessed everything to the professor. He was angry and hurt, and rejected her. She left him and helped the police catch the drug lord. The movie ended with the professor and the drug lord's ex-wife getting back together. The moral of the movie was that we should not follow our impulses, but our wisdom. Otherwise, we will face disaster.

LETTER TO LOVING MOTHER

JULY 1

Dear Mom,

I hope this letter finds you in good health and spirits. I miss you very much and think of you often. I hope you have received my previous letter and will write back to me soon. I have placed the group photo that we took before I left home on my table. It reminds me of you and the rest of our family.

Your loving Bilu (nickname),

My health had deteriorated significantly - I was frail and depressed. Dr. Kangamani diagnosed me with severe anemia and prescribed Reditone Plus capsule, a medicine that helps to restore the blood levels in the body. After taking this medicine, I noticed a remarkable improvement in my well-being.

SURVIVING THE HARSH POLAR NIGHT: STRATEGIES FOR SEVERE COLD AND BLIZZARDS

JULY 4

The sky had been overcast for several days, and the wind was relentless. It blew at an average of 20 knots, which seemed normal by now. The mercury dropped to -16 degrees Celsius. I shivered as I stepped out of the lab. It was a different kind of cold, piercing and persistent. The weather was always changing and hard to predict. But we had learned to recognize the signs of a blizzard from our daily observations of the clouds. It usually went like this: first, the clouds would thicken and the wind would pick up without any snow drifts. This would last for two or three days, then suddenly the wind would intensify and the snow would start to drift. Then the blizzard would begin and rage on for three or four days more without stopping.

As the long polar night continued, we had to find ways to keep ourselves busy and productive indoors. Going outside was not an option until the daylight returned, but I still had to check on my laboratory every day. We had been trained to use our time in Auli creatively and innovatively. Each of us had a different project or hobby to work on. Some were growing vegetables in the greenhouse inside Maitri, others were organizing and inventorying the storeroom. A few of us decided to set up a gymnasium in one of the rooms. We gathered all the equipment we could find, such as a table tennis table, a jogger unit, a bicycle and some weights. The room was very cold, so we added a blower and an oil heater to warm it up. The leader Ajay inaugurated the new gymnasium and encouraged us to use it regularly.

Despite the blizzard, I was determined to visit the observatory and keep it running. I had set myself a challenge before the storm: I would not let the weather force me to close down the observatory for even a day. It was a critical situation for all of us who worked there. We were fearless but not reckless, cautious but not timid, ready to face whatever came our way. How I managed to visit the observatory is another story that I will share later.

Even though the days were getting slightly longer, we never witnessed the sun rising above the horizon. We had spent most of our time indoors, watching the Mahabharata, a legendary TV series based on an ancient Indian epic. It was broadcasted every day at 3:00 PM for an hour, since the polar night began. After we finished all the episodes of the Mahabharata, we started another epic series - The Ramayana. These two shows taught us many valuable lessons about life.

One of the challenges faced by the members of the expedition was the lack of regular medical check-ups. Dr. Kanagamani and Dr. Nag had planned to conduct fortnightly examinations based on the format prepared by AIIMS, New Delhi and DIPAS-a DRDO establishment. These data were crucial for medical research in such harsh conditions, but the members were reluctant to cooperate despite repeated requests over the amplifier system and personal interactions. As a result, the doctors had to settle for monthly check-ups instead. Actually, it was the reflection of desperation evolved within members for any harsh eventuality. Dr. Kanagamani assured us that the medical unit was capable of performing any kind of surgery except brain surgery. However, most of us suffered from insomnia and could only sleep for two to three hours at night. This indicated that we were anxious about our survival and wondered if we could complete our tenure in such extreme conditions of cold, darkness and blizzard. I had an additional problem of anemia besides increased pulse rate. All of us wanted to be mentally stronger to overcome such challenges, regardless of our physical health. I adopted some strategies to cope with the situation, which were as follows: -

- Be disciplined
- Explore your objective of survival and work on it extensively to fulfill it
- Express your views politely to others if you have confidence in them
- Inculcate positivity within yourself
- Practice to eradicate the negativity within yourself
- Volunteer yourself to help others who need it
- Be humble and accept the situation as it comes
- Do mild exercise and meditation regularly
- Stay away from any kind of intake of toxicity, especially liquor

ENDURING THE LONG WINTER: STRATEGIES FOR PERSISTENCE IN MOST HARSH CONDITIONS

JULY 15

The winter was harsh and long, but we could see some signs of change outside. The sky was brighter and the days were longer. We watched the snowflakes dance in the air from our windows, covering everything in a white blanket. It was extraordinarily beautiful, but also boring. We decided to spice up our living rooms with some new decorations and colors. We worked together to change the wallpaper and the carpet in each room. My room got a green carpet that reminded me of the grass and trees in RRL, I missed so much. The new look of the room made me happy and hopeful. We were learning to live with the cold and the dark, but we also looked forward to the spring.

My daily routine in the laboratory started with a visit to the wooden Tirumala hut. I had to check the instruments, the power supply, and the condition of the hut every morning in the dim light. Then I had to wear a strap on my hand that was connected to the ground to discharge the static electricity from my body. This was a crucial step to avoid damaging the sensitive instruments by electrostatic discharge. After that, I had to collect the raw data from the digital seismograph and the GPS module, and replace the analog seismogram paper with a new one. The data analysis was done on a daily basis using a computer. I had to examine the raw seismograms carefully and identify the teleseismic earthquakes that occurred far away from Antarctica. However, I was more interested in the local earthquakes and their mechanisms, so I had to scrutinize the seismograms more closely. After picking up the P and S wave arrival times, amplitudes, and coda durations of each earthquake, I had to save them in ISC format and send them to NGRI-Hyderabad and International Seismological Centre (ISC) via email after logging in my log-book. Most of the earthquakes were of oceanic origin, which were not very relevant for my research.

One of my cherished memories was going to the Mandir (temple) on the first floor every evening with some of my friends. Dr. Kanagamani, Mr. Krishnamurthy and Subedar M. C. Sharma were always there, performing different kinds of Puja. I learned a lot from them about various religious traditions and teachings that I did not know before. I also used to recite the Pali Sutra from “Magala Bhavana” for a few minutes before going to the Mandir.

The Ramayana serial was a popular source of entertainment for most of the members. They never missed an episode and enjoyed the stories and lessons. The serials had a positive effect on their mood and focus. The 16-member logistic army personnel had a lot

of free time when everything in Maitri was functioning well. Moreover, there were no convoy movements. They needed some activities to avoid psychological issues. Watching serials was one of them.

The weather change was sudden and severe. We had to limit our outdoor activities due to the snowfall, low temperature and darkness. To make matters worse, we lost our internet connection a few days ago because of a problem with the INMARSAT satellite. The satellite terminal at Maitri station could not lock onto the satellite signal because of the extremely low temperature of -28 degrees centigrade with no wind. The temperature has dropped even further to -31 degrees centigrade today, the lowest in two weeks. Windchill effect was furious, even though I was a daily visitor outside.

CONFRONTING NATURE'S FURY: ENDURING THE MOST SEVERE BLIZZARD

JULY 22

Caught in blizzard, we were facing a terrible situation outside. The wind was howling and roaring with a deafening noise. It felt like the whole building was shaking. I checked the anemometer and saw that it registered 103 knots, which is equivalent to 187.66 km/h. That was the highest wind speed we had ever recorded since we arrived here. It seemed like nature was unleashing a new disaster on us.

Myself and Dr. Nag were ready to go to Tirumala for our regular visit at 9:00AM. We left Maitri and walked hand in hand on the ground. Suddenly, a strong gust of wind lifted us up and threw us a few feet away. We could not stand up even after letting go of each other. Dr. Nag tried to help me up but failed. The wind was too powerful. I tried to pull him up but we both fell again. Then, I crawled to a wooden pillar and told him to do the same. We managed to get up and hold on to the pillar until the gust stopped. We gave up on going to Tirumala. Nobody in Maitri saw what happened. When we told them, Leader Ajay decided to tie a thick rope between Maitri and Tirumala hut, which were 250 meters apart. In the evening, the wind slowed down for a while. I seized this opportunity. I ran to Tirumala in complete darkness with a tolerable wind speed. I knew a blizzard could start any time. I finished the work as fast as I could and ran back to Maitri. It was 10:40PM, and the blizzard was raging with wind gusts over 100 knots.

EMBRACING THE DAWN: WITNESSING SUNRISE AFTER THE LONG POLAR NIGHT

JULY 25

Today was a remarkable day for us at the Schirmecher oasis. After enduring the long polar night, we finally witnessed the Sunrise again. It was a beautiful sight that filled us with hope and joy. The polar night was a unique but terrible experience. It was an experience that can not be

Experiencing the Initial Rays of Sunlight after a Prolonged Polar Night,
Filled with Joyful Spirits, All Members Celebrated: one was raising "V" symbol

described in words. It was too worrisome. None could visit outside and it was restricted as well except few of us who had to travel to observatory daily.

The Horizon Welcomes the First Sunrise as Maitri Emerges from Four Months of Polar Night.

Antarctic Dawn: Instilling Hope for Survival among Expedition Members

Meanwhile, we also had some visitors: Peter-the seismologist, and the Russian Doctor. Peter wanted to compare his earthquake data with that of mine for some specific events. He was very interested in the seismic activity of this region. We sat for long hour for the data processing and subsequent comparison.

Regrettably, we had a problem with our communication system. The wind had blown away our dome antenna two days ago, and we were isolated from the rest of the world. We could not use the telephone or fax to contact anyone. But today, we managed to install the dome antenna again and restore the connection amidst chill, snow flake and wind. It turned out that the dome was facing the wrong direction before. Once we fixed that, everything worked smoothly. We were very relieved and happy to be able to communicate again.

SUSTAINING PRISTINTY: WASTE MANAGEMENT IN ANTARCTICA

JULY 27

Gradually, we were enjoying the longer days of sunlight in Antarctica and decided to do some outdoor activities. However, we were dismayed to see a lot of trash around the Maitri campus, such as broken plywood, wooden plank, plastic sheets. These items were probably carried away by the wind and the blizzard. According to the Antarctic Treaty, we have to keep the area around any Antarctic base clean and not leave any unwanted material on the ice or the terrain. The Department of Ocean Development, government of India, sent us two empty containers to collect this garbage and dispose of it properly in mainland India. One of these containers was for medical waste only.

As the sun rose above the horizon, I could see a clear and bright sunrise in the north-east direction of Maitri. It was a sign that the days were getting longer and brighter. I felt a sudden urge to call my family and share this beautiful moment with them. I dialed their number, but no one answered. The phone kept ringing and ringing, but there was no response. I felt a pang of worry in my chest. "What if something happened to them?" I wondered. "What if they are in trouble or need my help?" I tried to calm myself and think positively, but it was hard to shake off the negative thoughts.

