How some dinosaur discoveries might be wishful scientific thinking

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Credit: AI-generated image (disclaimer)

According to Catholic doctrine, transubstantiation is the process whereby the bread and wine of the Holy Mass are transformed into the body and blood of Christ. I am unaware of any rigorous chemical investigations into this claim – but I doubt the conclusions would please those who favour a literal interpretation of the Eucharist sacrament.

Sometimes scientific analysis fails to give us the results we are hoping for.

Ever since 1993, and the release of the Hollywood blockbuster Jurassic Park, many people have dreamed of finding a way to resurrect extinct dinosaurs. The problem is that readable DNA will almost certainly not survive beyond about 1m years, let alone 66m, when the last dinosaurs (excluding birds) died out.

But what about other biomolecules the dinosaurs may have left behind?We know that some, like the pigment melanin and molecules known as sterols, can remain (in altered form) over very long periods of time – even when subjected to intense heat and pressure during deep burial.

But there are claims that other, much less stable molecules have also been found in dinosaur fossils. Reports at the beginning of 2017 of dinosaur proteins, the second-least stable large biomolecules (after nucleic acids such as DNA) caused a stir both in science and the public imagination. They were linked to remains of *Brachylophosaurus canadensis*, a type of duck-billed dinosaur found in Montana in the USA.

These studies usually focus on relatively robust proteins such as keratin, which makes up skin structures including hair, nails, feathers, and scales, or collagen.

Having access to dinosaur protein sequences would revolutionise our ability to study their physiology and evolution. But the claims do not stop there. Academic journals have published reports on apparent findings of dinosaur blood vessels, blood cells, and bone cells – all seemingly defying the odds of preservation.

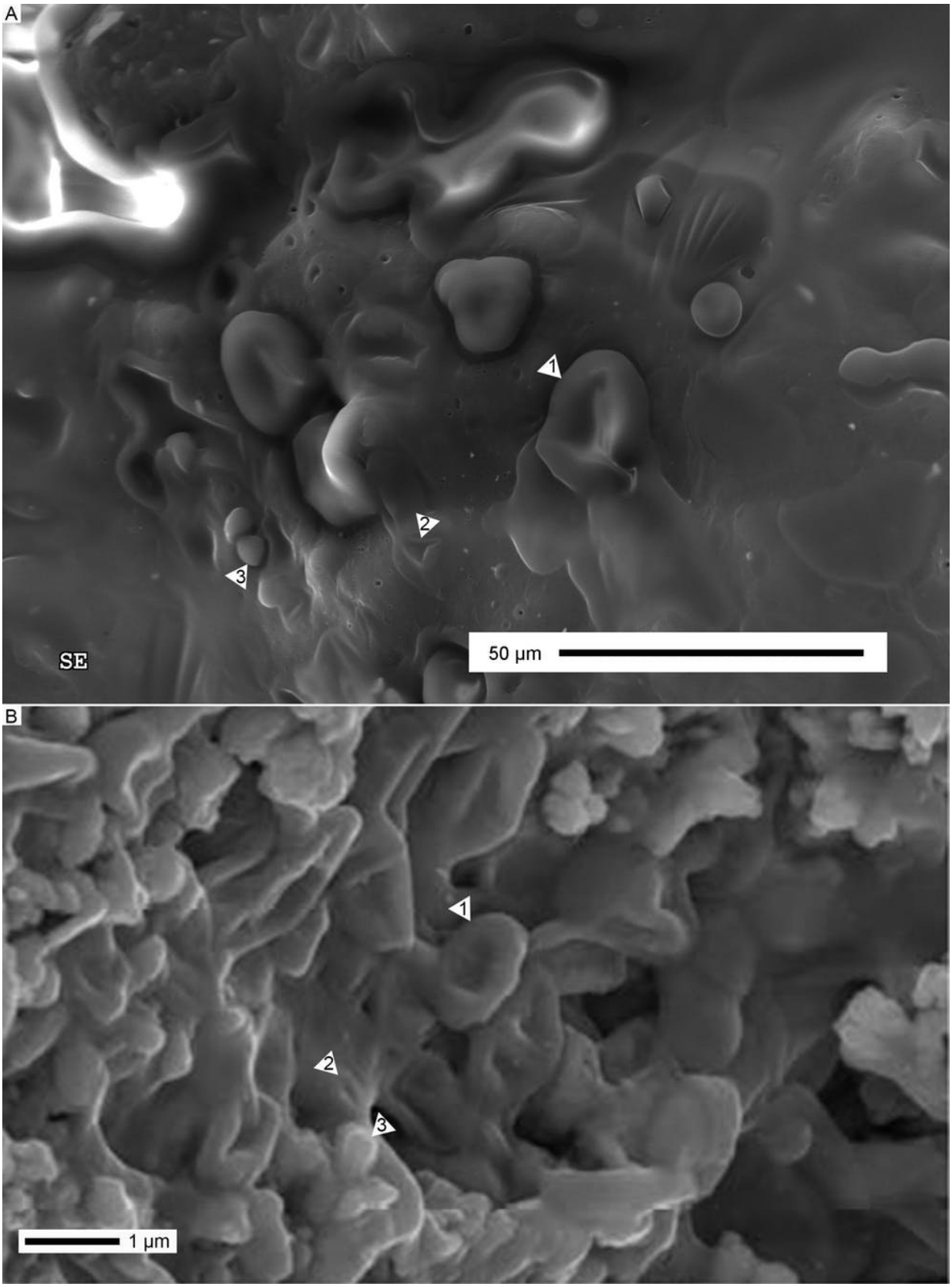
One peculiarity of these widely publicised reports is the inevitable

