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SUN LIKE STARS IN THEIR LATER LIFE HOLD KEY FOR LI INCREASE IN THE UNIVERSE – NEW FINDINGS

Relevant for: Geography | Topic: The Earth and the Solar System

In a study recently published in Nature Astronomy (On 6th July 2020)scientists from Indian Institute of Astrophysics (IIA) an autonomous institute of the Department of Science & Technology, Government of India along with their international collaborators have provided a robust observational evidence for the first time that Li production is common among low mass Sun-like stars during their He-core burning phase.

Light inflammable, metal lithium (Li) has brought about transformation in modern communication devices and transportation. A great deal of today's technology is powered by lithium in its various shades. But where does the element come from? The origin of much of the Li can be traced to a single event, the Big-Bang that happened about 13.7 Billion years ago, from which the present-day Universe was also born.

Over the course of time, Li content in the physical Universe has increased by about a factor of four, which is meager compared to the rest of the elements carbon, nitrogen, oxygen, iron, nickel and so on which grew about a million times over the lifetime of the Universe. Stars are primary contributors to this significant enhancement of heavier elements through mass ejections and stellar explosions. Li, however, understood to be an exemption!

As per the current understanding based on today’s best models, lithium in stars like our Sun only gets destroyed over their lifetime.

As a matter of fact, the composition of all the elements in the Sun and the Earth is similar. But, the measured content of Li in the Sun is a factor of 100 lower than that of the Earth, though both are known to have formed together.

Prof. Eswar Reddy, one of the lead authors of the above paper says “this discovery challenges the long-held idea that stars only destroy lithium during their lifetime implying the Sun itself will manufacture lithium in the future, which is not predicted by models, indicating that there is some physical process missing in stellar theory.”

Authors used spectra of hundreds of thousands of stars collected from large surveys of GALAH (Galactic Archaeology project, Anglo-Australian Telescope, Australia) and distances from European Space mission (Gaia).

Figure 1: Figure 1:Evolution of Li in stars from the main sequence through red giant, He-flash (RGB tip) and to He-core burning phase of RC. The dashed line is the model prediction. Band of red symbols represents the He-core burning phase of the red clump region.

Further, the authors identified “He flash” (on-set of He-ignition at the star's core via violent eruption), at the end of the star’s core hydrogen-burning phase, as the source of Li production. Our Sun will reach this phase in about 6-7 billion years.

The study also suggests new limits (A(Li) > -0.9~dex) for classifying stars as Li-rich, which is 250 times below the threshold (A(Li) > 1.5~dex) used till now.

Prof. Reddy further added, “The next crucial step for us is to understand the nucleosynthesis of Li during the He-flash and mixing mechanisms, which hitherto remain unknown, and also to find out whether the increase from its creation in Big-bang to the current value is accounted by only stars as the newly created lithium will end up of being blown off stars as stellar winds which replenish next generation of stars with it.”

“The work of Prof. Eswar Reddy and his team is a compelling example of the profound discovery science being done in the nation and serves as a beacon for the younger scientists to excel in their scientific pursuits,” said Prof Ashutosh Sharma, Secretary, DST.

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For more details, Prof. Eswar Reddy (ereddy@iiap.res.in) can be contacted.]

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AS INDIA MOVES TO SLOW POPULATION GROWTH, BIHAR GETS LEFT BEHIND

Relevant for: Geography | Topic: Demography of the World - Growth of Population

India's south and west are now at replacement fertility, but it will be several decades before the country's population starts shrinking

Gujarat has now joined 13 other states at or below replacement fertility, new data from the Sample Registration System (SRS) for 2018 shows. Bihar is now the only Indian state where a woman as of 2018 was likely to have over three children in her lifetime.

The SRS is a large-scale household survey, representative at the level of big states, used by India to measure indicators relating to births, deaths, and fertility. A country is said to have reached replacement fertility when its total fertility rate (TFR) drops to 2.1, a level that indicates that the population will stop growing, and only replace itself over time. India's TFR now stands at 2.2.

A TFR of 2.1 is considered to be an important milestone for developing countries seeking to slow down their population growth. In India, it's also intensely political, because of a wide gap in TFR between southern states --- that have better education and health outcomes, and have long reached replacement fertility --- and northern states, which are still some way off.

As the average number of children in a family has declined, the age at which women are giving birth has moved up. In urban areas of the country, the age-specific fertility rates have declined for women below 30, and gone up in women of all ages over 30. Age-specific fertility rates refer to the number of children born to women in a particular age group per 1000 women in that age group.

Across the country, age-specific fertility rates have declined across all age groups except for women in their early 30s, who have seen a rise in the age-specific fertility rates.

This is also the first time in five years that a fall in fertility has not been accompanied by a fall in the sex ratio at birth. After five years of declining sex ratios at birth, there has been a small uptick in the sex ratio.

Yet national-level improvements hide some state-level failings. Bihar is now the only Indian state that still has a total fertility rate of over 3. Among states that have not yet reached replacement fertility, Bihar had one of the slowest reductions of any state over the last ten years.

The state's Total Fertility Rate has moved very little over the last seven years, even as the gap between Bihar and Uttar Pradesh has widened, and UP too is now at a TFR of under 3.

"There has been a lack of energy in Bihar on not just family planning, but all of the allied areas that affect family size - women's health, girls' education, access to contraception," says Poonam Muttreja, executive director of the Population Foundation of India, a non-profit organisation that has worked on reproductive health in India for over 50 years. "For some time now, there has been no real movement. In UP, we have been seeing a lot more energetic and imaginative efforts on the ground and some good officers in charge."

The TFR reaching the replacement level of 2.1 does not mean that populations will decline

immediately, notes P Arokiasamy, professor and head of the department of development studies at the Mumbai-based International Institute of Population Sciences (IIPS). Given the still large cohort of young children, the number of girls who will go on to have children remains large, even if they go on to have fewer children, he said.

“The southern states, especially Tamil Nadu and Kerala, have been at replacement levels for 15-20 years," said Arokiasamy. “But it will still take another ten years before their populations start to decline, and the country on the whole will only see a population decline after 2060."

Arokiasamy, whose research focuses on fertility and ageing, sees two distinct demographic patterns within India. While population policies focus heavily on one, family planning, the other phenomenon, of rising ageing in the south is being neglected. Southern states should “now wind up their family planning efforts" and focus on ageing instead, he said.

This dynamic has been particularly important in the last few months. With the elderly most vulnerable to covid-19, Kerala for instance, has implemented a “reverse quarantine" for them, to force them to stay home and protected.

Rukmini S. is a Chennai-based journalist.

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THE BIG HIMALAYAN EARTHQUAKE IS COMING

Relevant for: Geography | Topic: Important Geophysical phenomena - Earthquakes, Tsunamis & Volcanoes

It might come tomorrow, or it might come in 300 years, but a big Himalayan earthquake is overdue. Lounge delves into the heart of the gigantic tectonic forces that are shaping our world

25 April 2015, Lo Manthang, Nepal, 11.56am

Photographer and trek leader Sujoy Das was taking photographs of a 'thangka' painter in a studio in the fabled high-altitude town of Lo Manthang in Mustang, north-western Nepal. Members of his trekking group were spread across town, visiting monasteries and shops on their day off from the trek. "The 'thangka' painter was sitting on the ground and painting, with these small bowls of paint around him. I remember there was a bowl of yellow paint and a bowl of red paint," says Das. "I was on the ground as well, taking photographs. Suddenly, I noticed through my camera viewfinder that the paints in the bowl were jumping up and down. I started wondering if I am seeing things." The floor began to vibrate. Then it started shaking so hard that all the paint sloshed out of the bowls. "Meanwhile, people had started shouting in the street. We ran out and that's when I finally realized it was an earthquake. Opposite me there was a dilapidated building. Some of the walls just keeled over and started to crumble." Das says the vibrations continued for a few more minutes and then came the aftershocks, spreading further panic. "The locals were convinced that there was more coming," he says. Later that day, Das organized an emergency evacuation of his group to Pokhara, a three-day trip. On the way, his colleague Shyam Tamang received a call. His village, Kaule, in Langtang had been destroyed by the earthquake. His father had been killed.

25 April 2015, Patan, Nepal, 11.56am

Researcher and scholar Padmini Ray Murray was conducting a workshop on archiving for the Nepal Picture Library in Patan in the Kathmandu valley. "We were in an old building that's part of the library, on the second floor," she says. Suddenly, the ground lurched. "Then there was another big lurch, and it kept happening. And the building began to kind of crumble around us. Cracks started to appear on the walls." Her local Nepali audience ducked under tables, so did she. "All around me people were praying and crying." Then there was a pause in the earthquake's pulse. "We were told to just run," Murray says. "We ran down those two floors and thankfully we were next to a tennis court. So we ran out into that space." The earthquake continued for a few more minutes, and then came the aftershocks. That evening, Murray walked back to her hotel to get her luggage. She had been told that the hotel was too unsafe to sleep in, and that everyone would sleep in the parking lot of the library guest house. Walking down her favourite route through the old quarter of the city, she kept noticing disappearances. Buildings that had existed that morning, no longer did. A shrine she had passed every day, gone. They were so reduced to rubble that they seemed atomized, vanished. "Like a human being burnt to ashes," she says.