WINTER MAGIC UNVEILED: A GLIMPSE OF MAITRI'S SNOW-COVERED LANDSCAPE

AUGUST 1

Wow, what a sight to behold! I couldn't believe my eyes when I saw the snow-covered landscape of Maitri this morning. I had slept in a little longer than usual, and when I got up, everything was white. The snow had fallen overnight and transformed the place into a winter wonderland. The small rocks on the ground were buried under the fluffy snow, and only a few big ones peeked out from the blanket. They looked like they were gazing at the sky in awe. It was an amazing experience to witness such beauty.

Maitri Complex Blanketed in Snow Following Overnight severe Blizzard

The snowfall was light but the wind was strong. I was glad to have Dr. Kanagamani with me as we walked to the laboratory. He was a kind and calm person, always smiling and attentive. He used to spend most of his time reading medical books and journals in our library. I enjoyed his company very much. We followed the same route to Tirumala hut, but it was hard to recognize because of the snow cover. I could see Dr. Kanagamani's footprints on the snow ahead of me. I was behind him. Even the 250 meter was covered under snow.

On the way to Novolazarevskaya : walking over the frozen lake

We were working in Tirumala when Leader Ajay and Praveen came in and asked us to finish our work quickly. They wanted us to join them for a survey outside. We agreed and after a few minutes we went out with them. We walked on the frozen lake behind Tirumala, which was very slippery because of the ice waves on the surface. We heard a cracking sound in the middle of the lake and realized that we had disturbed the balance of the lake. It was very dangerous. We stopped and changed our direction towards the side of the lake. We climbed a small hill on the lakeside and reached the top.

Extensively Fragmented Antarctic Rocks: Ice Crystal Growth Likely a Key Factor in Sustained Fracturing Processes.

It was very cold on the peak. We saw a large rock mass, about 6 ft high and 3 ft wide, standing with many broken pieces around it. The pieces had fallen from the main rock because of the temperature changes in Antarctica. The rock mass had a mysterious history. No one knew when or how it was formed or how it survived the forces of nature for so long. It was a silent witness to the changes of Antarctica, but it kept its secrets to itself. We surveyed the area and found some places with scatter debris flown away by wind from Maitri complex.

The weathering of granitic rocks in a hyper-arid and hypothermal environment in Schirmechar oasis, East Antarctica

GOOD WEATHER

AUGUST 2

The Schirmecher oasis has seen a significant increase in the span of daylight. During 9:30 AM to 3:30 PM, there was a good amount of sunlight. This motivated the members to go outside more often and engage in various activities. Some of them explored the hilltop, while others enjoyed the glacier and the frozen lake. It was a fun time for everyone.

Engaging in Volleyball with Russian Visitors at Maitri Complex: Vital for Antarctic Survival

TROUBLESHOOTING A TECHNICAL SNAG IN THE LAKE PUMP HOUSE

AUGUST 5

Let me narrate a tale at Maitri, where the relentless battle against the elements was a constant backdrop to our daily lives.

On this particular day, I found myself still on galley duty, a responsibility that weighed heavily on my shoulders as the weather report had issued a dire warning. A blizzard was looming on the horizon, and the forecast predicted it would unleash its fury upon us for several relentless days. As I looked outside, I could see the snowflakes swirling in the air with an almost tangible intensity, a harbinger of the impending tempest.

Amidst the growing tension caused by the impending blizzard, a new crisis emerged. The water supply in Maitri, a lifeline for our survival, was suddenly in jeopardy. The pump house situated at Priyadarshini Lake, tasked with maintaining the water temperature at a steady 10 degrees centigrade, had faltered in its duty. During the frigid night, the temperature had plummeted to a perilous 4.6 degrees centigrade, risking the freezing of water within the pipes and potentially leaving us without this vital resource in the morning.

Instinctively, I sprung into action, alerting my comrades Mr. Sarjeet and Mr. Jasbindar to the impending disaster. They, in turn, informed Captain Venkatesh. Being, a Mechanical Engineer from EME of Indian Army, with his expertise, he was well-equipped to tackle such emergencies.

In the midst of the blizzard's relentless assault, Captain Venkatesh and I ventured out into the biting cold at an uncivilized hour—1:00 AM. Armed with determination and a knowledge of the inner workings of the pump house, he set about inspecting and rectifying the issue.

In the dim, icy depths of the night, Captain Venkatesh made a crucial discovery. The ferocious Antarctic winds had damaged the insulation on the pipe, causing the temperature to plummet. With a steady hand and unwavering resolve, he swiftly fixed the insulation, effectively restoring the water temperature to its normal, life-sustaining levels.

In that pivotal moment, our valiant efforts bore fruit, and we emerged victorious over the dual forces of nature and mechanical failure. We had saved the day, ensuring that Maitri's water supply remained intact, and the looming blizzard would not find us vulnerable and unprepared in its icy grip.

This experience served as a stark reminder of the unpredictable and unforgiving nature of life in Antarctica, where every task, no matter how routine, could quickly transform into a life-or-death situation. It also reinforced the unbreakable bond that held our team together, united by a common purpose and a shared commitment to survival, science, and the relentless pursuit of knowledge in the harshest of environments.

AMIDST THE BLIZZARD: A WALKIE-TALKIE'S CRITICAL ROLE IN SURVIVAL

AUGUST 6

Let me share with you the harrowing tale and the lessons I learned during visit to my seismological observatory, Tirumala. It was a day like no other in this icy continent. The laboratory at Tirumala beckoned to me, despite being concealed by a raging blizzard. The memories of barely surviving the last storm were still fresh in my mind, and I knew that this time, I needed to take extra precautions. I was determined to visit the laboratory.

With a heart full of resolve, I retrieved the Blizzard rope that connected our lifeline, Maitri, to Tirumala. It was my lifeline, and I clipped a sturdy carabiner to my waist, securing myself to the rope. The wind roared and howled around me, the snow swirling in a frenzy, but I felt a newfound sense of security with the rope by my side. It was a lifeline not just to my destination but to life itself.

As I ventured deeper into the blizzard's fury, Maitri became an elusive Specter, hidden by the swirling whiteout. The treacherous conditions were a stark reminder of the perilous nature of Antarctica, and I pressed on, determined to reach Tirumala and fulfil my mission.

With a walkie-talkie in hand, I reached Tirumala and immediately contacted Mr. Hemant Gaur, communication engineer, to inform him of my arrival. I also mentioned that Maitri was no longer visible, inadvertently planting the seeds of confusion back at our research station.

After our brief exchange, I made a grave mistake. I switched off the walkie-talkie, believing my work needed my full attention. Little did I know that this action would further confound my colleagues back at Maitri, who were desperately trying to reach me.

My work at Tirumala progressed, and I was nearing completion when Leader Ajay emerged from the blizzard's wrath. He looked anxious and angry, his voice laced with concern as he asked, "Why did you turn off the walkie-talkie? We've been trying to reach you."

In that moment, the gravity of my error struck me like a bolt of lightning. I had not only put myself at risk but had caused undue worry and confusion among my fellow researchers. I swallowed my pride and offered a heartfelt apology, "I'm sorry, Leader Ajay. It was a lapse in judgment, and it won't happen again."

Leader Ajay's response was a mix of sternness and compassion. He knew that we were all bound by a common purpose and that mistakes could happen even to the most experienced of us in this unforgiving environment. He nodded, acknowledging my apology, and without further ado, we began our return journey to Maitri.

As I reflected on the day's events during that perilous trek back to safety, I couldn't help but feel an overwhelming sense of gratitude towards Leader Ajay. His selflessness, leadership, and kindness had shone through in my time of need. It was a testament to the unity and camaraderie that defined our team, a group of individuals brought together by a shared purpose and a desire to explore the unknown.

In that moment, I realized how fortunate I was to be a part of Maitri base that not only provided the best facilities but also fostered a sense of community and support. Our Leader was an inspiration, a beacon of strength, and I thanked him from the depths of my heart for his guidance and unwavering commitment to our collective mission in the icy heart of Antarctica.

SNOWBOUND: OVERCOMING THE MASSIVE BARRIER TO TIRUMALA'S ENTRANCE

AUGUST 13

I can still vividly recall that day as if it were yesterday. It had been three days of calm, a brief respite from the harsh conditions that defined our lives at Maitri. But as fate would have it, another blizzard was brewing on the horizon, and it was unlike anything we had ever experienced before.

Tiramala's Entry Door Blanketed in Snow Amidst Persistent Blizzard,
Access Granted via Emergency Ventilation above door

The storm system, massive and unrelenting, descended upon Maitri with a vengeance. The snow drifts that accompanied it were the stuff of legends, towering over us like frozen monoliths. It was as though nature itself had decided to test our resilience to the limits.

Continuous Blizzard Causes Snow to Turn into Ice Inside Tirumala Doorway

As I got up in the morning, I was in dilemma how to visit Tirumala for routine job that I perform daily. I remember the day clearly when Major Kadam approached me with a proposal. He extended me help so that I could make a trip to Tirumala, the same route I used to follow. I was so overwhelmed by his proposal that I my head just bowed down with honor to his humility, of course without his notice silently. His mission was clear that I should not stop my scientific investigation at any cost for the weather condition. We needed to check on the conditions at Tirumala and ensure its accessibility. We knew that this endeavor would be fraught with danger, but we were a team bound by a common purpose and unwavering determination.

With carabiners securely fastened to our bodies, we ventured out into the maelstrom. The journey was arduous, with the biting wind and snowflakes stinging our faces. But we pressed on, knowing that Tirumala held important data and equipment that we couldn't afford to lose.

As we approached the entrance to Tirumala, a shocking sight greeted us. A colossal wall of snow had blocked our way, as if nature herself had erected a barrier to test our resolve. Undeterred, we grabbed shovels and began the backbreaking work of clearing the

path. I couldn't help but pause for a moment to capture the surreal scene with my camera, a testament to the power and beauty of the wilderness.

Conditions deteriorated rapidly as we ventured further into Tirumala. Entire entry was covered with snow accumulation. We had to remove the fresh snow for making passage into the hut. The blizzard's fury intensified, and the wind howled around us with a ferocity that was both awe-inspiring and terrifying. Both of us spent half a day for the work.

Back at Maitri, life went on as usual, albeit with a sense of impending doom. Dr. Nag and Havildar Sarjeet were on galley duty that night, a responsibility that weighed heavily on my mind. I couldn't help but feel sorry for them as I lay in my bunk, the deafening roar of the wind and the relentless fury of nature serving as a constant reminder of the challenges we faced.

Preparation of celebration of Indian Independence Day was going on. We were just exited to hoist Indian National Flag in a Pristine Island Antarctica.

