Plankton fossils tell tale of evolution and extinction

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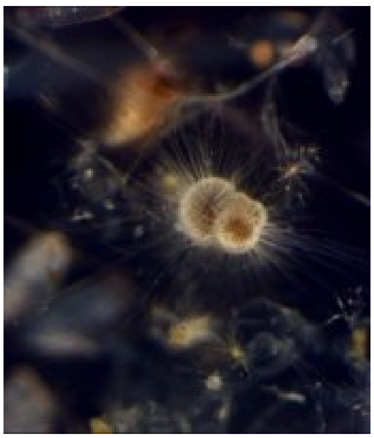

(PhysOrg.com) -- Scientists studying the fossils of tiny ocean-dwelling plankton, called foraminifera, have uncovered another piece in the puzzle of why species evolve or become extinct.

The issue of whether extinctions and evolution are controlled more by the environment or by the existing diversity of species in an ecosystem is one that scientists have been debating since Darwin's time.

Writing in the journal *Science* on Friday 15 April, researchers from Imperial College London and Cardiff University say their study of foraminifera, or ‘forams’, suggests that new species are more likely to evolve when there are fewer species already and that extinctions are more closely linked to a change in environment than they are to the number of existing species.

Forams are marine plankton measuring not more than half a millimetre across, smaller than a grain of sand. They are abundant in oceans the world over, where they have existed for over a hundred million years. When forams die, they sink into the seabeds where they accumulate in layers many kilometres deep, providing a largely unbroken record of their history.

They have distinct shells made from calcium carbonate, similar to the shells of snails and birds' eggs, which can tell scientists about the environment in which they lived. For these reasons forams make excellent subjects for studying changes in environment and evolution.

Advanced techniques in geochemistry and microscopy have allowed the scientists to interrogate the foram fossil record in greater resolution than ever before. This enabled the researchers to model the interactions between the diversity of different foram species, the climate and the species' ecology over time, in order to see what factors had the greatest impact on the species’ evolution.

By looking at the shells under a microscope and using information derived from chemical analysis of the shells, the team was able to make interpretations about the environments the foraminifera were living in; for example, whether they lived in the surface waters and hosted even tinier photosynthetic organisms or whether they lived hundreds of meters down where the light and heat from the sun was greatly reduced.

Professor Andy Purvis, from the Department of Life Sciences at Imperial College London is a lead author of the study. He said: "Newly obtained paleontological data about forams and the environmental conditions they endured are only just starting to yield valuable information about how life has changed form and function over time. This work is another step towards improving our understanding the complexity of extinct ecosystems and could help scientists predict future changes in modern biodiversity."

Tracy Aze, co-author on the study and a PhD student in the School of Earth and Ocean Sciences at Cardiff University, said: "The fossil record is a critical resource for understanding how today's species might react to our changing climate because it is the only way to study evolution's winners and losers."

Co-author Dr Thomas Ezard, now at the Department of Mathematics at the University of Surrey, devised a mathematical framework to analyse the interactions of species diversity, climate and species behaviour whilst at Imperial College London. He said: "The richness of the foram fossil record lends itself ideally to detailed mathematical and statistical modelling. This richness provides us with the robust evidence we need to make predictions about how complex interactions drive evolutionary dynamics."

Dr Ezard concluded: “if we want to understand evolution fully, we need to acknowledge that not all species are one and the same. The astonishing abundance and diversity of these foraminifera provides crucial clues in awkward parts of evolution’s puzzle”.

More information: www.sciencemag.org/content/332/6027/349.full

Provided by Imperial College London