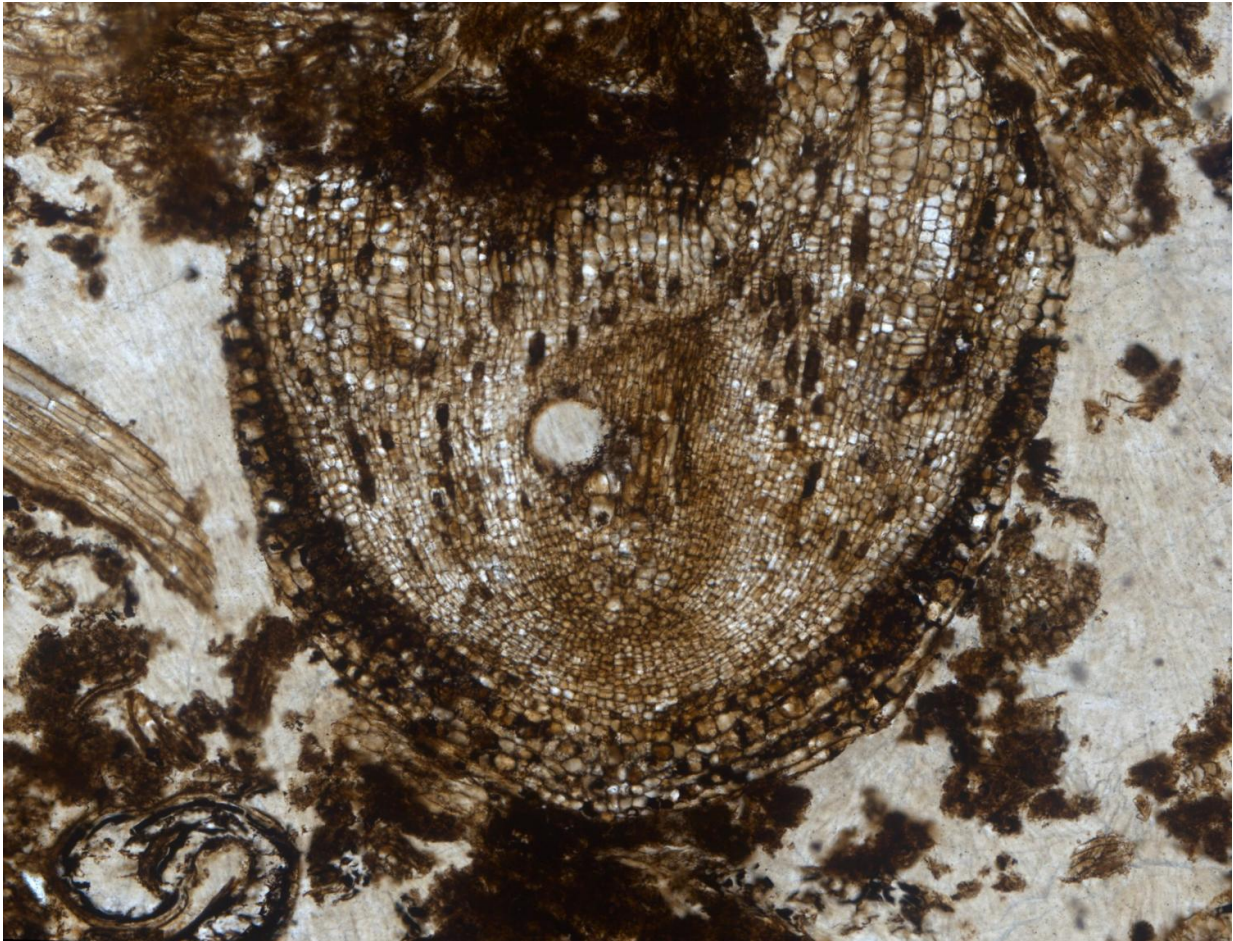


Scientists discover oldest plant root stem cells

June 2 2016



The discovery of the 1.5 mm tip of a root was discovered in the fossil soil. The tip was recognisable as root by the clear dark brown cap which protected the growing apex as it grew through the soil. From examining the size and number of cells which radiate out from the tip the researchers were able to establish that the root was actively growing at the time it was fossilised. This makes the finding the first and only discovery to date of the fossilised remains of an actively growing root meristem. Slide number 81 (by permission of the Oxford University)

Herbaria), image taken by Alexander (Sandy) Hetherington (Department of Plant Sciences University of Oxford)

Scientists at Oxford University have discovered the oldest known population of plant root stem cells in a 320 million-year-old fossil.

The cells, which gave rise to the roots of an ancient plant, were found in a fossilised root tip held in the Oxford University Herbaria.

As well as revealing the oldest plant root [stem cells](#) identified to date, the research also marks the first time an actively growing fossilised root has been discovered - in effect, an ancient plant frozen in time.

The study is published in the journal *Current Biology*.

Oxford Plant Sciences PhD student Alexander (Sandy) Hetherington, who made the discovery during the course of his research, said: 'I was examining one of the fossilised soil slides held at the University Herbaria as part of my research into the rooting systems of ancient trees when I noticed a structure that looked like the living root tips we see in plants today.