AURORA AUSTRALIS: A SPECTACULAR VIEW WITH 197 DAYS UNTIL OUR RETURN

AUGUST 17

It was a stunning sight to behold: the night sky over Maitri lit up by a brilliant aurora. The blue hues shimmered and shifted, creating mesmerizing patterns and shapes. I couldn't take my eyes off the spectacle. It felt like a gift from nature, a way of soothing our souls and lifting our spirits.

Antarctic Landscape Illuminated by Spectacular Aurora Borealis Display: Ethereal Green Lights Cast a Glow Over the Maitri complex

Auroral lights are caused by disturbances in the magnetosphere by solar wind, causing particles to move into the upper atmosphere and emit light

The prolonged isolation had a severe impact on the mental health of the people. Many of them suffered from depression and insomnia, just like me. I struggled to focus on anything properly, but I kept doing my daily tasks. Even when I talked to someone, my mind was elsewhere.

Every night, I felt a wave of despair wash over me. It was hard to keep going when everything seemed hopeless. My physical condition was deteriorating as well. I counted the days until I could return to the mainland, but it seemed like an eternity. There were still 197 days left in this isolated place.

SOUTHERN LIGHT ~ AURORA:

Polar regions, renowned for their mesmerizing auroras like the aurora australis and aurora borealis, fascinated early explorers. They described these celestial displays vividly. Robert Scott's June 1911 account depicted arches and curtains of shimmering light, while Edward Wilson's July 1911 journal detailed curtains of auroras in orange, green, and yellow.

Back then, the auroras' cause was a mystery, linked to Earth's magnetism. Modern science has since explained that the Sun initiates auroras. The Sun's atmosphere, the solar corona, constantly expands outward, carrying a weak magnetic field and charged particles into space.

Earth's magnetic field deflects the solar wind, forming a magnetosphere. Solar wind fluctuations influence this region, and when the solar wind field connects with Earth's magnetic field, it intensifies. Subatomic particles follow magnetic field lines into the auroral ovals, creating electric currents and polar auroras.

Auroral display in geographic south pole (ref. www.timestorm.com)

Aurora colors depend on thermospheric atoms and molecules, like nitrogen (violet) and atomic oxygen (red and green). Particle energy influences intensity. Researchers analyze auroral spectra to study thermospheric properties.

Audacity a breathtaking colour palette that goes away from the green and blues commonly seen at the Southern Lights, to include pinks, purples, oranges and golds (ref. www.timestorm.com)

Ongoing research aims to map thermospheric temperature and wind patterns across the sky, enhancing understanding of auroral impacts on Earth's polar magnetic field.

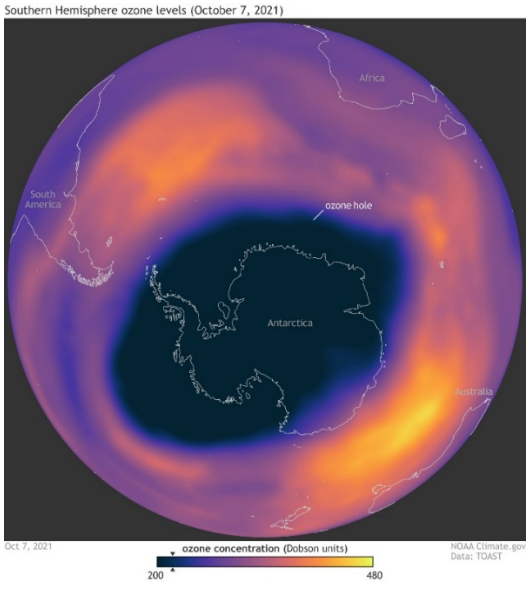
SURVIVING AT -24.9°C: NAVIGATING THE CHILL AND BATTLING DANGEROUS UV RADIATION

AUGUST 19

It was a rare day of calm and brightness in the middle of winter. The sky was blue and cloudless, and the sun shone with a warmth that belied the season. But despite the appearance of summer, the air was bitterly cold. The thermometer showed a reading of -24.9 degrees Celsius, making it one of the coldest days on record.

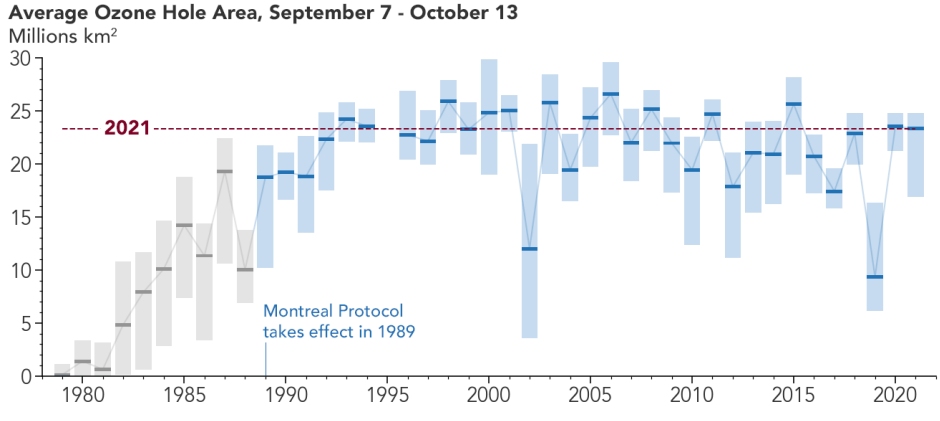
Cloudless Blue sky with endless ice

The Sunlight's ultraviolet emission had risen to dangerous levels. We had to wear face shields, UV-protected goggles and hand gloves whenever we went outside. Even then, we could not stay out for more than half an hour without risking skin damage and eye problems. The grey patches on our skin were a constant reminder of the threat of skin cancer. It was a nightmare to live under such conditions. Antarctica experiences high levels of ultraviolet (UV) radiation due to several factors:



This visualization depicts the ozone hole over Antarctica at its maximum extent on October 7. 2021. Scientists define the "ozone hole" as the area in which ozone levels are depleted below 220 Dobson Units (dark blue, marked with black triangle on color bar). (Climate.gov)

Ozone Depletion: One of the primary reasons for elevated UV levels in Antarctica is the depletion of the ozone layer, particularly the ozone hole that forms over the region during the Southern Hemisphere's spring (September to November). The presence of the ozone hole allows more UV radiation to reach the Earth's surface.



This chart depicts the average extent of the Antarctic ozone hole during peak ozone depletion season from 1979 to present. Scientists said the 2021 ozone hole would have been 1.5 million square miles larger if atmospheric chlorine levels today were as high today as they were in the early 2000s. (NASA)

Low Sun Angle: Antarctica's geographic location near the South Pole means that during the austral summer (December to February), the sun remains closer to the horizon. This low sun angle results in a longer path through the Earth's atmosphere for UV rays, increasing their intensity at the surface.

Seasonal Variation: UV levels in Antarctica vary throughout the year, with the highest levels occurring during the summer months when the sun is above the horizon for extended periods.

Because of the elevated UV levels, individuals spending time in Antarctica, such as researchers and station personnel, are at an increased risk of UV-related health issues like sunburn, skin cancer, and eye damage. Consequently, protective measures, including wearing sunscreen, sunglasses, and protective clothing, are essential for those in Antarctica to minimize the harmful effects of UV radiation.

CONTINUING SEISMOLOGICAL OBSERVATORY WORK AMIDST A FIERCE BLIZZARD EN ROUTE TO TIRUMALA

AUGUST 29

I was ready to visit Tirumala hut, waiting in the lounge thinking. Looking at my face Mr. Shinde and Mr. Pandkar from R & D E Pune volunteered to join me to the hut and shouted “Hey, are you crazy moving alone?”

As we made our way towards the Tirumala hut, we faced the fierce blizzard of unparalleled intensity. The wind howled and whistled, whipping snow and ice around us at a staggering speed of 180-200 kilometers per hour. The air was frigid, and visibility was reduced to almost zero. It was as if we were battling the forces of nature herself.

We huddled together, forming a human chain. We tied ropes securely around our waists, and each of us held on to the lifeline that connected us to Maitri. The lifeline was our only link to safety, and we couldn't afford to lose it.

Step by step, we forged ahead. The wind tore at our clothing, biting into our skin with its icy teeth. It felt like an eternity as we battled the relentless gales, but we never wavered. We had a mission to complete, and we were determined to see it through.

As we approached the Tirumala hut, the full force of the windstorm became even more apparent. The structure itself groaned and creaked under the immense pressure. We knew that shelter was within reach.

Inside the hut, we finally found refuge from the tempest outside. It was a small, sturdy structure designed to withstand the harshest of Antarctic conditions. We caught our breath and huddled together, grateful for the warmth and safety it provided.

But my adventure was far from over. My mission involved monitoring seismic activity in this remote region, and the windstorm was wreaking havoc on my equipment. The seismographs, which were essential to our research, were not spared. Sometimes they showed mild tremors caused by the wind's relentless assault, and at other times, they shook violently, making it challenging to differentiate between natural seismic activity and the storm's chaos.

The data are gathered despite the challenging conditions that would contribute to a better understanding of Antarctica's seismological activity. As we left the Tirumala hut behind, we knew that we had not only survived an incredible adventure but had also added to the body of knowledge about this remote and enigmatic continent.

BATTLING THE ELEMENTS: A NIGHT OF PERIL AND BEAUTY AT MAITRI

SEPTEMBER 10

No one can imagine what a treacherous the Antarctic blizzard is, staying in mainland. A night in Maitri base, still I shiver if try to remember. We found ourselves in the midst of a relentless and unforgiving blizzard. The snow had been falling relentlessly for hours, burying everything in its path under a thick, white blanket. It was a breathtaking sight, but also a perilous one. The wind howled like a chorus of angry spirits, making it nearly impossible to venture outside without getting lost in the whiteout.

Inside the station, a sense of urgency filled the air. We knew we had to check on the genset room to ensure it remained operational. Without power, our survival in this harsh, frozen wasteland would be in jeopardy. A team of four brave souls, including myself, Praveen, Dr. Nag, and Som Prakash, volunteered for this crucial mission. Bundled up in layers of clothing and wearing goggles to shield our eyes from the blowing snow, we ventured out into the biting cold. It was a battle for survival.

The elements were relentless. The wind battered us from every direction, threatening to push us off our feet. We clung to each other for support, forming a human chain as we trudged through the knee-deep snow. Our footsteps were quickly covered by fresh layers of powder, erasing any trace of our passage.

As we battled the elements on our way to the genset room, we couldn't help but admire the sheer power and beauty of nature. The snow piled up like mountains that stretched as far as the eye could see. The wind roared like a lion, a reminder of the untamed wilderness that surrounded us.

Meanwhile, back at Maitri, some of our friends had volunteered to help in the galley. They knew that keeping the team fed and warm was just as vital as our mission to the genset room. They toiled tirelessly, cooking hearty meals and serving hot food to the rest of us. In the face of this relentless blizzard, they were the unsung heroes of the day, providing comfort and nourishment to keep our spirits high.

