Climate Science: Shooting the Messenger

Contributed by Alex Smith, Radio Ecoshock
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Regarding the recent attacks on top climate scientists, Radio Ecoshock takes the case of Richard B. Alley. He is the Evan Pugh Professor of Geosciences, at Penn State University. Alley is a Fellow of the American Geophysical Union (AGU), and a member of the National Academy of Sciences. His popular book about ice cores is called "The Two Mile Time Machine."

Alley was expected to give one of the best speeches of the December 2009 annual meeting of the AGU in San Francisco, and he did not disappoint. Here is a short digest of that hour-long Bjerknes Lecture to the AGU in San Francisco in December.

Professor Alley begins with the attack:

"I said these were interesting times. This is a copy of an email that was sent to my administration [at Penn State] by an alum [alumni, former grad of Penn State], and said alum copied me on this, so I believe I am fair. The alum asks for certain personnel changes to be made, and I have just put in the ones that relate to me.

"So for what it's worth, 'Dr. Alley's work on CO2 levels and ice cores' - now I don't actually do that but I talk about it - OK, 'Dr. Alley's work on CO2 levels and ice cores has confirmed that CO2 lags Earth's temperature. This one scientific fact alone proves that CO2 is not the cause of the recent warming.'

"I continue to mislead the scientific community. There should be prompt response (getting rid of me), I have 'crimes against the scientific community, Penn State, the citizens of this great country and the citizens of the world' that 'must be dealt with severely' because of my 'shameful' activities."

[laughter from the audience][applause]

"So there'll be a wanted poster which will be up here somewhere, but the thing which is fascinating, and we'll come back to, is that this email has in it a logical fallacy which is evident on casual observation. And I think it's worth our understanding at some level, how polarized the world is, how easy it is for someone to misunderstand our science, if they aren't fully within it, the amount of education, the amount of outreach, the amount of clarification, that we have to make, to get from this to a proper scientific understanding."

In fact, the former Penn State grad calls for "an investigation into...Dr. Alley's activities [that] will... start prior to the end of this year."

Later in this program, we'll follow Professor Alley as he explains the denialist bugaboo of carbon dioxide lagging temperature rise in climate history. In excerpts from this important speech, we'll learn more about the scientific history of our planet, and its atmosphere.

This was part of a concerted effort against climate scientists at Penn State, including the famous "hockey stick" graph

creator, Michael Mann, and others.

The Bjerknes Lecture is one of the keynote speeches to the American Geophysical Union annual meeting each year. Named after a famous Arctic researcher, Professor Bjerknes - Penn State's Professor Richard B. Alley received the award, and gave his speech at the December 2009 meeting in San Francisco, for his work teaching the history of Earth's past climates.

The title of the speech was "The Biggest Control Knob, Carbon Dioxide in Earth's Climate History". The entire speech, with accompanying slides, can be seen as a 57 minute: video here.

I have made this transcript of the excerpts used in our radio program – likely the only print version from the speech so far.

The first 20 minutes of Alley's speech go into the many ways that scientists can measure past CO2 levels. These include actual air samples trapped in ice cores, plus a whole range of cross-checking available from sea-bed analysis, shells of creatures... a list of techniques too long to list here.

In a sense, this is the most important foundation for everything we will hear next - because it establishes how we know. These are not mere guesses, or religious beliefs, but the results of millions of careful measurements, by hundreds of thousands of scientists around the world. The result is compiled and cross-checked by large scientific bodies, ranging from national Academies of Science, to the Intergovernmental Panel on Climate Change, through peer review and criticism by the world's scientific community. The results are not opinion, and are moving toward established facts about our world.

Dr. Alley explains, with graphs, the "Rock-Weathering Thermostat" that operates, over long periods of time, to balance both the CO2 and the temperature on planet Earth. This was developed by Walker, Hays and Kasting in 1981, and has stood the test of further research.

Dr. Alley tells us about the coldest times, labeled "Snowball Earth." But we begin our radio coverage with an event that must concern us all: 250 million years ago there was a massive extinction event called "The Great Dying."

"Basically, 251 million years ago, almost every critter on the planet dies. "The Great Dying" - the end Permian extinction. Maybe 95 percent of the species go, but because you can keep a species alive with a reasonably small number of individuals, this is really nasty.

