Commentary for *Journal of Cosmology* Volume 22

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Polonnaruwa4 - Yes, Diatoms Have Been Found in the Polonnaruwa Meteorite

This commentary on the recent publication of evidence of formerly and presently living species in a cometary meteorite was met with skepticism, but further research has corroborated all of the initial claims. However some of the most recent criticism has been wholly unjustified, and the following is a specific response to the critical review published on March 12, 2013 following two papers published front-to-back in *Journal of Cosmology* on 4 and 5 March 2013 (Wickramasinghe et al 2013e and Wallis et al 2013).

In the commentary to follow, we follow the organization and in particular the section headings of the most outrageous misrepresentation of scientific facts on the commercial blog site which is maintained by Bad Astronomer Phil Plait (PP).

1. Introduction

The 5 introductory paragraphs state the overall science issues raised by discovery that life forms, both living and extinct, are seen both living and fossilized into ancient meteorite material. He then summarizes these reports, based upon inaccurate citation and with bogus arguments, often ignoring critical science laboratory results and procedures, "It's wrong. Really really wrong. Way, way, way ridiculously oh-holy-wow-how-could-anyone-publish-this wrong."

2. That's the J of C

Here the blog seeks to defame the character and career of Professor Chandra Wickramasinghe, who is the founding director of the world's oldest astrobiology institute at Cardiff University and also a Professor and Director of the Buckingham Center for Astrobiology at Buckingham University. Here PP uses *ad hominum* arguments comparing a distinguished university professor and researcher, who has made paradigm-shifting contributions to the astrophysics of interstellar dust, to Sylvia Brown and Jenny McCarthy. Along the way he portrays Professor Wickramasinghe as a fanatic proponent of life beyond our planet's surface. In fact, the weight of evidence is now tipping in favor of abundant off-planet life, and perhaps continuing developments within science will justify such enthusiasm.

It should be mentioned in passing that Professor Wickramasinghe holds the highest science degree of the University of Cambridge (ScD), was formerly a Fellow of Jesus College of that ancient University and holds honorary doctorates from universities

worldwide. He has over 300 papers in so-called "peer-reviewed" journals, some 70 of which are in the journal Nature.

At this point, we note that Professor Wickramasinghe, maliciously labeled a fringe scientist by PP, is joined in authorship by 12 additional scholars, and perhaps it is time to take notice of their conclusions.

Then PP seeks to impugn the Journal of Cosmology. Probably all journals have published at least one article that is regrettable, and it is still probable that Tyche is in fact a rogue planet; I would remind that most theoreticians today will admit privately, though not publicly, that 90% of what they publish in The Astrophysical Journal is wrong. And the private comments of an editor no longer associated with Journal of Cosmology are irrelevant.

(Note: It is now well documented that Tyche is in fact a 3-Jupiter mass object at the Oort cavity boundary 3x10^15 meters from Earth, CHG)

3. Diatomaceous Earth

We do not comment on this section, which describes the reaction of Dr. Patrick Kociolek to only the photographs in Wickramasinghe et al (2012d)
and not to the technical laboratory analysis reported previously in Wallis et al (2013). It was unfair and prejudicial of PP to ask Dr. Kociolek to comment on a single manuscript without the supporting documents.

It would be fair to say that Dr. Kociolek would probably have moderated his remarks had he known of the extensive laboratory work reported in Wallis et al (2013) that shows from chemical and structural analysis that some of the diatoms are indeed fossilized and therefore not understood as post-fall contaminants.

And Dr. Kociolek does not comment on the other life forms seen in the proven cometary meteoritic material (Wallis et al, 2013, Fig. 6)

4. Meteorwrong

Here we find six seemingly relevant questions. But in fact the six questions have been fully answered in the two companion papers published 10 days *before* the criticism (Wallis et al, 2013; Wickramasinghe et al, 2013e).

Some of the answers are complex, and we copy the answers with quotations from the published scientific reports.

Q1 Exactly where was the meteor found?

A1. The question contains the assumption that the meteorite was found intact in a single location. But as reported in Wallis et al (2013) "the meteor exploded and showered the area with hot explosion fragments. Thus PP is forcing upon us his assumptions that are at variance with scholarly reporting. The fact that the meteor "disintegrated into sparkling fragments" (Wallis et al 2013) makes credible that many fragments would be found, and if Dr. Kociolek or PP were to ask the authors, they would probably be sent a fragment if the requesting party could demonstrate an ability to conduct sterile analysis with useful instruments such as those already applied.

The clear identification of many fragments as meteoritic is also clearly stated in Wallis et al 2013); "a distribution of stones [was] recovered from a strewn field of >10 km. Police records indicate reports of low level burn injuries from immediate contact with the fallen stones and subsequent reports of a strong aroma. One woman was reported to have lost consciousness and was transported to the hospital after inhaling fumes from one of the stones. Witnesses reported that the newly fallen stones had a strong odour of tar or asphalt. Local police officials responded immediately by collecting samples and submitting them to the Medical Research Institute of the Ministry of Health in Colombo, Sri Lanka.

