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- Longevity Research and AI Innovation
- Human Evolution Origin
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- Mains



By saurabh Pandey



THE HINDU

Target Mains -2025/26 -

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**BY SAURABH
PANDEY SIR**

**Test -10 scheduled
on Monday - 9:30 am**

'Mindless splurge': Odisha govt.'s decision to seek external loan for PVTG development faces scrutiny

Satyasundar Barik
BHUBANESWAR

The Odisha government is planning to secure a ₹734.86-crore external loan from the International Fund for Agricultural Development (IFAD), a global financial institution, to implement Phase II of the Odisha Particularly Vulnerable Tribal Groups (PVTGs) Empowerment and Livelihood Improvement Programme (OPELIP-II), the proposal of which is expected to be placed before the State Cabinet for approval soon.

Tribal experts, however, have raised concerns over the move, questioning the rationale behind taking an international loan at a time



Women of the Bonda tribe, classified as a PVTG, in Odisha's Malkangiri district. FILE PHOTO

when the Centre has already launched the Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM-JANMAN) with ample financial outlay. With a substantial allocation of ₹24,104 crore for the 2023-24 to 2025-26 period, PM-JANMAN aims to ensure the holistic deve-

lopment of PVTGs in 18 States and Union Territories. Odisha, home to 13 of the 75 PVTGs identified across India, is likely to receive a significant portion of these funds.

Sources in the State ST & SC Development, Minorities and Backward Classes Welfare Development Department said there was a move to implement Phase II of the programme at a cost of around ₹2,422 crore with a loan component of ₹734 crore from IFAD.

Actual outcome

Tribal rights experts questioned the haste in securing an international loan when NITI Aayog sought to know the proposed outputs of OPELIP-II and the actual

outcomes achieved during the previous phase, along with the details of fund utilisation.

OPELIP-I was implemented with IFAD assistance from March 18, 2016 to March 3, 2024 at a project outlay of ₹795.41 crore. Of this, ₹312.37 crore was the share of the donor agency and State funding was ₹483.04 crore. Though the Phase-I project came to an end on March 31, 2024, the project closure report is yet to be submitted.

A senior officer on condition of anonymity said there had never been a fund crunch for development of PVTGs as the communities are given first priority in all welfare programmes. In addition, PM-

JANMAN now covers concrete houses, drinking water supply, road infrastructure, electricity, education hostel, health care etc.

Jitu Jakesika, an activist working for the rights of Dongria Kondhs, a PVTG in Rayagada district, said, "Officials and NGOs exploited the OPELIP initiative to serve their own financial interests. The programme, intended to uplift PVTGs, failed to create a meaningful impact on their lives."

Laxmidhar Singh, another tribal rights activist, said assessment of PVTG development has not been carried out and mindless pumping of development funds would only lead to splurge.

Topic → What are PVTGs?

In simple terms, they are tribal communities that face more challenges than other Scheduled Tribes. The government created a specific list of these groups to focus on improving their living standards and preserving their way of life.

Historical Context

The journey to recognize PVTGs began with the Dhebar Commission in 1960-61. This commission identified disparities among Scheduled Tribes, leading to the creation of the “Primitive Tribal Groups” (PTG) category. Fast forward to 2006, and this category was renamed to PVTGs, reflecting a more nuanced understanding of their needs.

The Dhebar Commission's Role

The Dhebar Commission played a pivotal role in highlighting the inequalities faced by various tribal groups. By categorizing them, it laid the groundwork for targeted interventions that would eventually lead to the establishment of the PVTG list.

Characteristics of PVTGs

Now, let's dive into some defining characteristics of PVTGs that set them apart from other tribal communities.

Pre-Agricultural Practices

One of the most fascinating aspects of PVTGs is their preservation of pre-agricultural practices. Many of these communities still rely on hunting and gathering, showcasing a lifestyle that has remained largely unchanged for centuries. It's like stepping back in time!

Low Literacy Levels

Unfortunately, PVTGs often have lower literacy rates compared to other tribal groups. This lack of education can hinder their ability to access resources and opportunities, making it even more crucial for the government to step in and provide support.

Small Population Size

PVTGs typically have small populations, which can lead to physical isolation. This isolation not only makes it difficult for them to access basic services but also puts their cultural practices at risk of fading away.

Simple Technology

When it comes to technology, PVTGs tend to use simpler tools and methods. Their slower rate of change means they often stick to traditional ways of living, which can be both a strength and a challenge in today's fast-paced world.

Government Initiatives for PVTGs

The Indian government has recognized the need for targeted initiatives to uplift PVTGs.

The PVTG List

Currently, there are 75 PVTG communities identified across 18 states and the Union Territory of Andaman and Nicobar Islands. This list serves as a crucial tool for policymakers to focus their efforts where they are needed most

The Importance of Cultural Preservation

Preserving the culture and heritage of PVTGs is not just about maintaining traditions; it's about ensuring their identity survives in a modern world.

Retaining Heritage

The government's initiatives aim to retain the rich cultural heritage of these communities while providing them with the tools to thrive. It's a delicate balance between modernization and tradition.

Habitat Level Development

Habitat level development is another key focus area. By improving living conditions and access to resources, the government aims to empower PVTGs without compromising their way of life.

Conclusion

In conclusion, Particularly Vulnerable Tribal Groups are a vital part of India's cultural landscape. While they face numerous challenges, the government's efforts to uplift these communities are a step in the right direction. By focusing on their unique needs and preserving their heritage, we can ensure that these communities not only survive but thrive in the years to come.




Ecologist Madhav Gadgil gets Champions of the Earth award

The United Nations on Tuesday recognised ecologist Madhav Gadgil with the annual Champions of the Earth award, the UN's highest environmental honour, for his seminal work in the Western Ghats. Mr. Gadgil, the only Indian on the list of this year's award recipients, chaired the government-constituted Western Ghats Ecology Expert Panel to study the impact of population pressure, climate change, and development activities on the ecologically fragile region in India. The panel recommended in 2011 that the entire hill range be declared an Ecologically Sensitive Area (ESA) and divided it into three Ecologically Sensitive Zones. PTI


Topic → Madhav Gadgil: Champion of the Earth



Recognition and Achievements


 United Nations Honor: Madhav Gadgil was awarded the Champions of the Earth award for his significant contributions to environmental conservation.