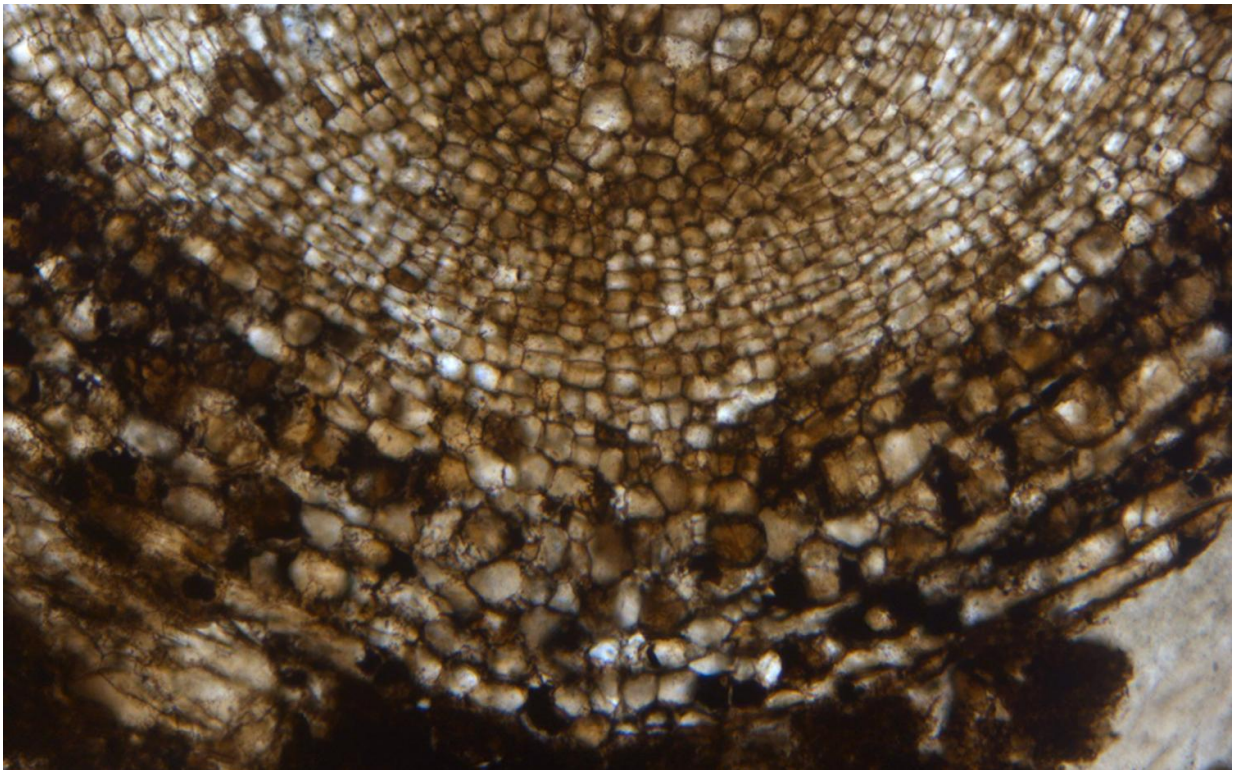
'I began to realise that I was looking at a population of 320 million-year-old plant stem cells preserved as they were growing - and that it was the first time anything like this had ever been found.

'It gives us a unique window into how roots developed hundreds of millions of years ago.'

Stem cells - self-renewing cells responsible for the formation of multicellular organisms - are located in plants at the tips of shoots and

roots in groups called meristems. The 320 million-year-old stem cells discovered in Oxford are different to all those living today, with a unique pattern of cell division that remained unknown until now. That tells us that some of the mechanisms controlling root formation in plants and trees have now become extinct and may have been more diverse than thought.

These roots were important because they comprised the rooting structures of the plants growing in the Earth's first global tropical wetland forests with tall trees over 50m in height and were in part responsible for one of the most dramatic climate change events in history. The evolution of deep rooting systems increased the rate of chemical weathering of silicate minerals in rocks - a chemical reaction that pulled CO₂ out of the atmosphere, leading to the cooling of the Earth and thus one of the planet's great ice ages.



All cells in plant roots have a common origin from a self-renewing population of stem cells. The discovery that *Radix carbonica* was actively growing at the time of fossilisation allowed the description of a fossil root stem cell population for the first time. By comparing the cellular organisation of the stem cells and differentiating cells of the fossil with living plants it was clear that *Radix carbonica* had a unique cellular organisation. This discovery demonstrates that developmentally distinct root types were present over 300 million years ago which have now gone extinct. Finally, it indicates that the number of distinct root stem cell niches present in plants is greater than previously thought. Slide number 81 (by permission of the Oxford University Herbaria), image taken by Alexander (Sandy) Hetherington Credit: Department of Plant Sciences University of Oxford

The fossils studied during this research are the remains of the soil from the first giant tropical rainforests on Earth. The rock in which the soil is preserved formed in the Carboniferous swamps that gave rise to the coal sources spanning what is now Appalachia to central Europe, including the coal fields in Wales, northern England and Scotland.

Sandy has named the stem-cell fossil *Radix carbonica* (Latin for 'coal root').

Professor Liam Dolan, Head of the Department of Plant Sciences at Oxford University and senior author of the paper, said: 'These fossils demonstrate how the roots of these ancient [plants](#) grew for the first time. It is startling that something so small could have had such a dramatic effect on the Earth's climate.

'This discovery also shows the importance of collections such as the Oxford University Herbaria - they are so valuable, and we need to maintain them for future generations.'

More information: Unique Cellular Organization in the Oldest Root Meristem, *Current Biology*, [DOI: 10.1016/j.cub.2016.04.072](https://doi.org/10.1016/j.cub.2016.04.072)

Provided by University of Oxford

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