Q2. What kind of environment did it fall in?

A2. The inference from Dr. Kociolek that the samples must have been recovered from fresh water is entirely untrue. Most of the fragments were found in sandy freshly plowed fields.

We read in Wallis et al (2013), "The fragments were found initially by native farmers, when the rocks were still hot, and the local police were immediately engaged to collect all available samples for delivery to the Medical Research Institute of the ministry of Health. There they were received and collected by Dr. Anil Samaranayake, Director of the Medical Research Institute, Colombo. Sri Lanka."

Additional stones were found by local residents and were emphatically not found in freshwater. We read in Wickramasinghe et al (2013c). "Two samples examined by us included one recovered by a farmer from his own property, and another that fell on a roof a few hundred metres away. Both stones, when examined using an electron microscope, displayed the diatom structures we described in our earlier papers.

Q3. How did they handle it ?

A3. These samples were stored in sealed glass vials for later analysis. (Wallis et al 2013)

Q4. What precautions were taken to prevent contamination?

A. "To rule out contamination as the explanation of the results in Fig. 2 we have subjected the soil 10 cm below the collection site to the same SEM and optical microscope examination. The results obtained so far in this control experiment gives us confidence to conclude that the living diatoms are indigenous to the meteorite and were not introduced from the surrounding soil." (Wickramasinghe et al, 2013d

B. The surface of a meteoritic stone was sterilized and a sterile wide-bore hypodermic syringe inserted into a depth of about 2-3 cm into its interior. By this means a small quantity of fine powdery material from the interior was extracted and dispersed onto a drop of sterile distilled water on a sterilized microscope slide. Examination under a light microscope showed a range of diatoms exhibiting motility as well as evidence of chlorophyll-containing chromophores. (Wickramasinghe et al, 2013d)

C. A flame sterilized large bore hypodermic needle was used to extract some of the deep samples. Others were extracted by deep cleavage to the interior sections, and mounted on aluminum plugs and coated for microscopic inspection (Wallis et al, 2013).

D. The sample was powdered, mixed with a small amount of acetone and pipetted out onto a glass slide. Analysis was carried out using X-ray diffraction. A scan was run using the Philips PW1710 Automated Powder Diffract meter using Cu Ka radiation at 35kV and 40mA, between 2 and 70 °2q at a scan speed of 0.04 °2q/s. From the scan, phases were identified using PC-Identify software and from the peak areas, semi quantitative analysis was performed and a percentage of each phase present calculated.

E. The principal experiment demonstrating the meteoritic nature of the sample comes from a triple oxygen isotope analysis performed at the Stable Isotope Laboratory at the University of Göttingen, Germany. We read in Wallis et al (2013), "Triple oxygen isotope analyses were conducted in the Stable Isotope Laboratory at the University of Göttingen, Germany. Approximately 2mg of crushed sample was placed inside a Ni sample holder, evacuated overnight and heated to 70°C for 12h. An infrared (IR) laser (50W CO_2 laser, $\lambda = 10.6\mu m$) was used to fluorinate the samples in purified F_2 gas under pressures of approximately 20 mbar. Sample O_2 was purified through the removal of excess F_2 by reaction with NaCl at 110°C to form NaF. Cl_2 gas was collected at a cold trap at -196°C. Sample oxygen was then collected at a 5Å molecular sieve at -196°C, expanded into a stainless steel capillary, transported with He carrier gas and re-trapped before release at 92°C through a 5Å molecular sieve GC-column of a Thermo Scientific GasBench II. The GC column was utilized to separate interfering NF_3, from O_2, as required for analysis of ^{17}O (Pack et al, 2008). The resulting purified sample O_2 was then expanded to the dual inlet system of a Thermo MAT 253 gas mass spectrometer.

> **F.**"We conclude that the oxygen isotope data show P159/001-03 and P/159001-04 are unequivocally meteorites, almost certainly fragments originating from the fireball-causing bolide. The most likely origin of this low density meteorite with delicate structures, some highly carbonaceous, is a comet (Wickramasinghe et al., 2013b)." (Wallis et al 2013).

Q5. Why are there no photographs of it in situ?

A5. "It" does not apply, because as noted above, the meteor exploded and a large number of fragments were recovered by local farmers, by local police, and by Dr. Anil Samaranayake, as well as by local geologists.

We read in Wallis et al (2013), "These [samples] included substantial quantities of stones recovered by the Department of Geology, University of Peradeniya."

Q6. (The million dollar question): How do they know that it was from the meteor sighting

A6. We read in Wallis et al, (2013)

"This fragment was portioned for interior section Scanning Electron Microscopy (SEM), oxygen isotope analysis, compositional analysis by X-Ray Diffraction (XRD) and elemental analysis by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES)."