 Highest Environmental Honor: This award is the UN's highest environmental accolade, recognizing outstanding efforts in protecting the environment.

 Unique Recognition: Gadgil is the only Indian recipient among this year's award winners.


Saurabh Pandey IAS

Contributions to Environmental Conservation

 **Leadership Role:** Chaired the Western Ghats Ecology Expert Panel, established by the government to assess environmental impacts in the region.

 **2011 Recommendations:** Proposed declaring the entire Western Ghats as an Ecologically Sensitive Area (ESA).




 **Zoning Proposal:** Suggested dividing the Western Ghats into three Ecologically Sensitive Zones for better management and protection.

 **Addressing Critical Issues:** Focused on population pressure, climate change, and development activities affecting the fragile ecosystem



About Champions of the Earth Award



Overview

-  The Champions of the Earth award is a prestigious recognition by the United Nations.
-  It honors individuals, groups, and organizations for significant contributions to environmental protection and sustainable development.
-  The award aims to inspire others to take action towards a healthier planet.

Selection Criteria

-  Recipients are selected based on their innovative solutions and leadership in addressing environmental challenges.
-  The award is part of the UN Environment Programme (UNEP) initiatives.

Historical Context



It has been awarded annually since its inception in 2005.



The award highlights the importance of collaboration and collective efforts in environmental conservation.

Summary

The Champions of the Earth award is a UN initiative recognizing outstanding contributions to environmental sustainability since 2005

PM POSHAN: Centre to bear additional cost of ₹425.62 cr. due to food inflation

The Hindu Bureau
NEW DELHI

The Centre has announced that it will bear the additional cost of ₹425.62 crore on account of inflation in food material cost under the Centrally sponsored PM POSHAN Scheme in the financial year 2024-25.

Under the scheme, one hot cooked meal is served to 11.7 crore students studying in Balvatika and Classes 1 to 8 in 10.24 lakh government and government-aided schools.

On the basis of the inflation index provided by the Labour Bureau, the Education Ministry has enhanced the material cost of pulses, vegetables and oil by 13.7%.

“The material cost is enhanced from ₹5.45 to ₹6.19 for primary and Balvatika classes and from ₹8.17 to ₹9.29 for upper primary classes with effect from December 1,” said a release



On the basis of the inflation index, the material cost of pulses, vegetables and oil have been enhanced by 13.7%. FILE PHOTO

from the Ministry. The material cost could not be revised during 2023-24; therefore, the inflation value of items under PM POSHAN basket for both 2022-23 (6.45%) and 2023-24 (6.74%) has been considered for enhancement of cost.

Each Balvatika and primary school student is eligible for 20 grams of pulses, 50 grams of vegeta-

bles and five grams of oil. Similarly, each upper primary student is eligible for 30 grams of pulses, 50 grams of vegetables and seven grams of oil.

State contribution

The new rates will be applicable across all the States and Union Territories.

“These rates of material cost are the minimum

mandatory rates; however, States and UTs are free to contribute more than their prescribed share, as some States and UTs have been contributing more than their minimum mandatory share from their own resources for providing meals with augmented nutrition under the PM POSHAN Scheme,” the statement said.

The Centre also provides about 26 lakh tonnes of foodgrains through the Food Corporation of India for which it bears 100% cost, including subsidy of approximately ₹9,000 crore a year and 100% transportation cost from FCI depots to schools.


“The per meal cost after adding all components including foodgrains cost under the scheme comes to approximately ₹11.54 for Balvatika and primary classes and ₹16.74 for upper primary classes,” the statement said.

Topic → PM POSHAN: Pradhan Mantri Poshan Shakti Nirman Yojana




Overview


 **Program Name:** PM POSHAN stands for Pradhan Mantri Poshan Shakti Nirman Yojana.


 **Objective:** Aims to provide nutritious meals to school children to improve their health and educational outcomes.

 **Target Group:** Focuses on children in primary and upper primary schools across India.

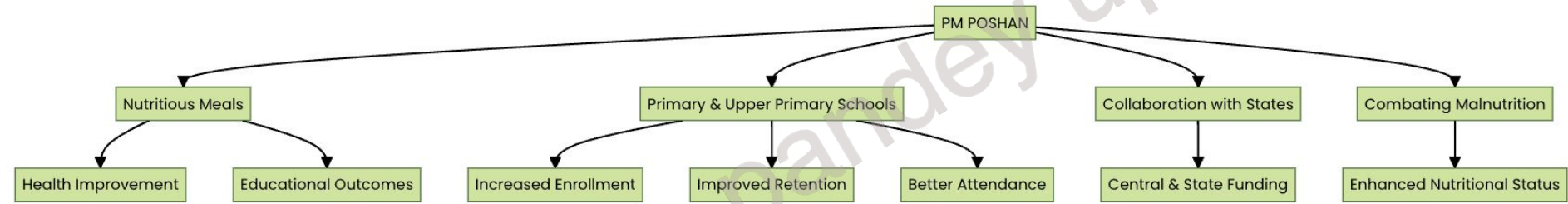
 **Implementation:** The program is implemented in collaboration with state governments and local bodies.

 **Funding:** The initiative is funded by the central government, with contributions from state governments.

 **Expected Outcomes:** Seeks to enhance enrollment, retention, and attendance in schools while combating malnutrition.

 **Broader Impact:** Contributes to the overall goal of improving the nutritional status of children in India

Program Structure and Impact:



Summary

- **PM POSHAN** is a government initiative aimed at providing nutritious meals to school children in India to enhance their health and educational performance.

Researchers develop AI-based platform to rapidly find age-defying molecules

Ramya Kannan

CHENNAI

Longevity has always been the Holy Grail of medicine, and extending life beyond its conceivable end has driven kings, researchers and pharma companies alike through a roller-coaster ride that invariably stops at ground level; no wonder the search continues. Now, it is an Indian group from the Indraprastha Institute of Information Technology, Delhi, that has used a platform based on Artificial Intelligence to discover molecules that promote healthy ageing.

