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## Transcript

### „The Anthropocene – evidence for the proclamation of a new epoch“

#### Panelists

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- ▶ **Prof. Francine McCarthy**  
Professor at the Department of Earth Sciences and appointed to the Department of Biological Sciences and the Environmental Sustainability Research Centre at Brock University, Canada and a voting member of the Anthropocene Working group
- ▶ **Prof. Colin Waters**  
Honorary Professor at the School of Geography, Geology and the Environment, University of Leicester, UK and he is the Chair of the Anthropocene Working group
- ▶ **Prof. Jürgen Renn,**  
Director at the Max Planck Institute for the History of Science, Berlin, and director at the Max Planck Institute of Geoanthropology, Jena, Germany
- ▶ **Annegret Burkert**  
Editor for Medicine and Life Science, Science Media Center Germany, und Host of the Briefing

#### Recording

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- ▶ You can find the recording here: <https://www.sciencemediacenter.de/alle-angebote/press-briefing/details/news/the-anthropocene-evidence-for-the-proclamation-of-a-new-epoch>
- ▶ If you need an audio file or a speaker's view of the recording, you can contact [redaktion@sciencemediacenter.de](mailto:redaktion@sciencemediacenter.de).



press briefing

## Transcript

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**Host** [00:00:00]

Welcome, everybody, to this press briefing about the Anthropocene. My name is Annegret Burkert and I am an editor for Medicine and Life Sciences at the Science Media Center Germany. If you are not registered with any of the Science Media Centres yet, check out the international Family of Science Media Centres and you might want to register with one of them. I also want to mention first that this press briefing is under embargo till next Tuesday 11th of July 7 p.m. Central European Time. My colleague will post several time zone dates now in the chat so you can check out the embargo date for your time zone – hopefully yours is among it – to make sure that you find the correct embargoed date, and that this press briefing stays under embargo to this date. The today's press briefing is about the Anthropocene, a term which is already commonly used, the time we are currently living in and where human life has such a drastic influence on earth that it is shaping the planet's history irreversibly. However, the Anthropocene has not been ratified as an official epoch of Earth's history yet. Since 2009, a group of scientists, the Anthropocene Working Group, is collecting data to provide evidence that the Anthropocene is not just an idea, but an evidently proven phenomenon that can be defined by using stratigraphic methods. Next Tuesday, the Anthropocene Working Group will present the final step of their work by announcing a Global boundary Stratotype Section and Point (GSSP) that is also referred to as a golden spike. It's a reference point which defines the beginning of a geologic epoch. Today, two members of the Anthropocene Working Group are here with us. They are both geologists. It is Colin Waters, the chair of the group from the University of Leicester in the UK, as well as Francine McCarthy from the Brock University in Canada. Welcome. You too, and good morning, Francine. I would also like to welcome Jürgen Renn as a third expert in today's round. His research group focuses on the structural changes in systems of knowledge, and they founded the Anthropocene Curriculum, an initiative that brings together different scientific disciplines to explore pathways towards a novel transdisciplinary knowledge production. So, I would start my briefing now with an opening question for each expert and then we can open the panel to your questions. Therefore, please post your question and the Question-and-Answer-Tool. My colleague will forward the question to me, and I will raise them to the experts. I would like to start with you, Colin. Could you please give us a short wrap up what the Anthropocene Working Group has been researching on? And what will happen next Tuesday at the STRATI Conference and what is supposed to happen afterwards.

**Colin Waters** [00:03:05]

Can I just make a slight correction? So the introduction is the University of Leicester, not Lancaster. Sorry.

**Host** [00:03:11]

Oh, sorry.

**Colin Waters** [00:03:12]

So. Okay. The announcement represents the culmination of a three-year project to assess 12 sites as potential candidate Global boundary Stratotype Section and Point, or just as you say a golden spike. The Anthropocene Working Group has no budget in order to seek formalization as a formal chronostratigraphic unit. Any nominated Golden Spike section would need to be fully analyzed to assess the suitability of the section and its component anthropogenic markers. We needed to have more than one site analyzed as it was necessary to demonstrate that the signals associated with Anthropocene are present in sections across the planet and in diverse environments. In December 2018, the Haus der Kulturen der Welt (HKW) – the house of world cultures



