Martian clay minerals might have a much hotter origin

September 12 2012

(Phys.org)—Ancient Mars, like Earth today, was a diverse planet shaped by many different geologic processes. So when scientists, using rovers or orbiting spacecraft, detect a particular mineral there, they must often consider several possible ways it could have been made.

Several such hypotheses have been proposed for the formation of clay minerals, which have been detected from orbit and are sometimes considered indicators that the surface has, in the past, been altered by liquid water. Now, publishing in the journal *Nature Geoscience*, a team of French and American scientists led by Alain Meunier of the Université de Poitiers and including Caltech's Bethany Ehlmann, has suggested a new, very different possibility.

Previously, planetary scientists considered two hypotheses—both offering the potential for once-habitable environments on Mars—that explain clay mineral formation. One holds that over long enough periods, contact with liquid water can alter igneous rock, such as basalt, producing clays; the other proposes that waters flowing through the martian subsurface can produce clays through a hydrothermal process.

In the new paper, the authors suggest that the clay minerals instead might have precipitated directly from scalding hot magmas.

"This new hypothesis is less exciting for astrobiology because life could not survive in those types of conditions," says Bethany Ehlmann, an assistant professor of planetary science at Caltech and a research scientist at the Jet Propulsion Laboratory. "But all three hypotheses need to be on the table as we consider a given clay-bearing deposit. Each hypothesis has a different implication for the history and habitability of ancient Mars."

Ehlmann says that scientists hope to use the Curiosity rover and its suite of instruments to study the clays found in sediments at Gale Crater—the impact crater that the robotic geologist was sent to explore. However, she notes, clays are typically found in even older igneous bedrock on Mars. Future rover missions would need to study clay formation in that ancient crust to rigorously test the various clay formation hypotheses. "There's more exploration that needs to be done before we understand all the mysteries of Mars," she says.

Provided by California Institute of Technology