Was early animal evolution co-operative?

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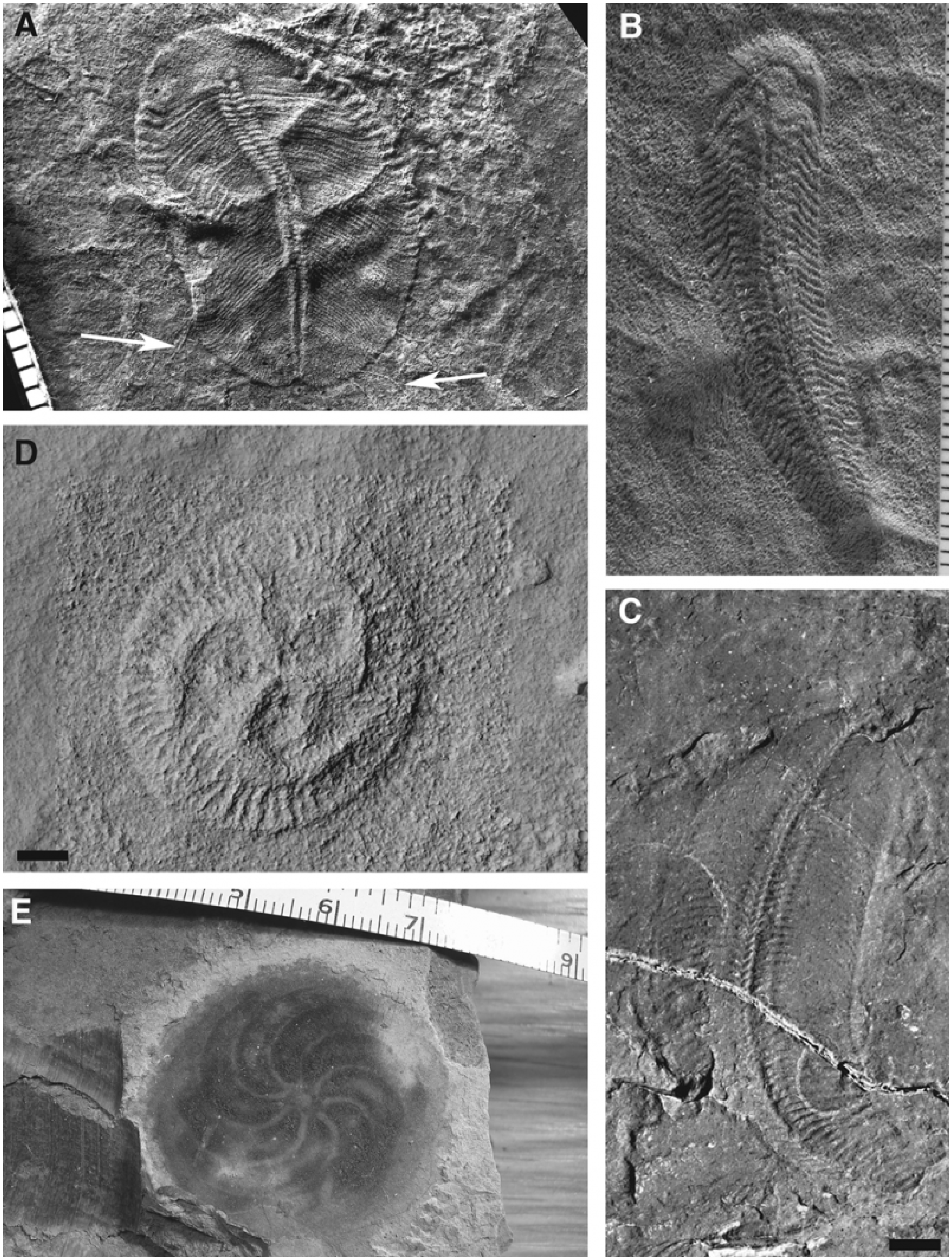
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Selected Ediacaran fossils. Credit: (A) Andrej Ivantsov; (B) Jim Gehling; (C) S. J.; (D) Martin Smith; (E) Stefan Bengtson.

The fossil group called the *Ediacaran biota* have been troubling researchers for a long time. How do these peculiar organisms relate to modern organisms? In a new study, published in *Biological Reviews*, researchers from Sweden and Spain suggest the Ediacarans reveal previously unexplored pathways taken by animal evolution. They also propose a new way of looking at the effect the Ediacarans might have had on the evolution of other animals.

The fossil record of animals starts for sure by about 540 million years ago, but their origins before this point have remained obscure. Darwin himself worried about this problem at length in the "Origin of species". But after Darwin was writing, a famous group of fossils were discovered called the Ediacaran biota, named after a remote mine in South Australia where many were found. They are now known to be widespread around the globe from the interval of time just before the animal fossil record starts.

But what are these peculiar organisms? Their very strange morphology has made relating them to modern organisms very difficult, and they have been suggested to be related to anything from plants, fungi and lichens through to recognisable animals such as worms and arthropods.

In a major review of the Ediacaran fossils recently published in *Biological Reviews*, Graham Budd, professor of palaeobiology in Uppsala University, Sweden, and Sören Jensen, researcher at Badajoz University, Spain, suggest that most of the Ediacarans are very basal representatives of animal lineages, and as such are likely to reveal the hitherto very obscure pathways taken by animal evolution. This goes some way to explain why they happen to appear just before clearly recognisable animals do in the fossil record, and raises the question of what the ecological relationship between the two biotas is.

Traditionally, it has been thought that the more advanced animals, many of which are mobile and can burrow energetically through the sediment, were kept in ecological obscurity by the largely immobile Ediacarans, just as the mammals were by the dinosaurs; and it was not until the Ediacarans all went extinct that the mobile animals could diversify in the so-called "Cambrian explosion".

Budd and Jensen propose a new view of this relationship however, inspired by the interaction between the vegetation and animals in the modern savannah environments of east Africa. In their new 'savannah' hypothesis, they propose that concentration of nutrients both above and below the sediment-water interface were enhanced around the stationary Ediacarans, and the creation of these resource "hot spots" created a very diverse environment, ideal for both diversification and for investment of energy into movement. Rather than the Ediacarans and later animals being direct competitors then, the Ediacarans themselves created a permissive environment that was ideal for higher animals to evolve in. This idea fits well into a modern view of evolution, called "ecosytem engineering" whereby key species (such as beavers) influence the environment in order to create new evolutionary and diversity opportunities for other species. Perhaps then, the Ediacaran taxa weren't impediments but the drivers of the evolution that was eventually to lead to all the rich animal diversity we see today.

More information: Graham E. Budd et al. The origin of the animals and a 'Savannah' hypothesis for early bilaterian evolution, *Biological Reviews* (2015). DOI: 10.1111/brv.12239

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