based in Berlin – was able to secure funding that allow the AWG and HKW to collaborate in the search for the Golden Spike. In 2019, we contacted research groups from around the planet trying to encourage them to put forward their study areas as a potential golden spike and agreed budgets to help co-fund the studies. The studies formally started at the beginning of 2020, though some had been researching their site for other purposes for many years beforehand. Just as they started the project, the COVID-pandemic paused their work. Some sites were unable to collect the planned core material, and others couldn't access their laboratories to carry out the analyses for much of 2020. It is a testament to the dedication of the team's work on the 12 sites that by the autumn of 2022 they had completed their research and each had produced a peer-reviewed paper detailing the evidence supporting their case as the golden spike section, these being published in a special volume of the Anthropocene Review – Volume ten, Part one, which is now available and free to download as well. These papers are then used to guide the voting members at the AWG in their decision as to which of the sites should be the GSSP section, as there can only be one. Three of the sites were deemed to be only suitable as reference sections: San Francisco Bay, Ernesto Cave and Karlsplatz, Vienna. The remaining nine sites were included in the vote. Now ICS requirements are that a site needs to have a 60 percent supermajority to be approved. In the first round of voting, which ended on the 17th of December 2022, only four sites had received votes, with Crawford Lake receiving significantly more votes than the others, but well below the 60 percent supermajority. A second round of voting, which ended on the 20th February 2023, considered the top three sites from the previous round: that was Crawford Lake, Sihailongwan in China and Beppu Bay from Japan. Again, Crawford Lake received the strongest support but without achieving the supermajority. So in the third round of voting, it was decided just to have the top two sites: Crawford lake and Sihailongwan. The results from voting complete on the 19th of April, saw Crawford achieve 60.9 percent of the vote, so it was confirmed to be the AWG candidate GSSP section. To celebrate the long collaboration between AWG, HKW and Max Planck Institute and the conclusion of the study, we wish to hold an announcement of the results – this being originally planned for earlier this summer. However, Phil Gibbard, the Secretary-General of the International Commission of Stratigraphy asked that we delay this announcement so that it could be made at the 4th International Congress on Stratigraphy in Lille on Tuesday the 11th of July. There will be a short Anthropocene session in the late afternoon in which they will be four presentations from AWG members, including one that will announce the results of the conference attendees. Some of those involved with the Anthropocene session will then transfer to a nearby hotel to hold a panel discussion that will be linked through to a conference being coordinated by the Max Planck Institute in Berlin, which commences at 7 p.m.. Here, the results will be more widely announced and discussed. In the autumn, we aim to submit the final submission to the Subcommittee on Quaternary Stratigraphy (SQS), which is our parent body. This submission will take three parts. It will require a detailed justification why the Anthropocene should be added to the international chronostratigraphic chart as a formal geological time unit at epoch rank and the Crawfordian at age rank. We will and need to provide a full description of the proposed Crawford GSSP site. This needs a final vote to confirm the precise level of the GSSP in the core. The team had proposed 1950 coinciding with distinct level core and the simplicity of the date itself linked to the Great Acceleration concept. However, previous discussions in the AWG had expressed a preference to linking the base of the Anthropocene to the abrupt increase in plutonium in the core. Existing data couldn't provide the date of this upturn to annual resolution. So, the Crawford team are currently carrying out additional plutonium analysis to ensure annual resolution so the decision can be made. And finally, in 2023 ICS has agreed that there should be a formal process for all future submissions in which there is a Standard Auxiliary Boundary Stratotypes (SABS) should be selected, and these should be used to support the GSSP sites and allow correlation of the boundary into other environments and parts of the world. These SABSs need to meet the same criteria as a GSSPs. So, we're currently voting as to which of the eight remaining sites should be selected as SABS and the selected ones will also be written up in the proposal. Once the proposal is received by SQS they will need to discuss the content, then vote on the three parts covered by the report. If there is a 60 percent or more support for the proposal, it will then go up to the ICS voting members who again will discuss and vote. If they too vote with 60 percent or more supermajority it will finally go up to IUGS for their decision as to whether it should be ratified. The process is expected to be completed in time for the International Geological Congress in Busan, Korea, in August 2024. Thank you.



**Host** [00:09:19]

All right. Thank you, Colin, for this overview. Francine, you have been analyzing the drilling core from the Crawford Lake which was now selected by the Anthropocene Working Group as the Golden Spike. What does it tell us and why is it so important? What makes it so special?

**Francine McCarthy** [00:09:43]

Crawford Lake is so special because it allows us to see at annual resolution the changes in Earth history throughout two separate periods of human impact on this small lake. One was between the late 13th and 15th centuries by Iroquoian language peoples, and much later, beginning in the early 19th century, the impact of European colonists. Within the annually laminated sediments, there are a number of markers, what we call proxies, that are retained in the geologic record that will be retained there for many, many years to come. That people can come back to and at annual resolution, identify what was going on or reconstruct what was going on in the atmosphere, in the water – the hydrosphere. How that communicates itself to the sediments or the geosphere. And of course, a component of the geosphere, the sediments are the organisms and their remains that were in the water and that blew in from outside, like pollen grains for instance. So, it's the fact that in this lake in Canada, which is very deep, nearly 24 meters and quite small, 2,4 hectares, that physiography, that shape, restricts the mixing of the water column so that the bottom waters do not mix with the surface waters. The bottom of the lake is completely isolated from the rest of the planet, except for what gently sinks to the bottom and accumulates in sediment. And this very small, deep lake is a sinkhole. So, it's a cave in the Silurian rocks of the Niagara Escarpment in Canada. So, there are limestone rocks and there was a cave that had been dissolved in the rocks, the roof caved in, so the water fills this lake. And in this lake, there is obviously a lot of weathered calcium and carbonate from the rocks. And when the water gets warm enough, the calcium and carbonate ions join together in ... they precipitate, they crystallize into little crystals of calcite, that snow down, that rain down, that fall slow through the water column, and they form each summer a white layer. And it is that white layer that we can count, and we can identify exactly which year we're looking at. In Crawford Lake, because there is a strong climatic control on how much calcite is produced every year, the pattern that we see is quite distinct, like fingerprints. So, it's not just counting one, two, three, four, five. Each layer has a very unique appearance. So, for instance, the thickest layer of the 20th century is 1935. That's a very easy one to pick out. 1956, 57, 58 form a very clear triplet. So, there are some very distinctive varves that we can correlate very easily across these small basins so that we're confident that we have annual resolution. And amongst the annually resolved things that we've studied as part of our team and that HKW very generously supported the analysis of key markers independently and in other labs, not just by my own colleagues – to assess whether we could detect the impact of the great acceleration, which was number one. And number two, whether chronologically, in addition to having this annual precision, we could see the effects of the Cold War. Because the AWG had voted in, you know, group discussion... we had decided to use the plutonium 239 that falls out from the atmosphere from aboveground nuclear testing as the main marker. So it is the great acceleration, as Colin indicated, that we decided to use as a major tipping point in Earth history. But it is that increase in plutonium and all radioactive fallout actually, but plutonium 239 specifically that we chose as the marker. And fortunately for us the tests done in independent labs confirm that each of these things like dominos changes very, very quickly right around 1950. So I think that's why the Anthropocene Working Group chose our site in the end.

