



25 September, 2023

## Asteroid Sample Return

**Context:** After a seven-year journey, NASA's initial samples from an asteroid were safely delivered to the Utah desert via parachute on September 24th.

- The Osiris-Rex spacecraft released its sample capsule during a flyby of Earth from a distance of 100,000 km (63,000 miles).
- The capsule landed on a remote area of military land approximately four hours after being released, while the mothership continued its mission to explore another asteroid.
- Scientists believe the capsule contains at least a cup's worth of material collected from the carbon-rich asteroid known as Benu. However, the exact contents won't be confirmed until the capsule is opened.
- Japan, the only other country to return asteroid samples, gathered about a teaspoon's worth during two missions.

### Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-Rex)

- **Mission Goal:** OSIRIS-REx was designed to collect a sample weighing at least 2.1 ounces (59.5 grams) from asteroid 101955 Benu, with the purpose of bringing this sample back to Earth for scientific study.
- **Scientific Objectives:** The mission aimed to provide insights into planetary formation, the origins of life, and a better understanding of asteroids that could potentially impact Earth.
- **Historic Mission:** OSIRIS-REx marked the United States' first asteroid sample return mission, representing a significant milestone in space exploration.
- **Launch Date:** The spacecraft was launched on September 8, 2016, and embarked on a seven-year-long journey to reach Benu.
- **Arrival at Benu:** OSIRIS-REx reached its target, asteroid Benu, in 2018, where it conducted extensive observations and assessments.
- **Sample Return:** The spacecraft successfully collected a sample from Benu's surface, and these samples were scheduled to arrive on Earth in 2023, which happened yesterday.
- **TAGSAM Success:** A pivotal moment in the mission was when the spacecraft's robotic arm, known as the Touch-And-Go Sample Acquisition Mechanism (TAGSAM), successfully collected a sample from a designated site on the asteroid.
- **Extended Mission:** Following the sample collection from Benu, the spacecraft was expected to embark on an extended mission that would take it into orbit around the near-Earth asteroid Apophis in 2029.

### Asteroid Benu

- Benu is an ancient celestial body, over 4.5 billion years old, offering insights into the early solar system.
- It represents a building block of rocky planets and may contain organic molecules relevant to the origins of life on Earth.
- Benu is relatively small, about one-third of a mile wide.
- Its average distance from the Sun is approximately 105 million miles, slightly farther than Earth's orbit.
- Benu orbits the Sun every 1.2 years and completes one rotation every 4.3 hours.
- It makes close approaches to Earth every six years, with varying distances during these encounters.
- Benu's orbital path is tilted about 5 degrees relative to Earth's orbit.
- The asteroid's equator is tilted by about 175 degrees, in contrast to Earth's 23-degree tilt, which causes our seasons.
- Benu likely originated from a larger carbon-rich asteroid 700 million to 2 billion years ago and likely formed in the Main Asteroid Belt.
- Gravitational interactions with giant planets and the Yarkovsky effect caused Benu to drift closer to Earth over time.

### Yarkovsky effect

- The Yarkovsky effect is a force affecting small space objects, primarily asteroids and meteoroids (10 cm to 10 km in diameter), caused by uneven emission of thermal photons carrying momentum.
- It consists of two main components:
  - **Diurnal Effect:** On rotating bodies like asteroids, uneven surface heating and cooling during their day-night cycle create a force along their orbit's direction. This causes prograde rotators to move away from the Sun and retrograde rotators to move inward. It's dominant for objects larger than about 100 m in diameter.
  - **Seasonal Effect:** This effect is prominent when non-rotating bodies orbit the Sun. Excess thermal radiation in the orbital motion direction results in a braking force, causing them to spiral inward. It's more important with greater axial tilt and can dominate when the diurnal effect is minimal or changes over long periods.
- The Yarkovsky effect is size-dependent, impacting the semi-major axis of smaller space objects while having minimal effects on larger ones.
- Over millions of years, the Yarkovsky effect can perturb the orbit of an asteroid, potentially moving it from the asteroid belt to the inner Solar System.
- The effect becomes more complex for objects with strongly eccentric orbits.

## Five Eyes Alliance

**Context:** US Ambassador to Canada, David Cohen, stated in an interview with Canada's CTV that Canada's claims were supported by "shared intelligence from Five Eyes partners."

### What is it?

- The Five Eyes partnership involves countries sharing intelligence in a highly unified multilateral arrangement.
- **Members:** USA, UK, Canada, Australia and New Zealand
- The participating nations are diverse societies governed by the rule of law and robust human rights, sharing a common language.

