When will we know we have found extraterrestrial life?

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This is the "South Pillar" region of the star-forming region called the Carina Nebula. Like cracking open a watermelon and finding its seeds, the infrared telescope "busted open" this murky cloud to reveal star embryos tucked inside finger-like pillars of thick dust. Credit: NASA

(Phys.org)—As we become more advanced in astronomy, continuously searching and finding lots of potentially habitable extrasolar planets that could harbor alien life, it seems that it's not a matter of if but when we will find extraterrestrial organisms. However, the real tough problem

here is: How we could determine if the alien life has really been found? "The question is not so much 'when will we find extraterrestrial life?' But 'when will we know we have found extraterrestrial life?'" Terence Kee, the President of the Astrobiology Society of Britain told Phys.org. "My feeling is that we may indeed find signs of life in a few decades, but whether we will be unambiguously able to identify it as 'extraterrestrial life' - as opposed to terrestrial contamination or abiotic far-from-equilibrium processes - in such a short time-frame, I'm not so sure."

Kee noted that we are able in any realistic sense to detect only life forms that have a terrestrial-based biochemistry, so we would probably bet on bodies that have liquid water and some form of geological free energy source. He puts his hopes on space probes looking at out-of-equilibrium gas distributions in exo-planetary atmospheres. However, any potential findings revealed by these probes would be only an indication, without the capability to definitively determine the existence of alien lifeforms.

We could also turn to meteorites in the ongoing search for E.T. and hope that these rocks came from a parent body that may have harbored life. If we're lucky, relics of life are contained within that sample and have not been destroyed. Kee surprisingly admits that luck is really the key condition here.

"As most of these relics are likely to have been fossilized in some way, we would need to cash in on some more luck so that we can demonstrate sufficient differences between such relics and potential abiotic mechanisms of formation on earth—chemical compositional differences, isotopic ratio's mineral morphologies or, most valuable perhaps, presence of specific molecules which could only be produced by biogenic processes, etcetera," he said.

The biggest challenge is to clearly identify if the life forms existed on

the studied meteorites a long time prior to re-entry into the Earth's atmosphere. Before that is established, any new finding would be just a potential signature of extraterrestrial life. For example, in 2011, Richard B. Hoover, an astrobiologist of NASA's Marshall Space Flight Center, claimed he had found the remains of living organisms from a parent celestial body in a rare class of meteorites, called CI1 carbonaceous chondrites.

"The complex filaments found embedded in the CI1 carbonaceous meteorites represent the remains of indigenous microfossils of cyanobacteria," Hoover claimed.

His team used Environmental (ESEM) and Field Emission Scanning Electron Microscopy (FESEM) to analyze the meteorite samples, studying internal surfaces. For comparison, Hoover compared the samples to those of terrestrial minerals and biological materials.

Hoover's claims sparked controversy and NASA distanced from his conclusions, pointing out his lack of expert peer reviews. The findings were soon debunked after publication.

More recently, two scientists suggested that the comet 67P/Churyumov-Gerasimenko, which is studied by the European Space Agency's Rosetta spacecraft, hosts microbial alien life. The University of Buckingham's Chandra Wickramasinghe and his colleague, Max Wallis of the University of Cardiff, insist that the characteristic features on the comet, including a black, carbon-containing crust and underlying ice; large, smooth 'seas'; flat-bottomed craters and a surface peppered with mega-boulders, might only be explained by the presence of life.

But the last week's claims also sparked skepticism among other scientists specializing in the search for extraterrestrial life, debunking the newly presented hypothesis. The researchers rejecting the new findings

emphasize that complex organics are generated in many places in the solar system through photochemistry and this is evidence for anything other than abiotic chemistry.

So far, we haven't found any convincing proof of alien life embedded in meteorites. However, Kee, undeterred by the long-lasting search and continuous skepticism, is looking to the future with hope.

"In order to receive Willy Wonka's Golden Ticket of Astrobiology, we would need to be ready to search as many meteorites as we can get hold of, which we already do. Overall, I reckon we would need to be lucky. But hey, many people have won the lottery. The trick is to keep buying the tickets," Kee concluded.

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