" It turns out that there are bugs in the ocean, green sulfur bacteria, that use hydrogen sulfide, rather than water in their photosynthesis, and they have very interesting biomarkers, and those biomarkers are found widespread at the time of the dying. Which means - and these things are living in the photic zone of the ocean, and they're living on hydrogen sulfide, which means that the ocean's surface is filled with hydrogen sulfide. And if you breath very much hydrogen sulfide, you die.

"And it's probable that was true for a whole lot of oxygen-breathing critters back in the past. And so some time here, the ocean runs out of oxygen, and then it gets [unknown term] and fills up with hydrogen sulfide, and then it kills off most stuff on the planet.

"And it turns out that happens to be a warm time. There's a big warming coming up to that and the warming seems to have been because there was a big volcanism [volcanoes erupting]."

This is the theory popularized in the book "Under A Green Sky" by scientist Dr. Peter Ward. Listen to our Radio Ecoshock interviews with Dr. Peter Ward, especially our "Under A Green Sky" interview in the September 12h, 2008 program, and then his later explanation "The Medea Hypothesis" in the October 10th, 2009 Radio Ecoshock Show. It's best to listen to the earlier interview first. Isn't it important to know how the worst case climate scenario and how it developed? If that explains how rampant warming could kill off 95 percent of life on Earth? Listen to

ecoshock.net/eshock08/ES_080912

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We know that Earth has experienced extreme warming, where crocodiles played in tropical seas at the Poles. Professor Alley:

"Now come a little farther forward in time, and we're now in the Saurian Sauna of the mid-Cretaceous. It's still hot. There's no ice near sea level at the Poles, anywhere. You have balmy temperatures, you have forests crowding up to the edge of the Arctic Ocean.

"The continents are not that different from now. And if you put them in a model, as has been done, you melt all the ice, and the sea level gets a little higher, and that changes the planet's Albedo a little, and you get a little bit of warming. And you move the currents around, and you get a little bit of warming with some configurations, you can't get much.

"And so it's really stinking hot, and the only explanation we can find on this is that CO2 is really high again. Probably again because volcanism is running pretty fast. If you put high CO2 in the models, you sort of match what happened, except the world seems little bit too warm at the Poles. If you leave the CO2 out of the models, you don't get very close.

"The only way we can attribute this warmth, of having an ice-free world, is to have a high CO2."

But let's look at another horrific example from Earth's past climate. This is the Paleocene-Eocene Thermal Maximum - something that looks possible for us even today. Professor Alley says:

"And that's a very interesting little blip. It's where the Paleocene meets the Eocene, and it is a thermal maximum, so we call it the Paleocene-Eocene Thermal Maximum...

" What do we find there? There's a big isotopic anomaly that says 'CO2, CO2, CO2'. Maybe starting as methane, but going to CO2.

"There's a big temperature change. The whole world is already hot, and it cranks up a few degrees C. in a fairly short

order. The ocean acidifies, and all the shells on the sea floor are dissolving, and there's a big extinction event of things that live on the sea floor.

"Pretty much all the ecosystems get kicked around. There's huge migrations, there's seems to be the start of some evolution going on. There's a lot of ecosystem disruption. Things get out of place, and out of time, as it were.

"You can't possibly blame this on drifting continents. The CO2 rises in a few thousand years, and it falls in tens of thousands, a hundred thousand years, so this is not a drifting continent thing. The CO2 shows up and it gets hot. And it's fast compared to other things.

"And the way that it recovers looks just like our carbon cycle models."

Alley continues with a detailed time-line of Earth's temperatures, showing a direct correlation between CO2 and temperature periods. The measurements are amazing for their breadth, running from soil and sea samples, to fossil teeth, to leaf damage in fossil leaves. The work of scientists all over the world, over decades. Boom! the CO2 goes up, and Boom! so does the temperature. Like dancing partners.

There were times that didn't seem to fit, beyond the meteorite hit. But, says Alley, in the last decades, almost all of those have been reasonably explained, and most turn out to be CO2-related after all.