As night descended upon Maitri, the blizzard showed no signs of mercy. It reached its climax, and the world outside became a chaotic tempest of wind and snowstorm. We were trapped, isolated in a vast frozen wilderness. The nearest signs of human life were the 18 members of Novolazaraveskya, 5 kilometers away. The blizzard howled and rattled our wooden shelter, Maitri, as if it intended to tear it apart piece by piece.

We were cut off from the outside world, with no means of communication or help. Fear bothered at our hearts as we huddled together, feeling like helpless dolls in the grip of a furious force of nature. Sleep was a distant dream, as the blizzard's fury shook our wooden refuge.

Despite the danger, we remained vigilant and prepared for any emergency. We stayed awake, fully dressed in our snow boots and equipped with life-saving gear. Each creak of the wooden planks and iron frame of Maitri made our hearts skip a beat, fearing that the structure might not withstand the blizzard's onslaught.

In the depths of that dark and chilling night, we found solace in one another's company. We shared stories and tried to lift each other's spirits, knowing that our unity was our greatest strength in this relentless battle against nature.

The blizzard raged on, its primal fury testing our resolve and resilience. We clung to the hope that dawn would eventually break, bringing with it the promise of a new day and an end to this terrifying ordeal.

As the blizzard continued to rage outside Maitri, we couldn't help but reflect on the causes of such extreme weather in Antarctica. The low-pressure systems over the Southern Ocean, the relentless polar winds, and the clash of cold, dry air with warmer, moist air over the sea ice all contributed to the creation of these intense blizzards.

In the end, we survived that dreadful night, thanks to our teamwork, resilience, and the unwavering support of our friends who kept the galley warm and our spirits high. The blizzard had tested us in ways we could never have imagined, but it had also shown us the remarkable strength of the human spirit in the face of nature's fiercest challenges. And as we watched the first light of dawn break through the snow-covered windows of Maitri, we knew that we were one step closer to conquering the blizzard, one day at a time, in the icy heart of Antarctica.

ACCESSING THE LOFT: NAVIGATING THE EMERGENCY DOOR AT TIRUMALA

SEPTEMBER 11

The blizzard had finally stopped, leaving behind a thick blanket of snow. Everyone was relieved and amazed by the sight, but also exhausted and shaken by the ordeal. It was a scary night, full of howling winds and flying debris. Everyone felt exhausted and shaken by the nightmarish experience of being trapped in the snow.

I arrived at the laboratory at 10 A M and found the entrance blocked by a massive pile of snow. It was impossible to get inside. The snow had reached the height of the emergency door above the main door. I could not clear the snow by myself in a short time. I returned to Maitri and asked some of the members to help me with the snow removal. I also informed the Leader about the situation. He told me that his laboratory, the Nandadevi hut, had a similar problem. The snow had accumulated behind the hut because of the direction of the blizzard.

We had a tough time clearing the snow behind Nandadevi hut after we managed to remove the snow from Tirumala hut. The snow had frozen into ice very quickly and it was hard to break it.

I was elated to see the seismometer vault working flawlessly after a long day of testing. The temperature module had been giving me some trouble earlier, but it turned out to be a minor glitch that I fixed by evening. As I walked back to the station, I felt like I was in a winter wonderland. The air was cold and foggy, and the clouds obscured the distant horizon. I could barely see the outline of Maitri. The nunataks, the rocky peaks that rose above the ice sheet, were also hidden from view. They usually looked so majestic and serene, but today they were shrouded in mystery.

AFTERMATH BLIZZARD: ITS HAZARD

The blizzard was a disaster for our communication systems. The email connectivity was disrupted by the high static electricity charge that accumulated during the storm. It also damaged the power cable duct line and made the automatic weather station at Sankalp point stop working. The temperature module of the seismic vault was also affected, showed abnormal readings. We were cut off from the rest of the world and had to rely on our backup generators. Entire Maitri campus was badly affected posing threat to our survival. One by one, we tried to streamline the damage.

The communication team from "Defence Electronics Application Laboratory (DEAL)", Dehradun, consisting of Hemant Gaur and Som Prakash, along with Leader Ajay and Major Kadam, worked hard to restore the email connectivity that was disrupted by the blizzard. They focused on fixing the INMARSAT dome, which provides satellite communication and surveillance. After several hours of struggle, they discovered that the problem was not with the INMARSAT dome, but with the computer module that was connected to it. However, they could not repair the module due to the lack of spare parts.

The genset room was our lifeline. We had to work in shifts to keep the snow from burying it and cutting off our power supply. It was a tough but rewarding job. The genset room remained intact and functional throughout the blizzard, thanks to our constant vigilance and dedication. Some of the dangers of blizzards for expedition members are:

- *Hypothermia:* This is a condition in which the body temperature drops below normal, causing shivering, confusion, and loss of consciousness. Hypothermia can be fatal if not treated quickly.

- *Frostbite:* This is another condition in which the skin and underlying tissues freeze, causing numbness, blisters, and tissue damage. Frostbite can lead to permanent disability or amputation of affected body parts.

A frost bite in left hand(L) and effect of UV radiation on face(R) *(representative)*

HOLY CONNECTION: A CLEAR SUNNY SKY AND OZONE HOLE

SEPTEMBER 15

After a month of cloudy skies and frequent blizzards, it was a very clear and sunny day. The daylight lasted for more than 12 hours, from 4 AM to 6:30 PM. The sun was extremely bright and full of ultraviolet radiation that could harm the skin and eyes. Therefore, everyone who went outside had to wear full protection for their skin.

We were so lucky to have UVEX snow goggles and balaclava with us! They were amazing devices that shielded our eyes and face from the harmful ultraviolet rays. We could enjoy the snowy scenery without worrying about damaging our vision and skin. The goggles were comfortable and stylish too!

Antarctic-Ready Goggles: Designed for UV Protection and Snow Conditions

The ozone layer is a protective shield that blocks harmful ultraviolet (UV) rays from reaching the Earth's surface. However, human activities have caused the ozone layer to thin over time, especially near the poles. As a result, there are regions where the ozone layer is almost absent, allowing more UV radiation to penetrate through. These regions are called ozone holes and they pose a serious threat to life on Earth. Some of the main reasons of ozone hole in Antarctica are:

- The low temperatures in the polar stratosphere, which create polar stratospheric clouds that facilitate chemical reactions that destroy ozone molecules.
- The presence of chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS), which are mainly released from human activities. These substances reach the stratosphere and are broken down by ultraviolet radiation, releasing chlorine and bromine atoms that catalyze the breakdown of ozone.
- The polar vortex, which is a large-scale cyclonic circulation that isolates the Antarctic stratosphere from the rest of the atmosphere during winter. This

prevents the replenishment of ozone from other regions and enhances the effect of CFCs and ODS.

These conditions are unique to Antarctica and do not occur elsewhere on the globe. In spite of having good quality balaclava on my face, I was effected heavily on my nose as nose was kept open to direct sunlight.

VISIT OF PETER KOSOY-A RENOWNED RUSSIAN SEISMOLOGIST

SEPTEMBER 20

Meanwhile , we welcomed eight Russian visitors, led by Sergei and Peter Kosoy, who arrived on foot except for two of them. They had planned to join us on August 15th for the Independence Day celebration, but they were delayed by bad weather. They finally made it today, taking advantage of the clear sky, the bright sun and the calm wind.

Peter Kosoy, a famous seismologist from Obininsk, Russia, visited me with the phase-data of the earthquakes he had analyzed. He had a working seismograph in his laboratory that recorded the seismic waves caused by the quake. He brought me a box of Marlboro cigarettes and wanted some Indian Green tea for his friend. We had a lot of discussions about the earthquake activity in Antarctica. We also talked about how the seismograph sometimes showed false signals due to the ice breaking off in Antarctica.

Calving of ice in Antarctica is the process of breaking off of large chunks of ice from the edges of glaciers, ice shelves, or icebergs. Some of the causes behind calving of ice in Antarctica are changes in atmospheric temperature and precipitation that alter the accumulation and ablation of snow and ice on the surface of glaciers and ice shelves besides tidal forces and gravitational stresses that create cracks and fractures in the ice along the coastlines and rift zones.

EXPLORING THE CAUSES OF SEISMIC ACTIVITY IN ANTARCTICA

Peter and myself discussed specifically about seismicity in and around Antarctica, its study and related phenomena that occur in the Antarctic continent and the surrounding ocean. After a long discussion with available literatures, we drew some of the main aspects of seismicity in and around Antarctica as follows:

- The seismic activity in the continental areas is very low in Antarctica, but some small earthquakes are detected, especially in Wilkes Land in East Antarctica, which is the most tectonically active area in the continent.

- The seismic activity in the oceanic regions within the Antarctic Plate varies depending on the location and the interaction with other plates. The sector between 120°W and 60°W has the highest seismic activity, due to the stress concentration towards the Easter Island Triple Junction among the Antarctic Plate, the Pacific Plate and the Nazca micro-Plate.
- The seismicity in the coastal zone and continental margin is influenced by the interaction between glacial isostatic adjustment and lithospheric thickness, as well as regional tectonic factors. Glacial isostatic adjustment is the rebound of the crust after the removal of ice load, which can cause stress changes and faulting.

The Russian visitors often engaged in trade with the Indians, exchanging their Vodka and Cigarettes for Indian Rum and Green tea packets. Their Pisten bully driver, Ura, was especially keen on this kind of deal. He would demand one bottle of Vodka for two bottles of Rum or one carton of Cigarettes for two bottles of Whiskey.

Ura was not fluent in English, so Peter often acted as his interpreter. Whenever I talked to Peter, Ura would interrupt him many times because he had to deal with other members about bargaining. Peter was ashamed of him for engaging this kind of business.

Peter shared his views on the political situation in the USSR with me. He praised President Gorbachev's decision to introduce glasnost, a policy of openness and transparency in the Soviet government. However, he criticized the methods used to implement it, which he said caused more problems than solutions. He also told me that some of his relatives live in Ukraine, which is now a separate country. He said that visiting them is very difficult because of the border formalities. I felt sorry for him and his family, who are divided by a political boundary.

COMMITMENT TO SCIENCE: AILING GENSETS AND THE SINCERITY OF TEAM MEMBERS

SEPTEMBER 23

I was ecstatic to wake up to a glorious day. The sky was a brilliant blue, and the sun shone brightly over the snow-covered landscape. The wind was gentle, and the temperature was a balmy -19.5 degrees centigrade. I had been looking forward to visiting the laboratory ever since I finished my galley duty yesterday. I couldn't wait to see what discoveries awaited me. So, I jumped out of bed and got ready for another exciting day of research.