"In addition to the portioned fragment, a sample of sand fulgurite was also analyzed for comparative purposes together with a soil sample recovered from the fall site and a further sample of calcium-rich terrestrial rock selected for control purposes." (Wallis et al 2013). This reference contains several paragraphs detailing the differences between the 2 Polonnaruwa meteorite samples and the control fulgarite, soil sample, and native terrestrial rock.

"TX-Ray Diffraction was carried out using a Philips PW1710 Automated Powder Diffractometer using Cu Kα radiation at 35kV and 40mA, between 2 and 70 $^{o}2\theta$ at a scan speed of 0.04^{o} 2θ/s.

"A sample of the recovered stones was then sent to us at Cardiff University, where we conducted studies of freshly cleaved interior surfaces using the Environmental Scanning Electron Microscope at the University's School of Earth and Ocean Sciences. These studies resulted in a number of images showing diatom frustules, some of which were clearly embedded in the rock matrix, thereby excluding the possibility of post-arrival contamination. Other structures of various shapes including large numbers of slender cylinders of lengths 5 - 10μm, and a few micrometers in diameter were seen to be distributed extensively throughout the sample (Wickramasinghe et al., 2013a). A separate sample was then sent to the United States, where it was investigated by one of us (RBH)

using the Hitachi Field Emission Scanning Electron Microscope. This independent study on a different sample confirmed the presence of a range of diatom frustules, some of which were embedded in the rock matrix."

Scanning Electron Microscopy (SEM) was conducted using the FEI (Phillips) XL30 FEG $ESEM_{800}$ (Environmental Scanning Electron Microscope) FEG (Field Emission Gun) at the School of Earth Sciences at Cardiff University. The unit incorporates a secondary electron detector (SE), a back scatter electron detector (BSE) and a gaseous secondary electron detector (GSE). It also has an Oxford Instruments INCA ENERGY (EDX) x-ray analysis system. This provides clear and convincing evidence that these obviously ancient remains of extinct marine algae found embedded in the Polonnaruwa meteorite are indigenous to the stones and not the result of post-arrival microbial contaminants.

"Triple oxygen isotope analyses were conducted in the stable isotope laboratory at the University of Göttingen, Germany. Approximately 2mg of crushed sample was placed inside a Ni sample holder, evacuated overnight and heated to 70°C for 12h. An infrared (IR) laser (50W CO_2 laser, $\lambda = 10.6\mu m$) was used to fluorinate the samples in purified F_2 gas under pressures of approximately 20 mbar. Sample O_2 was purified through the removal of excess F_2 by reaction with NaCl at 110°C to form NaF. Cl_2 gas was collected at a cold trap at -196°C. Sample oxygen was then collected at a 5Å molecular sieve at -196°C, expanded into a stainless steel capillary, transported with He carrier gas and re-trapped before release at 92°C through a 5Å molecular sieve GC-column of a Thermo Scientific GasBench II. The GC column was utilized to separate interfering NF_3, from O_2, as required for analysis of ^{17}O (Pack et al, 2008). The resulting purified sample O_2 was then expanded to the dual inlet system of a Thermo MAT 253 gas mass spectrometer." (Wallis et al 2013). The analysis of the carefully prepared meteorite samples allowed a firm diagnosis. "We conclude that the oxygen isotope data show P159/001-03 and P/159001-04 are unequivocally meteorites, almost certainly fragments originating from the fireball-causing bolide. The most likely origin of this low density meteorite with delicate structures, some highly carbonaceous, is a comet (Wickramasinghe et al., 2013b)." (Wallis et al 2013).

"The presence of a number of carbonaceous biological structures exhibiting severe nitrogen depletion is highly indicative of ancient fossilized biological remains. Some of these were deeply integrated in the surrounding mineral matrix suggesting they could not have been recent terrestrial contaminants." (Wallis et al, 2013).

As described in Wallis et al (2013), independent laboratory testing of the meteorite sample has produced compelling evidence for off-planet properties of the sample. Such evidence, in the form of measured O(16)/O(17) ratios is considered the gold standard for detection of off-planet origin, since all terrestrial and lunar rock samples have a known fixed ratio. Further samples have been submitted to other laboratories in Cambridge Massachusetts and San Diego, California for further analysis.

At this point Phil Plait offers the opinion that the Polonnaruwa meteorite does not look like other meteors of what he considers to be similar type. However he fails to mention that the samples carefully prepared and photographed in Wallis et al 2013 look identical to the Brownlee particles of carbonaceous chondritic composition (Fig. 5 in Wickramasinghe et al, 2013e) of known cometary origin since they were collected with high-flying aircraft. The density of the materials is a principal determinant of origin, since asteroidal materials are normally denser than cometary materials. (mention NASA/IMPACTOR experiment?)

In light of this overwhelming detailed accounting of sophisticated chemical, mineralogical, and isotopic analysis, with careful procedures indicated at every step, how can PP claim,

" they didn't even send a piece of this rock to an experienced lab …."

"These aren't evidence for life from space, they 're evidence of life on earth."

" So right from the start, there's no reason to trust that what they have is a meteorite."