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- The origins of this alliance date back to World War II when the UK and the US began sharing intelligence after breaking German and Japanese codes.
- The BRUSA agreement in 1943 laid the foundation for the UKUSA agreement, which was officially formed in 1946.
- Canada joined in 1949, followed by New Zealand and Australia in 1956, creating the Five Eyes alliance.
- While its existence was known since the 1980s, the UKUSA agreement files were officially released in 2010.

#### How does it Work?

- The Five Eyes countries have grown closer due to shared interests, particularly in managing China's rise.
- Their common language and long-standing trust have contributed to this alignment.
- The Five Eyes Intelligence Oversight and Review Council, formed in 2016, promotes collaboration among intelligence oversight and security entities of these nations.
- Despite their closeness, these countries do not always have uniform foreign policies.
- New Zealand, in contrast to the other four, has not openly criticized Chinese actions in Hong Kong and Xinjiang, largely due to strong trade ties with China.
- The US has pursued its influence through other security groupings like the QUAD and AUKUS, involving countries with similar security concerns.

## Indo-European (Indo-Aryan) Languages

**Context:** In Turkey, an excavation has revealed an undiscovered Indo-European language.

- Boğazköy-Hattusha, the former capital of the Hittite Empire in Turkey, has yielded a previously unknown Indo-European language during archaeological excavations.
- Excavations at this UNESCO World Heritage Site, directed by the German Archaeological Institute for over a century, have unearthed around 30,000 clay tablets with cuneiform writing.
- These tablets, part of UNESCO's World Documentary Heritage, have provided extensive information about Hittite history, society, economy, and religious practices.
- A Hittite cultic ritual text revealed a hidden language referred to as the "language of the land of Kalašma," possibly located in the north-western Hittite heartland, near present-day Bolu or Gerede.
- The Hittites had a particular interest in documenting rituals in foreign languages, resulting in various languages being found in their cuneiform texts, including Luwian, Palaic, Hattic (a non-Indo-European language), and now the language of Kalasma.

#### Indo-Aryan Languages

- Indo-Aryan languages are one of the largest language groups in India.
- They constitute 74% of India's population and include major languages like Hindi, Bengali, Marathi, Gujarati, Punjabi, and more.
- These languages are also spoken by expatriate communities worldwide.
- There are over 200 known Indo-Aryan languages.
- Regions Representing Indo-Aryan Languages

#### Stages of Indo-Aryan Language:

- **Old Indo-Aryan Group:** Formed around 1500 BC, includes Sanskrit, considered the mother of all Indian languages.
- **Middle Indo-Aryan Group:** Formed around 600 BC to 1000 AD, characterized by Prakrit languages like Pali, Ardha-Magadhi, Shauraseni, and Maharashtri.
- **Modern Indo-Aryan Group:** Developed after 1000 AD, includes languages like Hindi, Bengali, Gujarati, and more, spoken in western and eastern India.

#### Development and Characteristics

- **Sanskrit:** Developed around 1500 BC, used in Vedas, Upanishads, and Puranas.
- **Prakrit:** Informal language commonly used by the masses alongside Sanskrit.
- **Apabhramsa:** Transitioned from Middle to Modern Indo-Aryan languages, became a literary language.



## Vibrio vulnificus

**Context:** Between 1988 and 2018, wound infections from *V. vulnificus* in the eastern US surged eightfold, as per a 2023 study in Nature Scientific Reports.

- *V. vulnificus* is a dangerous bacterium associated with wound infections and other severe health issues.
- Cases of *V. vulnificus* infections are likely underreported in India due to a lack of awareness.
- It can lead to gangrene, septicemia, and death within 24 hours.
- Infections occur through the consumption of infected raw shellfish or exposure of wounds to contaminated waters.
- The mortality rate of *V. vulnificus* is 15-50%, making it a serious concern.

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### Environmental Factors

- *V. vulnificus* thrives in tropical or subtropical regions with water temperatures of 20°C or higher and low salinity.
- Rising sea surface temperatures and increased rainfall due to climate change could lead to higher exposure risks.
- India's sea surface temperatures average 28°C, making it conducive to *V. vulnificus* growth.
- The Arabian Sea and the Bay of Bengal are warming, further enhancing the habitat for *V. vulnificus*.
- High rainfall reduces salt levels in the sea, which benefits the bacteria.

### Underreporting in India

- Sparse reports of *V. vulnificus* infections in India may be due to a lack of awareness among clinicians and laboratory personnel.
- Researchers recommend considering testing for *V. vulnificus* in patients with signs of flesh-eating disease living near marine environments.
- *V. vulnificus* has been routinely found in seafood and marine environments in India.
- Incidence rates vary, with marine fish at 13-16%, molluscan shellfish at 38.5%, and oysters at 43-75%.
- Indians primarily consume properly cooked seafood, reducing the risk of infection through this route.

