

# Science AMA Series: Scientists are on board the R/V JOIDES Resolution for two months to explore the story of climate change and of times past (paleoclimatic changes), AMA!

IODP <sup>1</sup> and r/Science AMAs<sup>1</sup>

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## Abstract

The International Ocean Discovery Program (IODP) conducts scientific ocean drilling expeditions throughout the world's oceans in search of clues to Earth's past. The current expedition is Expedition 359: Maldives Monsoon, aboard the U.S. vessel for scientific ocean drilling, the JOIDES Resolution [www.joidesresolution.org](http://www.joidesresolution.org). On this expedition we are exploring the story of climate change and of times past (paleoclimatic changes). Using core samples from off the coast of the Maldives the scientists aim to reconstruct paleoceanographic evolution over the past 23 million years. Drilling will provide cores required for reconstructing changing current systems through time that are directly related to the evolution of the Indian monsoon. As such the drift deposits will provide a continuous record of Indian monsoon development in the region. One important outcome of Expedition 359 is ground-truthing the hypothesis that the dramatic, pronounced change in the style of the sedimentary carbonate sequence stacking was caused by a combination of relative sea level fluctuations and ocean current system changes. The scientific objectives are to: - explore the variation in regional monsoon systems over multi-million year time scales - learn how scientists reconstruct the causes of fluctuations in ocean currents and triggers of evolution - learn how sea level respond to a warming climate - learn about magnitude and rate of past sea level change A team of 30 scientists from around the globe are on board for two months to work on these questions. Hand-in-hand with the amazing technology required to drill deep into the ocean floor, we are collecting the core samples that hold clues to answer these questions. Join us to ask us anything about this intriguing science, how we got here, what we hope to discover, and our lives on board the ship! Update: Thanks for joining us, we really enjoyed the questions. Some of us are now finished with our 12 hr shift and we're signing off. Please continue to send questions, visit our website at [www.joidesresolution.org](http://www.joidesresolution.org), follow us on twitter @TheJR, instagram [joides\\_resolution](https://www.instagram.com/joides_resolution), and like our [www.facebook.com/joidesresolution](https://www.facebook.com/joidesresolution) page!

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## ABSTRACT

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## CORRESPONDENCE:

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What are some arguments against climate change deniers. Especially: climate is changing since the beginning of time. Humans have no influence on climate

[yourmamaspenis](#)

From a geological perspective we know that climate has changed on a large scale throughout geological time and especially over the last two million years, during which we have had a succession of ice ages. So, we know the earth climate system is unstable and we also know that these climate changes have been caused by rather small changes in the solar insolation budget due to cyclic changes in the earth's orbital parameters (Milankovitch cyclicity). It is rather straightforward physics to show that anthropogenic inputs of CO<sub>2</sub> to the atmosphere are very likely to have impacts of comparable magnitude on the earth's energy budget and so on the climate system

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#### A few quick questions

1. What will long term data on currents and thus monsoons be able to tell ye about other aspects of the climate system?
2. Have you a longer term plan with other drilling locations? If so, how will they link together?
3. Could you briefly describe the different areas of expertise the scientists on-board have, and what they bring to the expedition and analysis.
4. What do ye do for fun?

Thanks.

[IceBean](#)

#### A few quick answers

1. .. ah we just answered this - see below (big questions question)
2. Other drilling locations? IODP is a big international program and they do four of these cruises every year using this ship (plus others with a Japanese ship the Chikyu and with other platforms). These are planned to answer a range of scientific questions from how plate tectonic processes work to recent oceanographic changes [we'll try and get back to you with a little more information on this].
3. Different scientists onboard - we have about 30 research scientists on board - basically we are geologists but with a wide range of specialisations including sedimentologists, geochemists, micropalaeontologists, and geophysicists.
4. What do we do for fun - watch sunsets and sunrises, play pocket pool, listen to Cole playing the guitar, and every now and then have a bit of a party - e.g. for starting the cruise, halloween, crossing the equator, getting half way thru the cruise, thanksgiving, ending the cruise....

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[IceBean](#)

To expand on your question about related expeditions we have an upcoming [expedition](#) with core from southern Indian Ocean and Mozambique Channel. This will actually help us explore the systems involved in nutrient deposits to help determine influence from the onset of the monsoon compared to formation of mountain ranges, deep sea currents, etc.

Can I ask some broad questions - what is the value of looking at past variations in Earth's climate system? What are the main things that have driven changes in the climate in the past and how do today's changes compare in scale and magnitude?

Thanks, and keep up the good work IODP!! <3

[mandalorgri](#)

Wow big questions for the last 30seconds of this AMA! Briefly:

1. Value of looking a past climate change - this is a massive part of our planet's history and immensely enriching for us - and more mundanely it helps tell us how the earth works and so helps us predict how we may change it.
2. Main drivers of past climate change - a very big topic but key drivers are - changes in continent distribution through plate tectonics, evolution of the biosphere, changing ocean circulation, changing atmospheric chemistry, changing solar radiation, changing planetary orbits (look up Milankovitch cyclicity) ...
3. How do todays changes compare in scale and magnitude - there was about 6°C change from the last glacial (when sea levels were 100m lower than today and most of Canada was covered in glaciers) to the present. By comparison we predict that if drastic action is taken we can limit future global warming to about 2°C.

I have been fascinated by the discoveries of Dorgoland (hope that is the correct spelling) between the coast of Scotland and the European Continent. The fact that it was a land bridge which existed during the last ice age. Am a wrong in my belief that ocean levels rise and fall more as a product of the ice ages and the warming in-between than any man made causes? Will you be able to determine what the maximum temperatures were, say, half way between ice ages? And last thing, are we now about half way between the last ice age and the possible next one?