The Nepal earthquake of 2015, also called the Gorkha earthquake, is the most studied Himalayan earthquake ever, since it occurred in the modern era of geodetic data, with pinpoint GPS images of the rupture and its effects. With a moment magnitude (Mw) of 7.8, it was a major tremblor. In Nepal, it killed nearly 9,000 people and injured some 22,000. In the Kathmandu valley, it destroyed buildings and infrastructure, reducing several historical temples and monasteries—many of them Unesco World Heritage sites—to rubble. It also triggered an avalanche on Mount Everest, killing 21 people. Another avalanche in the Langtang valley wiped out the village of Langtang, killing 243 people.

The quake was strong enough to shift Kathmandu south by 1.5m. And yet, it wasn't a big earthquake, over Mw8, monsters that can turn the ground into mud. If anything, the 2015 earthquake set the ground conditions that make a far larger earthquake, a "big one", more favourable.

In the middle of a global pandemic, and with climate change flexing its muscles in the form of extreme events like cyclone Amphan, 17 small earthquakes ranging mostly from Mw2-3.5 have shaken the National Capital Region between April-July. Of these, two, on 29 May and 3 July, were above Mw4.5. While these triggered some panic, they were localized tremors which didn't cause any harm, nor are they the harbinger of a bigger local earthquake. What seismologists are increasingly worried about, however, is the effect of a big Himalayan earthquake in the region. At least one, if not a few, is overdue. And mountain villages and towns, like Shimla, as well as cities like Delhi are woefully unprepared.

The Big One

With its epicentre in Gorkha district's Barpak in Nepal, the 2015 earthquake was a continental "mega thrust" rupture, caused by the ongoing tectonic collision of the Indian plate with the Eurasian plate. The two tectonic plates started converging some 65 million years ago and the slow-motion collision raised the prehistoric Tethys Sea into the Tibetan plateau and began the creation of the Himalaya, when the two continents were welded together, about 50 million years ago. As the convergence proceeded, the Indian plate started sliding under—or subducting—the Eurasian plate, giving rise to a series of underground faults, running roughly north-west to south-east along the line of collision. This is where the Himalayan range sits today, and the riverbeds of the Indus and the Yarlung Tsangpo (Brahmaputra), mark the line of the ancient suture.

The three main faults of the Himalaya are the Main Central Thrust (MCT), which runs roughly under the point where the lesser Himalaya meets the greater Himalaya; the Main Boundary Thrust (MBT); and the Main Frontal Thrust (MFT), which runs roughly under the meeting point of the north Indian plain with the Siwalik foothills. These are branches of the deeper Main Himalayan Thrust (MHT), the fault that marks the boundary between the two continental plates. India is currently converging with Tibet at the rate of approximately 17mm/year. As they converge, the MHT constantly gathers massive amounts of strain. Earthquakes are the most effective way of releasing this strain. The 2015 earthquake, for instance, ruptured a 50km segment of the MHT. But it was an underground, "blind" rupture. It would take the really big, infrequent earthquakes of Mw8 and above, the so-called "crack" ruptures, for the strain to be relieved.

Roger Bilham is a geological scientist at the Cooperative Institute for Research in Environmental Sciences (Cires), University of Colorado Boulder. He has been researching Himalayan earthquakes for decades. In February 2019, he published a review of earthquakes in the Himalaya in the past 1,000 years, for The Geological Society in London. The review shows that over the past 500 years, there haven't been enough big earthquakes (Mw8 and above) to ease the accumulated strain in large sections of the Himalayan arc. He writes that due to the average rate of convergence between the Indian and Asian plates, every year adds additional strain on the MHT that needs an Mw7.3 earthquake for release. In 100 years, the accumulated strain would need an Mw8.6 earthquake for release. In 350 years, a Mw9 earthquake would be required.

"Most of the Himalaya slipped in great earthquakes over a period of 200 years starting in the 12th century. Since then India has moved 12m northward. In only two locations (eastern Nepal

and eastern Assam) has this accumulating elastic energy been released.The remainder could be released in Mw8.2-8.7 earthquakes at any time," Bilham says via email.

The two locations which did see these great earthquakes were the 1934 earthquake in Nepal-Bihar (Mw8.4) and the 1950 earthquake in Tibet-Assam (Mw8.6). Both were extremely destructive. In 1934, an estimated 7,253 people died in Bihar alone. In Nepal, the death toll exceeded 8,500. Fissures over 250ft long and 9ft wide appeared in Bihar, venting sand, while the soft sediment of the Gangetic plain liquefied. The force of the earthquake knocked off the top 23ft from the historical Kesariya Stupa in Bihar's East Champaran district. It also toppled the original spire of St Paul's Cathedral in Kolkata.

The 1950 earthquake was one of the strongest known on earth and remains the largest intracontinental earthquake ever recorded. It caused landslides of such magnitude that several of the Brahmaputra's tributaries were dammed by landslides and ran dry for days. When the dams burst, prime minister Jawaharlal Nehru described in a radio broadcast that year, "They (the waters) came down with rush and a roar, a high wall of water sweeping down and flooding large areas and washing away villages and fields and gardens." It occurred in the evening and it was only the sparse population of the region at the time that prevented high casualties.

But the rest of the Himalaya now needs big earthquakes like these two to release the strain. Bilham writes in his review: "Historical earthquakes in the past 200 years have ruptured less than 30% of the Himalayan arc, and those that have unequivocally ruptured the frontal thrusts account for less than 13% of the arc. In contrast, medieval earthquakes from 1100 to 1600 CE (AD) apparently ruptured 78% of the arc's frontal thrusts."

There have been some strong earthquakes in the western and central Himalaya in the past 100 years. The Kangra earthquake (1905, Mw7.8, 20,000 deaths), the Uttarkashi earthquake (1991, Mw6.8, 768 deaths), the Chamoli earthquake (1999, Mw6.8, 103 deaths) and the Muzaffarabad/Kashmir earthquake (2005, Mw7.6, 86,000 deaths) were actually moderate to major earthquakes. Seismologists are increasingly certain that what these earthquakes have done is to load greater strain where they occurred, making a big earthquake even more necessary. Smaller earthquakes just won't do. Look at it this way: One Mw7 earthquake packs as much power as 30 Mw6 earthquakes; one Mw8 earthquake is equal to a thousand Mw6 earthquakes. A big earthquake is simply a more efficient way of relieving the elastic strain built up in the faults.

Where will it occur?

Earth scientist C.P. Rajendran, from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, says that if a big earthquake were to occur now, it would be like the 1934 one. "It's about scale. 1934 was very damaging to the floodplains, the alluvial plains where ground cracks occurred along with liquefaction. It impacted the Bihar plains as well as Nepal. So the most comparable example is the 1934 earthquake," he says.

Rajendran, in a 2004 paper co-authored with seismologist Kusala Rajendran, discussed a so-called "seismic gap" in the central Himalaya. This is a section of the Himalaya, bracketed between the 1905 and 1934 earthquakes, which hasn't seen a big earthquake in at least 500 years. "The historical records we have in India are not very reliable," says Rajendran. "They contain lots of stories, some exaggerated. So we need to go through all the maze of truths and untruths, through all the available archaeological records of earthquakes in India and Nepal, to construct a picture of medieval earthquakes."

These include taking note of British reports from the 1860s that the cupola of the Qutb Minar in

Delhi had collapsed during a strong Himalayan earthquake in 1803 (Mw7.8). This same earthquake caused massive damage to the Tungnath shrine in Garhwal and partly damaged the nearby Kedarnath and Badrinath shrines. Then there are reports in Lodhi-era accounts of widespread destruction in Agra in 1505 due to multiple earthquakes, correlated with Tibetan accounts of a big earthquake that ripped through western Tibet that year, destroying monasteries from Guge, just north of Badrinath, to Mustang. Some seismologists think this was a big one (Mw8.2-8.9), with one or more big aftershocks of Mw7.6 (hence the medieval reports of several earthquakes hitting Agra). Others think it was more like the Gorkha earthquake (around Mw7.8).

Bilham writes in his earthquake review that the Mw7-7.9 earthquakes which didn't fully rupture the frontal thrusts, like the ones in 1803, 1905, 2005 and 2015, have left behind reservoirs of "'dark' strain energy". In his email, he says, "It appears rather probable that great (Mw>8) Himalayan earthquakes nucleate (originate) as Mw7 earthquakes and during their southward propagation encounter reservoirs of elastic energy left over from 'failed' earthquakes." These reservoirs might then act like force multipliers.

Bilham has identified 15 Himalayan segments that might fail, or collapse, because of such reservoirs, either individually or in tandem with neighbouring segments, in future earthquakes. Ten of these 15 ruptures could be in the form of big earthquakes. These include Kishtwar in Jammu (a probable Mw8.4), Nahan in Himachal Pradesh (Mw8.4), Almora in Uttarakhand (Mw8), the Central Gap stretching from east Uttarakhand to central Nepal (Mw8.5-8.7), Sikkim (Mw8.4), West Bhutan (Mw8.4) and Arunachal (Mw8.2).

