Researchers reveal mechanisms for regulating temperature sensitivity of soil organic matter decomposition

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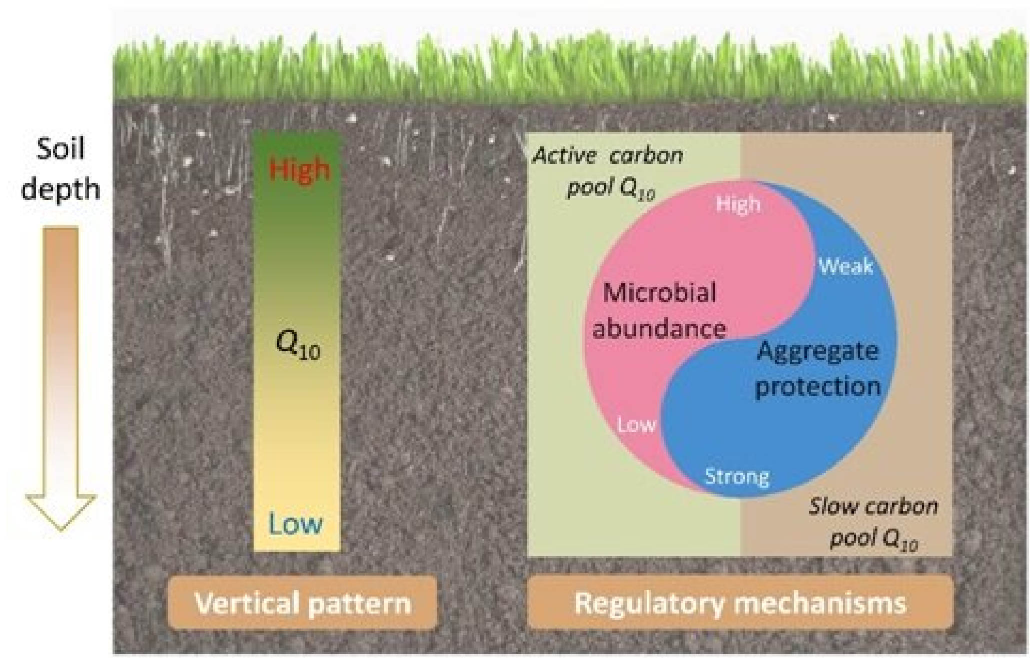

A schematic illustrating the role of microbial abundance and aggregate protection in regulating the temperature sensitivity of soil organic matter decomposition. Credit: Yang Yuanhe

The temperature sensitivity of soil organic matter (SOM) decomposition, commonly referred to as Q_{10}, is a key parameter in the terrestrial carbon cycle. It quantifies the increase in the rate of decomposition corresponding to a 10°C rise in temperature and can determine the sign and magnitude of terrestrial carbon-climate feedback.

The regulatory mechanisms involved in the temperature sensitivity of SOM decomposition has been a topic of great interest among the global change research community over the last 20 years. However, comprehensive analyses involving the roles of substrate, environment and microbial properties in regulating Q_{10} have been limited.

Recently, a research team led by Prof. Yang Yuanhe from the Institute of Botany of the Chinese Academy of Sciences elucidated the mechanisms underlying vertical variations in Q_{10}. Based on the natural gradient of soil profile in Tibetan alpine grasslands, the team collected soil samples at two soil depths and then conducted long-term incubation, SOM decomposition modeling and manipulative experiments.

The team found that lower microbial abundance and stronger aggregate protection were coexisting mechanisms underlying lower Q_{10} in subsoil. Substrate quality and mineral protection were less responsible for Q_{10} variations.

Further analysis revealed that regulatory mechanisms differed between various carbon components. Microbial communities were the main determinant of depth-associated variations in Q_{10} in the active carbon pool, whereas aggregate protection exerted more important control in the slow carbon pool.

These results revealed the crucial role of soil carbon stabilization mechanisms in regulating the temperature response of SOM decomposition, and provided important insights for accurately understanding the feedback between the terrestrial carbon cycle and climate warming.

More information: Shuqi Qin et al, Temperature sensitivity of SOM decomposition governed by aggregate protection and microbial communities, *Science Advances* (2019). DOI: 10.1126/sciadv.aau1218

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