[stokeitup](#)

Hi, Dorgoland – not quite the right spelling, it is actually Doggerland, but not to worry. This is a shallow area of the North Sea which was indeed exposed during glacials when sea-level fell by up to 100m. We know this since, for instance, trawlers often bring up mammoth teeth and fossil wood when fishing in the area. As you say the prime cause of sea-level change is variation in the volume of the polar ice-caps and, so far, these are not being effected by global warming to that extent (luckily as 100m of sea level rise would not be good news for anyone living in low lying countries - let alone the Maldives (highest land point 7' 10" - 2.4m).

Maximum temperature between ice ages? - in terms of global averages, best estimates are that temperature dropped by about 6 degrees centigrade during the last glaciation, so half way between it would have been about 3°C cooler.

Are we now about half way between the last ice age and the possible next one? Probably not, predictions based on orbital cyclicity actually suggest the next ice age would not have been for several tens of thousands of years, but anthropogenic warming will certainly have disrupted that anyway.

How are you marking your core drilling sites to prevent future misinterpretation of materials recovered from the same sites?

[floridawhiteguy](#)

The holes are not marked, they are located by direct positioning from a navigation system and very accurate coordinates are used, so in future expeditions if it is not planned to re-enter there is no chance of drilling accidentally in the same location. On this expedition we do not re-enter the holes. But in Chikyu expeditions, holes are re-entered in the following expeditions so they are cased and marked by caps.

The most important thing on-board each research vessel is the food. Hence, my question: how is the food on-board?

Since this is out of the way, here are some serious question in relation to the methods and the preliminary outcomes.

1. What other methods are being used on-board to correlate cores to each other besides biostratigraphy?
2. What is the influence of the Indian Monsoon on the distribution of sediment on the Maldives?
3. What are the oldest rocks you guys recovered?
4. What dating methods will you use to determine absolute ages of the sediments?

That's it for now! Thanks for doing this AMA, it is always good to bring Geosciences closer to the public, especially research cruises.

[thecarbsed](#)

Important stuff first - the food is really good (we have a glaswegian chef and philipino catering team so I have to be nice, but honestly they are doing a great job)

The other questions

1. Correlating cores - we are drilling lots of sites in a small area and we have very good seismic data from site survey work. Combining this, biostrat, and sedimentology is working really well
2. What is the influence of the monsoon? That is what we hope to find out! .. but one hypothesis we are testing is that the monsoon set up current systems which played a major role in controlling carbonate bank development.
3. Oldest rocks so far - top Oligocene - ca 25Ma
4. Absolute ages - none really, carbonate sediments are not suitable for dating by radioactive decay methods, but we are using a mix of biostratigraphy (fossils), magnetostratigraphy (magnetic reversals) and cyclostratigraphy (climate cycles) to develop a robust age model for the sites.

Your primary hypothesis seems to be:

that the dramatic, pronounced change in the style of the sedimentary carbonate sequence stacking was caused by a combination of relative sea level fluctuations and ocean current system changes.

Which is really interesting. What evidence will support this hypothesis? And what would disprove it?

[firedrops](#)

Yes this is a key hypothesis, which arises largely from seismic stratigraphic work in the Maldives. We are aiming to test this first by detailed sedimentological ground-truthing of seismic interpretation and

second by determining the age of the key events so we can compare them with other records of monsoonal system development.

do you expect or check for living microbes in the sediments? are there places in which sediments could harbor live like geologically active regions?

[elypter](#)

On this cruise we are not doing any work on the deep biota but this certainly is a hot topic in science research and will be studied in other cruises, especially of the Japanese ship the Chikyu.

Is there a list of names of those in the scientific community that do not agree with the general notion of Climate Change?

[ax255](#)

You probably could find some sort of list on climate change skeptic sites. That said whilst scientists do disagree on how strong the effects of man are on climate, pretty much all scientists agree with the general notion that climate change does occur.

I love the work you guys are doing. I'm currently a geology grad student working on my master's degree with a focus on sedimentology/stratigraphy, initially with the intention of going into the oil industry, but I've decided I would like to make a shift and go into studying the relationship between stratigraphy and paleoclimate. Do you have any advice for someone applying to PhD programs in the field currently?

[hoppierthanthou](#)

YES, go for it, doing a PhD is a great experience and stratigraphy and paleoclimate are both fine topics and ever more relevant as we try to understand climate change. Good advice for anyone applying to do a PhD? Write up your masters research or some aspect of it and get it published - even if it is not anything spectacular or in a big journal, publishing is a vital part of research and if you can demonstrate you have started that will really impress any potential supervisor.. and more generally read Schumacher's "Advice to Young Scientist"

So, we process the sediments and look for our bugs fast as we try to understand climate change.

[count\\_d7](#)

more or less - as micropalaentologists we both provide key data on the age of the sediments and study climate change through its effects on the biota. The age determination is mostly done rapidly onship, the climate change studies take a lot more time and are predominantly done after the cruise.

Is there any things found in past weather patterns, that would help explain the extreme climate change we are having in only a number of 20 years?

[IKnewBlue](#)

What we tend to find from geology is that the big driver in climate change is the global energy budget

and whether we change it over millions of years or over tens of years that drives climate change. Some of the effects will take a lot more than 20 years to work through the system but given the scale of the changes man has already made it is not surprising that we are already seeing effects.

Two months at sea? How does burning that much fuel affect ship stability?

[saganstarguy](#)

Fair question - the ship apparently was carrying 4000 tons (1.2 million gallons!) of fuel when we left Australia and we have got through over half of that. The ships displacement has also decreased - from 16850 tons to 15684 (we just got this information from the duty officer on the bridge) our ballast system is being used to compensate for the weight difference and to maintain stability.