Tiny pieces of 'deep time' brought to the surface

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Three-billion-year-old zircon microcrystals found in northern Ontario are proving to be a new record of the processes that form continents and their natural resources, including gold and diamonds.

The discovery was made recently by an international research team led by Earth Sciences professor Desmond Moser at The University of Western Ontario. Measuring no more than the width of a human hair, the 200-million-year growth span of these ancient microcrystals is longer than any previously discovered.

The findings provide a new record of planetary evolution and contradict previous experimental predictions that the crystals would change when exposed to heat and pressure upon burial in the deep Earth. Instead, they have an incredible 'memory' of their time below volcanoes, of transport to the shores of ancient oceans and of their burial beneath now-extinct mountain ranges billions of years before the time of dinosaurs. "This research shows that these crystals are incredibly resistant to change and proves for the first time that the growth zones we see inside them contain an accurate record of their movements through and around the Earth," says Moser.

Containing trace amounts of uranium, the crystals continued to grow over hundreds of millions of years, even as the planet evolved and underwent a series of dramatic shifts. "The oldest pieces of our planet are crystals of zircon," says Moser. "These crystals are the memory cells of the Earth and with our study we can now say they are an accurate

recorder of planetary evolution over eons – in the same way that rings on an old growth tree can record changes in a forest over hundreds of years."

Keeping with the tree analogy, Moser found that these crystals had roughly circular growth zones that he was able to date and analyze with specialized ion probes. These zones track the formation of the early North American continent, from its beginning as a series of volcanic island chains, to its eventual fusion into a large, thick continental plate that became the core of North America.

As the crystals formed around the same time as gold, diamond and other metal deposits, this research provides not only insight into the formation of Earth itself, it can also help answer the question, "Did plate tectonics operate early in our planet's history or did some other process create the large metal and diamond deposits of the Canadian Shield?" "It also provides a new tool for dating the appearance of oceans on other rocky planets like Mars, where Rover results indicate zircon crystals should exist" says Moser.

Over the course of millions of years, the crystals have been pushed back to the surface from depths of 30 kilometres by a series of pushes on the edges of the original continent, which give us globally-rare exposures in northern Ontario. "It's not every day you find a piece of the deep Earth that you can walk around on and explore," Moser says.

Moser's findings are further detailed in the March issue of *Geology*, published by the Geological Society of America.

Source: University of Western Ontario