Researchers at IIIT-Delhi have developed AgeXtend as a tool to efficiently cut down the time taken to identify viable molecules with geroprotectors, or age-defying properties, through conventional research. The authors who have published the experiment in a recent issue of

AgeXtend also helps in understanding the biological mechanism of compounds, says one of the scientists

Nature Aging, have said that they screened over 1.1 billion compounds, over a period of two years, and the platform had uncovered several promising candidates validated through experiments on yeast, worms (*C. elegans*), and human cell models. A fraction of them, less than 1%, have been identified with anti-ageing properties.

Gautam Ahuja, one of the authors, from the department of Computational Biology, IIIT-Delhi, says, "AgeXtend uses AI to predict and identify compounds with anti-ageing properties, assess their safety, and understand their biological effects. It looks

at the structure of new molecules and can predict accurately if they have geroprotective characteristics. But where this product diverges from others that might already have been employed by researchers is that it can explain why it considers certain compounds as anti-ageing, it reveals why it chose these components – the mechanisms. This will help to guide further research and indicate the particular direction in which validation needs to proceed."

How exactly does it work? "The chemical space is like a universe, and I do not know the coordinates for my intended destination. What AgeXtend does is to serve as the GPS, pointing out to us where exactly we need to go," Dr. Ahuja explained. Apparently, it had successfully identified the benefits of well-known molecules like metformin and tau-

rine, even without prior knowledge of these compounds, he added.

IIIT-D Ph.D. scholar Sakshi Arora who is also the lead author in the journal paper, described AgeXtend as "a discovery engine unlocking new possibilities for promoting health and longevity."

Scanning 1.2 billion molecules makes this the largest study so far on the subject, Dr. Ahuja claimed. Candidates scanned included compounds from commercial drugs, Chinese drugs, ayurveda and molecules approved by the FDA.

The research team has made available its code and data on open source on the website, free for researchers and students, and at a charge for companies.

A Python package for AgeXtend is provided via pip at pypi.org/project/AgeXtend



Topic → Longevity Research and AI Innovation



Longevity Research

The pursuit of extending life has been a long-standing goal in medicine. Stakeholders: Kings, researchers, and pharmaceutical companies are involved.

AI Platform Development

Researchers at the Indraprastha Institute of Information Technology, Delhi developed **AgeXtend**. This AI-based tool is designed to identify molecules that promote healthy aging.

Extensive Screening

Over a two-year period, more than 1.1 billion compounds were screened. This marks the largest study on anti-aging properties to date.

Promising Candidates

The platform identified several candidates with anti-aging properties. Less than 1% of the screened compounds showed potential.

Mechanism Explanation

AgeXtend predicts anti-aging properties and explains the mechanisms behind these predictions. This guides further research.

Open Source Availability

The research team has made their code and data available as open source. Companies are charged for access, while researchers and students can access it freely.

Python Package

A Python package for **AgeXtend** is available for download via `pip`. This facilitates its use in research.

Saurashtra fossils say early humans didn't stick to coast as they migrated

Scientists know *Homo sapiens* evolved in Africa, then emigrated to different parts of the world, but they disagree over what routes the humans took and when. Several studies have supported the coastal dispersion idea – that migrating humans travelled along the coast. But the idea suffers an important flaw: no archaeological evidence

Sayantan Datta

Genetic studies have painted a neat picture of human evolution and migration around the world. By studying how frequently DNA in the mitochondria (the cellular structure responsible for producing energy) mutates, scientists have found that *Homo sapiens* evolved in Africa for millennia, then emigrated to different parts of the world.

Scientists mostly agree on this out-of-Africa theory of human evolution and migration, but they frequently disagree on when exactly our ancestors migrated and what routes they took to different parts of the globe.

Several genetic studies have supported the coastal dispersion idea: that migrating humans travelled along the coast, especially in the tropics, where the weather was warm and wet and food was plentiful. In 2005, the mitochondrial genomes from 260 Orang Asli people revealed early humans dispersed rapidly around 65,000 years ago on the coast of the Indian Ocean before reaching

Australia. In 2020, the nuclear and mitochondrial DNA from the remains of a 2,700-year-old individual in Japan showed a strong "genetic affinity" with indigenous Taiwanese tribes. The authors of the study concluded the finding supported coastal migration. Human settlements in the Andaman archipelago have also been linked to coastal journeys.

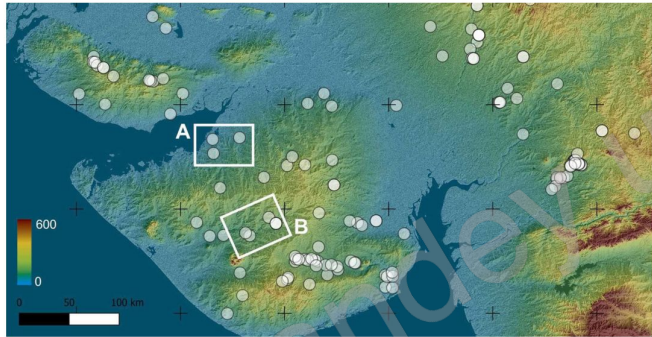
But there's a problem: archaeological evidence has disagreed with the coastal dispersion model. For example, "all Palaeolithic archaeological sites in India are inland," Michael Petraglia, director of the Australian Research Centre for Human Evolution at Griffith University, said. Along with his team, Petraglia has studied several archaeological sites in the country. "There is not a shred of archaeological evidence along the entire Indian Ocean coastline to support this model."

Instead, Petraglia deferred to the inland dispersal model: the idea that human ancestors took "more interior, terrestrial routes."

A new study of archaeological sites in India's Saurashtra peninsula, published in the journal *Quaternary Environments and Humans* in October, has mounted yet another challenge to the coastal dispersion model.

Early humans in Saurashtra

In the study, scientists from the Max Planck Institute for Geoanthropology and the Tübingen University, Germany; the Maharaja Sayajirao University of Baroda, Vadodra; and the University of the Philippines investigated the Bhadar



A digital elevation map of Saurashtra showing the study area (A is Aji basin and B is Bhadar basin) and Middle Palaeolithic site distribution. JNA ET AL. (2024)

and Aji river basins of the Saurashtra peninsula in Gujarat. They discovered artefacts of tools made by early human inhabitants – pieces of chert, jasper, chalcedony, bloodstone, and agate that were chipped again and again to achieve a desired shape and size.

