Soil or sea for ancient fossils?

Mysterious fossils deposited 635–542 million years ago might originate from life on land and not from ocean-dwelling animals (*Nature* **493,** 89–92; 2013). The controversial theory pushes back the conventional date for life's appearance on land by tens of millions of years.

Fossils of the so-called Ediacaran biota show bizarre structures that look like fern leaves, squashed jellyfish, worm tracks and more. When they were discovered in Australia in 1947, there was much debate about whether the traces were left by animal, mineral or vegetable, and whether the creatures lived in water or on land. But in the past decades, most researchers have come to agree that the remains are from marine animals that lived in warm, shallow seas, and whose descendants ran into an evolutionary dead end. The life we see around us today is generally thought to have arisen from the Cambrian explosion — a diversification of marine life forms that occurred about 530 million years ago, pre-dating the accepted appearance of life on land.

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But Gregory Retallack (University of Oregon), a specialist in soils from the deep geological past, thinks that life on land appeared much earlier. When he visited the Ediacaran hills in Australia in the 1970s and 80s, he thought the rock looked more like ancient soil than sea bed. Retallack has been publishing pieces of his theory since the 1990s, and earlier in 2012 argued that the Australian rock preserves soils from a cool, coastal desert (*J. Sedimentol.* **59,** 1208–1236; 2012). As a follow-up, he now suggests that Ediacaran fossils embedded in these rocks lived on land, in an area perhaps similar to the coastal plains and floodplains found today in Kazakhstan. The fact that the fossilized creatures aren't jumbled and overlapping, Retallack notes, suggests that they were not washed up on to shore from the sea.

Retallack does not claim that all Ediacarans were land-bound, but proposes alternative interpretations for many famous fossils. Radulichnus, thought to be tracks left by grazing organisms, could instead have been formed by needles of ice in soil. The quilted leaf shape of Dickinsonia could have been a lichen rather than a marine invertebrate. Disc-shaped fossils could have been microbial colonies, not jellyfish, and those shaped like a knight's shield could have been fungal fruiting bodies rather than early arthropods.

The evidence remains ambiguous. The red colouration of the rock could be a result of iron in desert soils being exposed to air at the time of fossil deposition, or the rock could have turned red through weathering after it emerged from the ocean, long after its formation. Carbon isotopes of the rock are characteristic of soils, according to Retallack, but others note that the same isotope ratios could be produced in marine settings. His unconventional ideas need further testing, admits Retallack. But he is convinced that textbook ideas about the Ediacaran biota will eventually be rewritten. ❐

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The journalist's take

The 'lone wolf' with an unconventional idea poses an interesting conundrum to a science journalist. On the one hand, such people are often passionate, interesting characters who offer an eye-catching headline with their surprising ideas. On the other hand, reporting on an outlier theory risks giving it inappropriate weight. Such stories can raise the profile of a rogue idea in the public's mind so much that it seems to be a winning or equal contender in a debate.

Journalists have learned (sometimes the hard way) to balance these considerations. Take the case of climate change; in the 1990s, newspaper reporters — especially those used to covering politics, where there is often no right or wrong opinion — believed they should seek out people with opposing views. When confronted with many scientists saying that the world is warming as a result of rising emissions, and a few saying it is not, some reporters quoted one person from each side in order to cover the debate. In their attempt to achieve balance, the media thus introduced a bias into public perception (*Glob. Environ. Change* **14,** 125–136; 2004).

Science reporting requires a different approach. I teach budding journalists three guiding principles: one, call enough independent experts to see whether there is room for a reasonable difference of opinion; two, assess the expertise of those in the debate; and three, look at the evidence yourself.

Retallack's ideas pass these tests. *Nature* published a pair of commentaries along with the paper, making clear that although the article goes against the general view, the evidence is so open to interpretation that there is room for educated divergence. As for expertise, Retallack has literally written the book on ancient soils. Though the technical details of this paper are hard for the uninitiated to follow in detail, it is clear that Retallack has been collecting evidence for decades, culminating in a piece of work that made it through the in-house assessment and peer review of a top scientific journal.

A journalist's job, then, is to report the finding in context, to ensure that the lasting impression in the reader's mind reflects the state of the science. Headlines of coverage of Retallack's paper avoid definitives — such as *Popular Science*'s "Who were the first organisms to live on land?" and the Australian Broadcasting Corporation's "Ediacaran study shakes the tree of life" — and thus appropriately set the scene for such controversial work.