At minute 40 in the talk, Richard Alley goes into the science discounting other theories of climate disruption, such as the volcanoes and the Sun. Of course, there are many factors in this complex system. Volcanoes and the Sun, among others, do matter. But myriads of scientific studies show they are not "the control knob" when it comes to climate. Carbon dioxide is.

One theory, which still needs more research is this:

"People say 'Oh, wait a minute, the Sun doesn't change much, but the Sun modulates the Cosmic Rays, the Cosmic Rays modulate the clouds, the clouds modulate the temperature, so the Sun is amplified hugely.'"

I believe this is the main theory from dissenting University of Alabama scientist Roy W. Spencer. He's coming out with two new books from the Conservative publisher Encounter Books, titled "Climate Confusion: How Global Warming Hysteria Leads to Bad Science, Pandering Politicians and Misguided Policies That Hurt the Poor" in January 2010, and "The Great Global Warming Blunder: How Mother Nature Fooled the World's Top Climate Scientists" in March 2010. A barrage of denial of human-induced climate change, and a comfort to fossil fuel producers and users everywhere.

Alley says of this theory:

"It's a really interesting hypothesis. There's really good science to be done on this. But we have reason to think it's a fine tuning knob. Because this record, this is sixty thousand years ago on the left, up to today, and this is a record that is Beryllium 10 in the ice core. And Beryllium 10 is made by cosmic rays.

"Now the Sun modulates cosmic rays, so do the magnetic field. Forty thousand years ago, the magnetic field basically zeroed out, in what we call the Le Champs anomaly, for a millennium or so. And when it did, the cosmic rays came screaming into the Earth's system, and you see, and basically in all sedimentary records, this peak in cosmic rays-produced nucleotides.

"We had a big cosmic ray signal - and the climate ignores it. And it's just about that simple. These cosmic rays didn't do enough that you can see it. So it's a fine tuning knob at best."

Alabama scientist Roy W. Spencer has also denied the theory of evolution, replacing it with intelligent design and creationism, theories embraced by the deeply Conservative Christian movement.

Here is the end of the talk by Professor Richard B. Alley, to the American Geophysical Union, December 2009, in San Francisco:

"So where do we end up? ... If higher CO2 warms the Earth, climate history makes sense. And if CO2 doesn't warm, then we have to explain why the physicists are stupid, and we also have no way to explain what happened.

"And it's really that simple. We don't have any plausible alternative at this point, and so it surely looks like it...

"CO2 can be a forcing. It can be a feed-back. The warming effect of a CO2 molecule - it does not remember why it's there. It only remembers that it is there. And the paleo-climate data shows that sort of the mid-range models are right, and if there's a problem, the world is a little more sensitive to CO2 on some time scales than the models tend to predict.

"Now, be clear. There's lots of knobs that control the climate. The Sun knob, we're really lucky it doesn't get twiddled very much. The cosmic rays, the space dust, the magnetic field, and the other knobs, if they matter, we can't find it yet.

"There are really interesting things to be learned. And I hope that the science rolls forward on those. But so far, they're either not doing anything, or they're not doing much. They are fine tuning knobs, and that's how it looks.

"This is not a regional story! You close the Isthmus of Panama and the people who used to have coastal property don't anymore. Their climate changed.

You take India from the Pole, and you run it to the Equator, and it's climate changes. The Younger Dryas was a big regional thing. There's lots of things in regional climate, that don't do much to the globe. The Younger Dryas is warm in the South and cold in the North, so it doesn't do much to the global temperature.

So, in terms of things that people care about, CO2 is just the start, it's not the end. There's real interesting things to be done in here. And I think there's a lot more work that needs to be done here yet, because where we really stand now, we're not quite yet at that pound on the table, this is nailed, we're done and this is our confidence interval level.

"The paleo-climate data they are coming in real fast, they're really good, it's really sharp. But, sort of, these latest advances have not had time to percolate through to the IPCC yet. And so we're going to see more on this. We're going to see more discussion on this. This story is very clearly not done.

"But it's fairly clear where we stand now. Which would be: an increasing body of science indicates CO2 has been the most important controller on the global average climate of the Earth."

[Applause]

But what if we burn all the fossil fuels we can get our hands on? Richard Alley answers that question in the short Q and A session:

"The question was: if we burn we burn all the fossil fuels, where do we get to. And there's this huge gap between sort of proven reserves, and what we think is out there if we're really clever, and really desperate.