### Spread and Impact

- The first case of *V. vulnificus* in humans was recorded in the US in 1976.
- Between 1988 and 2018, wound infections due to *V. vulnificus* increased eightfold in the eastern US.
- Northern Europe has also seen a rise in *V. vulnificus* infections, linked to swimming or bathing in coastal waters.

### Marine Carriers

- *V. vulnificus* spreads through marine organisms, with some fish species carrying the pathogen.
- The bacterium was documented in Japanese eel in 1975 and arrived in Spain through imported eels in 1985.
- In 2018, an outbreak occurred in a tilapia farm in Kerala, India.
- The pathogen affects various marine organisms, including derbio, tilapia, trout, and shrimp.

### Preventive Measures

- Predictive tools are being developed to assess the abundance of *V. vulnificus* based on sea surface temperature and phytoplankton levels.
- High phytoplankton blooms are associated with increased *V. vulnificus* infections.
- Japan avoids consuming bivalves like oysters and mussels in summer when bacterial levels are high.
- Properly treated cholera has a fatality rate of 1%, while *V. vulnificus* has a mortality rate of 15-50% even with prompt treatment.

## NEWS IN BETWEEN THE LINES

### Mukurthi National Park



**Location:** Mukurthi National Park is situated in the **western corner of the Nilgiris Plateau** in Tamil Nadu, India.  
**Part of Nilgiri Biosphere Reserve:** It is a crucial component of the Nilgiri Biosphere Reserve and is **bordered by Mudumalai National Park and Silent Valley National Park.**  
**Wildlife Sanctuary to National Park:** The area was initially designated as a wildlife sanctuary in **1982** and later upgraded to a National Park in **1990.**  
**UNESCO World Heritage Site:** It holds the distinction of being a **UNESCO World Heritage Site** and was formerly known as **Nilgiri Tahr National Park.**  
**Flora:** Vegetation includes **Gaultheria fragrantissima, Helichrysum, Berberis tinctoria, Rhododendrons, Cinnamon, Mahonia, Satyrium** and **Raspberries.**  
**Fauna:** Mukurthi National Park is habitat to endangered species such as **Nilgiri Tahr, Indian elephants, Nilgiri Langur, Bengal tiger** and **bonnet macaque.**

### Galactic tides



#### About the Galactic Tides:

- Galactic tides are **gravitational forces** within **galaxies**, similar to Earth's ocean tides but on a much larger **cosmic scale.**
- These tides arise due to interactions between **celestial objects** within a **galaxy**, such as **stars** and **gas clouds**, exerting gravitational forces on each other.
- Galactic tides influence various aspects of a galaxy's evolution, including reshaping its structure by creating **tidal tails** and **bridges**, promoting star formation and disrupting smaller star systems.
- Over immense time spans, galactic tides disrupt **star orbits**, leading to significant long-term changes in a **galaxy's structure.**
- Galactic tides also affect the interactions between neighboring galaxies. For example, **tidal streams** near the **Andromeda galaxy** suggest the absorption of **dwarf galaxies**, foreshadowing a future collision with the **Milky Way.**
- Galactic tides impact the behavior of **supermassive black holes** at the centers of galaxies, altering how these cosmic entities interact with nearby stars.

### Chinar






#### About Chinar Trees:

- Chinar, scientifically known as **Platanus orientalis**, holds the prestigious title of being the **official tree of Kashmir.**
- Chinar trees are recognized by their **tall stature (up to 25 meters)** and the **striking transformation** of their leaves from green to **vibrant red and orange during autumn.**
- These trees play a vital role in the ecosystem. They offer **shade**, shelter for various species, **filter pollutants** from the air and help **prevent soil erosion** with their deep roots.
- Recent years have **seen a decline** in Chinar trees in Kashmir, leading to government-led **plantation drives** to protect and conserve this iconic species.