Rajendran uses a banking metaphor to describe the inevitability of a big Himalayan earthquake. "It's like you are putting money in your savings account and never taking it out. So it gets accumulated. In central Himalaya, you have had very little release of that kind of energy. Not to speak of the smaller ones like the Uttarkashi and the Chamoli earthquakes. They were all moderate earthquakes, which accounts for only 5-10% of the total stress accumulation. So in order to release this kind of stress that has been built up over centuries, you need to have a massive earthquake," he says.

Some Himalayan observers are trying to understand the mechanisms that underpin the two types of Himalayan earthquakes: the "blind" failed ones and the big "complete rupture" ones. The point is to try and map whether Himalayan earthquakes follow something like a "super-cycle" of blind earthquakes followed by big earthquakes, and prepare accordingly.

Luca Dal Zilio is a geophysicist at the California Institute of Technology's (Caltech's) seismological laboratory. Along with fellow researchers, he co-authored a paper in *Nature Communications* in 2019 titled *Bimodal Seismicity In The Himalaya Controlled By Fault Friction And Geometry*. On the basis of a two-dimensional seismic cycle model of the Nepal Himalaya, the study finds that moderate earthquakes begin a process that "leads up to a final complete failure of the MHT". These are the mega earthquakes.

"These simulations illuminate two puzzling features of the Himalayan seismicity: how large yet blind earthquakes (Mw7+) tend to cluster in the deeper part of the MHT, whereas infrequent great earthquakes (M8.5+) propagate up to the MFT," says Dal Zilio on email.

This has grim implications for both Himalayan cities and villages as well as for cities on the Gangetic plain. "The violence of shaking is about the same in a Mw8.6 and a Mw7.8 earthquake, but the duration can be five-eight times longer in a large Himalayan earthquake. The difference between 1 minute of shaking and 5 minutes of shaking is that many more structures will be damaged. It is probable that significant liquefaction will occur in the Ganges plain as it did in the

1934 earthquake," says Bilham. He writes in his survey that Himalayan earthquakes so far have mostly occurred in daylight hours, preventing mass casualties. Over 200,000 people might die if a big earthquake were to strike at night in a heavily populated segment of the Himalaya, like the Almora/Dehradun segment.

“The MFT is approximately 220-250km from Delhi," says Dan Zilio, adding, “I personally believe that the seismic gap in the region of the 1803 and, in particular, the 1505 events are the most important ones because they are closer to Delhi, they are capable of generating large events, and they did not experience any large earthquakes over the last two centuries (or even longer for the 1505)."

Are we ready?

When Sujoy Das heard of the destruction of the village of Kaule due to the Gorkha earthquake, he raised 20 lakh in relief funds for the village. Three weeks after the earthquake, he flew back to Nepal, with Ashish Sharan Lal, a Kolkata-based conservation architect who often treks with Das’ company. The two made their way to the village in the devastated Langtang region. “It was the third week of May and the monsoon was coming and they said we have no houses. We used the money to build makeshift roofing for their houses, so they could see out the monsoon," says Das.

But Lal wanted to do more. “We decided that let’s take one house and reconstruct it from scratch. And in the process of doing that, educate ourselves and the village how to construct houses that can withstand seismic forces," he says. In doing so, he decided to use only local materials, which were readily available and which the locals were used to working with.

“They already knew how to build stone walls, how to use mud," he says. “We covered the gap in knowledge about construction provisions that can handle seismic forces." Like using bamboo to construct the frame of the house. “Most of these houses are two floors. The stone walls and gables went right up. And those are the ones which fell on the first floor. So the upper- floor gables crashed on the floor and then the floor gave way and the whole thing crashed on the ground floor," says Lal. The new house was made from treated bamboo, and better-engineered stone walls that were restricted to the lower floor. “We made the upper floor using an engineered bamboo frame with bamboo panels plastered in mud. In terms of appearance, it was the same, but bamboo is a very resilient material. It will bend but it will not break."

The house was called the Kaule Prototype and in 2017 the Nepal government included the design in its Earthquake Resistant Design Catalogue. The prototype won Lal’s firm and his collaborators Areen Attari and Manu Narendran the 2017 Hudco (Housing and Urban Development Corporation) Design Awards for Disaster Resistant Self-Help Housing. Lal wishes the Indian agency hadn’t stopped at the award. “I would have expected them to initiate some kind of project based on the award," he says.

Planning for disaster resilience, especially for earthquakes, presents a glaring gap in Indian preparedness. Rajendran says floods are more frequent than earthquakes, and in terms of Himalayan planning, the government doesn’t pay any attention to those, let alone earthquakes. “Look at the destruction caused by the 2013 Uttarakhand floods. Most of this was because of construction on the floodplain. So when you are talking about an infrequent earthquake, you can imagine!" he exclaims.

Last September, the National Disaster Management Authority (NDMA) published an Earthquake Disaster Risk Index (Edri) report. It looks specifically at 50 cities, which includes the metros and cities in seismic zones IV and V (the two most active regions in India). Of the cities surveyed, 30

cities (including Delhi) are at medium-level risk and 13 (mostly Himalayan cities, including Shimla) at high risk.

Architect and urban planning expert Garima Jain is a consultant with the Bengaluru-based Indian Institute for Human Settlements (IIHS) and specializes in what she calls the geography of urban risk. Speaking on the phone from New York, Jain says places like Shimla are unregulated “time bombs".

Such cities are becoming more dense and precarious by the day and are extremely exposed to risks as a result. “There are all sorts of multi-storeyed buildings, with blatant violation of building by-laws. The high court in Shimla is an 11-storeyed structure on the edge of a hill! Even though buildings there aren’t allowed to go beyond one or two floors, they received an exception for the high court," says Jain. Certain parts of Shimla, like Sanjauli, are so dense that “people there say that if you have to take a dead body out, you have to take it through the window of one house to the next and so on because there is not enough space between the buildings for sufficient turning radius".

The only thing to do in such densely built-up areas is to come up with evacuation routes. “It’s called safe failure. The buildings may fail but at least the loss of lives might still be minimized," she says. As soon as there is a tremor, people can follow predefined routes to reach open ground. Beyond that, and insurance, there’s not much else that can be done.

A city on the Gangetic plain, like Delhi, has its own problems, emblematic of Indian cities in seismically active zones in general. Jain had studied Delhi’s disaster risk in terms of large-scale infrastructure and real estate in a 2012 report. “The bulk of the city is self-constructed, without technical inputs. Which makes it not resilient at all to shocks," she says.

It’s the Capital’s largely unregulated built environment and density of population that makes it vulnerable to seismic forces. No more than 10% of Delhi’s buildings are actually designed structures, says Jain. Most are self-constructed structures, JJ (slum) clusters, unauthorized colonies, resettlement colonies, urban villages and regularized unauthorized colonies. “In terms of exposure and vulnerability, cities like Delhi, which are denser, have more population, have older structures, they may actually even have greater losses than other smaller cities," she says. Buildings with “soft-storeys", i.e. with pillars on the ground floor for parking, are at great risk of collapse. These need to be retrofitted quickly, says Jain.

She suggests better enforcement of building by-laws, the formation of a council for structural engineers to better fix accountability, and earthquake-resistant retrofitting of old and self-built structures as possible preventative measures. However, says Jain, these are slow processes and people from weaker socioeconomic sections may not have the wherewithal for them. Again, well mapped out evacuation routes and trained rescue response teams would be of great help, as would educating people to invest in financial instruments like multi-hazard insurance schemes to cover residual risks.

Again, it is the Gorkha earthquake which provides an example of what can go wrong. Three days after the earthquake, Jain had gone to Nepal as part of an IIHS damage assessment team. “If you saw the news, it looked like the entire city of Kathmandu had been flattened. That wasn’t the case," she says. Newly-built houses with soft-storeys had collapsed. The low-lying parts of the city, with softer soils, had liquefied. “Many of the buildings, due to the lack of planning guidelines, were built partly on natural drainage channels. They were practically cut in half. Like half the building just sunk and went down," she says, adding: “Those are the kinds of buildings which had the biggest loss of lives. When the building just sinks, it doesn’t take that long."

The people living in these buildings probably didn't even have time to register that an earthquake was upon them. This is a scenario that may well be repeated in India if the lessons of Himalayan earthquakes are ignored. Earth's tectonic forces move in geological time frames that are impossible to imagine but when the ground shrugs, the effects are instantaneous.It's impossible to predict when the megaquake will come, though we keep our eyes peeled for signs. It may come tomorrow, or in a few hundred years. But come it will, sooner rather than later. We had better be ready.

