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

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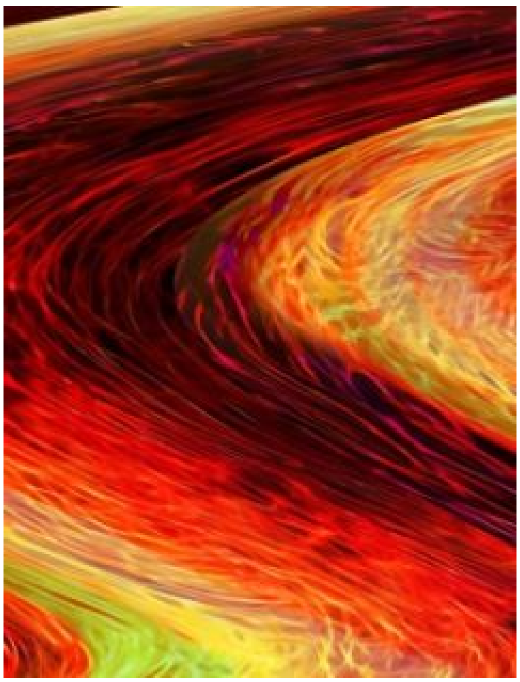

Komatiites are formed from super hot molten rock

A new technique using X-rays has enabled scientists to play 'detective' and solve the debate about the origins of a three billion year old rock fragment.

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

Working in conjunction with Australian and US scientists, an Imperial College London researcher analysed a magma using the Chicago synchrotron, a kilometre sized circular particle accelerator that is commonly used to probe the structure of materials.

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.

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

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

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 year period

Lead researcher, Dr 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. He says:

"It has long been a 'holy grail' in geology to find a technique that analyses the chemical state of tiny rock fragments, 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, Dr 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 which internally heat the planet.

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

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

Source: Imperial College London

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