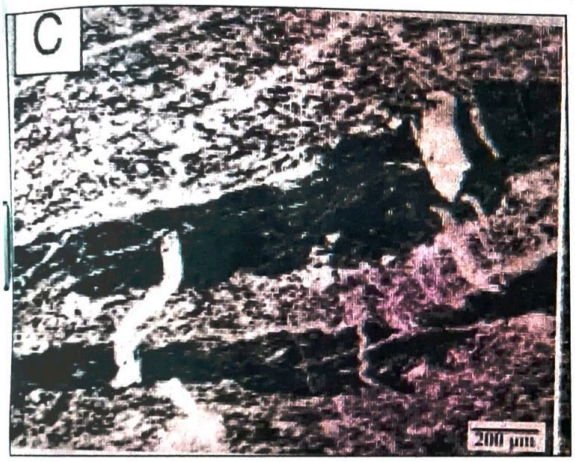
REMNANTS OF MICROBIAL MATS ON 3.5-BILLION-YEAR-OLD ROCK

Oldest direct proof of life, near Jamshedpur



The black band represents the microscopic microbial mat

G.S. MUDUR

New Delhi: Twelve years ago, Trisrota Chaudhuri noticed a set of black-and-white patterns embedded on an ancient rock near Bhitardari, about 20km south of Jamshedpur, and wondered whether the black might represent carbon from ancient life forms.

Now, Chaudhuri, a scientist at the Geological Survey of India (GSI) in Calcutta, and her colleagues have found that the 3.5-billion-year-old rock contains distinct chemical signatures of past biological activity — the oldest directly dated evidence for life yet documented on Earth.

The scientists have interpreted tiny black bands running through the silica-rich rock, known as chert, as remnants of microbial mats, or fossilised remains of thin carpet-like layers of microscopic organisms. Their findings appeared in the US journal *Proceedings of the National Academy of Sciences* on Monday.

"The chemical signatures preserved in this rock suggest that by 3.5 billion years ago, life forms were already using sophisticated ways of turning carbon dioxide into organic matter," Chaudhury told The Telegraph.

Earth formed about 4.6 billion years ago, but when life first emerged remains unclear. Various research groups have over the past decade proposed evidence of life, ranging from 3.9 billion years ago in Quebec and 3.7 billion years ago in southwestern Greenland to 3.4 billion years ago in western Australia.

The two older dates remain under debate because some scientists have argued that extensive geological processes would make it difficult to distinguish their biological signatures from features produced by non-biological processes.

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Proof of life

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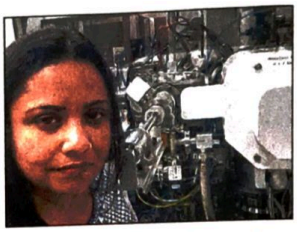
Chaudhuri began her field visits to Jharkhand — home to some of the world's oldest rocks — in 2014. Modern dating studies, for instance, have shown that some rocks in Singhbhum are 3.5 billion years old.

During one such trek, she explored thick layers of ancient volcanic rock interspersed with other rock layers near Bhitardari village and came across black-and-white patterns on the chert.

She collaborated with scientists in Europe and the US to date the samples and analyse their carbon content. Differences in the carbon profile and molecular-structure analysis, using a technique called Laser Raman Spectroscopy, helped distinguish biological carbon from non-biological carbon.

Dating analyses put the chert containing the microbial mats at 3.497 billion years old.

"What distinguishes our study is that we were able to directly date the rock samples," said Rajat Mazumder, professor of geology at the German University of Technology in Muscat, Oman, who had accompanied Chaudhuri during her 2014 field visits and later for sample extraction.



Trisrota Chaudhuri at the Geological Survey of India in Calcutta

Similar rocks containing organic residues have been found in Western Australia and South Africa, Mazumder said, but they lack material that can be directly dated. Their ages have instead been inferred from nearby rocks.

Scientists have long hypothesised that life emerged underwater around volcanic vents, where heat and mineral-rich fluids may have provided the chemicals and energy needed for early life to emerge and evolve.

Some of the oldest rocks in the Singhbhum region preserve evidence of such underwater volcanic environments, suggesting that the setting in which Chaudhuri found the chert may have been conducive to life.