Zircon crystals reveal onset of plate tectonics

May 31 2012

(Phys.org) -- We're familiar with the theory that the Earth's crust is composed of tectonic plates that move, sometimes dramatically to create earthquakes and tsunamis - but until recently, nobody knew how long this movement has been going on.

An international team of researchers, including Dr. Anthony Kemp from The University of Western Australia, believes they have found out and their work is published in *Nature* today.

Dr. Kemp, an Australian Research Council Future Fellow in UWA's School of Earth and Environment, said as far as we know, Earth is the only planet in the solar system with active plate tectonics.

"The purpose of this study was to examine the earliest rock record to find out when plate tectonics started and when the continental crust began to form," he said.

"We analyzed zircon crystals from ancient rocks of Greenland. These rocks included some of the oldest and best-preserved parts of the Earth's crust and were between 2.85 and 3.9 billion years old.

"In much the same way that tree rings record the growth of a tree, zircons provide important insights into the nature and composition of the magma (molten material deep within the Earth's crust) from which the zircon crystallised."

The researchers analyzed the isotopes of oxygen and hafnium in the zircon to learn more about the crystals' growth bands and discovered that the Greenland crust had evolved in two stages. The first involved a simple re-melting of 3.9 billion year-old rocks, followed by a second more complex period after about 3.2 billion years ago involving more diverse magma sources associated with re-melting and the formation of new continental material.

"We attribute this transition to the onset of plate tectonics at approximately 3.2 billion years ago and infer that significant volumes of crust began to be stabilized as continents only after that time," Dr. Kemp said.

"We're now trying to verify and extend these findings by studying rocks from the Pilbara, which span the same key time period from 2.8 to 3.6 billion years ago. A broader aim is to identify the triggers for plate tectonics.

"High-precision isotope measurements will be done at the Advanced Geochemistry and Mass Spectrometry Facility recently established at

UWA by Winthrop Professor Malcolm McCulloch."

The project was led by Dr. Tomas Naeraa from the Geological Survey of Denmark and Greenland, and also involved researchers from Sweden and Germany.

Provided by University of Western Australia