The researchers used a method called relative dating to date these artefacts. In this method, archaeologists first identify how deep in the earth an artefact was found. As older civilisations fall and newer ones replace them, the older artefacts become buried deeper. They are thus often found organised in layers. Based on the layer in which an artefact is found, researchers can figure out the layer's age from older studies that used more precise dating methods (a.k.a., absolute dating). In this way, the researchers estimated the artefacts found in the Aji and Bhadar river basins were 56,000 to 48,000 years old – around the Middle Palaeolithic age.

Among other things, this period is characterised by an advanced tool-making technique where humans flaked off small pieces from a larger oval piece of stone.

Coast v. hinterland

In 2011, British archaeologist Paul Mellars suggested human ancestors moved from Africa to Australia through coastal routes in the Late Palaeolithic age 40,000-10,000 years ago. If this was true for Saurashtra, the team would have found artefacts indicative of the Late Palaeolithic, particularly sharper blade-like tools. But the researchers

As civilisations fall, artefacts are buried deeper and are found in layers. Based on the layer the age can be deduced. Researchers estimate artefacts in the Aji and Bhadar basins were 56,000 to 48,000 years old – around the Middle Palaeolithic age

wrote in their paper that they found no such tools dating to the Late Palaeolithic. According to Petraglia, Mellars's hypothesis "was not based on any convincing archaeological evidence on the coast."

The researchers also drew on existing models of sea-level changes during the Middle Palaeolithic. From these models, they deduced "Saurashtra would have been a vast landmass connected to Kutch in the north, Makran in the northwest, and the Western Ghats in the southeast," according to their paper. In other words, the sites the researchers studied would have been much further from the coast in the Middle Palaeolithic.

Together with the fact that other Middle Palaeolithic sites have been found in "central and peninsular India," the authors have suggested that human ancestors moved inland to disperse across the Indian subcontinent instead of sticking to the coast.

Petraglia also said that if the humans had indeed stayed on the coast, they would have depended on "marine resources like fish and shellfish" for food – whereas the current study found no

such evidence.

Thus, it seems people arrived at the Saurashtra peninsula in the Middle Palaeolithic and explored the Indian landmass – both by dispersing away from the coast and using inland routes.

Beyond the debate

According to Shanti Pappu, visiting professor of archaeology at Krea University, Andhra Pradesh, the study's strength lies in providing new data from "an important region in Indian prehistory." At the same time, she said "precise dating must be done to confirm" the age of these artefacts, which the researchers also said in their paper.

Pappu, who is also secretary of the Sharma Centre for Heritage Education, agreed there is mounting evidence disputing a purely coastal migration of human ancestors, but she also advised caution: "debates on coastal movements for this time period are difficult to prove or disprove, owing to the lack of securely dated sites on the land and the later rise in sea levels.

Like Pappu, Gyaneshwar Chaubea, a professor of biological anthropology at the Banaras Hindu University, said that the study is a prompt to move beyond the "debate on dispersal." "The current study highlights a broader expansion of Palaeolithic occupation in the Saurashtra region, encompassing coastal margins, hinterlands, and inland areas," he said. (Sayantan Datta is a science journalist and a faculty member at Krea University. (dattasayantan95@gmail.com))


THE GIST


Archaeological evidence disagrees with coastal dispersion. Researchers say, "All Palaeolithic archaeological sites in India are inland," and "There is not a shred of evidence along the Indian Ocean coastline to support this model"

Studies suggest that humans who arrived at Saurashtra moved inland, dispersing away from the coast. Further, there is no evidence of the utilisation of 'marine resources,' which would indicate coastal settlement


Some researchers feel that though evidence disputes coastal migration, 'debates on coastal movements are difficult to prove or disprove, owing to the lack of securely dated sites on land and the submergence of other sites'


Topic -- Human Evolution Origin


 Human Evolution Origin: Homo sapiens evolved in Africa over millennia before migrating globally.


 Mitochondrial DNA Studies: Scientists study mitochondrial DNA mutations to understand human migration patterns.

 Coastal Dispersion Theory: Some studies suggest early humans migrated along coastal routes, particularly in tropical regions.

 Archaeological Discrepancies: Archaeological evidence in India contradicts the coastal migration model, showing inland sites instead.

 Research Findings: Genetic studies from Orang Asli people and ancient remains in Japan support coastal migration, but archaeological evidence does not.

 Inland Dispersal Model: Some researchers advocate for the inland dispersal model, suggesting human ancestors took terrestrial routes.

 Ongoing Debate: There is a significant disagreement among scientists regarding the timing and routes of human migration.

The recent study conducted by scientists from the Max Planck Institute and other prestigious institutions sheds new light on early human life in Saurashtra.

By examining the Bhadar and Aji river basins, they uncovered artefacts dating back 56,000 to 48,000 years, revealing advanced tool-making techniques of the Middle Palaeolithic era.

- Crucially, the absence of Late Palaeolithic tools challenges the long-held coastal migration theory proposed by Paul Mellars.
- This compelling evidence suggests that our ancestors likely moved inland, expanding their presence across the Indian subcontinent.
- As experts call for further precise dating, it is imperative to reconsider our understanding of human migration patterns. This study is not just an academic exercise; it is a pivotal moment in unraveling the complexities of our past.

Saurabh pandey upso

Two hominin species 'existed' together



Q: Have different hominin species coexisted?

A: Yes, researchers recently reported a remarkable example of this

possibility. More than a million years ago, in a place in modern-day Kenya, two distinct hominin species walked together.

Researchers revealed this extraordinary piece of history when they found fossilised footprints near the lake dating to the Pleistocene Epoch.

These 1.5-million-year-old tracks, described in a study published in *Science*, provide the first concrete proof of two hominin species coexisting.

Discovered in 2021, the footprints are of *Homo erectus*, a direct ancestor of modern humans, and *Paranthropus boisei*. Researchers have been able to shed light on the behaviours and interactions of these species as they navigated the tough African terrain. The tracks were found on soft sediments near the lake's shore. Footprints can capture the movement of ancient life in their natural environments.

