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A U.S. Department of Energy National Laboratory

News Release

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For immediate release

21st Century detective work reveals how ancient rock got off to a hot start

ARGONNE, Ill. (Nov. 6, 2008) — A new X-ray technique has enabled scientists to "play detective" and solve the debate about the origins of a three-billion-year-old rock fragment.

In the study, recently published in the journal *Nature*, a scientist describes the new technique and shows how it can analyze tiny samples of molten rock called magma, yielding important clues about the Earth's early history.

Working in conjunction with Australian and U.S. scientists, an Imperial College London researcher analyzed a magma using the Advanced Photon Source, a kilometer-sized circular particle accelerator that is commonly used to probe the structure of materials at the U.S. Department of Energy's Argonne National Laboratory.

In this case, the team used its X-rays to investigate the chemistry of a rare type of magmatic rock called a komatiite, which was preserved for billions of years in crystals. Komatiites are formed from super hot molten rock.

It has previously been difficult to discover how komatiites formed because earlier analytical techniques lacked the power to provide key information.

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Now, thanks to the new technique, the team found that komatiites were formed more than 2.7 billion years ago in the Earth's mantle, a region between the crust and the core, at temperatures of around 1,700 degrees Celsius.

These findings dispel a long-held alternative theory, which suggested that komatiites were formed at much cooler temperatures, and also yields an important clue about the mantle's early history. They found that the mantle has cooled by 300 degrees Celsius over the 2.7 billion years.

Lead researcher Andrew Berry from Imperial College London's Department of Earth Science and Engineering says more research needs to be done to understand fully the implications of this finding. However, he believes this new technique will enable scientists to uncover more details about the Earth's early history.

"It has long been a 'holy grail' in geology to find a technique that analyses the chemical state of tiny rock fragments," Berry said, "because they provide important geological evidence to explain conditions inside the early Earth. This research resolves the controversy about the origin of komatiites and opens the door to the possibility of new discoveries about our planet's past."

In particular, Berry believes this technique can now be used to explain Earth's internal processes, such as the rate at which its interior has been cooling, how the forces affecting the Earth's crust have changed over time, and the distribution of radioactive elements that internally heat the planet.

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He believes this information could then be used to build new detailed models to explain the evolution of the planet.

"It is amazing," he said, "that we can look at a fragment of magma only a fraction of a millimeter in size and use it to determine the temperature of rocks tens of kilometers below the surface billions of years ago. How's that for a piece of detective work?"

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