Editorial

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Water on Mars

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A team of scientists at the University of Glasgow and the Scottish Universities Environmental Research Centre and the Natural History Museum (London) have discovered the first evidence of water dissolving the surface of Mars. In a paper published in the Meteoritical Society's journal MAPS, the research team outline the results of tests on a 1.7-gram fragment of a Martian meteorite known as Nakhla, which was provided by the Natural History Museum. Nakhla, named after the town in Egypt where it landed in 1911 after being blasted from the surface of Mars by a massive impact around 10 million years ago, has been studied for decades by scientists around the world. Previous research on Nakhla has provided evidence of the existence of water on Mars through the presence in the meteorite of 'secondary minerals' – types of carbonates, hydrous silicates and sulfates most likely formed when Martian minerals reacted with liquid water.

"What has been unclear in the past is exactly where the chemical elements which made up the secondary minerals within Nakhla came from," said Martin Lee of the University's School of Geographical and Earth Sciences, lead author of the paper. "Using a scanning electron microscope, we examined many tiny bowl-shaped depressions, known as etch pits, in grains of the minerals olivine and augite found in the meteorite. "What we've found for the first time is evidence that the etch pits were created when water dissolved the olivine and augite, and that the elements released from those minerals led to the formation of the secondary minerals. It's an exciting discovery and better informs of our understanding of how water affected rock on Mars."

By examining the amount of dissolution which occurred in the etch pits (Image below) formed within the minerals, the team have also been able to estimate how long the water was present within the sample. "From the amount of dissolution we observed, it's likely that this particular piece of Mars was affected by water for only a few months and probably less than a year in total," Lee added. "That's certainly not long enough to sustain a life-supporting biosphere; however, the findings of our study are from a tiny piece of a very small chunk of the surface of Mars, so it's difficult to draw any large-scale conclusions about the presence of water on the planet or its implications for life."Our research does raise fascinating questions about exactly how long ago the water interacted with the part of Mars which Nakhla came from and where the water might have gone. We'll be continuing to look for clues to the answers to these questions in future research. Results from NASA's Curiosity rover, currently on the surface of Mars, will also help us build a clearer picture of the history of Martian water."

[Mars might have been cold and dry with a transient presence of water at the surface some four billion years ago — the early Noachian period. But it is becoming increasingly clear that the environment below the surface was surely warmer and wetter, with liquid water present at varying depths during the Noachian period. The presence of clay minerals on the floor of many craters clearly indicates that they had formed as a result of long-term interaction of liquid water with the parent rock. Even the presence of massive ridges was noticed earlier, but the likely cause that led to their formation was not known. A paper published recently in *Geophysical Research Letters*, which studied the over 4,000 ridges in the Nili Fossae and Nilosyrtis highlands, postulates a likely cause: The ridges could be mineral deposits that filled the subsurface fractures and faults caused by massive impacts on the surface. The ridges are found in association with clay-containing bedrock. Hence it is postulated that the hydrous clay present in the rock could have played an important role in supplying fluids to cement the fractures. Another study in *Nature Geoscience* not only supports the idea of subsurface water but suggests an alkaline nature for the water. This is based on the presence of magnesium-iron bearing clay and carbonates found in the McLaughlin Crater. The Martian surface faces hostile conditions that are quite inimical to life. However, there is a greater possibility of finding some signs of life on Mars if we remain focussed on exploring the subsurface sedimentary rocks that today lie exposed in many craters. Carbonates in particular are a perfect medium not only to provide an ideal habitat for life, but also to preserve fossil traces indicative of life. Moreover, carbonate minerals can reveal the temperature and chemistry of the depositional environment. NASA's Mars rover Curiosity, which is all set to drill at four locations in the coming days, may soon provide the answer to the most sought after question — did Mars ever harbour life? For now, the rover has unequivocally proved that Mars had a wet depositional environment in the past. It found the amount of water molecules bound to sand grains in the soil sample was much "higher than anticipated." If the discovery of gypsum at several places in the past meant water on Mars, the latest find of veins and sedimentary rocks — layered rocks and sandstone — by Curiosity vastly strengthens the possibility of wet depositional environments in the past. After all, Mars's reduced gravity translates to "more subsurface porosity to a greater depth." This allows water to accumulate to a greater thickness than seen in Earth. [Courtesy: The Hindu (2013), Vol.136, No. 30, p. 4].