**Host** [00:15:09]

Thank you very much. I would like to introduce Jürgen now as a third expert, to give us an overview. Like, what is the motivation of the Anthropocene working group to collect all this evidence in order to call a new epoch? And what are the implications?

**Jürgen Renn** [00:15:27]



Yeah, thank you very much. I would really like to contextualize this discussion a little bit. The Anthropocene concept has been popularized in the year 2000 by the chemist, Nobel Prize winning chemist Paul Crutzen, and he was at the conference and had the impression, you know, the Earth has been so dramatically changed by human intervention on a planetary scale that it's no longer legitimate to use the traditional current term for the Earth epoch that was used broadly or still used broadly, namely the Holocene. And he said, you know, we cannot say with all these changes that we are living still in the Holocene. We are living... And then he was searching for a term, and he came up spontaneously with the term Anthropocene. Now Paul Crutzen was, as I said, a chemist. He was the one who figured out what causes the ozone hole that got him the Nobel Prize. But he was an Earth system scientist as well. But he was not a geologist. Now when he announced the Anthropocene at this conference, the reaction was worldwide, very intense, and the Anthropocene concept became a media attention and an interdisciplinary concept because it pointed to these global impacts of humanity in their connectivity. You know, it's not just about climate change. It's not just biodiversity loss. It's not just the sediments that humans are moving. It's all of this together. So, and this one earth system science is, of course, you know, a remarkable fact. We are not looking at just one physical or chemical phenomenon. We are looking at a lot of interrelated phenomena. Now, this has launched a worldwide discussion. The concept has been used also in the social sciences, in the humanities. Who has caused and who is responsible for these global changes. And so there was a very intense discussion starting in the year 2000. Now, as we just heard, the Anthropocene Working Group was founded only nine years later in 2009 and started its work. Why the delay and why is this so different? Because we heard about, you know, precise measurements now, a precise location and so on. Now, as I said, the Anthropocene is a truly multidisciplinary concept, and the scale, the timescale of Earth history is in the responsibility of the geologists. Now, the geologists have their own very careful and very well-proven methods. And they were then called to verify if, from their perspective, in particular from a stratigraphic perspective, the Anthropocene can really be labelled as a new Earth epoch, which is not the same as, you know, the perspective from the Earth system science. So, the geologists are also not responsible for finding out, you know, the causes, neither the natural causes, the dynamics of the earth system nor the social causes of the Anthropocene. Their mission is really to anchor this discourse of the Anthropocene, this broad discourse in the very precise discipline of all stratigraphy. And they are talking within a well-established system. Now, the one problem is, of course, that that well-established system of geology normally works with earth periods that had started thousands or even million years ago. So now the Anthropocene, as we just heard, is now being proposed to be dated to the middle of the 20th century. Now, the geology discipline had hence to adapt their methods to this, you know, new challenge to do what has been called a geology of the present. That's very, very unusual. And hence, the Anthropocene Working Group was composed not only of professional geologists. We have just heard two highly prominent professional geologists, but there are also, for instance historians, who are members. And the Anthropocene Working Group has looked at this Anthropocene phenomenon itself from an interdisciplinary perspective but trying to anchor this in their precise terminology. And we are approaching this anchoring now in a very serious way. And I think there are three consequences. One is, as I said, it makes the concept very precise. It's a challenge, a challenging object for geology. It had to adapt its method. You know, plutonium signals, plastic, microplastic sediments. This is all completely new, also methodologically. And third, it creates a bridge between the natural sciences and the humanities, because it's about the humans, about the *Anthropos* that has had an impact here. So social science, history, archaeology, all of these disciplines from a humanities side are also involved in understanding this process. And I realize that the question of why this is the middle of the 20th century may race in your minds and the answer has been given to you already, as a matter of fact, because it's for these very specific stratigraphic reasons. But let me add just one remark and then I close. This is not about the cause of the Anthropocene. So, Paul Crutzen, in 2000, anchored the Anthropocene concept in the Industrial Revolution of the 19th century. That's very plausible. You know, the use of fossil energy started on a big scale. But this is not the question here. The question is how we can determine on the basis of sediments of stratigraphy, the beginning of the Anthropocene in the terminology and in the conceptual framework of geology and stratigraphy in particular. But the Anthropocene research is going on because it involves all these other disciplines. And the HKW, the Haus der Kulturen der Welt, has as together with the Max Planck Institute for the History of Science in Berlin, done a great deal of enlarging and broadening this interdisciplinary discourse. And not my really last remark is the Max Planck Society has, as a consequence of these discussions,





founded a new institute dedicated to the study of this interdisciplinary phenomenon of the Anthropocene. I'm now talking to you from this institute in Jena, and it's called the Max Planck Institute of Geoanthropology in order to draw attention to this interaction of the Earth system and of the human global society. Thank you for your attention.

