Earth's crust melts easier than previously thought

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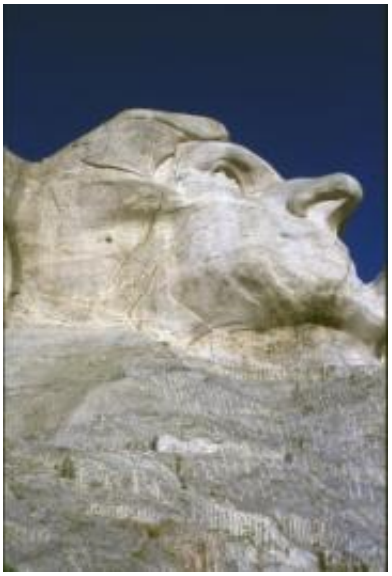

Mt. Rushmore granite crystallized from a magma that was generated 1.7 billion years ago during collision of smaller tectonic plates that together produced the nucleus of the North American continent. Reduced heat diffusion in colliding and deforming tectonic plates, as reported in the paper, contributed to melting of crustal rocks in the ancient mountain belt, in a manner analogous to granite production in the active Himalayan continental collision. Photo courtesy of Peter Nabelek.

A University of Missouri study published in *Nature* this week has found that the Earth's crust melts easier than previously thought. In the study, researchers measured how well rocks conduct heat at different temperatures and found that as rocks get hotter in the Earth's crust, they

become better insulators and poorer conductors. This finding provides insight into how magmas are formed and will lead to better models of continental collision and the formation of mountain belts.

"In the presence of external heat sources, rocks will heat up more efficiently than previously thought," said Alan Whittington, professor of geological sciences in the MU College of Arts and Science. "We applied our findings to computer models that predict what happens to rocks when they get buried and heat up in mountain belts, such as the Himalayas today or the Black Hills in South Dakota in the geologic past. We found that strain heating, caused by tectonic movements during mountain belt formation, quite easily triggers crustal melting."

In the study, researchers used a laser-based technique to determine how long it took heat to conduct through different rock samples. In all of the samples, thermal diffusivity, or how well a material conducts heat, decreased rapidly with increasing temperatures. Researchers found the thermal diffusivity of hot rocks and magmas to be half that of what had been previously assumed.

"Most crustal melting on the Earth comes from intrusions of hot basaltic magma from the Earth's mantle," said Peter Nabelek, professor of geological sciences in the MU College of Arts and Science. "The problem is that during continental collisions, we don't see intrusions of basaltic magma into continental crust. These experiments suggest that because of low thermal diffusivity, strain heating is much faster and more efficient, and once rocks get heated, they stay hotter for much longer. Of course, these processes take millions of years to occur and we can only simulate them on a computer. This new data will allow us to create computer models that more accurately represent processes that occur during continental collisions."

More information: The study, "Temperature-dependent thermal

diffusivity of the Earth's crust and implications for magmatism," was published in this week's Nature and was co-authored by Whittington, Nabelek and Anne Hofmeister, a professor at Washington University.

Source: University of Missouri-Columbia (news : web)