Everything went well at Tirumala hut, where the instrument performed excellently. I finished the routine work and started to record the data in tape cartridges. This process took about an hour, so I went back to Maitri with Mr. Shinde to check the weather chart in the communication room. There, I learned that there was a problem with the generator and the power supply would be switched to another one soon. I hurried back to Tirumala to stop the data downloading, because it could cause technical issues if the power supply failed during that time. However, when I got there, Mr. Shinde and Dr. Kanagamani followed me and told me that the power supply would not be stopped until the evening. I was very happy and grateful for their support and dedication to Antarctic science. I resumed the data downloading and let the seismographs run.

We were down to our last three gensets, Aditya 1, Aditya 2 and Bhaskara 2, from the original ten that we had brought for the expedition. These gensets were the lifeline of our mission, providing us with portable energy from fuel. We felt a surge of anxiety as we realized that we had to rely on just one genset at a time to power both Maitri and Summer huts, while keeping the other two as backups. Normally, a genset would run for a maximum of seven days before needing maintenance. We hoped that our gensets would last long enough for us to complete our expedition successfully.

CULTURAL EXCHANGE AT MAITRI: RUSSIAN BREAD AND INDIAN VEGETABLES

OCTOBER 1

We were just on our toes psychologically due to torture by blizzard, relentless storm, strained interpersonal relationship, malfunctioning of generator and bitter cold. Behind our fogged, frozen goggles, the outside world had ceased to exist. The warmth of mainland India, our families, and the scent of dry monsoon earth were completely erased, replaced by the merciless, blue-white void of the polar desert. We became desperate for any situation now. We knew how to brave it. Even then our objective could not be shattered by these elements. Survival became the only mantra in this territory.

A storm was brewing and the air pressure dropped rapidly. The wind howled and whipped around us again, making us shiver. The sky was covered with dark clouds and the temperature plunged to -16.4 degrees Celsius.

Russian came with 100 numbers of breads prepared at their bakery. It was fluffy and soft. They assisted us to fix a problem with the water heating system that was caused by a faulty iron pipe. They repaired the pipe in their workshop and installed it back in our

station. As a token of our appreciation, we sent them some fresh green vegetables, pickles, sausages and other food items that they liked. We were happy to have such good neighbors in this remote and harsh continent.

The severe blizzard on 10th September caused extensive damage to three of our HF communication antennas. Our engineers Hemant Gaur and Som Prakash were assigned to repair one of the antennas as soon as possible. Meanwhile, Major Kadam and Praveen went to the SASE tower point, to fix a malfunctioning wind mill. They attempted to communicate with Maitri, but they faced some technical issues as the transmission was only one way. We could hear them, but they could not hear us.

UPGRADING LOGISTICS: INSTALLING NEW TOILET MODULES FOR SUMMER MEMBERS

Our logistic team had a challenging task of delivering two containers with new toilet modules and their components to our base before the start of the polar night. The modules were intended for the next summer expedition members who would arrive in a few months. The containers brought from Indian bay and were placed in their designated spots. The modules were pre-fabricated, so our team was able to assemble them quickly and efficiently. We were glad to finish this project ahead of time.

SCALING HEIGHTS: AN EXPEDITION TO MOUNT REBRISTAYA-VETAIHA PEAK IN SCHIRMACHER OASIS

OCTOBER 6

Picture this: a team of seven of us, led by our intrepid leader Ajay, embarked on an adventure to the remote Vetaiha peak in the southeastern reaches of our base camp, Maitri. Our mission? To set up a repeater station, a lifeline that would bridge the gap between Maitri and the Convoy team.

Our brave crew consisted of Captain Venkatesh, Hemant, Som Prakash, Naresh, and Soreng.

After a grueling journey, we finally found ourselves standing atop the pinnacle of Mount Rebristaya, the highest point of the Schirmacher Oasis. The view from up there was something to behold – an endless vista of snow and ice that seemed to stretch on forever. The Schirmacher Oasis, a long stretch of pristine white, unfolded before us like a work of art.

Installation of Repeater station for HF communication in Vetaiha peak

Our task was to install the instruments required for our research activity. But as we went about our work, the Sun began its descent, casting a warm, golden glow across the icy expanse. The colors danced and shimmered on the continental ice, creating a scene so breathtaking it left us in awe.

Our next challenge lay in the formidable Vetaiha peak, where we had to install the repeater station. The biting Antarctic wind and the bone-chilling cold made it no easy task, but we were determined to see it through. Carrying all the equipment from foothills to the peak was a Herculean effort, but our spirits remained undeterred.

The author observing the Snow-Covered Landscape and Rocky Horizon from the Summit of Schirmechar Oasis

Following a meticulously planned series of steps, we assembled the transmitting and receiving antenna mast. We then connected a windmill to charge a 12-volt battery. The windmill sprung to life, providing a reliable source of power for the repeater station. When we tested the communication with Maitri and received a crystal-clear response, our hearts swelled with happiness and relief, ensuring that the Convoy team and Maitri could maintain seamless communication.

Capturing the Magnificent Shiva Linga from Vetaiha Peak: A Panoramic Vista

With our mission accomplished, our attention turned to the next challenge – the end of the polar night. Time was of the essence, as we had only a meager two-week supply of ATF (Aviation Turbine Fuel) remaining.

Observing the Continental Ice Coverage from the Vetaiha Peak Perspective

We meticulously inspected the Pisten bullies, those specially designed vehicles capable of traversing snow and ice, and set out for Sankalp point, a designated area for camping and recreation.

RESILIENCE IN ACTION: CONVOY TEAM RESUMES OPERATIONS AFTER A HARSH WINTER

OCTOBER 8

As the stock of reserve of ATF was critically less the Convoy team was elated to resume their journey after a long hiatus. They had been forced to halt their expedition in May, when the harsh winter and the endless night made it impossible to continue. But now, the sun was shining again, and they were eager to explore the wonders of the polar region. They packed their gear and started the second lap of their adventure, hoping to make new discoveries and have fun along the way.

Indian Convoy Transporting Fuel from Indian bay at Ice Shelf to Maitri Base

The convoy of eight vehicles left at 6:15 AM for this crucial mission. The team was led by Major Kadam, the Convoy Commander, and included Captain Venkatesh, HMT Naresh Kumar, HMT Sitaram, HMT R. B. Singh, Subedar M C Sharma and HMT P R Bishnoi. They were all courageous and dedicated soldiers.

The convoy had been travelling all day and reached Barrel number 35, where they decided to spend the night. Major Kadam informed us that they had to halt their journey due to the extreme weather conditions. It was clear that they were trapped in a white-out situation as we could sense in Maitri.

HMT Khattri, a senior expedition member and a friend of mine, asked me to write a draft letter for the Prime Minister of Nepal to express his best wishes on the occasion of Dasssera - the Vijaya Dashami. I was honored by his request and delighted to compose the letter. Dasssera is a festival that celebrates the victory of good over evil and the power of truth and righteousness. I wanted to convey these values and sentiments in the letter and also highlight the activities of Indian Scientific expedition to Antarctica.

Due to the adverse weather conditions, the planned outdoor activity at Maitri was cancelled. The wind speed and the wind chill factor made it unsafe to venture outside. The Maitri base was unusually quiet and peaceful, as the Convoy personnel had left earlier.

URGENT MEETING IN LOUNGE: IRRITATION REFLECTED

OCTOBER 9

The Leader had instructed all the members to assemble in the lounge at 9:00AM sharp yesterday night. However, he arrived from his laboratory at 9:40 AM, making us wait for a long time. Mr. Shinde and Dr. Kanagamani were furious and cancelled the meeting. The harsh environment, personal issues, isolation and psychological stress had made everyone irritable. The Leader understood the situation and remained calm and quiet, but did not apologize.

The convoy arrived at Indian bay, where the shelf ice was thick and hard. They started to unload the fuel tanks and other supplies, while keeping in touch with Maitri station through the Vetaiha peak repeater. The recently upkept repeater station boosted the radio signal.

We had a blast at HMT Jaswinder's party last night. He threw a lavish bash for his son Saajan's first birthday. The food, music and decorations were amazing. All these periodic events kept us alive.

TRIUMPHANT RETURN: A SUCCESSFUL CONVOY JOURNEY AFTER POLAR NIGHT

OCTOBER 13

We made it! The convoy reached at 5:30 PM with a successful trip. It was the first one after the polar night. We brought 60 kl of ATF, which gave us some hope for survival.

The convoy team informed that they had a hard time finding the track because of the huge snow accumulation. The route was invisible. The barrels that marked the path were gone, blown away by the blizzard. There was new snow accumulation along the route.

It was the toughest trip ever. The snow and wind made it impossible to repair the vehicles. The Pisten bully also gave us trouble. We had to leave one behind because it was broken and useless.

The HMT Bishnoi got hurt by the cold. His face had cold bite and boils. Some of convoy team members had frost bite too.

Snow Accumulation on Faces During a Snowy Convoy Amid Drifting Snow

SUPPORTING THE DECANNING OF AN OIL TANKER: A VITAL OPERATION

OCTOBER 16

In the morning, Leader requested my assistance to tie and untie the oil tanker left at Drazar point, belonging to Mr. Jaswinder. The convoy team had transported approximately 60KL of ATF in the last convoy, so the decanting process of the final oil tanker was underway. The oil tanks were located about half a kilometer away from the main fuel dump. HMT Jaswinder was diligently engaged in transferring the oil from the tanker to the fuel storage, handling the task smoothly and without requiring any assistance. I observed the exceptional dedication and hard work displayed by all the army personnel, which was truly commendable. Jaswinder, in particular, exemplified these qualities. We successfully completed the task.

Due to the work, I had lunch a bit late than usual. Suddenly, Leader Ajay entered the lounge and invited me to join him outside for a game of cricket, instructing me not to go to my room.

BADDHAI HO: ARRIVAL OF SKUA

OCTOBER 17

I heard that a Skua bird was spotted on the Maitri campus, although I didn't witness it myself. When I entered the lounge for breakfast, HMT Dilbag Singh, who happened to be there, greeted me in Hindi with a cheerful "Baddhai Ho." Intrigued, I asked him the reason for his happiness. He excitedly replied, "I saw a Skua bird near the workshop for the first time since the winter period."

Skuas arrive at Maitri Complex Marking the start of summer time in Antarctica

Skua birds travel in pairs for breeding, crossing vast distances from coastal islands in the Indian Ocean, Pacific Ocean, and Antarctic Ocean to reach the Schirmacher oasis. This sighting brought good news to all of us. The arrival of the Skua bird signaled the onset of the Antarctic summer, and it was the first living creature we had seen in a long time. The sight filled everyone with joy and renewed hope, as it symbolized new life in our Antarctic surroundings. During this period, our focus shifted away from the outside world, and we only embraced the challenges and wonders of Antarctic survival.

CONVOY CAUGHT IN BLIZZARD

OCTOBER 18

After a gap of 5 days, a mini convoy was dispatched on a rescue mission to retrieve the abandoned Pisten bully from barrel number 75, left behind by the last convoy.