**Host** [00:22:27]

Thank you, Mr. Renn. You gave me a bridge to the first question already, the start of the Anthropocene. Why did the working group choose the Great Acceleration as a start and not, for example, the industrial area? So, making it sharp what are the real characteristic, why did you choose this starting point – maybe Colin or Francine?

**Colin Waters** [00:22:51]

Yeah, should I start with that one? And it's a good point because obviously when we started this analysis, we were guided by Paul Crutzen individual thoughts and he was very much of the attitude as an atmospheric chemist that the start of Anthropocene should link to the start of interest revolution. So maybe towards the latter part of the 1700s, about 1780, he even suggested linking it to the invention of Watt's steam engine. But that's a very historical conceptual thing for us to try and find the evidence of Watt's steam engine in a geological succession. We just can't find the effects of that despite there's a clear cause. What we had to do was look at the sedimentary successions, the archives that we can read and see where we start to see significant changes happening. If you're based in Northern Europe, if you're based in the UK, you do see the first evidence of interrelation happening early in the 1800s. But if you are based in large parts of Asia, Australia, Southern hemisphere, there is just no effects. The sediments just do not show any significant effect from the industrial revolution. So the more we looked into this and it was not until probably about 2014 that we actually came to this conclusion that really the point on that across the planet where you start to see a synchronous change is in the middle of the 20th century and the advantage there, as well as the indicators of the effects of things like increased burning of fossil fuels, changes to agricultural practices, increased industrialization, increased globalization and transfer of species across the planet. As part of that process, all these things linked to this concept of the great acceleration that Will Steffen proposed earlier on in the in the 2000s. So, there was a clear link to the cause, to an effect in the sedimentary succession, which was synchronous across the planet. And that's what we look for. One, to have a geological time interval, the very prominent boundary that synchronous across the planet. And the great advantage of this one as well, is that because of the aboveground nuclear detonations, the testing that went on in the 1950s, there's a very precise geochemical boundary that is present across the planet, across all environments that links to the onset of those detonations. So, it again ties into the 1950s.

**Host** [00:25:29]

Does tying the advent of the Anthropocene to plutonium mean, tying it to the development of large-scale testing of nuclear weapons.

**Colin Waters** [00:25:40]

Well, no, actually it's just a very useful synchronous marker. I mean, the key thing here is that if the only thing that we had was the detonations of nuclear weapons and there was no ever change, there would be no need for the Anthropocene. It's just a very practical tool for us to use to recognize if you can look at a section in detail, analyze it for plutonium, radiocarbon iodine isotopes, what you'll see routinely is a very sudden increase in the content within the sedimentary successions. As soon as you have that, you know, you've appeared into the 1950s in that succession. So, it's a very clear marker. But the principal thing here is that you



have all these other markers reflecting the big changes to the planet that happened in the great acceleration. So, this increasing consumption of fossil fuels, the greater use of nitrogen fertilizers, the sort of increased trade globally that's spreading species across the planet and homogenizing the biota of the planet, all of these things change very rapidly at that point. That's the critical thing about the Anthropocene. The presence of the plutonium mark is a very useful tool to allow you to define that boundary. And of course, since the 1960s, that signal has in effect been reduced because of the limited test ban treaty. There are no longer these above ground destinations, so there's no more plutonium being added to the atmosphere because of those destinations. The plutonium coming from nuclear fuel processing plants. So there still is plutonium in the environment, but the signal is very much more reduced. So, it's just a very short interval of time that represents a clear boundary that we can use.

**Host** [00:27:31]

The next question probably goes to Francine. Are there any differences in the choice for the Anthropocene GSSP in comparison to choices of other GSSPs to other epochs and geological times?

**Francine McCarthy** [00:27:45]

I think both Jürgen and Colin touched on that a little bit in their initial statements, because by making the decision to define the Anthropocene, using a GSSP in the stratigraphic sense, there are very clearly defined rules around GSSPs, but they have been designed for cliffs of rocks with fossils in them. So [...] when you get more recent, up the stratigraphic column, you get to the point that cliffs of rock are not necessarily the best places to look. But most of the Quaternary is actually based not on cliffs of rock, but on ice cores and even a stalactite. So, we are looking at it by determining the place in the recent Earth record where the effects of humans overwhelm the Earth's system. So, the interrelated, intertwined systems of the atmosphere, hydrosphere, the geosphere, the biosphere, et cetera. That with the effects of the great acceleration. When the Anthropocene working Group decided to do that, it had to look for not cliffs of rock, but for other geological environments. So that included things like living corals, for instance. There were two sites that had living corals. [It is] very unusual to use these kinds of environments. A peat bog, for instance. So, environments that are not traditionally geologic, stratigraphic environments. We did make every effort to adhere to the rules. And I'm not aware that we didn't adhere to them. But it requires a little bit of a shift in perspective to look at varve lakes, for instance, and apply the rules that have existed for a long time now that define a GSSP.

**Host** [00:29:56]

Yeah, I would stay a bit on the geological questions so far and come to the further implications a bit later. I will split this a bit. For Francine, do you have any update on the new plutonium analysis, are the results in yet on where the plutonium is in the various layers?