"there is not a single shred of evidence to back up this claim. Nothing"

"They do not present a chemical analysis …"

"Like zero chance they are from space"

"It could simply be a bit of black rock that they found somewhere,"

"I don't think what they found is a meteorite at all, let alone from the meteor event seen in December."

Conclusion

Thus we find that the claims made by Phil Plait are in flagrant discord with scientific facts presented in the technical reports that he presumes to be excerpting from. After impugning the reputation of Professor Wickramasinghe along with his scientifically trained and laboratory equipped colleagues, by comparing them to Sylvia Brown and Jenny McCarthy, he proceeds to refer to an expert who has never observed the samples and immediately proceeds to contamination issues that are potentially irrelevant. What is lost in this process is the care with which samples were taken, including the careful extraction and preservation of soil samples from under some fragments and the negative results from testing of such samples. His so-called expert claims that the collected samples were contaminated by fresh water, whereas they were found on sandy soil in general, and on hilltops in particular. Has Dr. Kociolek written to Dr. Wickramasinghe to ask for a sample so he can offer informed comments? The editors of *Journal of Cosmology* are sympathetic to Dr. Kociolek who may not have known of all of the research results available, and who may not have wished to have his remarks exaggerated

and possibly misquoted by Phil Plait.

In fact, the editors of *Journal of Cosmology* find that the reporting and commentary on the scientific results presented is egregiously inaccurate and in many cases serious disinformation. Failure to report the many laboratory reports on chemical, mineral, and isotope analysis of the meteoritic and biological materials found is a misleading omission, and his claims that no such tests were undertaken is egregious disinformation. Publically offering such egregiously erroneous writing and urging it upon WIKIPEDIA are so contrary to the principles and methodology of science that Phil Plait should be kept distant from the workings of contemporary scientific research. We are aware that Phil Plait has a PhD degree from the University of Virginia, and wonder whether that great University might reconsider this important award that honors science. Perhaps the amusing title assumed by PP of ***Bad Astronomer*** should be extended to include ***Bad Scientist***.

References

Wallis, J. et al, 2013, The Polonnaruwa Meteorite: Oxygen Isotope , Crystalline and Biological Composition Analysis, Journal of Cosmology, 22, 10004-10011

Wickramasinghe, N. C. et al. 2013d, Living Diatoms in the Polonnaruwa Meteorite, Journal of Cosmology, 21, 9797-9804

Wickramasinghe, N. C. et al, 2013e, Incidence of Low Density Meteoroids of the Polonnaruwa-Type, Journal of Cosmology, 22, 9995-10003

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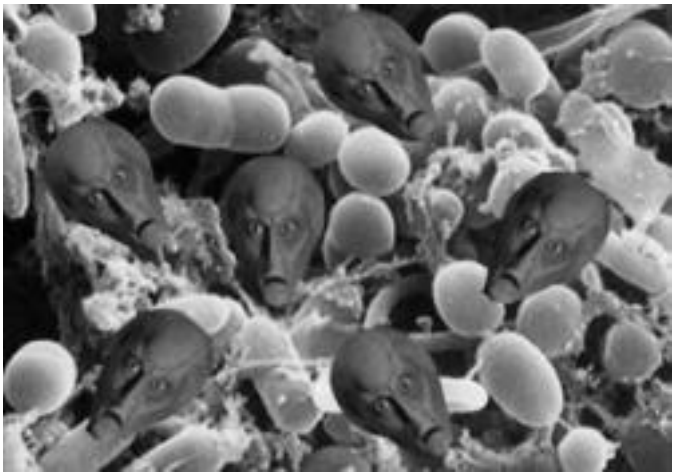
FOLLOWING IS THE COMPLETE DOCUMENT POSTED ON :

http://www.slate.com/blogs/bad_astronomy/2013/01/15/life_in_a_meteorite_claims_by_n_c_wickramasinghe_of_diatoms_in_a_meteorite.html

No, Diatoms Have *Not* Been Found in a Meteorite

[UPDATE (Mar. 12, 2013): The authors of this very shaky "life in a meteorite" paper described below published another paper recently, causing a minor media frenzy. In it they try to show the samples are meteorites, but the evidence they present is in many ways even ***worse*** *than the outrageous claims they made in the first paper! I have written a take-down of that paper as well; but you should read this one here first.]*



If only it were this easy...

If there's a story practically guaranteed to go viral, it's about evidence of life in space. And if you have *pictures*, why, that's going to spread like, well, like a virus.

So the moment I heard that a paper had been published saying that diatoms—a type of algae, microscopic plant life, that have hard outer shells made of silica and come in a variety of shapes and forms—had been found *in a meteorite*, I knew I'd get flooded with emails and tweets and Facebook messages because LIFE IN SPACE!

And so I did. People are really curious about this!

But then I read the actual paper, and guess what? Let me be delicate: It's wrong. Really, really wrong. Way, way, way ridiculously oh-holy-wow-how-could-anyone-publish-this wrong.

[deep breath]

OK, let's dive in, shall we?