According to Kevin Hatala, the study's lead author and a professor at Chatham University, Pennsylvania, footprints often reveal details bones can't.

The coexistence of *H. erectus*



Professor Chris Stringer of London's Natural History Museum, with a *Homo erectus* skull, left, a cast of *Homo floresiensis*, centre, and the cast of a modern *Homo sapiens* skull in London. AP

and *P. boisei* underscores the complexity of human evolution. Both species walked upright and on two feet but occupied different ecological niches. *H. erectus* hunted for meat, while *P. boisei* was adapted to a diet rich in tough vegetation.

The fossil record also suggests divergent fates for these species, and the researchers don't know why. *H. erectus* survived for nearly a million years more, but *P. boisei* went extinct a few lakh years after their lakeside sojourn.

— Arkatapa Basu

For feedback and suggestions

for 'Science', please write to science@thehindu.co.in with the subject 'Daily page'

Topic -- **Two distinct hominin species**

Introduction

The recent discovery of fossilized footprints in Kenya has unveiled a stunning chapter in the story of human evolution. Dating back 1.5 million years, these ancient tracks provide the first solid proof that two distinct hominin species, **Homo erectus and Paranthropus boisei, coexisted in the same environment.** As researchers delve into the implications of this find, we gain a deeper understanding of the behaviors and interactions of our ancient relatives.

The Discovery of the Footprints

The footprints were unearthed near a lake in modern-day Kenya, an area rich in geological history. Researchers stumbled upon this extraordinary find while investigating the Pleistocene Epoch's sediment layers, which are known for preserving ancient life

Understanding the Species

Homo erectus

Homo erectus, a direct ancestor of modern humans, is known for its advanced tool-making abilities and adaptability to various environments. This species showed remarkable resilience and innovation.

Paranthropus boisei

In contrast, Paranthropus boisei was a specialized herbivore with strong jaw muscles, adapted to consume tough vegetation. This species occupied a different ecological niche, focusing on a diet rich in fibrous plants.

Dietary Differences: While H. erectus hunted for meat, P. boisei thrived on a plant-based diet, showcasing the diversity of early hominin adaptations.

Physical Characteristics: H. erectus walked upright, just like P. boisei, but their body structures reflected their divergent lifestyles.

What the Footprints Reveal

The footprints left by these ancient species offer a treasure trove of information about their daily lives and interactions.

Behavioral Insights: Researchers can glean details about gait, speed, and social behavior from the footprints, which bones alone cannot reveal.

Ecological Interactions: The discovery emphasizes the complexity of human evolution, highlighting how multiple species can coexist and interact within the same ecosystem.

Future Research Directions: This find opens new avenues for research into early human behavior and environmental adaptation.

Conclusion

The discovery of these fossilized footprints in Kenya is nothing short of groundbreaking.

As we piece together the puzzle of early human existence, we gain invaluable insights into the lives of *Homo erectus* and *Paranthropus boisei*.

The coexistence of these species not only enriches our understanding of human evolution but also underscores the intricate web of interactions that shaped our ancestors.



Saurabh pandey upsc

BIG SHOT



This image, provided by the Alaska Volcano Observatory, shows the summit of Mount Spurr in Alaska on October 24. AP

Topic → Mount Spurr: A Geological Marvel



Location: Mount Spurr is located in Alaska, USA.



Type: It is a stratovolcano, characterized by its conical shape and explosive eruptions.



Eruptions: Mount Spurr has had several eruptions, with significant activity recorded in 1953 and 1992.



Geological Significance: The volcano is part of the Aleutian Range, which is known for its volcanic activity due to tectonic plate interactions.



Wildlife: The surrounding area is home to diverse wildlife, including various bird species and mammals.

Saurabh Pandey IAS

Deepening India's steps as a key space-faring nation



India has set ambitious goals for its space programme in the next two decades. These goals hinge on powerful, reusable rockets such as the Indian Space Research Organisation (ISRO)'s upcoming Next Generation Launch Vehicle (NGLV). In addition to the NGLV, India must tap into its private sector to develop more such rockets in order to secure strategic autonomy in its access to outer space.

ISRO's road map

From an infant space programme in the 1960s, India has grown into a powerful space-faring nation. Preparations for the Gaganyaan mission are underway. Gaganyaan will take an Indian crew to space for the first time, demonstrating Indian human-spaceflight capability. By the end of the next decade, India aims to have a more sustained presence in space by having its own space station in orbit around earth. It also aims to expand its human-spaceflight capabilities to the moon.

Realising these objectives effects a road map that consists of multiple uncrewed missions to the moon, mastering human-centric technologies for space travel and developing powerful new rockets. These rockets have to carry heavier payloads to support humans in space. They should also be financially viable as it will take many test flights to reach the safety and the reliability standards for human-spaceflight to the moon. ISRO is fulfilling these requirements with its upcoming NGLV, which has been recently approved for development by the Union Cabinet.

The significance of the NGLV lies in its heavy lift capability and reusability. The NGLV will triple the payload capacity of the LVM3 (Geosynchronous Satellite Launch Vehicle Mk III), which is India's most powerful rocket. This comes with numerous benefits. Heavy lift rockets ease restrictions related to weight and volume. It frees up the focus of engineers and scientists that



Ashwin Prasad

a Research Analyst at
The Takshashila
Institution

Space is an emergent sector with much potential for commercialisation

would otherwise have to be spent on miniaturisation or weight reduction. It greatly increases the potential of space-related missions. The possibilities increase exponentially.

In contrast to all of India's existing rockets which are expendable as they are built for one-time use, a major part of the NGLV will be reusable. Reusability requires that the rocket keep some of its fuel for controlled descent back to the earth's surface. This reduces the capacity of the rocket to carry heavier loads but offers massive cost savings. Reusability has become necessary for rockets to remain competitive.

The immediate need

The NGLV's development phase will last for the next eight years. In the meantime, the need for heavy lift capability is already felt. India's next uncrewed moon mission is slated to use not one, but two rockets. Two LVM3s will carry the requisite modules. They will then be assembled in space to form one composite vehicle that will go to the moon.