**Francine McCarthy** [00:30:19]

Not yet. But we're promised that we'll have something for the 11th [of July]. And it's a novel collaboration between the lab at Southampton that measures activity and a lab in Vienna that is actually going to use accelerated mass spectrometry. So, when they give us these results, they are focusing right now on the late 1940s through mid 1950s. So just eight or ten years, I think they're focusing on for the 11th [of July]. The reason for that, as Colin mentioned earlier: We chose – Team Crawford – 1950 for reasons that we feel are compelling in our core. It is near the base of a very clear color change so stratigraphically it works for our core. But more broadly and more philosophically, 1950 is the cut-off date for radiocarbon dates for present. So before present refers to before 1950. So, the present we would consider as the Anthropocene since 1950. Before then we would call the Holocene. And so, when you hear reports of radiocarbon ages as before



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present, the reason that they use 1950 as the cut-off is that since then all of that aboveground nuclear radioactivity has created so much artificial radiocarbon that the time clock from radiocarbon analysis doesn't work. So back to your question. I'm expecting to be able to present data from those eight or ten years on the 11th [of July]. So, at the press conference, I may be able to show those, assuming we have them. But based on analysis from two previous cores from Crawford Lake – cores collected in 2019 and in 2022 – the rapid increase is between 1950 and 1953. So as Colin says, when we have those annually resolved, 1951 and 52 and 53 as well as 1950, the Anthropocene Working Group will look at those data, revisit that discussion of "should the base, the lower boundary, be at the most rapid inflection point? Is that going to be 52 or 53, or do we leave it at 1950?" And that's something that we will be discussing and making a decision on before writing up the proposal for the Subcommittee on Quaternary to consider because the point in the Crawford Lake core, exactly what depth, is going to be determined by that.

**Host** [00:33:14]

There's also a question about other markers. So, what role will the other discussed markers like microplastic, black carbon particles or others play in the future? What other markers are present at Crawford Lake?

**Francine McCarthy** [00:33:29]

I think the presence of secondary markers is important because the ability to detect the activity of radionuclide decreases through time with decay. So, we're not looking at centuries, we're looking at millennia. But nonetheless, if we're assuming that there will be individuals looking at the geologic record in millennia to come, it's important that things like the spheroidal carbonaceous particles or fly ash, that are produced by very high temperature combustion of fossil fuels, primarily coal, and primarily in industrial applications like steel mills. We have a very, very clear increase, dramatic increase, in the concentration of these little carbonaceous particles in our core at exactly the same depth that we see that rapid rise in plutonium. We also see a distinct change in nitrogen isotopes. And as Colin mentioned, in addition to the combustion of large amounts of fossil fuels that led to this great acceleration, we also see nitrogen fertilizers [...] the technique to grab nitrogen out of the atmosphere and use it as fertilizer that has affected the isotopic composition of the atmosphere. And we see that very clearly in Crawford Lake again at the same place in our core that we have all of these other markers. So there is a very synchronous signal across secondary markers and the primary marker at Crawford Lake, and we can correlate those across our basin and our multiple cores and we can correlate that with cores – not just cores, but with other geologic environments like, you know, in living corals, even – [...] the record at Crawford Lake is representative of the changes that make the time since the mid-twentieth century geologically different from before and then worthy of, we think, a golden spike.

**Host** [00:35:46]

Maybe one last question to the Crawford Lake and the selection of this spot as a golden spike: Like, what does it make with the Lake? Does it now need special protection [...]? What would it make with the place if it was selected or if it's not selected?

**Francine McCarthy** [00:36:05]

Yeah. So, I mean, Crawford Lake is now the candidate being proposed to the submission quaternary and then hopefully up the line, hopefully by next summer to be the golden spike. So, for the Conservation Authority that has managed the site since 1969, this poses it's exciting, but it also poses some concerns about management so that they've been in communication with us for a while now. What will this mean in terms of increased visitor ship, in terms of they are now, of course, committed to changing the signage and some of the messaging and late to update the recent findings from the geology and the hydrology that team Crawford has





come out with, but also to communicate the importance of the Anthropocene as a concept. So irrespective of the ultimate decision of the Subcommittee on Quaternary and so on, this is going to be a place where discussions about human impact on the planet to the point that a tipping point was reached can be had. So there is currently an interpretive center reconstructed along houses, et cetera and interpreted board rock around the lake. Those are going to be upgraded, which is of course going to cost the money. But in terms of security, there is no reason to suppose that there will be, you know, a need for added security. There is some security because it is a protected conservation area. There will be on the signage. It will make it very clear that even if we are awarded a golden spike designation, that little brass plaque will not be at the bottom of a 24-meter-deep lake so that people don't die to try to find it and steal it as a memento. It will, you know, it would be in the museum in Ottawa in a cryogenic facility. So, if they [...] And that would be very difficult to break into, that has a lot of security. So that's not going to be easily stolen like some of the plaques have been. So, in terms of visitor ship, it is a very well visited site. They are very well equipped to communicate through their park interpreters with everyone from schoolchildren to, you know, senior citizens who are interested in all aspects from the indigenous culture to the natural history. And this Anthropocene question is going to be just one more layer. And for a short while it will probably cause a big uptick like it has in my life in terms of media requests, but then it'll die back down and hopefully it will just be a very calm and beautiful site to encapsulate what is maybe not as beautiful a change to the earth. But people can easily visit.

**Host** [00:39:19]

I cite the next question. It says we currently live in the Meghalayan age of the Holocene epoch. If we adopt a new epoch, will a working group have to start work on a new age or can this age only be recognized after the fact?

**Colin Waters** [00:39:36]

Just to confirm, what I mentioned in the presentation I gave: It is a jointing here that when you define the base of the Anthropocene, you're also, which is an epoch level, you're also defining the base of the Crawfordian, which would be the age. So, they're synonymous. It's the same point.

**Host** [00:39:55]

Okay.