The morning sky was covered with sporadic clouds that gradually thickened, obscuring the horizon from Maitri. The sun was on the verge of disappearing beneath the dense cloud cover. Meanwhile, an announcement came through the PA system by Mr. Gaur, informing us that the convoy team had reached Sankalp Point and would be returning to Maitri by 3:00 PM. This announcement was crucial for logistical purposes, ensuring the arrangement of hot food items and any necessary medical attention.

During the afternoon, the base usually remained calm and quiet as most people either slept or engaged in their routine project work. However, a shout from the lounge drew our attention to the barometer adjacent to it, indicating a sudden drop in atmospheric pressure. We rushed to the lounge and witnessed an immediate onset of snowfall and strong winds. Within an hour, a blizzard had begun. Although we were concerned about the convoy, they safely returned around 5:00 PM, albeit with a damaged Pisten bully.

The blizzard persisted, with continuous snowfall and drifting. Visibility was moderate. I accompanied HMT Jaswinder, who volunteered, to the Tirumala hut. After completing our laboratory work, as I met Leader Ajay at the entrance door of Maitri, he playfully teased me, asking if I still needed someone to venture outside in the blizzard. I replied, "It's always better to have someone nearby."

Meanwhile, in mainland India, Dussehra and Vijaya Dashami were being celebrated with great enthusiasm.

4:00 AM WARMTH: PROVIDING HOT TEA TO THE DEDICATED CONVOY TEAM

OCTOBER 29

Things were getting pretty interesting, during that second convoy mission. After a lot of hard work, they finally managed to upload the entire stock of ATF onto the vehicles. The shelf ice work was tough, but they were all dedicated to getting it done. Once the job was completed, they started making their way towards DG (Dakshin Gangotri) point.

Now, while all this was going on, back at Maitri, I had a bit of an unexpected surprise. I received a call from Major Kadam via HF mobile communication. His voice was crackling through the line, making it quite challenging to hear him clearly. The thing was, our designated communication officers, Hemant and Som Prakash, were either busy with galley duty or sound asleep, so I decided to answer the call myself rushing to the communication room.

When Major Kadam realized it wasn't Hemant's voice on the line, he asked who I was. I replied, "It's Saurabh from Maitri." He had this playful tone as he corrected me, saying, "Not Saurabh, but Dada," which was his nickname for me. Our conversation was far from smooth due to the noisy communication set.

Realizing the difficulty, I knew I had to get Hemant involved. He was an expert in communication systems. So, I called him over the PA system to attend the call. Hemant got to work right away, adjusting knobs and switches to improve the clarity of our conversation.

Major Kadam wanted to know about the weather forecast for the next couple of days. Hemant informed him, "According to the forecast, the weather is clear for the next 48 hours." Hearing this, Major Kadam made a decision, "In that case, we will stay back at Dakshin Gangotri(DG) today." Hemant acknowledged with a simple "Roger."

The next day, it was my turn for galley duty, which meant an early start. At 3 AM, the convoy reached the workshop point, and I brewed some hot tea for them. It took them nearly an hour to get everything rearranged, from the Pisten bully to the fuel tankers and other equipment, before they finally made it back to Maitri by 4 AM. The outside temperature was absolutely bone-chilling.

When they arrived at the Lounge, I could see that most of them were exhausted and worn out. I offered them tea and biscuits, knowing that Mohan would soon be waking up

to serve breakfast at 6 AM. In this unforgiving place, we always looked out for each other, especially during those long, cold nights.

SURPRISE VISITOR: THE ARRIVAL OF PENGUINS IN SCHIRMACHER OASIS

NOVEMBER 4

In the last convoy, Praveen had uninstalled the AWS (automatic weather system) from DG and thoroughly checked all the instrument parameters and their working condition. Praveen and Pandkar were now prepared for their journey to the SASE point. Praveen approached me and asked if I was interested in joining them to download data at the SASE point. I replied that I could join them after lunch, as I was occupied with important tasks until then. They agreed, and I felt delighted at the thought of going on an outing. The day was cloudy, with thick clouds hanging in the sky and a moderate wind speed.

Adiele Penguin's Arrival in Proximity to Maitri: Its summer time

Praveen took the wheel of the Pisten bully 170, with Pandkar as his co-passenger, and I sat in the back. After covering nearly, a kilometer, we encountered HMT Naresh Kumar, standing with a load of Jivanjyoti on a snow sledge on the road ahead near Drazer Point. I felt slightly annoyed as the sledge was moving on a road filled with pebbles and rocks,

which was not suitable for such a heavy load. Consequently, the sledge got stuck on the road, and the Pisten bully was unable to tow it. We learned that a drazer was on its way to assist Naresh, and it arrived after half an hour to push the sledge until it reached the icy and snowy terrain, just a hundred meters away. Naresh was then able to easily drag the sledge. As we returned to our vehicle and resumed our journey to SASE, we realized that Naresh had vanished with his vehicle.

After traveling a few meters, we noticed a convoy vehicle ahead of us and decided to follow them. Snowflakes were flying in the air, pouring onto our windshield and causing difficulties for Praveen due to the speed of the Pisten bully. I advised Praveen not to chase after the convoy. As we crossed a few meters from Drazer Point, I noticed movement of a black and white object in the snowy, icy hilly terrain. Upon getting closer, I realized it was a penguin. We immediately stopped the vehicle, grabbed our cameras and video camera, and rushed towards the penguin. This was the first penguin I had seen since January 16th in Schirmacher Oasis. I chased after the penguin to get a closer look, but I ended up sliding and hitting a lump of ice, injuring my ankle. Nonetheless, we managed to capture several photographs. The penguin appeared panicky, and we respected its need for space. After spending a few more moments observing the penguin, we left it to continue its journey to lay eggs and raise chicks in the hilly terrain. Following this memorable encounter, we resumed our journey towards the SASE point.

A Majestic Adélie Penguin at Maitri Striking a Pose for the Camera

Near the SASE point, we encountered the convoy team returning from Sankalp point. It was Diwali, a major festival in mainland India. All of us gathered at the SASE point on the continental ice to exchange Diwali greetings and embrace each other. It was a moment

of joy and pride for all of us, despite the challenges imposed by the harsh weather. From there, we could witness parts of the oasis, the shelf ice stretching to the horizon, and more. Praveen successfully installed the instrument and downloaded data from another instrument. The screen displayed a surface temperature of -26 degrees Celsius. We cleared the snow-covered sensor responsible for measuring surface temperature. The AWS was mounted on a single iron mast, comprising a solar panel to charge the battery (12VDC), an anemometer, an albedometer, a barometer, and a thermometer. The AWS also had the capability to send real-time data online through satellite communication.

ARRIVAL OF FEW MORE PENGUINS

NOVEMBER 12

A few more penguins had appeared near Maitri, bringing a sense of hope among us. The members were going through both physical and psychological torment. To rejuvenate ourselves, Praveen, Pandkar, and I decided to embark on a trip to DG Snout, an exceptionally beautiful and serene location. The weather was delightful, with clear sunshine illuminating the surroundings.

Penguins' Arrival Near Maitri Brings Bustling Excitement and Renewed Hope

As we walked on the glacier, we encountered a steep slope leading down to a frozen lake. During our previous visit, the lake had not been frozen. DG Snout was positioned

directly opposite Sivling, and the setting sun cast its radiant reflection on the surface. The Pisten bully awaited us at the foot of the glacier.

Standing atop the hill, I had a clear view of Maitri and a portion of the Schirmacher Oasis. I gazed at the hills we had traversed during our previous journey. From my current vantage point, those same hills appeared to be a challenging uphill task.

POLAR DAY STARTS

NOVEMBER 14

No sunset from today onwards ie., 24 hours daylight. All of us were mostly worn out, not much energy left it seemed. Most of us were going through a phase of restlessness. This caused immense strain among members. Everyone was trying hard to cope up with the situation either by talking less or by avoiding each other keeping ourself busy in assigned work.

Snow-Kissed Dawn: A Post-Blizzard Sunrise

Commencement of Polar Day: Abundance of Illumination Everywhere

These extreme variations in daylight and darkness are a result of the Earth's axial tilt and its orbit around the Sun and are responsible for the unique seasonal patterns observed in polar regions like Antarctica.

NAVIGATING DEPRESSION: A RAY OF HOPE WITH THE ARRIVAL OF NEW EXPEDITION MEMBERS IN CAPE TOWN, SOUTH AFRICA

DECEMBER 1

During this time, last year, we all were busy in preparation for our expedition. At this moment each and every day was extremely hard to pass. Just like a machine, I used to complete my day-to-day routine work somehow. Mindset was not so humble and stable that except data generation, the research activity was far flung. At times members stopped talking each other except a few due to interpersonal tussle and differences. Even for a small issue, it used to get aggravated to big one which needed some interventions. It was not that those members were immoral. But it was all due to isolation which brought a kind insecurity and unstable attitude among some of us. Whenever two or more members gathered, they used to discuss about

1. Date of Arrival of Ship
2. The probable date of returning to India and
3. How many more days were left for us to reach India.

Sometimes, I felt tired and humiliated of thinking about my contribution towards Antarctic Science. I was not able to justify myself participation in Antarctic expedition. Except precious database generation, subsequent research output was negligible. One way I was not able to concentrate and on the other hand I developed stress created by self myself. I was just dwindling among these waves of frustration to explore the ray of light.

Penguins near Maitri

One can imagine how much harmful the depression is. Over the period we inoculated all the symptoms related to depression which made our stay more challenging during third quarter onwards. Depression caused significant impact on individuals living in Maitri due to the extreme environment and unique circumstances.

Solace to Psyche: Green pea plants inside Green house of Maitri

Even though we had access to support systems to address these challenges however addressing the management of mental health issues effectively was next to impossible. So, we had to suffer a lot but always motivated towards our main objective ie., service towards science of Antarctica.

Peter visited me on 5th of December for the last time and gave me a copy of the Holy Bible and five candle sticks made up of honey combs. He categorically asked me to hand over the same for my beloved Mother.

The new Indian expedition members had left for Cape Town, South Africa on December 6. They would fly directly to Cape Town from Mumbai unlike ours voyage. On 7th they arrived Cape Town, South Africa. This time the voyage would be directly from Cape Town to Indian Bay, Antarctica reducing the travel time of the ship. We were eagerly waiting for their arrival at Maitri.

BIDDING ADIEU TO THE 44TH RUSSIAN ANTARCTIC EXPEDITION (RAE) MEMBERS

DECEMBER 12

While the news of arrival of next Indian team reached us, we were bidding farewell to the 44th Russian Antarctic Expedition (RAE) members at Maitri station. Their ship was scheduled to arrive within next week, so we had an early celebration. They walked into Maitri around 2:30 PM, led by their leader. Mr Volodiya, a veteran Polar explorer who had visited both poles altogether 21 times, was also part of the group. They enjoyed a variety of vegetarian and non-vegetarian dishes and drinks with us.