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	<ul style="list-style-type: none"> <li>Beyond aesthetics, Chinar trees provide vital environmental benefits, including <b>climate regulation</b> and <b>support for biodiversity</b>.</li> </ul>
<p><b>Fish Mint</b></p> 	<p><b>What is Fish Mint?</b> Fish Mint, or <b>Houttuynia cordata</b>, is an herb known for its <b>fish-like taste</b> and <b>smell</b>, though it doesn't resemble fish in appearance. <b>Origin:</b> Native to <b>Southeast Asia</b>, it thrives in <b>moist soils</b> and is <b>flood-resistant</b>. <b>Flavor Varieties:</b> There are two main varieties - <b>Chinese (coriander-like aroma)</b> and <b>Japanese (lemon or ginger-like aroma)</b>. <b>Usage in India:</b> It is found in northeastern states under different names like "<b>ja mardoh</b>" in <b>Meghalaya</b> and "<b>tokning-khok</b>" in <b>Manipur</b>, used in <b>salads</b> and <b>garnishes</b>. <b>Medicinal Properties:</b> Documented in traditional <b>Chinese</b>, <b>Japanese</b>, <b>Ayurveda</b>, and <b>Siddha medicines</b> for <b>anti-allergic</b> and <b>anti-inflammatory</b> properties. <b>Asthma Treatment:</b> Used in traditional Chinese medicine to <b>treat asthma</b>, with potential to mitigate symptoms and prevent <b>airway narrowing</b>. <b>Oral Health:</b> Herbal tea controls <b>dental biofilms</b>, <b>dental caries</b>, and <b>periodontal disease</b>; exhibits <b>anti-plaque</b> formation activity. <b>COVID-19 Potential:</b> Explored as a <b>nutraceutical agent</b> for therapy against viruses like <b>SARS-CoV-2</b>.</p>
<p><b>Mathale Caves</b></p> 	<p><b>About Mathale Caves:</b></p> <ul style="list-style-type: none"> <li>Mathale, Sri Lanka, houses <b>ancient Buddhist rock-cut caves</b> dating to the <b>3rd century BC</b>.</li> <li>These caves are where the <b>teachings of Lord Buddha</b> were first written down on <b>palm leaves</b>, marking the shift from <b>oral to written transmission</b>.</li> <li>Sri Lankan king <b>Devanampiya Tissa</b> sponsored the transcription of Buddha's teachings here, a pivotal moment in <b>Buddhist literature in India</b>.</li> <li>Buddha's teachings, called <b>Tripitaka</b>, including <b>Sutr</b>, <b>Vinaya</b>, and <b>Abhidhamma Pitakas</b>, were transcribed at <b>Mathale caves</b>.</li> <li>Renowned Theravada Buddhist philosopher Acharya Buddhaghosha lived in these caves and authored the <b>important text Visuddhimagga</b>.</li> <li>The nearby <b>Mathale Buddha Vihara</b> maintains a school in tribute to <b>Acharya Buddhaghosha's</b> legacy.</li> <li>The caves, surrounding monasteries, and artifacts underscore the deep <b>historical</b> and <b>cultural ties</b> between <b>India's Telugu States</b> and <b>Sri Lanka's Buddhist heritage</b>.</li> </ul>
<p><b>Place in News</b></p> <p><b>Ijmuiden</b></p>	<p>Recently, the Dutch National Institute for Public Health and the Environment revealed that individuals living near the Tata Steel plant in Ijmuiden, Netherlands, are experiencing a reduced life expectancy of 2.5 months compared to the national average.</p> <p><b>Netherlands (Capital: Amsterdam)</b> <b>Location:</b> The Netherlands is located in <b>northwestern Europe</b>. <b>Political Boundaries:</b> It shares its borders with <b>Germany</b> to the east and <b>Belgium</b> to the south.</p> <p><b>Geographic Features:</b></p> <ul style="list-style-type: none"> <li><b>Major Rivers:</b> Important rivers include the <b>Rhine</b>, <b>Meuse (Maas)</b>, and <b>Scheldt (Schelde)</b>, which flow through the country.</li> <li><b>Major Ports:</b> Rotterdam is one of Europe's <b>busiest seaports</b>, and <b>Schiphol</b> is a major international airport.</li> <li><b>Caribbean Territories:</b> In the <b>Caribbean</b>, <b>Aruba</b>, <b>Curaçao</b> and <b>Sint Maarten</b> are the constituent countries within the <b>Kingdom of the Netherlands</b>.</li> </ul> 

## POINTS TO PONDER

- ❖ The National Green Tribunal (NGT) ordered a ban on cruise ships operating on water bodies of which state? - Madhya Pradesh
- ❖ Which state Chief Minister has been awarded the Lee Kuan Yew Exchange Fellowship? - Assam
- ❖ Which country has enforced a European Union (EU) ban on all Russian-registered passenger cars entering the country? - Poland
- ❖ Which institution announced special awards to artists above 75 years of age? - Sangeet Nataka Akademi
- ❖ Which state launched 'Griha Adhar' and 'Chavath e Bazaar' initiatives? - Goa

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