**Francine McCarthy** [00:39:56]

And there could be a thumbs up for a Crawfordian age, but not for the higher level, which would be the Anthropocene epoch. So, I mean that there are two questions that the Subcommittee on Paternity and the other bodies are going to be evaluating. First of all, is the geological evidence sufficient for any golden spike at all? And does it rise to the level of the epoch as opposed to a fourth age of the Holocene, for instance?

**Host** [00:40:26]

Jürgen, what does the addition of the Anthropocene to the stratigraphic chart mean to science? Can you oversee this already?

**Jürgen Renn** [00:40:36]



## press briefing

No, of course I cannot oversee it, because the Anthropocene concept already has had major implications for scientific developments. And now that this is sort of made so precise and anchored so well in the stratigraphic record, it will certainly boost the discussion about the Anthropocene concept. In the humanities, people have talked about other labels for this major impact of humanity on the planet, like the Capitalocene. And I think it will help, as I said also in the beginning, to consolidate the bridge between the humanities and the natural sciences. That is at least a development for which I hope because the Anthropocene concept has now received a firm anchoring in a very precise stratigraphic definition. And it makes sense now for the other sciences to take this as a reference point for their discussions. And as we are looking at something that is shaping our fate as humanity and in a situation in which we have to act as humanity, if I may say so, then it's very important to have a common reference point. So, the Anthropocene strengthens this, I would hope at least global awareness, not just among the sciences, but also, political and economic awareness as well for the situation in which we are, we have a labor fights or we will have a labor for it now probably. But understanding is another matter and understanding precisely which actions we have to take in a highly nonlinear complex system is another challenge. Of course, we know some actions we need to take. We need to get out of the fossil energy in order to mitigate climate change. But there are so many other implications of the Anthropocene concept, and that will remain a huge challenge for science, politics and economy and society.

**Host** [00:42:40]

There's another question that is asking how do you know that humans will not continue to influence the sediments in the centuries to come? Isn't it too early to call this or does it matter if there are new markers introduced by humans? Can you already call the epoch now and it won't change even if there are more markers added?

**Jürgen Renn** [00:43:05]

I think that's a question to the geologist.

**Colin Waters** [00:43:07]

Yeah, I would say: almost certainly, even though geology is dealing with the past record. We're not trying to estimate what's coming in the future. Almost certainly humans will be changing the types of markers they are generating, as we move away from fossil fuel systems that we live by at present. Whatever we move to - whether it be lithium batteries or whatever sources of energy we get in the future - there will be some markers associated with that. When it's eight billion people all having an impact on the planet, there's bound to be a repercussion. The question is, I suppose: do you feel that you can possibly return to a Holocene state on the planet? And I think the answer is definitely no. Partly because the huge amounts of fossil fuel combustion have caused greenhouse gas emissions to the atmosphere, which will take thousands of years to return back to what might be considered to a Holocene level. It's already been estimated that the next Ice Age has been delayed by at least 50.000 years, if not 100.000 years. That's five to ten times longer than the existence of the Holocene as an epoch. But clearly, the biology of the planet has changed abruptly. We cannot go back to a Holocene state now. We can't take all of these species have been transported across the planet, whether on purpose or by accident, and return them back to where they came from. So, we are going to have a homogenized and, to a large degree, a depopulated biota on the planet in the future. That's very much a core characteristic of the Anthropocene. And I doubt that is going to change. [...] At present we've had 70 years of the Anthropocene that has been long enough because of the rapidity of the change, the preciseness of it, to recognize that we've moved into this new Earth state and that should be defined by a new geological epoch. Where it goes into the future will be potentially a continuation of that story.

**Jürgen Renn** [00:45:18]



May I add to this a brief remark, to emphasize what Colin has just said. It's not that we steer the Earth system in such a way that if tomorrow, we stop using fossil energy and emitting greenhouse gases, we can change the course of the planet. There are so many changes that have been committed already. The glaciers melting, the entire cryosphere, the ice on the earth. These changes that we have already induced will only unfold in the next decades and centuries. And there is no way that we can that we can stop this for the time being.

**Francine McCarthy** [00:45:59]

And changes will continue to happen, and the new inputs of geologic time are always established on the basis of the evidence at that moment in time. That's why there is a very specific point, the GSSP. When, for instance, there was the mass extinction at the end of the Cretaceous... [...] It was that particular extinction event due to the impact that is marked by the iridium that will never change. So yes, more things happened since the Cretaceous mass extinction event. That's why we still live in the Cenozoic era. But nothing of that magnitude has yet happened. But things will continue to happen in the future. But we can only concern ourselves with recognizing that, as Paul Crutzen hypothesized in 2000, we're no longer living in a Holocene world. So, to continue to refer to the planet as being in the Holocene is not accepting reality.

**Host** [00:47:11]

Another question I would like to ask is: what are the impacts on nature, on climate, on health of the Anthropocene now at a time when we only talk about climate change? Or are the impacts of both phenomena, so the impact of humans and the climate change, kind of combined or related?