pseudo-scientific discourse that tends to follow. Creationists love such claims of unstable, original molecules in dinosaur fossils – and use them to back up their belief in a "young Earth". The scientists in question retort that such hijacking of their work fails to comprehend the mechanisms of preservation.

Dinosaur blood? Are you sure?

But other scientists are not convinced that such unstable dinosaur "soft tissue" findings are actually genuine. Some have suggested that protein claims are caused by contamination or statistical error. The organic structures in the fossils, such as the blood vessels, have been alternatively identified as films produced by microbes living in the bones, moulded into the shapes of vessels that once occupied the cavities in the bone.

Others use experiments to examine preservation potential. For these experiments, tissues are decayed with microbes or subjected to "maturation". Maturation uses intense heat and pressure to accelerate the chemical degradation that normally occurs deep underground over millions of years. The method has become a staple in understanding fossilisation, and early work contributed to our current understanding of fossil fuel formation.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Scanning electron microscope images of abiotically formed structures as an explanation for ‘dinosaur blood’. A) Moderately matured turkey skin. B) Proposed ‘dinosaur blood cells’. Arrowheads indicate several shared shapes: (1) fold/disk visibly continuous with the underlying organic material; (2) pit/pock mark; (3) bleb/sphere.

In my maturation experiments, I found that under conditions commonly used to mimic old, thermally mature fossils, keratin fragments into a viscous, foul-smelling fluid capable of dissolving in water. This means that keratin is not likely to survive in such fossils. It will be eliminated.

Cold turkey

What came as a surprise, however, was seeing what resembled purported "dinosaur blood cells" in turkey skin that had been matured under more moderate conditions. Seemingly, a case of "palaeo-transubstantiation".

Scanning electron microscopy revealed the same shapes, and range of shapes, as widely publicised "dinosaur blood cells". The pits and pock marks, spheres, folds and disks are apparent in both.

My structures likely formed as a result of the vacuum chamber of the microscope distorting the pliable, degraded organic material from the skin. The supposed "dinosaur blood cells" found in the fossils were also found to be organic, and are seen to be continuous with (and attached to) the underlying material, rather than distinct cells.

The dinosaur structures are smaller than bird blood cells, while the turkey structures are larger. Such ranges of shapes and sizes indicate that the structures form through non-biological processes such as distortion of pliable material under vacuum rather than the coordinated formation

of cells.

They are what scientists call self-organising structures, and can deceive researchers into thinking they are biologically derived, even though they are produced through purely physical or chemical processes.

Intensive chemical analyses on the "dinosaur blood cells" in the fossil failed to yield any molecules that could not potentially come from microbes. Indeed, the organics in the fossil may come from a degraded and distorted film produced by microbes that had infiltrated the bone. Similar small disks were recently identified as blood cells in an ichthyosaur fossil. Although this fossil is preserved in carbonate rock, known to retain certain biomolecules such as sterols, in my opinion, the chemical data presented is again inconclusive.

Other proposed dinosaur blood cells are not organic, but have been alternatively identified as precipitated iron oxide or pyrite minerals. Again, these show variation in size even between directly adjacent "cells", characteristic of self-organising structures.

The results of these experiments urge caution when it comes to claims of dinosaur soft tissues discoveries. They also point out a great irony in the public debate.

As wrong as creationists are about the age of the Earth and of the mineral components of dinosaur bones, they may actually be correct in their suspicion about some of the organic materials we find within them. The less sensational truth may be that in some cases, the organic material inside ancient fossil bones may simply be formed from recent microbial infections.

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