Some like it hot: Site of human evolution was scorching

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If you think summer in your hometown is hot, consider it fortunate that you don't live in the Turkana Basin of Kenya, where the average daily temperature has reached the mid-90s or higher, year-round, for the past 4 million years.

The need to stay cool in that cradle of human evolution may relate, at least in part, to why pre-humans learned to walk upright, lost the fur that covered the bodies of their predecessors and became able to sweat more, Johns Hopkins University earth scientist Benjamin Passey said.

"The 'take home' message of our study," said Passey, whose report appears this week in the online early edition of Proceedings of the National Academy of Sciences, "is that this region, which is one of the key places where fossils have been found documenting human evolution, has been a really hot place for a really long time, even during the period between 3 million years ago and now when the ice ages began and the global climate became cooler."

Passey, an assistant professor in the Morton K. Blaustein Department of Earth and Planetary Sciences at the university's Zanvyl Krieger School of Arts and Sciences, says that conclusion lends support to the so-called "thermal hypothesis" of human evolution.

That hypothesis states that our pre-human ancestors gained an evolutionary advantage in walking upright because doing so was cooler (when it is sunny, the near-surface air is warmer than air a few feet

above the ground) and exposed their body mass to less sunlight than did crawling on all fours. The loss of body hair (fur) and the ability to regulate body temperature through perspiration would have been other adaptations helpful for living in a warm climate, according to the hypothesis.

"In order to figure out if (the thermal hypothesis) is possibly true or not, we have to know whether it was actually hot when and where these beings were evolving," he said. "If it was hot, then that hypothesis is credible. If it was not, then we can throw out the hypothesis."

Evaluating whether the ancient Turkana Basin climate was, in fact, the same scorching place it is today has been difficult up until now because there are very few direct ways of determining ancient temperature. Efforts to get a handle on temperatures 4 million years ago through analysis of fossil pollen, wood and mammals were only somewhat successful, as they reveal more about plants and rainfall and less about temperature, Passey said.

Passey, however, previously was part of a team at the California Institute of Technology that developed a geochemical approach to the "temperature problem." The method involves determining the temperatures of carbonate minerals that form naturally in soil (including a sedimentary rock called "caliche" and hard pan, which is a dense layer of soil, usually found below the uppermost topsoil layer) by examining "clumps" of rare isotopes. (Isotopes are atoms of the same element that have different masses due to differences in the number of neutrons they contain.)

In the case of soil carbonates common in the Turkana Basin, the amount of rare carbon-13 bonded directly to rare oxygen-18 provides a record of the temperature during the initial formation of the mineral. It told the team that soil carbonates there formed at average soil temperatures

between 86 and 95 degrees Fahrenheit, leading to the conclusion that average daytime air temperatures were even higher. In other words, it was hot way back then in what is now northeastern Kenya.

"We already have evidence that habitats in ancient East Africa were becoming more open, which is also hypothetically part of the scenario for the development of bipedalism and other human evolution, but now we have evidence that it was hot," Passey said. "Thus, we can say that the 'thermal hypothesis' is credible."

More information: PNAS paper: "High-temperature environments of human evolution in East Africa based on bond ordering in paleosol carbonates," by John Eiler et al.

Provided by Johns Hopkins University

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