END

Source : www.thehindu.com Date : 2020-07-13

SURE POWER: THE HINDU EDITORIAL ON INDIA'S SOLAR STRATEGY

Relevant for: Geography | Topic: Distribution of Key Natural Resources - Energy Resources of the World

Prime Minister Narendra Modi's stated resolve to tap the energy of the sun to substantially power the economy and everyday life is to be welcomed, because it could help chart a green deal for the future. He restated the case for greater reliance on solar power, for energy and as a path for self-reliant industrialisation, at the inauguration of a 750 MW photovoltaic project at Rewa, in Madhya Pradesh last week. But as he would recognise, the idea of building a domestic solar manufacturing industry that delivers increasing volumes of quality photovoltaic cells, modules and associated equipment is long in the tooth. India's installed base of this green power source is about 35 gigawatts (GW), and its projected addition of capacity until 2024 in a COVID-19 affected future is estimated by the industry to be of the order of 50 GW. Viewed against the goals set five years ago for the Paris Agreement on climate, of installing 100 GW of solar power by 2022, there could be a sharp deficit. Combined with low domestic cell manufacturing capacity at 3.1 GW last year, and heavy reliance on China, high ambition must now be supported by aggressive official policy. The Chinese story is one of a steady rise from insignificant manufacturing capability in the 1990s, to virtual dominance through active government support in identifying and acquiring top technologies globally, importing critical raw materials such as polysilicon, acquiring solar manufacturers abroad, and investing in third countries with ready capability. Importantly, the domestic market was treated with great importance while promoting exports.

The pandemic presents a critical opportunity for India to plan a green deal, on the lines of what the EU has committed itself to: that future growth and employment should align itself to environmental and sustainability objectives, particularly in energy production, away from dirty fuels such as coal. There is no better time than now to make solar energy a strategic sector, giving it as much importance as defence. As the architect of the International Solar Alliance, which attracted about 120 nations at its launch, India needs to show leadership to advance the manufacture and absorption of solar photovoltaic infrastructure in low- and middle-income countries. The key requirements are integrated policies fully supported by States. Industry must get help to set up facilities and avail low cost financing — both important elements in China's rise — and be able to invest in intellectual property. A forward-looking programme should also look at emerging trends in deploying solar innovatively. These include newer technologies such as aesthetic photovoltaic window and roof tiles for buildings, multi-role urban structures, and greater use of residential and commercial buildings to deploy more panels. Rapid progress requires a strategic shift to aid competitive domestic manufacturing.

END

Source : www.thehindu.com Date : 2020-07-16

INDIA’S POPULATION MAY PEAK BY 2047

Relevant for: Geography | Topic: Demography of the World - Growth of Population

When this century ends, India may no longer be a country of a billion, says a projection that appears in the online edition of the *Lancet* on Wednesday.

At the current rate of growth, India's population is likely to peak by 2047 at about 1.61 billion and then decline to 1.03 billion by 2100. However, were it to meet UN Sustainable Goal Development targets, the peak would be earlier and see a population decline to 929 million.

Conventional wisdom is that though a decline in population is expected, it is expected to begin only around 2046 and that fall, according to the latest 2019 assessment by the United Nations Development Programme calculation, is expected to see India’s population settle at a little over 1.4 billion, though this too ranges from 2.1-0.9 billion

Access to contraception

The sharper fall, say the group of scientists who are affiliated to the Institute of Health Metrics and Evaluation at the University of Washington, is due to the assumption that all women globally will have have much higher access to contraception and education.

This scenario will lead to a sharper reduction in the Total Fertility Rate, a metric that shows on average how many children a women must have to keep replenishing population. A TFR lower than 2.1, it is said, leads to a decline in a country’s population.

The UNPD forecasts assume that all countries mirror the trend in selected low-fertility countries in Europe, east and southeast Asia, and North America, where the TFRs converge towards a level of approximately 1·75.

“In our model, in a population where all females have 16 years of education and 95% of females have access to contraception, the global TFR was projected to converge to 1·41 (1·35–1·47). The difference between a convergent TFR of 1·75 or 1·41 is profound,” the study said.

Seen this way, they argue, world population is expected to peak by 2061 at 9.73 billion and by 2100 dip to 8.79 billion. However, the UNDP forecasts about 10.8 billion by then.

Nigeria to grow

India will, however, remain the most populous country. The five largest countries in 2100 (are projected) to be India, Nigeria, China, the U.S. and Pakistan.

However, these forecasts showed different future trajectories between countries.

“Nigeria is forecast to have continued population growth through 2100 and was expected to be the second most populous country by then,” the study added.

END

Source : www.pib.gov.in Date : 2020-07-16

INFORMATION FROZEN IN MAGNETIC MINERALS CAN FORECAST CLIMATIC CHANGES FASTER & MORE ACCURATELY

Relevant for: Geography | Topic: Climate and Weather & Changes in Climate

Clues to climate change in the past are found in fossils, micro-organisms, gases trapped in ice and isotopes, but the laboratory techniques are cumbersome, costly, and time-consuming. Indian scientists have now unraveled a technique using magnetic minerals that is rapid and efficient.

Scientists from the Indian Institute of Geomagnetism (IIG), an autonomous institute of the Department of Science & Technology, Government of India, have tracked Climate change by following the Paleomonsoonal pattern of the subcontinent by harnessing magnetic mineralogy, a technique that is faster and more accurate than existing methods. Magnetic mineralogy is sensitive to changes in ambient chemical and physical processes that result in concentration, grain size, and mineralogy changes.

In the study published in the Sage Journal, Mr. Praveen Gawali and his team of researchers collated and conducted climatic and environmental studies by collecting sediment samples from different environments and climatic domains of India to glean out the information frozen in magnetic minerals in the form of magnetic parameters like magnetic susceptibility, anhysteretic remnant magnetization, saturation induced remnant magnetization, hysteresis loops and curie temperature.

Climate-related studies are carried out with the help of several proxies like fossils, microorganisms, gases trapped in ice, isotopes, and many others. They, however, take inordinate time and efforts to segregate from the original material, and the laboratory techniques are cumbersome. Additionally, the material needed for carrying out different measurements is quite vast. The instruments are also very costly. Indian monsoon and its variabilityhas been studied through different continental (tree rings, paleosols, speleothems, fluviolacustrine sediments, peat deposits, microfossils, magnetic minerals, etc.) and oceanic (foraminifers, isotopes, isotope ratios, organic content of sediments, etc.) proxies. The IIG Scientists used changes in properties of magnetic minerals for their research in India’s Paleomonsoonal pattern, which is a comparatively new technique applied in our country.

The study of these changes unravels physicochemical regime operative in the past, helping to gauge the then prevalent climate pattern. The magnetic minerals are sensitive to physical and chemical environment that they are embedded in. These external changes bring about modifications in the innate structure of these magnetic minerals, transitioning them from one magnetic phase to another. In this process, the magnetic mineralogy also changes, for example, from magnetite to hematite and vice versa. There are also some intermediate phases that draw the attention of the researchers to complex climatic conditions prevalent over a period of time

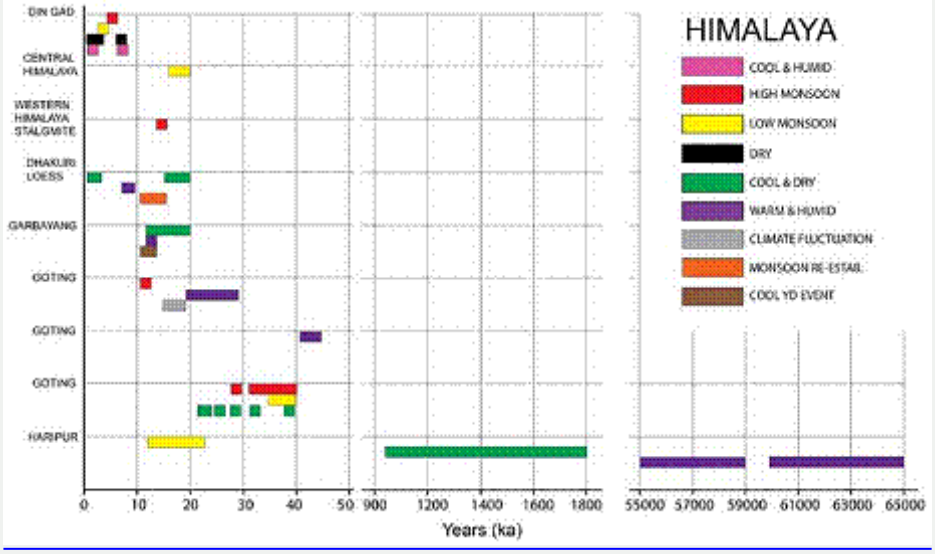
strictly from these magnetic phases.

Generally, the parent rocks from where the sediments are derived do not contain magnetic minerals that are more than 1% by total volume or weight of those rocks. The concentration of magnetic minerals is very low in sediments. However, this is sufficient to carry out climatic studies since these minerals reveal the true nature of climatic and environmental conditions prevalent at the time of their deposition. Once the instruments are installed in a lab (compared to other instruments, these are quite inexpensive), the overhead and maintenance charges are quite moderate, making the measurements, over the years, quite cheap. Additionally, the time taken is also very less. One of the magnetic parameters of a few hundred samples can be measured in a day. All these factors triggered interest at IIG to carry out climatic studies with the help of magnetic minerals.