**Jürgen Renn** [00:47:34]

We are not just talking about climate change. Climate change is a great challenge and it's an important one. But we're also talking about biodiversity loss, for instance, and the Anthropocene makes it clear how these things are related to each other. Let me take the issue of health. We are just coming out of the Corona pandemic. For all we know, research is still under way on the exact, origin of the pandemic. But with high probability it's a zoonosis. It's been a virus that comes from an animal and has gone over to humans. We know from statistics that the number of zoonoses of such diseases that have sprung over from animals to humans has increased in the last decades, substantially increased. And this is partly because of human land use. The areas available to wildlife have shrunk. The likelihood of encounters between domesticated animals and wild animals have increased. And so the likelihood [of zoonoses] has increased as well. Now, climate change is, of course, affecting our health already simply by extreme weather events. And it also has many other impacts on, for instance, coastal sites with sea level rise and so on. So all of these things are very closely intertwined. And that's really the one lesson that we should take away from the Anthropocene concept. We cannot slice these effects into separate areas. We have to address them as a phenomenon that is multiply connected. And we have to make an effort to understand it and adapt our societies accordingly.

**Host** [00:49:34]

Jürgen, maybe another quite abstract question. Do you see the concept of the Anthropocene as showing more the power of humanity or more the hybrid of humanity?

**Jürgen Renn** [00:49:45]

Well, one has to think for a moment what an answer to this question would imply. [...] Of course it's partly a hybrid because the Anthropocene is an unintended consequence, for instance, of our use of fossil fuels. But if we just say it's a hybrid, we basically have to be fatalist and have to give up on changing. So, I also think it's an



indication of the power of humans because we need that power, our knowledge, our technologies, but also our capacities of making better societies in order to prevent and to mitigate the worst consequences and to adapt to what we cannot change. And therefore, we need all our intelligence, all our ingenuity and all our empathy, because we cannot solve this as a local problem. It's a global problem so we have to understand how others may suffer from it. And so I think we have to take it as a challenge for human creativity and ingenuity.

**Francine McCarthy** [00:50:57]

If I can jump in there, I can think of one other species that has affected the planet more. And those are the cyanobacteria who back two billion years ago oxygenated the atmosphere. The cyanobacteria did not have the ability to think it through, recognize what they were doing and consider the consequences. But we do. So, when we talk about hybris and humans: yes, we have had a massive impact and we will continue. Eight billion humans particularly expecting a certain lifestyle, a standard of living, will inevitably impact the planet in the future. But we also can mitigate those impacts. We've learned lessons from the past. The environmental movements and technological fixes and so on are possible. [...] As Jürgen says, there is hope for the future. And that hope lies as much in humanity as it does in science.

**Jürgen Renn** [00:52:01]

Francine, there is one big difference between us and the cyanobacteria, if I understand it correctly, because I'm not a geologist. The changes that we have induced were much more rapid than the changes in previous geological transitions. So, we do have to cope with a factor of time.

**Colin Waters** [00:52:25]

[...] One of the positive messages here is that when we talk about an Anthropocene that starts in the 1950s, it represents a very rapid change that we have caused to the planet. There was nothing inevitable about this, even a century ago, that we would move into this new epoch. So, it shows that the combined impacts of humanity can be changed rapidly for the good and for the bad. There's hope in that respect. It's not inevitable that we have to slide into continuing poverty of environment.

**Host** [00:52:59]

What are the political consequences of declaring a new epoch?

**Jürgen Renn** [00:53:05]

It's hard to foresee. There are some politicians that have already taken up the concept and have taken it as an indication that things are challenging and that one needs to think systemically, as I keep emphasizing. That one has to take into account that you cannot solve the energy problem without [recognizing] that if you use bio energy, you may have an impact on agriculture because you are using the same surfaces for producing fuel that you would have needed for farming. So, this kind of connectivity is a very, very important message for politicians. And I can only hope that politicians will hear that message. It's not just a specialized method for fans of a geological time epochs. It should be and a wake-up call for politicians. We see it currently in Germany: there are well-meant political measures, but then they have economic consequences that nobody has thought about. They don't scale up to a European or global level. So, think systemically and think globally. And I think that that would be an implication for politics.

**Host** [00:54:26]



Thank you. I will come back to more precise questions that I would like to quickly answer before we have to close in some minutes already. Francine, maybe you can answer this quickly. Has the Anthropocene Working Group engaged with indigenous people around Crawford Lake for consent to this proposal?

**Francine McCarthy** [00:54:47]

We've engaged with the indigenous people for consent to core the lake, for permission to do fieldwork on the lake, because for indigenous people the natural world has personhood. And so in order to continue our fieldwork for geologic purposes, we endeavored to do that in the most respectful way possible. So, in order to get permission, we certainly did that. And that interaction has enriched both the scientists in Team Crawford and I think it has... I speak for the indigenous people, certainly Catherine Tamara, who's an artist and a Wyandot elder. It has influenced her artistic practice. And so certainly that dialogue will continue into the future, and they will have a voice in the new signage and description of materials at the Crawford Lake Conservation Area including not just the scientific changes that have occurred, but also bringing in that cultural perspective of the indigenous people as well.

**Host** [00:56:09]

Another question about the candidates. Which site was place second? Beppu Bay or Sihailongwan?

**Colin Waters** [00:56:15]

Sihailongwan.

**Host** [00:56:15]

And what was the advantage of Crawford Lake over the other?