That's the JoC

The paper was published online on a site called *The Journal of Cosmology*. I'll get back to that august publication in just a moment. The lead author is N. C. Wickramasinghe, and as soon as I saw his name alarm bells exploded in my head. Wickramasinghe is a proponent of the idea of panspermia: the notion that life originated in space and was brought to Earth via meteorites. It's an interesting idea and not without some merits.

However, Wickramasinghe is fervent proponent of it. Like, *really* fervent. So much so that he attributes *everything* to life in space. He's said that the flu comes from space. He's said SARS comes from space. He's claimed living cells found in the stratosphere come from space. (There is no evidence at all they do, and it's far more likely they are terrestrial.) He's said a weird red rain in India was from space (when it's been shown

conclusively that it isn't). The list goes on and on. Wickramasinghe jumps on everything, with little or no evidence, and says it's from outer space, so I think there's a case to be made for a bias on his part.

Now, you might accuse me of using an *ad hominem*, an argument that cast aspersions on the person making the claim, and not attacking the claim itself. I'll get to the claim in a moment, but sometimes an *ad hominem* is warranted! If Sylvia Brown claims she can predict someone's future, you would be right to doubt her based on her past, since she has continually failed in every attempt to do so. If Jenny McCarthy claimed botox cures autism, again, you might be forgiven for doubting it based on her previous anti-vaccine and other false claims. You still need to examine the claims on their own merits, of course, but: Fool me once, shame on you; fool me twice, shame on me.

So, to be polite about it, Wickramasinghe is something of a fringe scientist. Who would publish a paper by him?

The *Journal of Cosmology* is an online site that claims to be peer reviewed. However, the papers it publishes are not always of the highest quality. One paper they published a few years back claimed to have found fossils in meteorites, and it was roundly ridiculed by biologists familiar with the field—one even used the word "pathetic." Ouch.

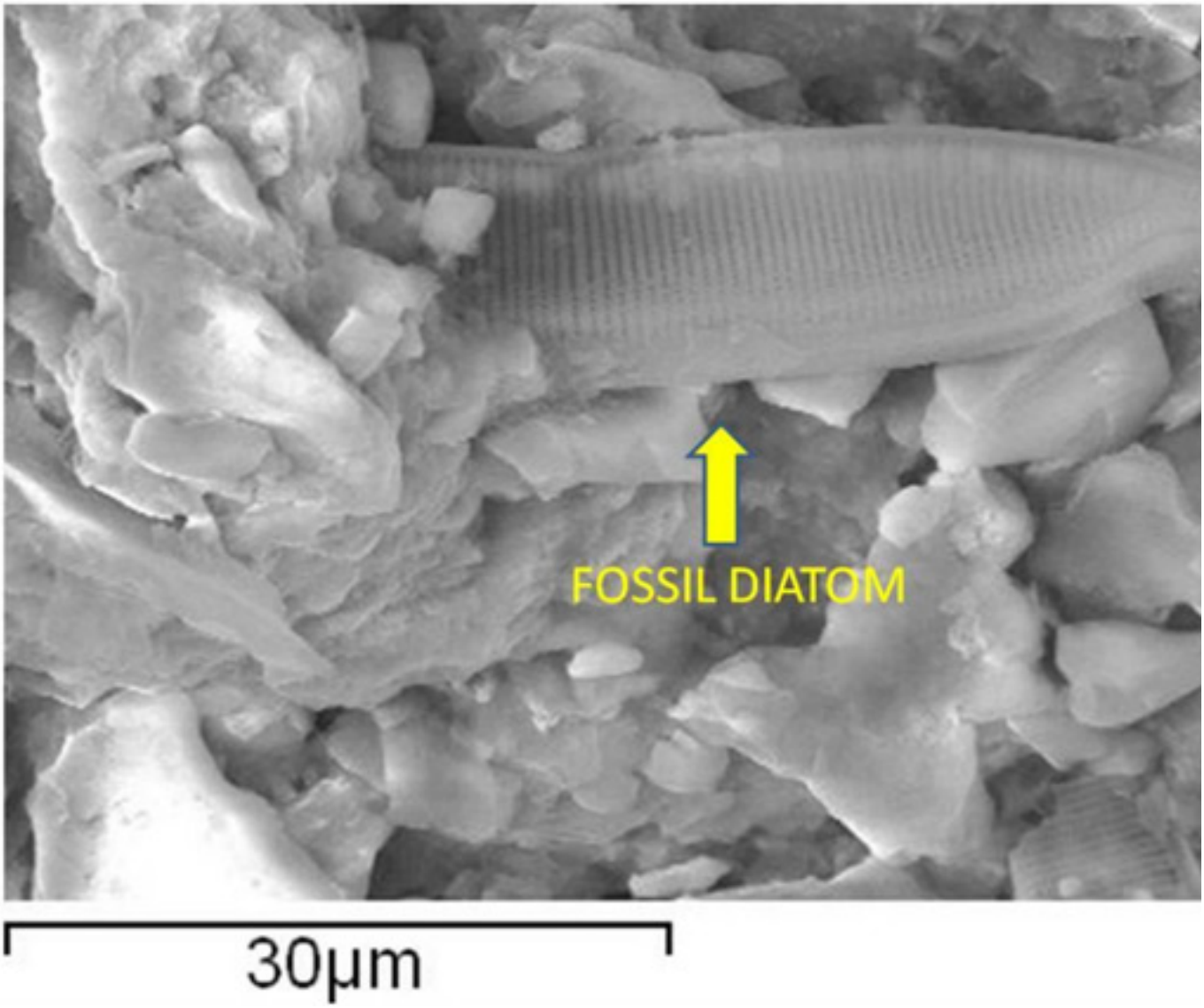
The journal also supports other fringe claims that have very little or no evidence to back them up. For an example in my own field, when some astronomers said they found circumstantial evidence for a previously unknown planet in the outer solar system, the JoC published a page with the headline, "Tyche: Rogue Planet Discovered in Oort Cloud," which was dead wrong. And because I wrote an article on my blog saying the planet idea is interesting but not convincing, the editors of the JoC expressed their opinion of me:

The torches and pitchforks crowd, led by astronomer-wannabe Phil Plait claims its [sic] not so. But then, Plait's most famous discovery was finding one of his old socks when it went missing after a spin in his dryer. RJ

Yeah. That's professional.

So right away, I was not inclined to give a lot of weight to the idea that scientists found diatoms in a meteorite. But to be fair, we need to look at the evidence. So let's take a look.

Diatomaceous Earth



One of the diatoms found in the specimen. The scale bar is 30 microns, about one-third the width of a human hair.
Image credit: N. C. Wickramasinghe et al.

The claim is as follows: A brilliant meteor was seen over Sri Lanka in December 2012. Meteorites from the fall were found and sent to a lab for analysis. When examined under a microscope, clear evidence of diatoms was found. They are fossilized, which means they aren't ones from Earth that somehow got into the meteorite after it fell. Therefore, this is evidence of life in space.

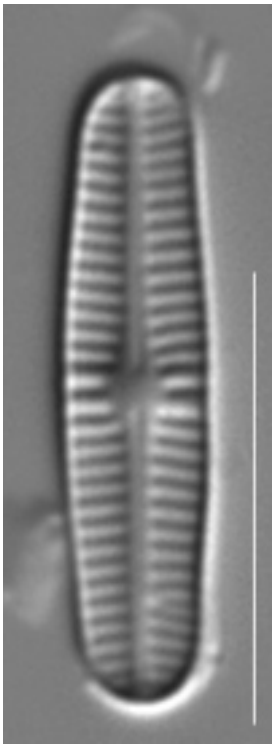
The microphotographs in the paper are pretty interesting, I'll admit. As you can see from the one above, there really is something that appears to be biological in the picture, and to my untrained eye it really does look like a diatom.

But I'm no expert! So I did what any good scientist should do. I contacted someone who *is* an expert. I sent an email with a link to the paper to Patrick Kociolek, a professor of

ecology and evolutionary biology at the University of Colorado at Boulder, and director of the University of Colorado Museum of Natural History. He kindly replied, saying,

I should say up front, that most (not all) of the forms pointed out in the paper are indeed diatoms. While the authors may have not referred to some of the images correctly (labeling one as "filamentous" when it is just a fragment of a cell), they are indeed diatoms.
Huh! So they are diatoms! So does this mean life has been found in space?

Not so fast. Kociolek continues:



An example of a known terrestrial diatom, called *Rossithidium pusillum*. The vertical line represent a size of 10 microns, one-tenth the diameter of a human hair.
Image credit: Marina Potapova via Diatoms of the United States

What is amazing about the forms illustrated is that 1) they are, for the most part, in great shape. There certainly is not any sign of this being fossilized material.

Uh oh. That's a strike against Wickramasinghe, since a big part of his claim is that the diatoms are fossilized and therefore must be native to the rock they found. But it gets worse:

In fact on page 8 of the journal, the authors indicate, "fossils [sic] diatoms were not present near the surface of the Earth to contaminate a new fall of meteorites." What must have been near, however, was water, since the forms are all freshwater species…

In other words, *all the diatoms shown in the paper are from known species on Earth*. That makes it *somewhat* less likely they are native to space. And by somewhat, I mean

completely. Like, zero chance they are from space.

Kociolek makes this even more clear:

> 2) the diversity present in the images represent a wide range of evolutionary history, such that the "source" of the diatoms from outer space, must have gone through the same evolutionary events as here on earth. There are no extinct taxa found, only ones we would find living today…for me it is a clear case of contamination with freshwater.

I find it curious indeed that Wickramasinghe and his co-authors didn't talk to diatom experts outside their group about this. I can't say anything about their own expertise on diatoms, except to note that, as Kociolek points out, they made some really basic errors in identification and didn't recognize these specimens as Earth diatoms (they compare them to known species, but they should have gone out of their way to try to *identify* them *specifically* against known Earth species). That doesn't speak very well for their scholarship here.