"And so, do we get it out of the oil shales, do we get it... and people are kicking around numbers like five or six thousand gigatons, I think is the number. There's a big number that's floating around on what might be recoverable.

"And if you take all of that, and you turn it to CO2 pretty fast, there's some chance of getting above that Cretaceous level. Like I say, the temperatures might have been a little high at that site, because the Atlantic is a little narrower, and so the ocean circulation has slowed a little bit - but that was 37, 38 sea surface temperature. That was hot.

"So you start thinking about this, and say 'well you know if we really crank it up, are we really confident we're stopping at 2 or 3 or 4 or 5 or 6 or 7 [degrees C]?'

"You can think of a burn-it-all future getting really hot."

In other words, we could get out of control global heating, where the seas could reach 38 degrees Celsius, or 100 degrees Fahrenheit - hotter than the human body. That has happened in Earth's past.

According to the National Oceanic and Atmospheric Administration (NOAA), the 20th century average sea surface temperature was 16.4 degrees C, or 61.5 degrees F. If we burned up all the fossil fuels, it is conceivable the average sea temperature could more than double in Celsius, or rise about 40 degrees Fahrenheit. Given what it takes to heat water, that kind of super-record warming would presumably take at least centuries, if not millenia, but in our strange case of rapid emissions, we really don't know. Human fossil mining is an ahistorical event. Nothing in the natural record prepares us for this.

Surely humans, and the ecosystems which support humans, would have gone extinct before that happens? Maybe not. The delay in warming, caused by sea absorption, among other factors, means we could burn many gigatonnes of carbon, with results a generation or three later. But then, the warming can last at least 100,000 years, as shown by David

Archer in his book "The Long Thaw" (see our Radio Ecoshock interview with Dr. Archer here: ecoshock.net)

Could we be so stupid as to burn it all? We are already doubling tar sands production, and fracking gas shales, while drilling miles deep below the ocean for oil - all to get more fossil fuels. Right now, barring a vast revolution in our economy, we are headed toward "Thermageddon," as described by the late Greenpeace founder, Robert Hunter. [ecoshock.org/podcasts]

But wait, we didn't allow Dr. Alley to answer one of the biggest denier complaints: that the climate record often shows CO2 following a temperature rise - so how could CO2 cause climate change? That's why they want him fired, if not charged with crimes against humanity.

In the talk, Alley showed graphs of time and ice cores to explain it. He compared the situation to interest on your credit card. Yes, the original debt comes first, but the debt becomes much larger with 18 or 28 percent interest. You can't say the interest costs don't exist, just because the debt came first. If you do claim that, bankruptcy follows.

The clearest way to understand the role of carbon dioxide and temperature change is found in the conclusion of the speech:

"CO2 can be a forcing. It can be a feed-back. The warming effect of a CO2 molecule - it does not remember why it's there. It only remembers that it is there."

When other lesser control knobs, like exploding chains of volcanoes, or even the regular tilt in Earth's orbit, begin the process of warming - CO2 becomes an amplifying factor which drives the planet into a much warmer state. That has happened many times.

But now, for the first time, a species on Earth has brought out CO2 accumulated over long eras, and burned it in a century or two. In this case "CO2 can be a forcing." That is, humans can trigger a great warming event, and it seems almost certain we have done so.

Could we save ourselves by mimicking natural processes? That's the last question of the night. So far, that doesn't look possible, because things like rock weathering take thousands, or tens of thousands of years. If we try to mine the right rock, grind it up, and expose it to form calcium carbonate - the energy involved in the process might be greater (and more carboniferous) than the carbon removed. It is easier, Dr. Richard Alley says, to applause, to prevent the carbon from entering the atmosphere in the first place.

In February 2009, Richard Alley shared the 2009 Tyler Prize for Environmental Achievement with Veerabhadran (Ram) Ramanathan, "for their scientific contributions that advanced understanding of how human activities influence global climate, and alter oceanic, glacial and atmospheric phenomena in ways that adversely affect planet Earth."

I'm Alex Smith. Feel free to download and share the radio program (24 min, 6 megabytes) - from our web site, ecoshock.org.

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Wikipedia. on Richard_Alley