Veteran Polar Explorer Mr. Volodiya, with 21 visits to both poles, was a key member of the Russian Expedition team

I had a chance to talk with Mr. Volodiya, who shared his fascinating experiences in the Arctic (north pole), where he started his polar research career. He has been to the Arctic 17 times and to Antarctica 4 times. Before the party began, Our Leader Ajay gave a concise and inspiring speech, congratulating the team on their successful mission and wishing them a joyful reunion with their loved ones. He also highlighted the importance of fostering the Indo – Russian collaboration between these two stations. The party was over by 8:00 PM and they departed from Maitri to NOVO at 8:30PM.

A NIGHT OF DESPERATION AND HOPE: THE SEARCH FOR VALERI IN ANTARCTICA

Praveen and myself were engrossed in the movie "Towering Inferno" when Victor, a Russian meteorologist with a grim face, burst into the lounge. It was around 1:15 AM, and the dimly lit room flickered with the fiery scenes on the screen. Victor's sudden entrance cast a shadow over our movie night.

"Valeri is missing. He hasn't reached NOVO, and it's been over six hours," Victor announced, his voice trembling with worry.

Our hearts skipped a beat. Valeri, a fellow scientist and a dear friend, was out on a return trip to NOVO. The isolation and extreme conditions of Antarctica were unforgiving, and any delay in returning to the base camp was absolutely a cause for concern.

We wasted no time informing the leader and the rest of the team. Panic rippled through the lounge as everyone rushed to gather their gear. The urgency of the situation was palpable, except for Hemant, who had to stay in the communication room to maintain contact with NOVO.

A search team was hastily formed, and a strategy was mapped out. Soon, we were joined by some Russian members who had arrived at Maitri: Andrey, the doctor; Sergei and Mike, communication officers; and Ura, the driver. Their faces mirrored our concern.

Praveen, Som Prakash, and I were assigned the task of conducting a preliminary search around Maitri. Armed with a stretcher and flashlights, we stepped out into the frigid morning. The sun was just beginning to rise in the east, casting long shadows across the landscape. I couldn't help but think of Valeri and his guitar skills, which had brought us all together as friends.

As we combed the area around Maitri, the tension was palpable. Every gust of wind seemed to carry Valeri's name, and every dark corner held the possibility of a grim discovery. Time seemed to stretch endlessly, our hope waning with each passing minute.

Then, the crackling voice of the walkie talkie broke the silence. It was a message from NOVO, instructing us to cease our search and return to the Maitri Lounge. They explained that they were searching for Valeri inside the station and needed us to wait for 25 minutes.

Reluctantly, we obeyed the order, our hearts heavy with uncertainty. The lounge buzzed with anxiety as we joined the rest of the team in waiting. Outside, a line of twenty

people formed with a twenty-foot gap between each person, prepared to resume the search when would be ordered.

The minutes dragged on like hours, and the atmosphere in the lounge grew more oppressive with every passing second. Fear and despair hung in the air, threatening to suffocate us all.

Then, at 3:00 AM, a call came in from NOVO. The tension in the room was almost unbearable as we anxiously waited for news. When the words finally came, they were like a lifeline, pulling us from the depths of despair. "Valeri is safe. He's sleeping comfortably inside an abandoned room at NOVO."

Relief washed over us like a tidal wave. The Russian members present in Maitri, who had been on the brink of tears just moments ago, now had tears of joy in their eyes. Valeri was alive, and we could hardly believe our luck.

We exchanged heartfelt thanks with our colleagues at NOVO for finding Valeri. The fear and uncertainty of the night had given way to a profound sense of gratitude and hope. Soon, we would be reunited with our friend, and the harsh landscape would once again feel a little warmer, thanks to our shared bond of friendship and the triumph of hope over despair.

PENGUIN WITH EGG AT THE PEAK: A TALE OF NEW LIFE AMIDST THE ARRIVAL OF THE 19TH ISEA

DECEMBER 19

I had a pleasing opportunity to join Leader Ajay and Major Kadam on a joy ride to DG snout, where they were testing a snow cat vehicle that had been repaired. The weather was perfect for the adventure, and we were in for a surprise. As we reached the top of the hill, we saw a penguin nesting on two eggs, sheltered by a wall from the wind. It was an amazing sight to witness a new life emerging in the cold and clear sky. The penguin was very agitated by our presence and our cameras, but we managed to capture some memorable photos.

She had no companions on this isolated island, far from the rookery where she belonged. It was a marvel that she could survive and raise her young in such harsh conditions. The skua bird was a constant threat to her unhatched chicks, waiting for a chance to snatch them away.

At the summit of the hill, a penguin caught our eye as it nestled beside two eggs, protected by a wall from the brisk wind.

We explored the vast expanse of continental ice, following a slope with a gentle angle of less than 30 degrees. Our goal was to reach a specific point on the ice sheet, but our snow cat vehicle failed to cope with the conditions. We had no choice but to turn back. The continental ice is usually very hard and dry during the peak of winter, with little or no water present. However, in the Antarctic summer, we could see streams of water flowing down the slope. Even we could also hear the sound of water falling into a lake near the edge of the glacier.

At the Hill's Peak: An Irritated Penguin Guards Its Two Eggs

Meanwhile, the Indian vessel MV Magdaleena Oldendorf, carrying 68 members of the 19th scientific expedition to Antarctica, had reached a position of 68.3 degrees South and 8 degrees East in the Indian Ocean.

Traversing the Extensive Continental Ice: Leader Ajay, Major Kadam and the author on a joy ride to DG snout, Testing the Repaired Snow Cat Vehicle along a Mild Slope below 30 Degrees

Arrival of M/V Magdaleena Oldendorf with New Members of the 19th Indian Scientific Expedition to Antarctica

Penguins Converge by the Ship, Offering a Warm Welcome to Newcomers

CHOPPER ARRIVAL DELAYED DUE TO SEVERE WEATHER CONDITIONS

DECEMBER 22

The centre of Priyadarshini lake remained frozen, but the ice on the lakes near Maitri was partially melted. It could be a sheet of ice floating on water. The edges of the lake were melting faster than the centre. The ship reached the Antarctic water this morning and headed for Indian Bay.

Magdaleena Oldendorff : Encircled by Vast Fast Ice in a Sea of Packed Ice

All of us waiting for Chopper to arrive from ship anxiously. At any moment it might arrive Maitri bringing letters from near and dear ones mostly. The ship was just 15 KM

away from Indian bay ie. Ice shelf which was positioned at 69.46 degrees South, 10.11 degrees E. Simultaneously, the Russian ship Academic Federer was arriving at Indian bay after visiting Troll, the Nowegian Antarctic base. The probable date of arrival of Russian Ship was December 24 at 12:00 noon. Weather got packed and the bad weather restricted the courtesy visit of new Team.

Stranded : M/V Magdaleena Oldendorff Trapped Amidst Vast fast Ice

DECEMBER 23

The day opened with a crystal-clear sky, devoid of any hint of wind. The temperature lingered at a cool +3.3 degrees centigrade. Anticipation and eagerness filled the air as we eagerly awaited the chopper's expected arrival for a courtesy visit. It had been months since we had the chance to welcome our fellow Indian expedition members, and the prospect had us buzzing with excitement. Each room was equipped with a music system, yet, until now, the serene quiet had reigned throughout the twenty-six rooms. However, today was a complete contrast as every room suddenly burst alive with music, each note resonating through the corridors at full volume. With the preparations for the grand

reception of the new team nearly completed, an air of enthusiasm enveloped us. Any lingering tension among us, accumulated during the long period of isolation, seemed to dissolve into thin air. Their arrival brought a glimmer of hope, marking a turning point for us. In the afternoon, the chopper descended, landing gracefully on the helipad before Maitri. A red-carpet welcome awaited them, meticulously adhering to the protocol. Surprisingly, the new team leader opted to send a representative in their place, but their visit nonetheless infused us with a sense of psychological abundance. Along with heartfelt letters from loved ones, they brought an abundance of fresh food and sweets, further elevating our spirits. The atmosphere crackled with an undeniable sense of grandeur, and some of us couldn't help but embrace the new members tightly, tears of joy and pride glistening in their eyes, despite it being their first meeting.

Joyous Arrival in Maitri: Chopper Emerges from Icebound Ship
After ten Months, bringing Hope and Goodwill

Such was the infectious jubilation that surrounded me, it was almost overpowering. It resembled the victorious revelry of a warrior on a battlefield, triumphantly vanquishing

their foe. In our case, the adversary was nature itself. Moreover, the arrival of heartfelt letters from our loved ones added to our collective elation, contributing another reason for our celebratory mood.

MOST OF THE 16 WOT MEMBERS SHIFTED TO THE SHIP IN INDIAN BAY

One after another, the summer members began to settle into the huts within the Maitri complex. The entire area transformed once more into a bustling research center, with a diverse array of projects being diligently pursued. Dedication ran deep, and not a single moment was allowed to slip by idly. Despite my desire to engage and learn from them, my energy was entirely depleted, as I found myself inclined to wrap up my assignment and draw conclusive insights. Meanwhile, my counterpart, Mr. Y V V S N Murthy from NGRI, who had joined as a summer member alongside me, arrived at Maitri to continue the remaining project work from where I had left off. I shared with him my experiences, both technical and strategic, over the course of a month and a half. He earnestly absorbed all the details, despite his own expertise in the field. Time seemed to slip away swiftly as we successfully completed most of our assignments according to our initial plans. The logistical teams efficiently managed multiple convoys for the transport of supplies, aided by the new army team. The continuous polar day bathed us in abundant sunlight, but the relentless busyness left us with scarce opportunities for meaningful conversations amongst ourselves. We were aware that within the next couple of days, the twenty-six of us would part ways. It was time for departure, marking the end of our collective journey.

February 24, 2000

Gradually, the wintering members began their departures from Maitri, making their way to the ship one by one. When my turn finally came, I bid farewell to Mr. Y V V S N Murthy and the others, taking off in a chopper from Maitri complex, leaving behind an unforgettable experience. Even so, I feel that I have only managed to convey half of my journey through my writings, leaving the rest unspoken.

Settling into one of the cabins aboard the ship, stranded in the Indian Bay amidst the Polynya, I observed the steady release of fumes from its chimneys. The vessel patiently awaited the arrival of all the team members, who were diligently wrapping up their project work, while the crew remained vigilant as ever.

Blessed with excellent weather, I embarked on an exploration of the Indian Bay with some fellow members. On the shelf ice, we encountered an Adelie Penguin standing guard

near the ship. Not far from there, we stumbled upon an abandoned container, a remnant left behind by earlier expedition members, which had become a refuge for penguins during blizzards. To our surprise, a few of these resilient creatures were still nestled inside when we paid a visit.