**Colin Waters** [00:56:24]

They were actually very, very difficult to choose between. And I think this is why we ended up going through three rounds of voting. Of course, individual voting members would have their own justifications for why they preferred Crawford. [...] One of the issues was that Crawford had some of the traditional aspects of looking at the paleontology, looking at the fossils. So the biological changes that happened with time. [...] Traditionally, geologists tend to subdivide their epochs and ages using fossil markers, first appearances of particular species of fossils. And you can see biological changes happening very rapidly at Crawford Lake. Things like the Dutch elm disease causing elm pollen to disappear very rapidly in the late 1950s is a very clear marker and one that is sort of regional over the Northern Hemisphere. And that sort of signal was missing from Sihailongwan. It would probably be there, but it hasn't been looked at. I think the other thing was that, as Francine mentioned, there is a clear pre-1950 human influence in the area. So it's not to say that the Anthropocene represents the start of human impact. [...] There's been record [of human influence] going back hundreds of years, whereas the Sihailongwan site is very remote. It's out towards the Korean border and an appearance of first human impact in the region is coming in the 1950s. So it's a very clear change from a sort of Holocene succession to an Anthropocene one, but it's perhaps a bit artificial in that it doesn't have that earlier human impact you would expect.

**Host** [00:58:17]





For the further process of the voting. Are the upcoming votings more formal approvings or will there be further discussions? And on what ground could the ICS reject the application of the Anthropocene Working Group?

**Colin Waters** [00:58:39]

Our additional voting, which is to first of all decide on auxiliary sites, will be done formally, as will the final approval of the level of the GSSP at the Crawford Lake site. So, there are two things that we deal with still. With regard to the submission that goes to SQS and ICS and eventually IUGS as well - they are obviously a formal vote, and it has the same process we followed of a period of discussion amongst the voting members and then they have 30 days to cast their vote. And certainly, there is no guarantee with regard to the whole process because [there has to be] a 60 percent supermajority of support at each round. [So] it has to be a very strong proposal for it to get through those three levels of voting. It's a very conservative process and probably there's good reason for that because you don't want to establish the formalization of the unit if it's not grounded on very strong evidence.

**Host** [00:59:49]

And what could be reasons for rejection? Is the evidence or they maybe don't like the Crawford site or solely because they don't like the idea of the Anthropocene? [...]

**Colin Waters** [01:00:02]

All of those. [...] It's slightly unusual in that normally by this stage the Chronostratigraphic Chart will already have the particular unit shown on it. For the Holocene it had been decided that it would exist as a conceptual unit long before they defined the GSSP for it. So really what they had to do was just define the site and define where the boundary was, what the mark was that defined that base. In our case, not only do we have to demonstrate that Crawford is a very good candidate, also we are now being asked to formalize these auxiliary sites, which hasn't been done in the past. In the past you just did it as an informal, 'we recommend these sites represent good sites'. Well, now we have to formalize that. And again, that's going to be voted on by the SQS. So they could reject it because they don't like the auxiliary sites. May not the Crawford site, but not the auxiliaries. We are very careful in our search which ones are suitable. But then they could also just say "well, at the end of the day, we are not impressed with the evidence you've provided to demonstrate the Anthropocene is justifiably a new epoch of geological time". So as Francine said, they may support the idea that there's a stage here and the Crawford site represents a new stage of the Holocene, but they're not prepared to accept that the Anthropocene is a significant change beyond the envelope of change that we see within the Holocene.

**Host** [01:01:40]

Maybe as a final question to all three of you. If you could say this in one sentence, what is for you the most important evidence and the biggest argument to call the Anthropocene? I start with you, Francine. Would you like to start?

**Francine McCarthy** [01:02:05]

There is evidence at all of the twelve sites that we studied as a group and certainly the nine sites that went forward into that Anthropocene review publication that is open to everyone to read... I urge everyone to read all of that evidence if you want to wade through all the science. But there is evidence globally of a massive shift, a tipping point in the Earth's system that is compelling.



**Host** [01:02:39]

Thank you. Colin.

**Colin Waters** [01:02:44]

We looked at eight very different environments across five different continents. And when you put twelve sites together, there is an incredible amount of consistency between them, which is something that we couldn't have anticipated when we started doing this work. So, it really endorses as a group all the twelve sites. It's a shame that we have to pick one site to be the GSSP, but actually the strength in the argument is the basis of the twelve sites together. When you combine them and read the stories that they tell you, it shows you that there is this very significant and very rapid change to the environment in a very short period of time. And that's the 1950s.

**Jürgen Renn** [01:03:26]

I would add exactly this, that we are looking at an Earth system that is rapidly changing. And those changes can no longer be understood without taking into account the human interventions. We can really see that humans have basically created a new Earth sphere beyond the biosphere. Some call it the technosphere, the infrastructures, the enormous structures, cities, energy systems, traffic systems that humans have constructed. If we want to really understand the system, we have to not only take into account the traditional Earth spheres, like the hydrosphere, the atmosphere, the biosphere, but also this human technosphere. And that speaks very much for a real new understanding of Earth's history as well.

**Host** [01:04:19]

Thank you so much to all three of you for taking the time today for the journalists to answer all their questions and to give us give us a short deep dive into the topic of the Anthropocene. I would like to remind you again that the briefing and all the information that you also received are under embargo until next Tuesday, 11th of June, 7 p.m. Central European Time. If you want to have a recording of the briefing or a transcript, please write us at [redaktion@sciencemediacenter.de](mailto:redaktion@sciencemediacenter.de). My colleague is posting the email address in the chat and you will find the email address also in the invitation email. We will provide the transcript as fast as possible. Thank you again all for joining, for your questions and thanks to the three experts for taking the time. I wish you a pleasant day or a pleasant evening. Thank you very much. Goodbye.



press briefing

## Contact person at the SMC Germany

### **Annegret Burkert**

Editor for Medicine and Life Science

Phone +49 221 8888 25-0

E-Mail [redaktion@sciencemediacenter.de](mailto:redaktion@sciencemediacenter.de)

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