The origins and evolution of life: Re-examining the evidence of early life traces

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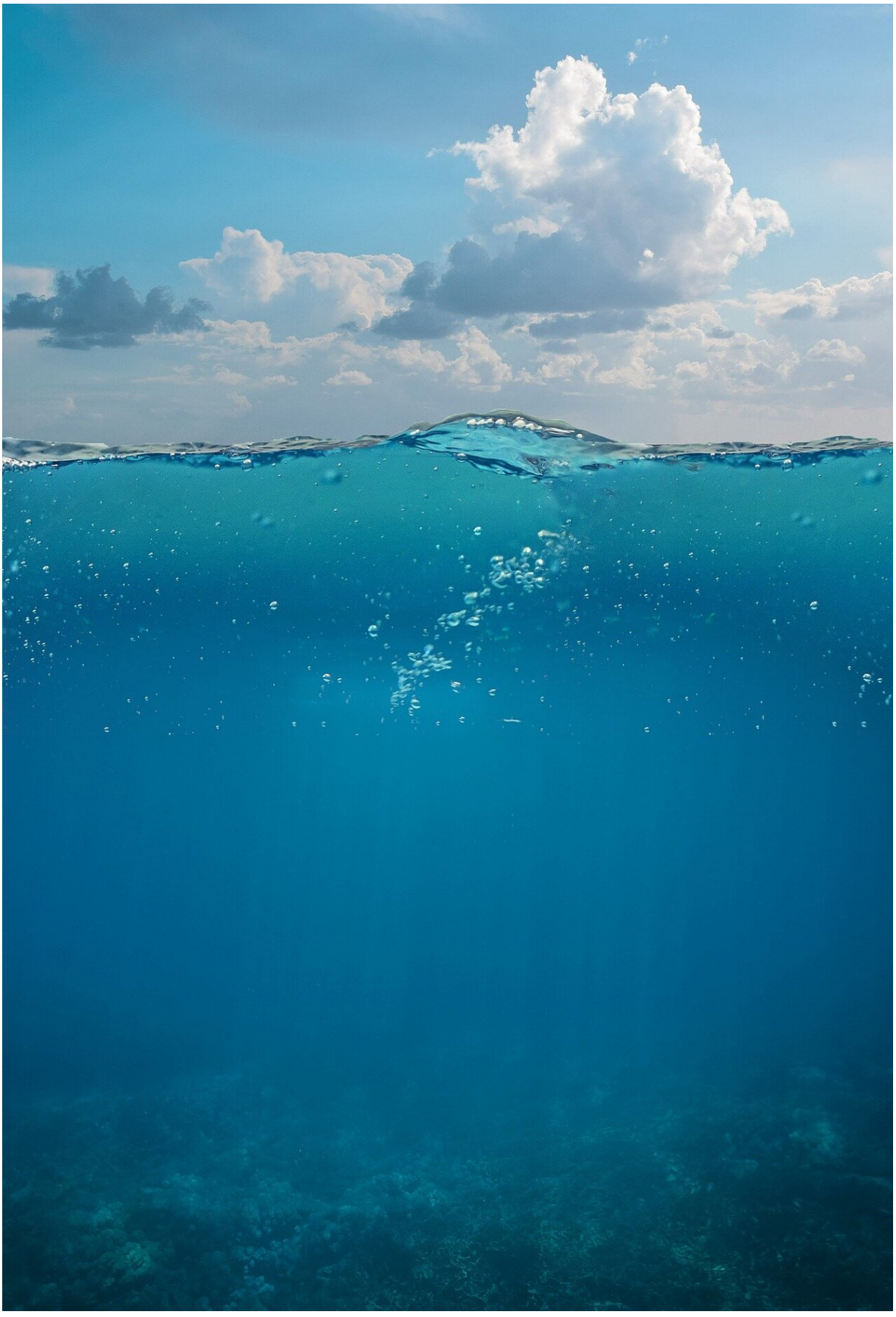

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Even though Earth has been habitable (has had surface liquid water and some crust) for 4.3 billion years, and the oldest putative traces of life suggested go back up to 4.1 billion years, the presence of a microbial biosphere is solidly demonstrated only since 3.4 billion years ago.

Re-examining the evidence of the first traces of life is essential in the search for the origins and evolution of life, on Earth and elsewhere in the universe, underlines this week Professor Emmanuelle Javaux, paleobiologist and astrobiologist at the University of Liège, in the journal *Nature*.

The challenges are numerous: the preserved rock record starts only around 4 billion years and is fragmentary, and ancient rocks that possibly contain biosignatures have been transformed by various geological processes over time, and may be contaminated by more recent life forms. In addition, natural non-biological processes can create mineral or organic structures with chemistries and morphologies that resemble life. Finally, when a trace of life is demonstrated, it is sometimes difficult to determine its identity and metabolism.

New advances in micro- and nano-scale analyses, as well as experimental approaches, make it possible to improve the characterization of these biosignatures and to constrain abiotic processes, taking into account the geological context. Re-examining the evidence of the first traces of life is a challenge, but is essential in the search for the origins and evolution of life on Earth but also beyond on habitable planets or moons, as space

agencies have come to realize.

This research is at the heart of astrobiology, a recent scientific discipline that aims to understand the origin, evolution, distribution, and future of life in the universe.

More information: Emmanuelle J. Javaux. Challenges in evidencing the earliest traces of life, *Nature* (2019). DOI: 10.1038/s41586-019-1436-4

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