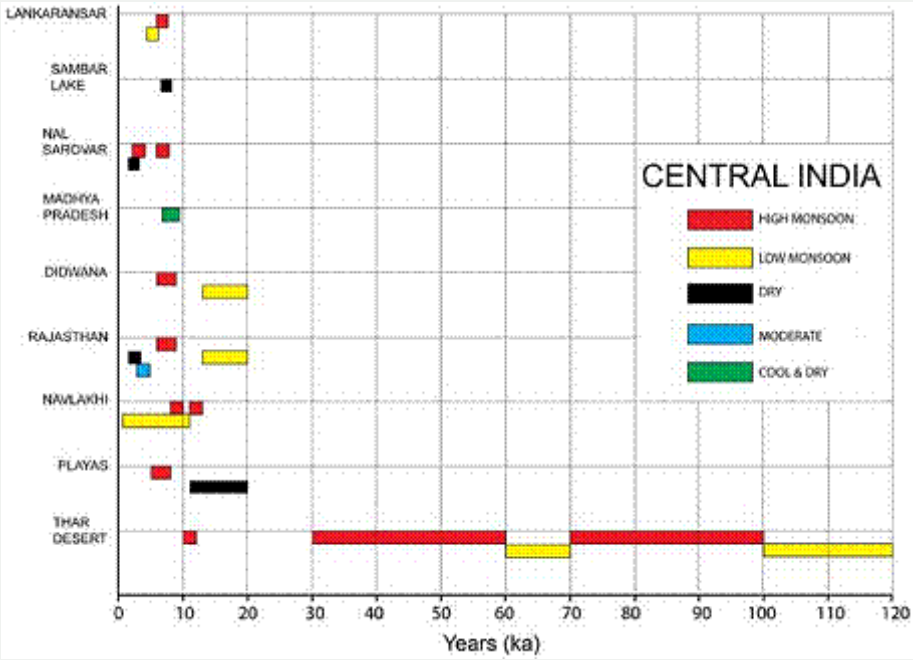
The mineral magnetic studies have unraveled 4 regional climatic features encompassing the entire Indian subcontinent and 1 localized climatic event. Higher monsoon precipitation in the western part of India between 25-60 ka (thousand years) was shown to be analogous with glacial melt in the Himalayas between 29 and 18 ka. Later, the weakening of monsoon was inferred in the Himalayas, and the hinterland of Arabian sea between 20 and 15 ka, analogically cold, and dry conditions were prevalent at Dhakuri, which led to the formation of loess deposits starting from 20 ka. The monsoon intensification is deciphered in the western and eastern part of India between 13 and 10 ka with major implications in the hinterlands of the Arabian Sea and Bay of Bengal. Between 4 and 2.5 ka, Holocene aridity and weakened monsoon was inferred to be prevalent across the subcontinent. The localized feature of Younger Dryas cooling seems to be confined to just the upper reaches of the Himalaya.

Climate is changing at a rapid pace, impacted by natural and anthropogenic activity. The research will help forecast climatic changes with more accuracy and speed.

The forecast of this change has to be accurate and high levels of accuracy can be achieved if we go very far back in time. Thus the present study by IIG with the help of sediments and the accuracy with which the magnetic minerals freeze the environmental and climate conditions will help to screen many different domains in a much faster speed and with high levels of accuracy.



Climatic changes seen across the Himalayan region reveal episodes of monsoonal fluctuations and temperature changes (depiction of temporal changes not to scale).



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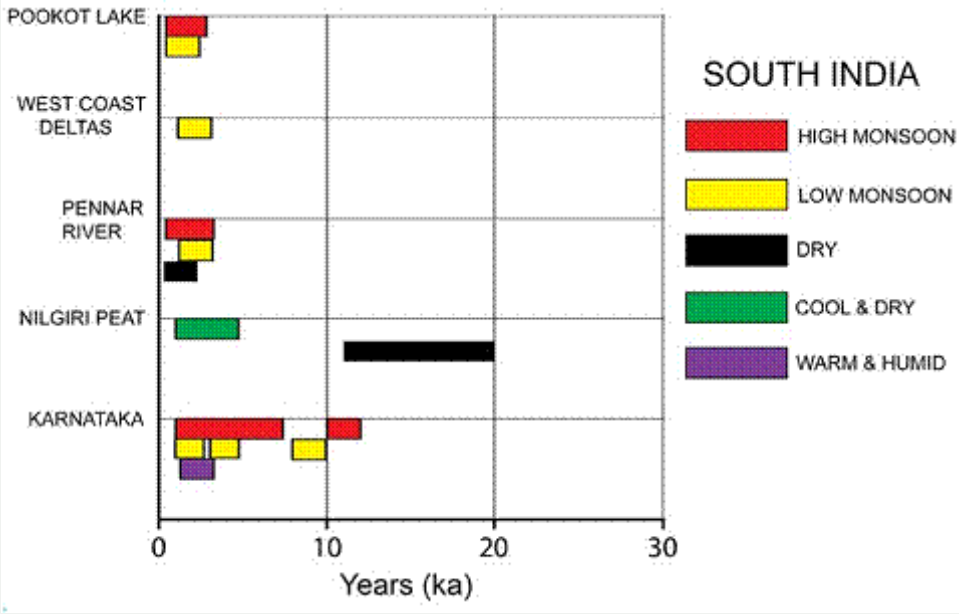

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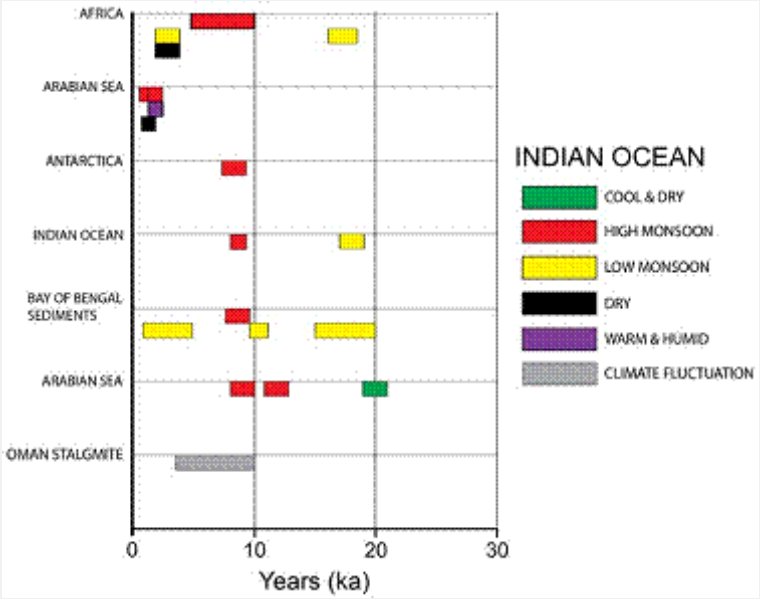

Environmental changes from the Indian Ocean and contiguous region having a bearing on the subcontinental climate (depiction of temporal changes not to scale).

[Publication link:

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For more details, Mr. Praveen Gawali (pravin@iigs.iigm.res.in) can be contacted.]

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NB/KGS/(DST Media Cell)

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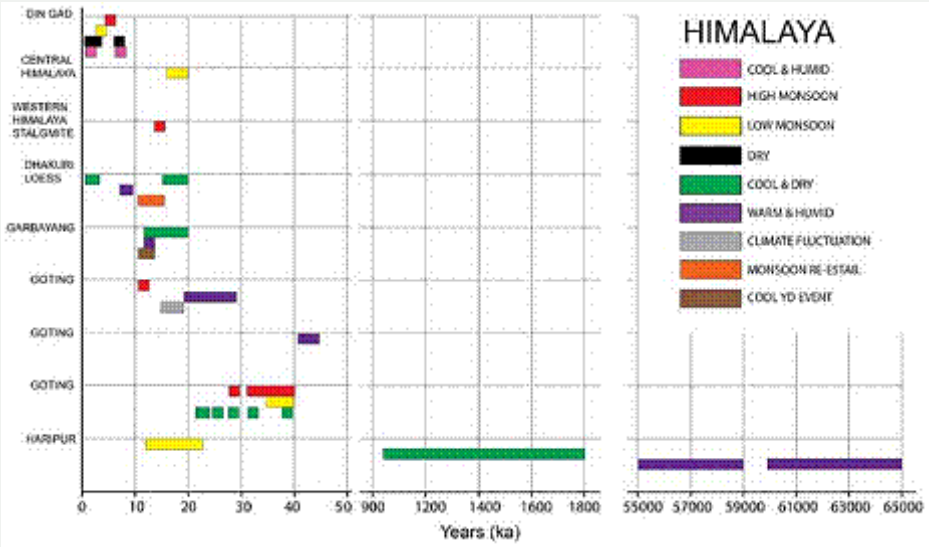