Penguin: Sentinel of the Shelf Ice, Protecting the Vessel in Indian Bay

The captain and crew members of the ship were regular visitor to the shelf ice because of logistic preparation. I had the opportunity to exchange dialog with them. They informed about Assam Tea when they could come to know that I hailed from Assam. They also informed that while returning they would leave us at Cape town, South Africa. The journey would not continue till Goa.

Snapshot Featuring the Ship's Captain, Crew and the author on the Shelf Ice

On board the ship, I had the pleasure of meeting Dr. Kamal Vilku, a resident doctor in the New Delhi health sector. Born on October 28, 1948, she made history as the first woman to winter over in Antarctica as part of the Indian Scientific Expedition to Antarctica.

Padmashri Dr. Kamal Vilku, a Medicine Doctor and the Pioneer Woman to Winter in Antarctica as part of the 19th Indian Scientific Expedition on board ship

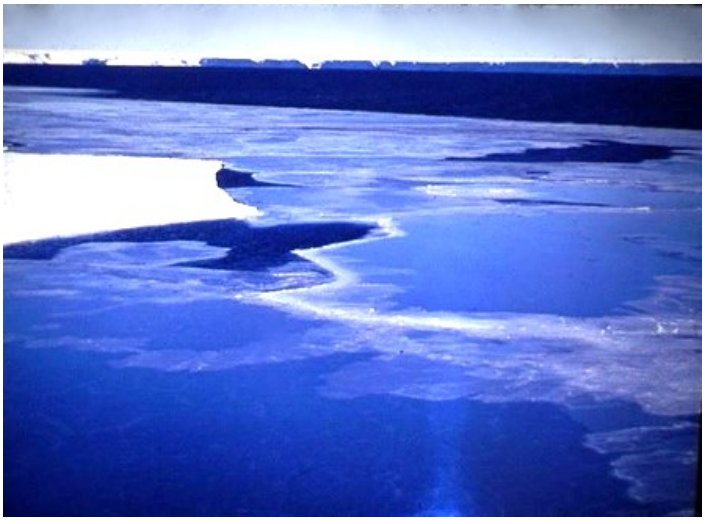
Prior to her, no Indian woman had ever spent the winter at Maitri. In recognition of her remarkable contribution to the Indian Scientific Expedition, the Government of India honored her with the prestigious civilian award, Padmashri. Despite being a mother of two children, she undertook this extraordinary feat. During our conversation, she shared a profound Hindi phrase that continues to resonate with me: "Jo Jagat Hey, Woh Payot Hey – Jo Soyat Hey, Woh Khoyat Hey," translating to "The one who is awakened, he/she grows -the one who sleeps, he/she loses."

Most of the wintering over team had boarded the ship, except for Leader Ajay and Major Kadam. Once they departed Maitri, the new expedition leader, Mr. Arun Chaturvedi from GSI, would take over, following the protocol. In the meantime, Mr. Chaturvedi was actively involved in coordinating and organizing the next steps.

During this time, we observed a fascinating occurrence in the field of snow science on the serene Antarctic water in Polynya. A delicate layer of ice had begun to form on the water's surface, commonly known as Grease ice due to its resemblance to a greasy surface.

Grease Ice: Nature's Delicate Veil on Antarctic Water's Surface

This is the indication that the temperature was reducing gradually. That means we were heading towards polar night. After four to five days, we saw another incredible feature. The grease ice was no more visible, most of the surface of water had been converted to transparent fast ice.



Transition from Grease Ice to Transparent Fast Ice: The Vanishing Act on Water Surfaces

After a few additional days, we observed that the previously transparent fast ice had transformed into thicker, intermittent patches of fast ice.

Observing the Transformation: From Transparent Ice to Sporadic, thick Fast Ice

The crews of ship were forcing us to accomplish the work as fast as possible in Maitri. If the rate of freezing of water persisted for long time, the entire water around would be frozen which would jeopardize the entire expedition. The ship would have to stay back for one more year without food and fuel in stock to survive. There were many instances like this that the ship got stranded because of lack of predictability. So, a wave of panic again struck among the members whether we would be able to return as planned. Soon we had to accomplish all the works because no one wanted to get stuck up here in this treacherous continent.

March 6, 2000

We found ourselves deep in the throes of the initial phase of the polar night. Eventually, Leader Ajay and Major Kadam arrived at the ship via helicopters, accompanied by a few remaining summer members. The atmosphere was bustling with activities both on board and inside the hold, where the helicopter was securely parked. A final comprehensive check of everything, from containers to oil tankers, rescue boats, ballast, and engines, was underway and being certified.

The Final Glimmer: My Last Sunset

Finally, the day of departure had come. A palpable mix of anxiety and melancholy hung in the air. The numerous events during our time here had made the expedition far from trouble-free. From the loss of a team member to challenges with the power generator, a few fire incidents, a broken leg, and strained interpersonal relationships, I pondered whether these issues were rooted in inadequate management at mainland India and, of course, at Maitri. Was it a result of poor planning? Or perhaps it was the unforgiving climate that played a role. These questions lingered in my mind. I believed that meticulous and thorough planning beforehand could have undoubtedly mitigated much of the damage. No one individual could be solely blamed, as we collectively shared the responsibility. Despite all the adversities, our team of scientists had made significant contributions to the study of Antarctica. Without a doubt, these contributions laid an exceptional foundation for further understanding the science of this icy continent, a legacy that would be cherished for years to come.

As the clock struck 6:00 PM, we witnessed the sun setting on the horizon. The ship was fully prepared to depart for Cape Town. Around 2:00 PM, a new group of eight convoy members from Maitri had come to bid us farewell. The Pisten Bully, Banjara, and Jivanjyoti were parked a short distance from the ship on the shelf ice.

Farewell at Dusk: A Memorable and Painful Departure from the Shelf Ice - the Indian Bay

After spending a few hours with us, the existing expedition members descended from the ship one by one, using the wooden staircase connecting the shelf ice and the vessel. They would return to Maitri after bidding us farewell, carrying oil tankers. Moments later, the crew members hoisted the wooden staircase from the shelf ice onto the ship. Dusk was approaching, and the lights of the Pisten Bully were shimmering. Our ship set sail. We all stood on the deck, waving our hands in farewell as they gradually faded from our view. Pushing through the packed ice, our ship forged ahead.

Leaving a Legacy: Continuing the Unfinished Scientific Journey in the Icy Continent by the Indian

It was a extremely painful moment, watching them depart into the unforgiving expanse, leaving behind a part of our collective spirit on that treacherous land. We never wished to leave anyone behind in that unforgiving, treacherous land of ruthless ice and isolation. We didn't want them to endure the same challenges, the biting cold, and the relentless isolation that we had faced over the passing months.

Tears welled up in our eyes as we saw our friends and colleagues fading, knowing that we might not see them again for a long, long time. The thought of them facing the harsh polar winter, the endless nights, and the bone-chilling cold sent shivers down our spines. But we knew we had to part ways. We knew that our mission demanded it, and the unwavering spirit of exploration called for sacrifices.

As we watched them disappear into the distance, we consoled ourselves with the hope that their unwavering determination would keep the Indian Tricolor flying high over this icy continent. The unfinished scientific work, the dreams we had envisioned, and the goals we had set would be carried forward by their unwavering dedication. Their presence would be a symbol of our collective commitment to scientific discovery and exploration.

References

- *Scientific Report Eighteenth Indian Expedition To Antarctica Technical Publication No. 16, 2002, Department of Ocean Development, Goa*
- *Building Dakshin Gangotri at Antarctica-A Miracle by Harsh K. Gupta, ISBN : 978-93-80998-37-4, 2021, Diamond jubilee publication of Geological Society of India*
- *Shirihai, H., & Jarrett, B. (2002).* A complete guide to Antarctic wildlife: The birds and marine mammals of the Antarctic continent and the Southern Ocean. *Princeton University Press.*
- *Fretwell, Peter.* The Antarctic Atlas: New Maps and Graphics That Tell the Story of a Continent. *Particular Books, 2020.*
- *Wordie, J. M. (1946). "The Falkland Islands Dependencies Survey, 1943-6". Polar Record. 4 (32): 372-384.*
- *Bryan, Rorke (2011). Ordeal by Ice: Ships of the Antarctic. Seaforth Publishing.*
- *Heirtzler, J. R. (17AugustBy1973). "Antarctica". Science.* ***181*** *(4100): 647–648. Bibcode:1973Sci...181..646U. doi:10.1126/science.181.4100.646. JSTOR 1736944.*
- *"The Endurance". Novelist Plus. Ebsco. Retrieved 24 October 2010.*
- *"Race to the South Pole". Novelist Plus. Ebsco. Retrieved 24 October 2010.*
- *A. R. H.; N. A. M. (July 1943). "Review: A New Chart of the Antarctic: Review". The Geographical Journal.* ***102*** *(1): 29–34. doi:10.2307/1789367. JSTOR 1789367.*
- *Davies, Frank T. (28 December 1956). "Review". Science.* ***124*** *(3235): 1297. Bibcode:1956Sci...124.1296A. doi:10.1126/science.124.3235.1296. JSTOR 1752405.*
- *"No horizon is so far". Novelist Plus. Ebsco. Retrieved 24 October 2010.*
- *"A rare earthquake in Antarctica", Saurabh Baruah and Indra Mohan, Current Science, October 2001, VOL. 81, NO. 8 : 883-885*
- www.ncpor.res.in
- www.bas.ac.uk
- www.antarctica.gov.au

- www.aari.ru
- www.timestorm.com
- "Antarctica" by Sudipta Sengupta, 1986, Anandabazar Publications, Kolkata
- Terrae Incognitae: The Place of the Imagination in Geography by John K. Wright, Annals of the Association of American Geographers, Vol. 37, No. 1 (Mar., 1947), pp. 1-15 (15 pages), Published By: Taylor & Francis, Ltd.
- Walton D. W. H. (ed.) Antarctica Science, Cambridge University Press, Cambridge, 1987, pp: 48-49
- Indian Scientific Expedition to Antarctica: General Guidelines; Govt. of India, Antarctic Study Centre, Department of Ocean Development (DoD), Goa

Author Introduction

Born in Dibrugarh, Assam, Dr. Saurabh Barua is a distinguished Seismologist with MSc-PhD in Physics from Dibrugarh University and an MS in S&T Management from BITS Pilani. A former Chief Scientist at CSIR–NEIST, he dedicated his career to uncovering the seismotectonics of Northeastern India.

His pursuit of scientific discovery took him from the Brahmaputra Valley to Antarctica during the 18th Indian Scientific Expedition (1998–2000), where he spent 16 months studying crustal geodynamics. Collaborating with top international institutions across the Institute of Physics Earth-Russia, EOS-Singapore, Strasburg University-France, and NORSAR-Norway, Dr. Barua's scholarly contributions continue to inspire generations of earth science researchers.