New light shed on ancient New Zealand fossils

March 5 2020

Credit: CC0 Public Domain

Ancient marine creatures once believed to have been mere 'bit players' in the fossil record have now found fame.

Using rare varieties of graptoloid fossils, research led by Professor James Crampton of Te Herenga Waka—Victoria University of Wellington's School of Geography, Environment and Earth Sciences reveals new species actually came and went much more quickly than palaeontologists previously thought possible.

Their origination and extinction may have been accomplished in just 25,000 years.

In a paper in the journal *Paleobiology*, Professor Crampton and his co-authors use the fossil history of these filter-feeders that floated through the Palaeozoic oceans between about 400 and 490 million years ago to argue that such ephemeral species can be recognized in the fossil record.

Professor Crampton hopes their research will bring together the views of palaeontologists and biologists on evolution.

"There is ongoing debate and research to try and reconcile evolution, as palaeontologists see it, with how biologists see it. One part of that debate is that studies of living organisms, using genetics and so on, suggest new species are arising relatively frequently; in contrast, the fossil record suggests new species arise relatively infrequently.

"To explain this apparent discrepancy, biologists have proposed that many new species recognized in the living biota are in fact destined to be 'ephemeral'—to become extinct or hybridize out of existence within a geologically short period of time, perhaps a few tens or hundreds of thousands of years. In this way, such ephemeral species are thought to be effectively invisible in the fossil record.

"Our findings perhaps bring these two views together. So, rather than upsetting any apple carts, I hope our findings will in fact help bring researchers together."

The rare species of the commonplace creatures have been known only from scattered and isolated fossil occurrences. As such they have generally played just a minor role in palaeontological research, compared with abundant or spectacular fossil forms.

"But now these 'bit players' are being given new significance," says Professor Crampton.

A hindrance to understanding the history of life on Earth is that many key evolutionary processes occur on timescales too long for biologists to observe directly, but too short to be easily seen in the fossil record.

"One example is the evolution of new species, which typically takes hundreds to thousands of generations.

"However, we have seen that pulses of extinction and speciation with these rare graptoloids were coordinated on timeframes of less than 50,000 years, or even as short as 25,000 years. These pulses apparently reflect the coordinated evolution and extinction of new, short-lived species, which we interpret to be the same thing as the ephemeral species of biologists.

"If correct, this interpretation provides a link between the highly detailed but 'instantaneous' observations from modern biology and the lower-resolution, but long-term observations from the fossil record," says Professor Crampton.

Graptoloid colonies ranged in size from less than a centimetre in length to more than a metre, and contained dozens to thousands of individual creatures.

They were largely extinct by about 400 million years ago but their rapid evolution and wide global distribution has made them important for dating Ordovician (485–444 million years ago) and Silurian (444–419 million years) rocks.

In New Zealand, their fossils can be found in rocks in the northwest of the South Island and in Fiordland.

Professor Crampton says the work for the paper was made possible by the "remarkable" dataset co-authors Roger Cooper, of GNS Science, and

Peter Sadler, of the University of California, Riverside, developed over many years.

"By using published literature, they collated information about the fossil record of all known graptoloid species in sequences of strata around the world. Then they used a sophisticated technique to infer what the 'true' time of origination and extinction was of each species.

"This crucial step is required because the fossil record is incomplete and biased—you cannot read it at face value. The important thing is that the resultant, rich timeline of species origination and extinction is very highly resolved in time—much more finely resolved than traditional paleontological time divisions.

"In many paleontological studies, one can only distinguish things that happened one million years or more apart. But in our dataset we can discriminate things that happened between 25 and 50 thousand years apart, which is a 20- to 40-fold increase in resolution."

More information: James S. Crampton et al. Ephemeral species in the fossil record? Synchronous coupling of macroevolutionary dynamics in mid-Paleozoic zooplankton, *Paleobiology* (2020). DOI: 10.1017/pab.2020.3

Provided by Victoria University of Wellington