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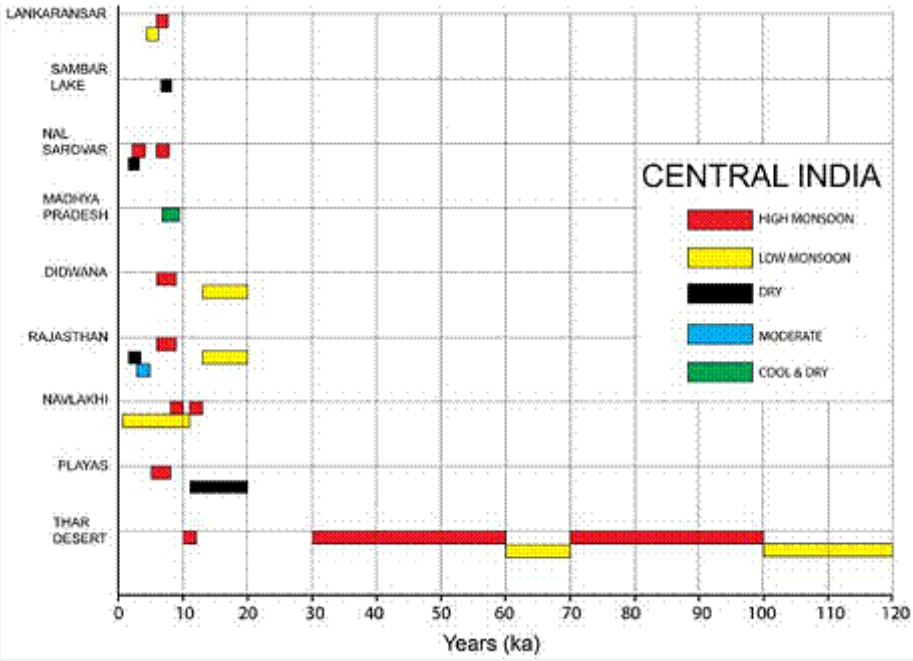

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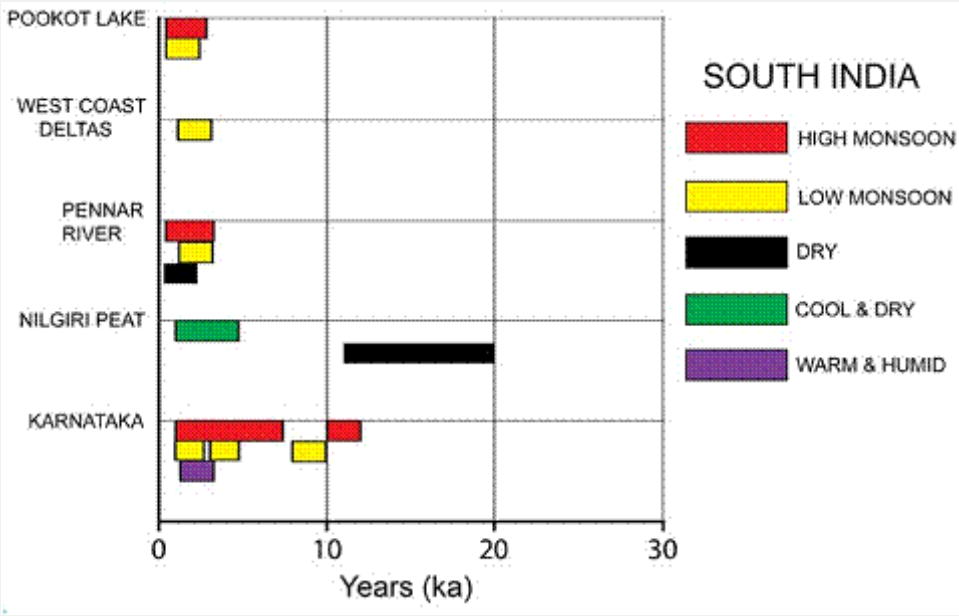

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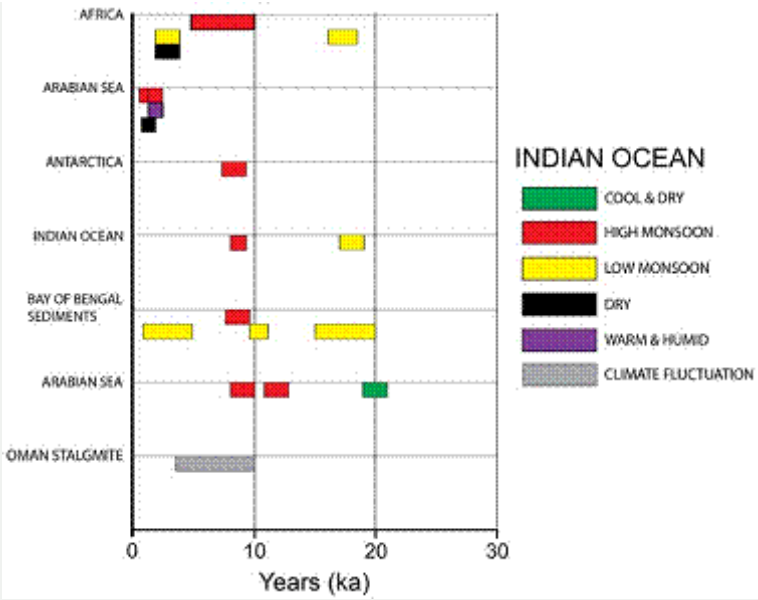

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Source : www.pib.gov.in Date : 2020-07-18

INDIA ON TRACK TO ACHIEVING THE MATERNAL MORTALITY RATIO (MMR) TARGETS FOR SUSTAINABLE DEVELOPMENT GOALS (SDG) & NATIONAL HEALTH POLICY (NHP): DR. HARSH VARDHAN

Relevant for: Geography | Topic: Demography of the World - Demographic Attributes

Union Minister of Health and Family Welfare Dr. Harsh Vardhan, speaking on the success achieved by India on the Maternal Mortality Ratio (MMR), said, “Maternal Mortality Ratio (MMR) of India has declined by 9 points in one year as per the Special Bulletin on MMR released by the Registrar General of India. The ratio has declined from 122 in 2015-17 to 113 in 2016-18 (7.4 % decline).” He highlighted that the country has been witnessing a progressive reduction in MMR from 167 in 2011-2013, 130 in 2014-2016, 122 in 2015-17, and to 113 in 2016-18.

Speaking on India’s commitment to Sustainable Development Goals, Dr. Harsh Vardhan said, “With this persistent decline, India is on track to achieving the SDG of 70/ lakh live births by 2030 and National Health Policy (NHP) target of 100/ live births by 2020. The number of states which have achieved the SDG target has now risen from 3 to 5 viz. Kerala (43), Maharashtra (46) Tamil Nadu (60), Telangana (63) and Andhra Pradesh (65). There are eleven (11) States that have achieved the target of MMR set by the NHP which includes the above 5 and the states of Jharkhand (71), Gujarat (75), Haryana (91), Karnataka (92), West Bengal (98) and Uttarakhand (99).”

Dr. Harsh Vardhan stated that three states (Punjab (129), Bihar (149), Odisha (150)) have MMR in between 100-150, while for 5 states namely, Chhattisgarh (159), Rajasthan (164), Madhya Pradesh (173), Uttar Pradesh (197) and Assam (215), MMR is above 150.

Dr. Harsh Vardhan congratulated the states of Rajasthan (which has shown the maximum decline of 22 points), Uttar Pradesh (19 points), Odisha (18 points) Bihar (16 points) and Madhya Pradesh (15 points). He also stated that two states (Telangana and Maharashtra) have shown more than 15% decline in MMR, while 4 states namely, Odisha, Rajasthan, Andhra Pradesh, and Gujarat have shown a decline between 10-15%. Seven states viz. Karnataka, Assam, Jharkhand, Haryana, Madhya Pradesh, Uttar Pradesh, and Bihar have witnessed a decline between 5-10%.

Highlighting the efforts taken by the Union and the State/UT governments, Dr. Harsh Vardhan said, “This success can be attributed to the intensive endeavor of the government in achieving impressive gains in institutional deliveries as well as focusing on quality and coverage of services under NHM through various schemes such as Janani Shishu Suraksha Karyakram, Janani Suraksha Yojana, and newer initiatives like LaQshya and Pradhan Mantri Surakshit Matritva Abhiyan. Government of India also envisages rolling out the overarching SUMAN initiative including the midwifery initiative, assuring delivery of maternal and newborn healthcare services encompassing wider access to free and quality services, zero tolerance for denial of services along with respectful maternity care.”

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MV/SG

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MV/SG

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Source : www.thehindu.com Date : 2020-07-18

INDIA REGISTERS A STEEP DECLINE IN MATERNAL MORTALITY RATIO

Relevant for: Geography | Topic: Demography of the World - Demographic Attributes

The Maternal Mortality Ratio (MMR) in India has declined to 113 in 2016-18 from 122 in 2015-17 and 130 in 2014-2016, according to the special bulletin on Maternal Mortality in India 2016-18, released by the Office of the Registrar General's Sample Registration System (SRS).

One of the key indicators of maternal mortality is the MMR, defined as the number of maternal deaths per 1,00,000 live births. The target 3.1 of Sustainable Development Goals (SDG) set by the United Nations aims to reduce the global maternal mortality ratio to less than 70 per 1,00,000 live births.

The MMR of various States according to the bulletin includes Assam (215), Bihar (149), Madhya Pradesh (173), Chhattisgarh (159), Odisha (150), Rajasthan (164), Uttar Pradesh (197) and Uttarakhand (99).