In another instance, GSAT-N2, a communication satellite built by ISRO, was launched on SpaceX's Falcon 9 rocket. It weighed 4,700 kg while the maximum weight that an LVM3 can carry to the Geostationary Transfer Orbit (GTO) is 4,000 kg. A reusable Falcon 9 from SpaceX, a U.S. company, can carry up to 5,500 kg to the Geostationary Transfer Orbit (GTO). Foregoing reusability, an expendable Falcon 9's capacity increases to 8,300 kg. Even this figure is dwarfed in comparison to SpaceX's Falcon Heavy and Starship rockets.

The Starship, which completed its sixth test flight recently, has already achieved significant milestones surrounding heavy lift and reusability. Its mind-boggling capacity to lift over 21,000 kg to the GTO (1,00,000 kg to the Low Earth Orbit) while remaining reusable, shows that the Starship is already past the level of advancement that the

NGLV hopes to achieve at the end of its eight-year development phase.

Leveraging the private industrial base

This is no surprise given ISRO's wider scope, capability and focus. However, it also raises questions about why India is not exploring more paths to produce multiple reusable, heavy lift rockets.

In parallel to developing the NGLV, the Department of Space can give out contracts to the private industry in India to design and develop reusable, heavy lift rockets of their own. Space is an emergent sector with massive potential for commercialisation.

There is likely to be strong private sector interest in India to take up these contracts with the right incentives. Even with a lack of existing faculty in rocket technology among Indian corporations, they can explore foreign collaboration. For instance, various rocket engines are already sold commercially.

A milestone-based funding mechanism where the Department of Space pays private players after they meet certain objectives at every stage is a great way to ensure accountability and reduce cost overruns. In the best case, India may end up with multiple NGLV-like rockets alongside the NGLV, resulting in much-needed redundancy and greater launch frequency. In the worst case, there may be delays but that is accompanied by positive spillovers of innovation, technical capability and infrastructure which will ultimately yield positive outcomes.

The entire gamut of space activities, which ranges from using satellite data for development to extending Indian presence to the moon and Mars, hinges on a resilient supply of space transportation services. India must foster a strong ecosystem for the growth of a specialised industrial base that can cater to India's needs and ambitions in outer space.

Topic → India's Space Programme Goals



Overview of India's Ambitious Space Goals

NGLV (Next Generation Launch Vehicle) Development 🚀

Powerful, reusable rockets

Strategic autonomy in outer space

ISRO's Roadmap 🛰️

From 1960s to a space-faring nation

Gaganyaan mission preparations

Sustained presence in space

Plans for a space station and moon missions



Key Components of the Roadmap

Uncrewed Missions to the Moon 🌕

- Multiple missions planned
- Master human-centric space technologies

Rocket Development ⚙️

- Heavy lift capabilities
- Financial viability for human-spaceflight

Importance of NGLV

Heavy Lift Capability 📦

- Triples LVM3's payload capacity
- Eases weight and volume restrictions
- Reduces focus on miniaturization

Reusability ♻️

- Keeps fuel for controlled descent
- Significant cost savings
- Competitive necessity



Immediate Needs and Challenges

Development Timeline

NGLV development phase: 8 years

Current Moon Mission Requirements

Use of two LVM3 rockets

Assembly in space for mission

Competitive Landscape

Comparative Launch Capacities

ISRO's LVM3 vs SpaceX's Falcon 9 & Starship

Need for heavy lift and reusable rockets



Role of Private Sector

Contracts for Private Industry 🏢

Encourage design and development of rockets

Collaboration with foreign entities

Funding Mechanism 💰

Milestone-based payments

Ensures accountability and reduces cost overruns

Future Prospects

Diverse Rocket Development 🌟

Multiple NGLV-like rockets

Increased launch frequency

Ecosystem for Growth 🌱

Specialized industrial base for outer space activities

Resilient supply chain for transportation services



The code of conduct judges need to follow

Judiciary draws its power from two fountains, public acceptance of the authority of the judiciary and the integrity of the judiciary. The Bangalore Principles of Judicial Conduct 2002 presents a framework to regulate judicial conduct

LETTER & SPIRIT

Krishnadas Rajagopal

The comments made by Allahabad High Court judge, Justice Shekhar Kumar Yadav, against the Muslim community at an event organised by the legal cell of the Vishwa Hindu Parishad in the High Court premises on December 8, has drawn public flak.

Justice Yadav has said that the country would function as per the wishes of the majority living in Hindustan. He remarked that while children of one community are taught kindness and tolerance, it would be difficult to expect the same from children of “another community” especially when they witness animal slaughter. On the push for the Uniform Civil Code, Justice Yadav has said that Hindus revere women as goddesses even as members of the “other community” practice polygamy, Halala or triple talaq. The Supreme Court, in a statement, said it has taken note of the newspaper reports on Justice Yadav’s speech. It said details have been asked from the Allahabad High Court and that the “matter is under consideration”.

In light of Justice Yadav’s remarks, the All India Lawyers Union have written to the Chief Justice of India (CJI) Sanjiv Khanna, saying the judge’s comments lean away from democracy and towards a “Hindutva Rashtra”. The Campaign for Judicial Accountability and Reforms led by advocate Prashant Bhushan, in its letter to the CJI, has alleged that Justice Yadav’s participation in a “right-wing event” and his communally-charged statements were a brazen violation of his oath of office. Supreme Court Bar Association president, senior advocate Kapil Sibal, has reportedly called for the impeachment of the High Court judge.

On judicial ethics

Judiciary draws its power from two fountains, public acceptance of the



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authority of the judiciary and the integrity of the judiciary. Experience gained over time has led the judiciary to codify the best conventions of judicial conduct, both in and out of court. The ‘Restatement of Values of Judicial Life’ is the primary code of ethics governing judicial behaviour adopted by the Supreme Court on May 7, 1997.

The very first rule of the code is that the behaviour of a judge must “reaffirm the people’s faith in the impartiality of the judiciary”. It underscored that “any act of a judge of the Supreme Court or a High Court, whether in official or personal capacity, which erodes the credibility of this perception has to be avoided”. Justice Yadav seemed to have missed the last rule of the code which mandated that “a judge must at all times be conscious that he is under the public gaze”. The Bangalore Principles of Judicial Conduct 2002 presents a framework to regulate judicial

conduct. It requires a judge to ensure that his or her conduct, both in and out of court, maintains and enhances the confidence of the public, the legal profession and litigants in the impartiality of the judge and of the judiciary. While the 2002 document recognises a judge’s entitlement to freedom of expression, it mandates that he or she “shall always conduct himself or herself in such a manner as to preserve the dignity of the judicial office and the impartiality and independence of the judiciary”. More importantly, the charter requires a judge to be “aware of and understand” the diversity in society and treat all equally.

