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## PRESS RELEASE

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# The lush past of the world's largest desert

An international team, including researchers from UNIGE, has revealed that the Arabian Peninsula's desert was once home to a vast lake and rivers that shaped its landscape.

The Empty Quarter (Rub' al-Khali), the vast desert of the Arabian Peninsula, was not always an arid landscape. A recent study by the University of Geneva (UNIGE), King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, Griffith University in Australia, California Institute of Technology, University of Texas and University of the Fraser Valley in Canada reveals that this region was once home to a vast lake and river system. These favorable conditions fostered grasslands and savannahs, enabling human migration — until drought returned, forcing populations to move. Published in *Communications Earth & Environment*, this research highlights the impact of climate cycles on landscapes and human societies.

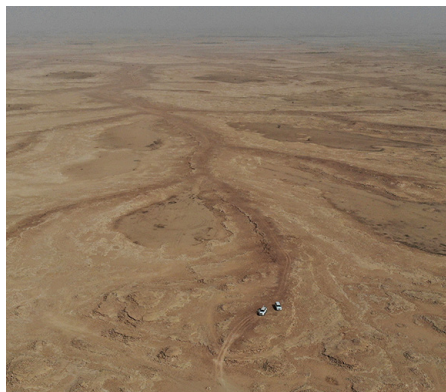
The Empty Quarter, or Rub' al-Khali in Arabic, is one of the world's largest deserts. Spanning nearly 650,000 square kilometers—mainly in Saudi Arabia—it dominates the Arabian Peninsula, with dunes towering up to 250 meters. Yet, this vast arid expanse was not always so inhospitable. A recent study by an international team led by UNIGE reveals a very different past.

“Our work highlights the presence of an ancient lake, which reached its peak around 8,000 years ago, as well as rivers and a large valley shaped by water,” explains Abdallah Zaki, first author of the study and a former researcher in the Section of Earth and Environmental Sciences at the UNIGE Faculty of Science and at the California Institute of Technology, currently a distinguished postdoctoral fellow at the Jackson School of Geosciences, University of Texas.

### A 42-metre-deep lake

These water sites emerged during the “Green Arabia” period, a time of heavy rainfall that lasted from approximately 11,000 to 5,500 years ago, at the end of the Quaternary era. “The lake is estimated to have been vast, covering an area of 1,100 km<sup>2</sup> - almost twice the surface area of Lake Geneva - and reaching a depth of 42 meters. As rainfall increased, the lake eventually overflowed, causing a major flood that carved a 150 km-long valley into the desert floor,” explains Sébastien Castelltort, professor of earth surface dynamics in the Section of Earth and Environmental Sciences at the UNIGE Faculty of Science, who led the work with Abdallah Zaki on the UNIGE side

Based on sediments and landform traced over 1000 km, scientists believe that the heavy rains feeding these ancient waterholes came from the northward expansion of the African and Indian



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The team led by A. Zaki, S. Castelltort, and colleagues from KAUST studies traces of ancient river and lake systems in Northern Saudi Arabia and the Rub' al Khali desert. The brown traces represent the beds of ancient streams, organized in dendritic drainage networks that are now abandoned

### High resolution pictures

monsoons. These wet phases, linked to orbital cycles, varied in duration depending on the region: lasting several millennia in the south compared to only a few centuries in the north. They favored the formation of grasslands and savannahs, which in turn facilitated human expansion across the Arabian Peninsula.

### Human Impact

“The formation of lake and river landscapes, along with grasslands and savannahs, would have facilitated the expansion of hunting, gathering, and pastoral groups into what is now a dry, barren desert. This is confirmed by abundant archaeological evidence found in the Empty Quarter and along its ancient lake and river systems,” says Michael Petraglia, professor at Griffith University’s Australian Research Centre for Human Evolution. 6,000 years ago, the region experienced a sharp decline in rainfall, creating dry, arid conditions that forced these nomadic populations to migrate to more hospitable environments.

These findings underscore the crucial role played by the African monsoon in the rapid transformation of the Arabian Peninsula’s desert landscape, as well as in shaping population movements. This narrative of climate perturbations and human migrations, written in rocks and landscapes, is fundamental to understanding and predicting the possible consequences of current climate change.

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