So, there you go. These aren't evidence of life from space, they're evidence of life on Earth. I hate to break it to you, but we already knew about that.

Meteorwrong

So much for the diatoms. But it turns out I was pretty sure the claim of life in space was wrong even before I heard back from Kociolek, though. And that's because of the meteorite itself.

Or, I should say, "meteorite." The evidence presented for that is pretty fishy as well.

First, the claim of a bright shooting star over Sri Lanka in December, 2012 is fine. And we do sometimes find meteorites—the actual solid bits of space rock and/or metal—after such a sighting. I love meteorites, and I'm fascinated by them. I own several myself.

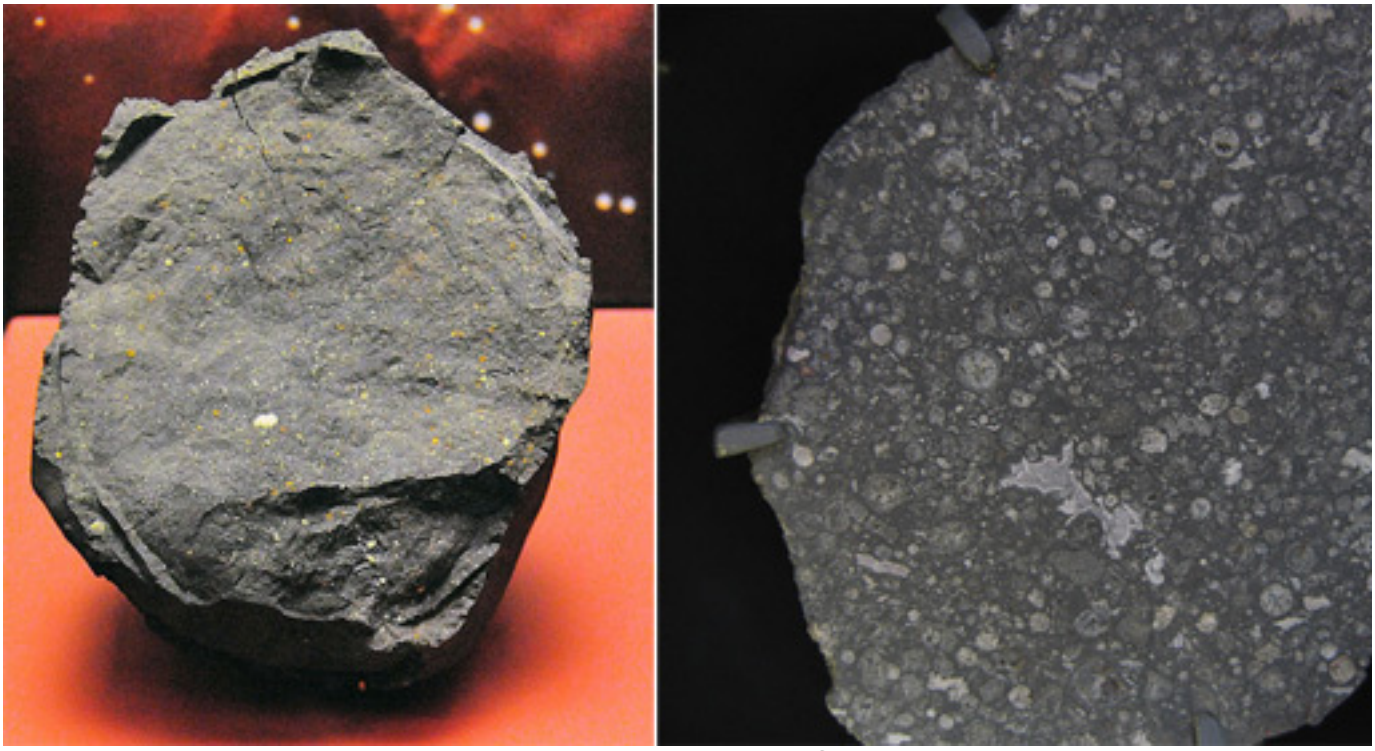
But the story presented in Wickramasinghe's paper gets a little sketchy at this point. They claim that one of the authors found a meteorite from the event and sent it to Wickramasinghe for analysis. However, there are no details whatsoever of the find itself. Where did they find it, exactly? What kind of environment did it fall in? Was it on a street, in a riverbed, on the roof of a building, or what? And how did they handle it? What precautions were taken to prevent contamination? Why are there no photographs of it *in situ?* The fact that none of this information is in the paper is irregular, to say the least.

And here's the million dollar question: *How do they know it was from that meteor sighting?* There is not a single shred of evidence to back up this claim. Nothing. It could simply be a bit of black rock they found somewhere. They do present a chemical analysis and claim it's a carbonaceous chondrite meteorite, a specific type of space rock with clear structures and composition. However, the analysis they present doesn't prove it's a carbonaceous chondrite, let alone a meteorite. For example, the chemicals (carbon, olivine, and so on) they found are also readily found in Earth rocks. Olivine is

everywhere, like in beach sand. So right from the start, there's no reason to trust that what they have is a meteorite.