How is a judge impeached?

The Constitution mandates that judges of the Supreme Court and High Courts can be removed by an order of the President after a successful process of impeachment on the grounds of “proved misbehaviour

or incapacity”. The motion of removal of a constitutional court judge must be supported by a special majority of the total membership of the House and of at least two-thirds of the members of the House present and voting. Except on a removal motion, the Constitution prohibits the legislature from discussing allegations of misconduct of judges in any other context. However, the Supreme Court has also evolved an in-house procedure to give judges facing serious allegations a window to take voluntary retirement, sparing themselves and the judicial institution the public embarrassment of an impeachment.

The procedure was formally adopted in 1999, and was put out in the public domain by the Supreme Court in 2014. The procedure allows a complaint against a High Court judge to be addressed to the President, the CJI or the Chief Justice of the High Court concerned. If a complaint is received by the High Court Chief Justice, depending on the seriousness of the grievance, a response can be sought from the judge concerned. On receiving the response, and if a deeper probe is called for, the Chief Justice could forward the complaint and the statement of the judge to the CJI.

The President, on receiving a complaint, refers it to the CJI. The CJI, either on receiving a complaint directly or referred to by the President, can forward it to the Chief Justice of the High Court concerned, who would follow the same procedure of collecting a statement from the judge concerned and returning it to the CJI if the allegations were serious enough to require an investigation. The CJI can then appoint a fact-finding committee of two Chief Justices from other High Courts and a High Court judge to inquire into the allegations.

If the committee reports sufficient material to remove the judge, the CJI can ask the latter to retire. In case, the judge refuses to do so, the CJI can intimate the President and PM about the allegations along with the committee report, clearing the way for impeachment.

THE GIST

▼ The comments made by Allahabad High Court judge, Justice Shekhar Kumar Yadav, against the Muslim community at an event organised by the Vishwa Hindu Parishad on December 8, has drawn public flak. Justice Yadav has said that the country would function as per the wishes of the majority living in Hindustan.

▼ The ‘Restatement of Values of Judicial Life’ is the primary code of ethics governing judicial behaviour adopted by the Supreme Court on May 7, 1997. The very first rule of the code is that the behaviour of a judge must “reaffirm the people’s faith in the impartiality of the judiciary”.

▼ The Constitution mandates that judges of the Supreme Court and High Courts can be removed by an order of the President after a successful process of impeachment on the grounds of “proved misbehaviour or incapacity”.

Topics->> Introduction to Judicial Ethics

Judicial ethics form the bedrock of a fair and impartial judiciary. These principles guide judges in their conduct, ensuring they uphold the integrity of the legal system. The judiciary derives its power from two paramount sources: the public's acceptance of its authority and its intrinsic integrity.

Public Trust: A judge's behavior significantly influences public confidence in the judicial system. The key question remains: how can judges maintain this trust?

Guiding Framework: Over the years, the judiciary has meticulously codified ethical standards, culminating in the 'Restatement of Values of Judicial Life,' adopted by the Supreme Court on May 7, 1997.

Figure 1.1: The Framework of Judicial Ethics:



Figure 1.2: Key Principles of Judicial Conduct:

Principle	Description
Impartiality	Judges must remain neutral and fair.
Integrity	Conduct must reflect honesty and moral uprightness.
Transparency	Decisions and processes should be clear and understandable.

The 'Restatement of Values of Judicial Life'

The 'Restatement of Values of Judicial Life' is pivotal in defining judicial conduct. This document emphasizes that the foremost responsibility of judges is to "reaffirm the people's faith in the impartiality of the judiciary."

Key Rules:

Any act by a judge, whether in an official or personal capacity, that undermines this perception is strictly prohibited.

Judges must be acutely aware of their public image, as their actions are continually scrutinized.

This framework not only sets standards but also serves as a reminder of the weighty responsibilities borne by those who uphold the law.

The Bangalore Principles of Judicial Conduct

In 2002, the Bangalore Principles of Judicial Conduct were established to provide a comprehensive framework for judges worldwide. This document mandates that judges must ensure their conduct enhances public confidence in the judiciary.

Rights vs. Responsibilities: While judges are entitled to freedom of expression, they must conduct themselves in a manner that upholds the dignity of their office.

Understanding Diversity: Judges are required to recognize and appreciate the diversity of society, ensuring equitable treatment for all individuals.

This duality of rights and responsibilities is crucial for maintaining the delicate balance of justice

Conclusion: The Path Forward for Judicial Ethics

Reinforcing judicial ethics is paramount for the future of the judiciary. Here are some suggestions to enhance judicial integrity:

Training and Education: Regular training programs on ethical standards should be mandatory for judges.

Public Engagement: Active engagement with the community can bolster public trust.

Transparent Processes: Establishing clear procedures for addressing ethical breaches is essential.

By prioritizing these measures, the judiciary can better navigate the complexities of modern society and maintain its integrity

What is the extent of the global share of solar energy?

What does the World Solar Report 2024 by the International Solar Alliance state?

Ajay Mathur
Saba Kalam

The story so far:

On November 5, the World Solar Report 2024 by the International Solar Alliance (ISA) was released. From 1.22 GW in 2000, the world's solar capacity has surged to 1,419 GW in 2023, charting a CAGR of about 36%. Today, solar capacity represents three-quarters of all renewable capacity additions worldwide.

What are new solar technologies?

Quantum dot solar cells have achieved a record-breaking efficiency of 18.1%, offering a promising approach to enhance solar energy capture and power atmospheric water harvesting technologies. Researchers are creating self-healing solar panels to extend the lifespan and reduce the maintenance of existing solar cell technologies.