The southern States registered a lower maternal mortality ratio — Andhra Pradesh (65), Telangana (63), Karnataka (92), Kerala (43) and Tamil Nadu (60).

"Maternal mortality in a region is a measure of reproductive health of women in the area. As per the World Health Organization, maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause related to or aggravated by the pregnancy or its management," noted the bulletin.

END

Source : www.thehindu.com Date : 2020-07-19

PREVIOUSLY UNKNOWN FAULTS AT THE FOOT OF THE HIMALAYA DISCOVERED

Relevant for: Geography | Topic: Mountains, changes therein and in Flora & Fauna and the Effects of such changes

Deeper look: The work highlights the need to look below the surface to fully understand earthquakes and structures within the Himalaya. | Photo Credit: John Waldron

Data from an oil and gas exploration company has now helped geologists discover a series of faults at the foot of the Himalaya. The international team notes that this fault system in the southeastern region of Nepal has the potential to cause earthquakes in the densely populated country.

The team looked at seismic reflection data, which are routinely collected by exploration companies looking for oil and gas. In this method, seismic waves are produced by small explosions at multiple sources, and many recorders called geophones record the sound echoing off layers beneath the surface.

The signals are combined to make an image that looks like a slice showing layers through the top few kilometres of the Earth's crust. The researchers were able to identify the faults because the pattern of layers showed bends.

"Our research highlights the need to look below the surface, and further afield, to fully understand earthquakes and structures within the Himalaya," said Michael J. Duvall a graduate student from the Department of Earth and Atmospheric Sciences at the University of Alberta, Canada, in a release. "This network of faults show that the Himalayan deformation reaches further [about 40 kilometres further south] than we previously thought." He is the first author of the paper recently published in the journal *Proceedings of the National Academy of Sciences.*

When asked if this fault could affect India, corresponding author John W.F. Waldron explained in an email to *The Hindu:* "The faults we detected don't appear to extend into India, but seismic waves from an earthquake occurring on them might affect regions of India near the border... other similar faults might be present elsewhere along the southern edge of the Himalaya and might extend beneath northern India. We don't currently have access to data that would help us explore this."

He adds that the study is at a preliminary stage and work with seismologists might add to the present study by clarifying how these faults move.

"The problem is that good scientific records of earthquakes go back less than a hundred years. During this time there don't seem to have been any earthquakes on the faults that we discovered. However, the time between earthquakes on typical faults is often hundreds or thousands of years, and is very haphazard," explains Prof. Waldron.

As to whether 2015 Nepal earthquakes could have had a connection to this fault, he answered that they "occurred much further within the mountain belt where we have known for many years about faults. As far as we know, the faults we newly discovered did not move in that event."

Prof. Waldron adds: "General earthquake preparedness is most important in my opinion, rather than trying to guess where the next earthquake will be. Making sure buildings are safe in an

earthquake is probably the most important factor."

END

Source : www.thehindu.com Date : 2020-07-23

HUMANS LIVED IN AMERICA 30,000 YEARS AGO, FAR EARLIER THAN THOUGHT: STUDY

Relevant for: Geography | Topic: The Earth, its Evolution and Origin of Life on Earth

The team carefully sampling the different cultural layers in the cave. | Photo Credit: Devlin A. Gandy/ www.joh.cam.ac.uk

Stone tools unearthed in a cave in central Mexico and other evidence from 42 far-flung archeological sites indicate people arrived in North America earlier than previously known, upwards of 30,000 years ago.

Scientists said on Wednesday they had found 1,930 limestone tools, including small flakes and fine blades that may have been used for cutting meat and small points that may have been used as spear tips, indicating human presence at the Chiquihuite Cave in a mountainous region of Mexico's Zacatecas state.

The tools spanned from 31,000 to 12,500 years old, said archaeologist Ciprian Ardelean of Universidad Autnoma de Zacatecas in Mexico, lead author of one of two studies published in the journal *Nature*. The site was occupied periodically for millennia by nomadic hunter-gatherers.

In the second study, evidence from 42 sites around North America and the location of a land bridge that connected Siberia to Alaska during the last Ice Age indicated human presence dating to at least a time called the Last Glacial Maximum, when ice sheets blanketed much of the continent, about 26,000 to 19,000 years ago and immediately thereafter.

The research also implicated humans in the extinctions of many large Ice Age mammals such as mammoths and camels.

Our species first appeared about 3,00,000 years ago in Africa, later spreading worldwide. The new findings contradict the conventional view that the first people arrived in the Americas around 13,000 years ago, crossing the land bridge, and were associated with the “Clovis culture,” known for distinctive stone tools.

The findings suggest low numbers of people entered the continent earlier than previously understood — some perhaps by boat along a Pacific coastal route rather than crossing the land bridge — and some died out without leaving descendants.

Archaeological scientist Lorena Becerra-Valdivia of the University of Oxford in England and the University of New South Wales in Australia said the continent's populations then expanded significantly beginning around 14,700 years ago. “The peopling of America was a complicated, complex and diverse process,” Ardelean said. “These are paradigm-shifting results that shape our understanding of the initial dispersal of modern humans into the Americas.”

END

Source : www.livemint.com Date : 2020-07-26

USA: VIRUS-WEARY TEXAS HIT BY CATEGORY 1 HURRICANE HANNA

Relevant for: Geography | Topic: Important Geophysical Phenomenon - Tropical Cyclones

CORPUS CHRISTI : Hurricane Hanna roared ashore onto the Texas Gulf Coast as a Category 1 storm on Saturday, bringing winds that lashed the shoreline with rain and storm surge, and even threatening to bring possible tornadoes to a part of the country trying to cope with a spike in coronavirus cases.

The first hurricane of the 2020 Atlantic hurricane season made landfall twice on Saturday afternoon within the span of little over an hour. The first landfall happened at around 5 p.m. about 15 miles (24 kilometers) north of Port Mansfield, which is about 130 miles (209 km) south of Corpus Christi and about 70 miles (113 km) north of Brownsville. The second landfall took place at around 6:15 p.m. in eastern Kenedy County, about 15 miles (24 km) north-northwest of Port Mansfield. As of Saturday evening, it had maximum sustained winds of 90 mph (145 kph).

Many parts of Texas, including areas near where Hanna came ashore, have been dealing with a surge in coronavirus cases in recent weeks, but local officials said they were prepared for whatever the storm might bring.

Corpus Christi Mayor Joe McComb said Saturday that he had seen some residents doing last-minute shopping for supplies, but he warned that if that hadn't been done already, people should stay at home and ride out the storm.

“We’ve been staying at home for five months because of the corona(virus). ... So staying home doesn’t sound real popular, but right now this is a real important matter," McComb said, adding that residents should remember to wear masks if they have to evacuate their homes.

Steady rain fell Saturday in Corpus Christi and the winds got stronger.

Sherry Boehme, who lives in a condo along the beach there, said the storm’s approach had increased the anxiety she has felt during the pandemic. The 67-year-old has mostly stayed at home because of health issues related to chronic lung disease.

“It’s almost like a double whammy to us," Boehme said Saturday by phone. “I think it’s made a lot of people nervous. ... We'll get through it. Everybody is good and strong and sticks together."

Boehme said she’d already felt 60 mph wind gusts at her condo and had seen a surge of water coming from the bay. Most people seemed to be staying home, as traffic was light, she said.

Judge Barbara Canales, Nueces County's top elected official, said officials were highly concerned about storm surge that was already moving inland. Live webcam footage showed waves sweeping over popular Whitecap Beach near Corpus Christi hours before the hurricane was expected to make landfall.

First responders in Corpus Christi proactively placed barricades near intersections to have them ready to go if streets began to flood, McComb said. More than 35,000 people throughout South Texas, including Corpus Christi, Harlingen and Brownsville, were without power early Saturday evening, according to AEP Texas.

Corpus Christi is in Nueces County, where health officials made headlines when they revealed that 60 infants tested positive for COVID-19 from July 1 to July 16.

Farther south in Cameron County, which borders Mexico and where Brownsville is located, more than 300 confirmed new cases have been reported almost daily for the past two weeks, according to state health figures. The past week has also been the county's deadliest of the pandemic.

The main hazard from Hanna was expected to be flash flooding. Forecasters said Hanna could bring 6 to 12 inches (15 to 30 centimeters) of rain through Sunday night — with isolated totals of 18 inches (46 centimeters) — in addition to coastal swells that could cause life-threatening surf and rip current conditions.

Coastal states scrambled this spring to adjust emergency hurricane plans to account for the virus, and Hanna loomed as the first big test.

South Texas officials' plans for any possible rescues, shelters and monitoring of the storm will have the pandemic in mind and incorporate social distancing guidelines and mask wearing.

Gov. Greg Abbott said Saturday that some sheltering would take place in hotel rooms so people could be separated.

"We cannot allow this hurricane to lead to a more catastrophically deadly event by stoking additional spread of COVID-19 that could lead to fatalities," Abbott said.

Various resources and personnel to respond to the storm were on standby across the state, including search-and-rescue teams and aircraft. Mobile teams that can continue testing for COVID-19 were also being deployed.

Abbott said he has issued a disaster declaration for 32 counties in Texas and had asked the federal government to approve a similar declaration.