The specimen found by Wickramasinghe's team. It's not terribly meteorite-like.
Image credit: N. C. Wickramasinghe, et al.

Then they show a picture of it:



Two carbonaceous chondrite meteorites: the Murchison meteorite (left) and the Allende meteorite (right).
Image credit: Murchison: Art Bromage on Flickr via wikipedia; Allende: Shiny Things on Flickr

Here's the thing: In my opinion, *it doesn't look like a meteorite*. At all. It isn't rounded, it looks too friable (crumbly), and the structure is wrong. Carbonaceous chondrites look very much like small stones, more solid, compact, and with an entirely different structure. In fact, chondrules are small, generally spherical grains inside this type of meteorite—hence the name—and in the pictures presented in the paper, there are clearly no chondrules. Here's what actual carbonaceous chondrites look like:

Those are very different beasts from the rock shown in the paper.

And again, as presented in their own write-up, the procedure they followed for this seems pretty sloppy. They didn't even send a piece of this rock to an experienced meteoritics lab for independent confirmation! That's the very least they should have done.

I'll be frank: *I don't think what they found was even a meteorite at all*, let alone from the meteor event seen in December. And given that it was embedded with a bunch of identifiable fresh-water diatoms found on Earth, I'm guessing this rock is nothing more than some rock from a river bed or other similar location.

Conclusion

So we have a journal with an, um, *unusual* publishing record, a man who claims with little or no evidence that everything we see comes from space, a rock that is almost

certainly from Earth and not space, and a bunch of diatoms inside it (the one claim they get right) that clearly evolved on Earth and are identifiable as native in fresh-water sites.

That does not fill me with confidence that this claim of life in space has any basis in reality whatsoever. Let me be clear: In my opinion, the claim that they have found diatoms in a meteorite is almost certainly incorrect, and just as certainly not something they can state so unequivocally in their paper. The evidence they present simply comes nowhere close to supporting their conclusion.

Having said that, I do think there is life in space, or at least that's the way to bet. We know there are billions of planets in our galaxy, and we know life on Earth arose almost as soon as conditions on our newly-formed planet were right for it. So I'm confident that, statistically speaking, there is life on other planets, at the very least "primitive" life such as one-celled plants.

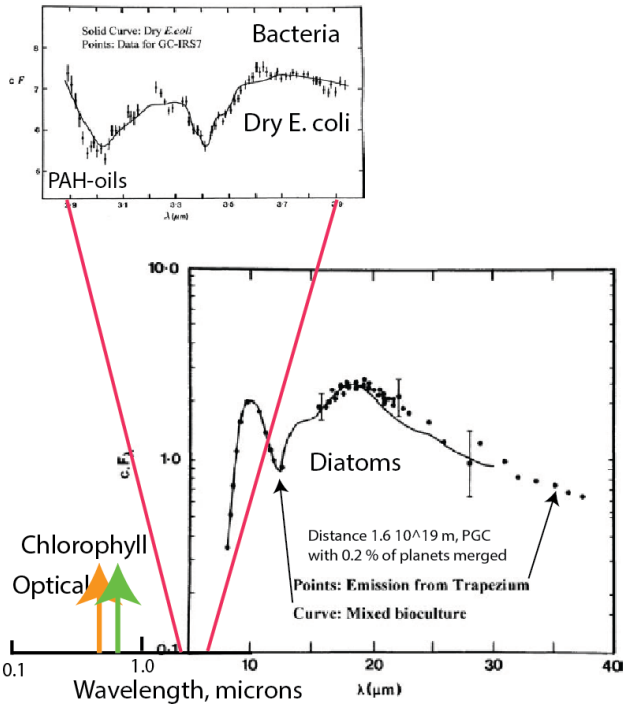
It's even possible life arose on Mars before it did on Earth and was carried here via meteorite. It's an interesting idea. But it's one with a lot of holes in it, the biggest being we have zero evidence of life on Mars. Getting it here is not that big a problem, but then having it live long and prosper is another issue altogether.

So to me, panspermia is an interesting idea but has no evidence to support it. There are a host of other problems with it as well, but I think the biggest black eye it has right now is the support it gets from both pseudoscience and sloppy science.

In the end, the idea of life in space is a scientific one, and must be solved with scientific processes. *Careful* scientific processes. After all, this is one of the biggest and most fundamental questions we have. Flamboyant articles with grand conclusions based on questionably-conducted research and incomplete reporting are not the right way to go about this.

(Note: Infrared spectra of the interstellar medium show strong evidence of living materials, including Diatoms. See Chapter 13 of Chandra Wickramasinghe's 2012 book *A Journey with Fred Hoyle* 2nd Edition. CHG)

Wickramasinghe, A Journey with Fred Hoyle, 2nd Ed. Chapter 13



Interstellar dust spectra match precisely with spectra of terrestrial organisms