Solar-powered phyto-mining uses solar energy to power the extraction of valuable metals from soil-using plants, offering a sustainable alternative to traditional mining practices. Solar paver blocks integrated with building infrastructure and BIPV (Building Integrated PV), like transparent solar panels, allow light transmission and visibility. The development of these alternative technologies will reduce reliance on critical materials like lithium and rare earth elements. The solar sector is also prioritising recycling panels and implementing circular economy practices to minimise environmental impact.

Have reducing costs helped?

The 2024 World Solar Report shows that the average auction prices for utility-scale solar photovoltaic (PV) projects have consistently decreased across all regions. Utility-scale solar PV costs averaged \$40/MWh in 2024. India topped the

global charts in solar PV capacity granted through auctions, securing a notable auction price of \$34/MWh. Investment in solar PV technology within the power sector is expected to surpass the \$500 billion mark by 2024, outstripping the combined investment in all other generation forms.

What about the global market?

As of 2023, China dominates solar PV as 43% (609 GW) of the cumulative capacity of solar panels installed globally is from China. The U.S. contributes 10% (137.73 GW). Japan, Germany, and India each captured a 5-6% share. Emerging solar markets like Brazil, Australia, Italy, and Spain each contributed about 2%. Solar PV manufacturing has nearly doubled in capacity for wafers, cells, and modules in 2023. China maintained the highest share in component manufacturing in 2023, with 97% in wafers, 89% in cells, and 83% in module installation capacity.

Has solar impacted other industries?

Employment in the solar PV sector rose to 7.1 million jobs in 2023, up from 4.9 million in 2022 worldwide, indicating a significant increase from the previous year and underscoring the sector's role in job creation and economic development. Solar-powered irrigation systems are transforming agriculture. The global solar pump market is expected to grow at a CAGR of 5.8% from 2021 to 2027, driven by declining costs of solar PV technology, cost competitiveness of solar-powered pumps, especially when compared to diesel-powered water pumping, and increased awareness among farmers. Beyond crop farming, agrivoltaics systems are being used in livestock management, with solar panels installed in pastures to provide shade for animals while simultaneously generating electricity. One of the key factors driving the adoption of solar systems has been the introduction of pay-as-you-go business models, allowing users to pay for their systems in small, regular instalments.

Technological advancements have made solar energy more affordable, while new applications are further driving adoption. We must promote technology and finance transfer, especially to the least developed and small island developing countries, to ensure no one is left behind.

Ajay Mathur is DG of the ISA, and Saba Kalam is Programme Specialist at the ISA.

THE GIST

▼ The 2024 World Solar Report shows that the average auction prices for utility-scale solar photovoltaic (PV) projects have consistently decreased across all regions.

▼ The Report further shows that the average auction prices for utility-scale solar photovoltaic (PV) projects have consistently decreased across all regions.

▼ Technological advancements have made solar energy more affordable, while new applications are further driving adoption.

Topic → World Solar Report 2024 Overview



Key Insights from the Report

Global Capacity Surge: Increased from 1.22 GW in 2000 to 1,419 GW in 2023, with a CAGR of about 36%.

Renewable Dominance: Solar capacity represents 75% of all renewable capacity additions globally.

New Solar Technologies

Quantum Dot Solar Cells: Achieved 18.1% efficiency; enhances solar energy capture.

Self-Healing Panels: Extend lifespan and reduce maintenance.

Solar-Powered Phyto-Mining: Uses plants for sustainable metal extraction.

Building Integrated PV (BIPV): Transparent solar panels for light transmission.

Recycling Initiatives: Focus on circular economy practices to minimize environmental impact.

Cost Reductions Impact 💰

Decreasing Auction Prices: Utility-scale solar PV costs averaged \$40/MWh in 2024.

India's Leadership: Achieved an auction price of \$34/MWh.

Investment Surge: Expected to surpass \$500 billion in 2024.

Global Market Dynamics 🌍

China's Dominance: 43% of global installed solar capacity (609 GW).

Market Shares:

U.S.: 10% (137.73 GW)

Japan, Germany, India: 5-6% each.

Emerging Markets: Brazil, Australia, Italy, Spain each around 2%.

Manufacturing Growth: Nearly doubled capacity for wafers, cells, and modules in 2023.

Socio Economic Impact

Job Creation: Employment in solar PV sector rose to 7.1 million in 2023.

Agricultural Innovations: Solar-powered irrigation systems transforming farming.

Growth of Solar Pump Market: Expected CAGR of 5.8% from 2021 to 2027.

Pay-As-You-Go Models: Facilitating access to solar systems.

Future Directions

Technology and Finance Transfer: Essential for developing countries to ensure inclusive growth in solar energy adoption.

Wild goose chase



Cleaning up: A veterinary technician with the New England Wildlife Center tries to capture an oil-covered goose along the Muddy River in Brookline, Massachusetts, U.S., on Monday, as wildlife rescuers tended to dozens of birds that were soaked in oil after an apparent spill. AP

Mapping

- **The Muddy River is a series of brooks and ponds that runs through sections of Boston's Emerald Necklace, including along the south boundary of Brookline, Massachusetts**



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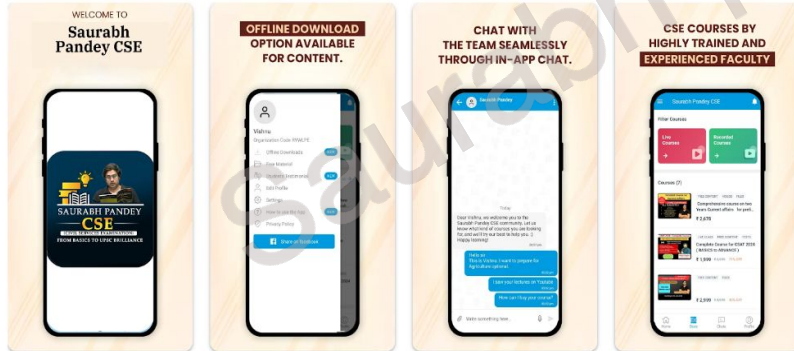
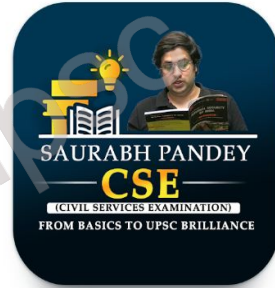
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