Tornadoes were also possible Saturday for parts of the lower to middle Texas coastal plain, forecasters said. A hurricane warning remained in effect for Port Mansfield to Mesquite Bay, which is north of Corpus Christi, and a tropical storm warning was in effect from Port Mansfield south to Barra el Mezquital, Mexico, and from Mesquite Bay north to High Island, Texas.

Mexico's northeasternmost states, coastal Tamaulipas and Nuevo Leon just to its west, also took precautions ahead of the storm's arrival. Tamaulipas was preparing shelters and disinfecting them to try to avoid spreading COVID-19, the state's governor, Francisco Cabeza de Vaca, tweeted. Meanwhile, the civil protection department was sending rescue boats and other equipment to northern Nuevo Leon because heavy rains were expected.

David León, the national director of the civil protection department, told Milenio TV on Saturday that as many as 800 shelters could be activated in the parts of Mexico that could be affected by Hanna.

In the Mexican city of Matamoros, which is in Tamaulipas and across the border from Brownsville, Texas, volunteers were keeping a close eye on Hanna, worried that the storm could affect a makeshift migrant camp near the Rio Grande where about 1,300 asylum seekers, including newborn babies and elderly residents, have been waiting under the U.S. immigration policy informally known as "Remain in Mexico."

Meanwhile, a Pacific Ocean hurricane, Douglas, was heading toward Hawaii on Saturday. Douglas was expected to be near the main Hawaiian Islands late Saturday night and will move over parts of the state Sunday and Monday. A hurricane warning was in effect for Oahu County.

And back in the Atlantic, the remnants of Tropical Storm Gonzalo were expected to move westward across the southern Caribbean for the next couple of days. Gonzalo was forecast to bring 1 to 2 inches (3 to 5 centimeters) of rain. Watches or warnings were no longer in effect.

END

Source : www.pib.gov.in Date : 2020-07-26

SEISMICITY STUDY OF ARUNACHAL HIMALAYA REVEALS LOW TO MODERATE EARTHQUAKES AT 2 CRUSTAL DEPTHS

Relevant for: Geography | Topic: Important Geophysical phenomena - Earthquakes, Tsunamis & Volcanoes

The exhumation and growth of the Himalaya is a continuous process that results predominantly from reverse faults in which the rocks on the lower surface of a fault plane move under relatively static rocks on the upper surface, a process called underthrusting of the Indian plate beneath its Eurasian counterpart. This process keeps modifying the drainage patterns and landforms and is the pivotal reason for causing an immense seismic hazard in the Himalayan mountain belt and adjoining regions, necessitating assessment and characterization of earthquakes in terms of cause, depth and intensity before construction activities are initiated.

The Tuting-Tidding Suture Zone (TTSZ) is a major part of the Eastern Himalaya, where the Himalaya takes a sharp southward bend and connects with the Indo-Burma Range. This part of the Arunachal Himalaya has gained significant importance in recent times due to the growing need of constructing roads and hydropower projects, making the need for understanding the pattern of seismicity in this region critical.

A study by the Wadia Institute of Himalayan Geology (WIHG) an autonomous institute of the Department of Science & Technology (DST), Government of India, exploring the elastic properties of rocks and seismicity in this easternmost part of India revealed that the area is generating moderate earthquakes at two different depths. Low magnitude earthquakes are concentrated at 1-15 km depth, and slightly higher greater than 4.0 magnitude earthquakes are mostly generated from 25-35 km depth. The intermediate-depth is devoid of seismicity and coincides with the zone of fluid/partial melts.

The crustal thickness in this area varies from 46.7 km beneath the Brahmaputra Valley to about 55 km in the higher elevations of Arunachal, with a marginal uplift of the contact that defines the boundary between crust and the mantle technically called the Moho discontinuity.

This, in turn, reveals the underthrusting mechanism of Indian plate in the Tuting-Tidding Suture Zone. Extremely high Poisson’s ratio was also obtained in the higher parts of the Lohit Valley, indicating the presence of fluid or partial melt at crustal depths. This detailed assessment of seismicity in this region will be helpful for planning any largescale construction in this region in the future.

The team of scientists led by Dr. Devajit Hazarika installed 11 broadband seismic stations along the Lohit River Valley of Arunachal Himalaya to understand the elastic properties of rocks and seismicity in this easternmost part of India, a study that has been published in the ‘*Journal of Asian Earth Sciences’.*

In the present study, the WIHG team used both teleseismic (earthquakes that occur more than 1000 km from the measurement site)and local earthquake data with the help of seismometers having a flat velocity response for the frequency range of 0.004-35 Hz. Data were continuously recorded at 20 samples per second, and the Global Positioning System (GPS) receivers were used for time synchronization. The study which used teleseismic and local earthquake data procured during January 2007-June 2008 has helped map underthrusting in this easternmost part of the country and can not only help plan construction but also improve earthquake preparedness in the area.

(Publication link:

https://doi.org/10.1016/j.jseaes.2019.104099)

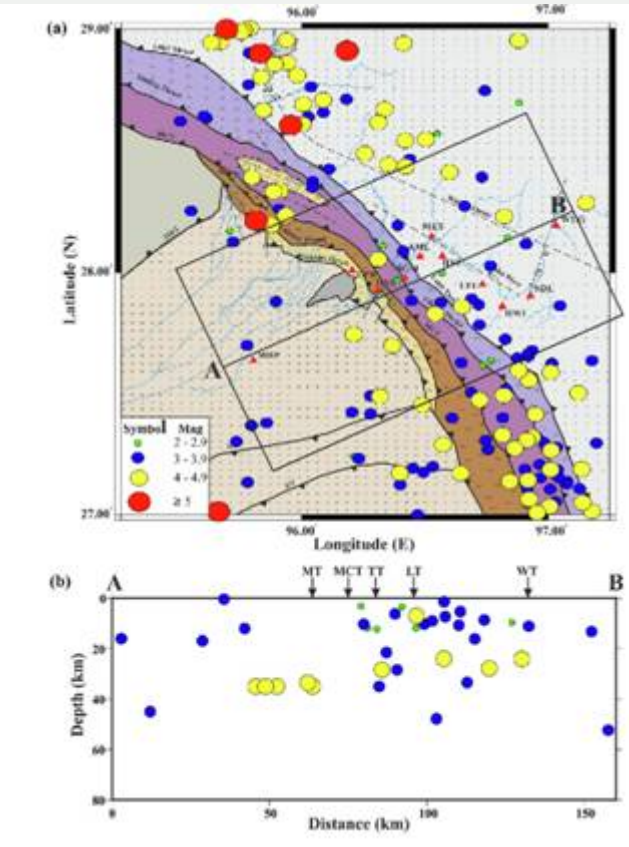

Fig. Spatial distribution of seismicity in and around the Tidding Suture Zone based on the earthquakes recorded by 11 broadband seismological stations (red triangles) during 2007–2008 and data obtained from the reviewed catalogue of the International Seismological Centre (ISC) for the period 1950–2016 (http://www.isc.ac.uk). Depth distribution of the earthquakes near the study profile marked by rectangular areas on either side of the AB profile is shown in (b). The main tectonic features marked on the profile are Mishmi Thrust (MT), Main Central Thrust (MCT), Tidding Thrust (TT), Lohit Thrust (LT), and Walong Thrust (WT).

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NB/KGS/(DST Media Cell)

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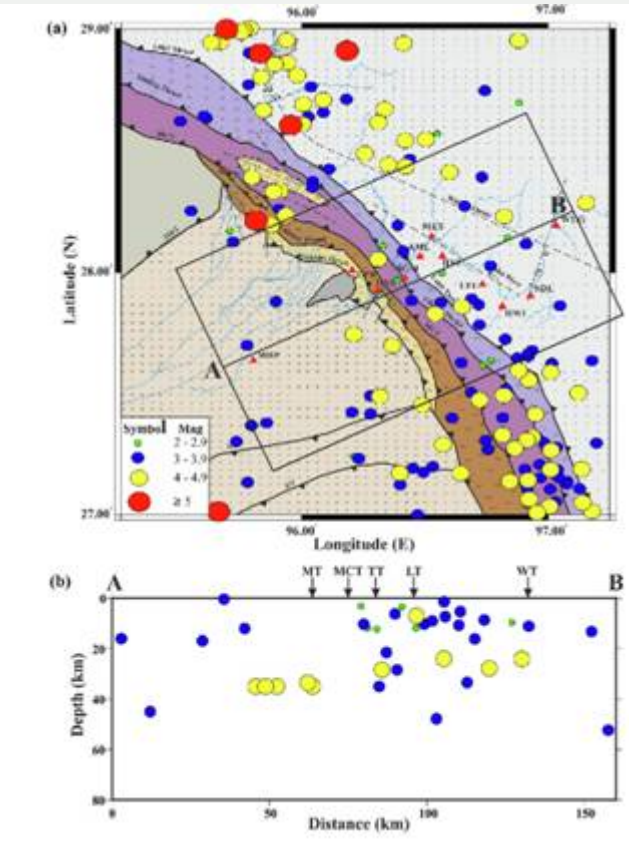

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