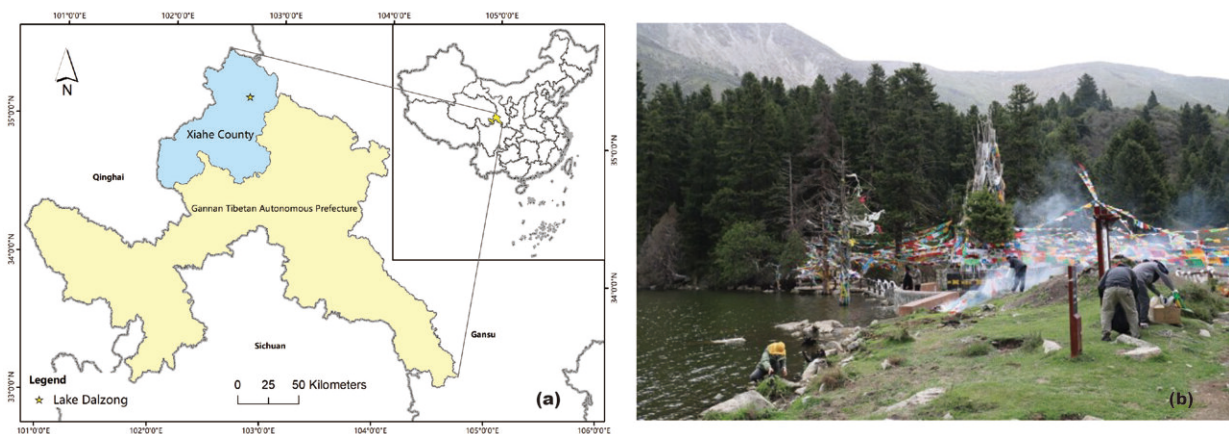


# Changes of Tibetan religious activities during the past millennium revealed from lake sediments

February 22 2023



(a) Geographical location of Lake Dalzong; (b) Photo showing the activity of aromatic plant-burning around Lake Dalzong (taken on June 7th, 2020). Credit: Science China Press

Xiahe County, located in Gannan Tibetan Autonomous Prefecture in the northeastern part of the Tibetan Plateau, is known as "Little Tibet." For a long time, all aspects of human survival, social development and cultural accumulation in the region have been strongly influenced by religious beliefs.

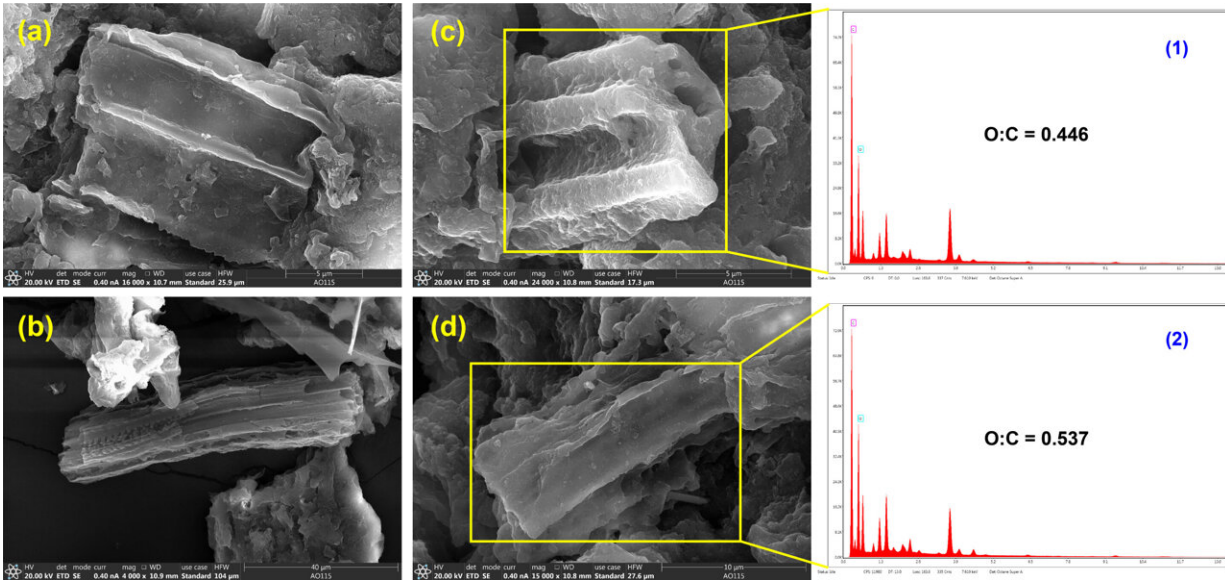
Aromatic plant-burning is one of the most important and common

religious sacrificial methods of Tibetan Buddhism in the region, mainly through sacrificial offerings in the form of smoke. Lake Dalzong is regarded as a sacred [lake](#) by the local people, who often come to the lake to perform various religious rituals.

As a product of the incomplete combustion of substances, [black carbon](#) (BC) is chemically stable, tiny and can be retained in the geologic record. The production, concentration, and variation in BC, as a product of fire events, are the most direct measures of fire activity. Therefore, the study of the products of anthropogenic fire events, such as religious sacrifices, has the potential to indicate changes in [religious activities](#) in the area where Lake Dalzong is located.

This study tested black carbon at a high resolution based on a reliable dating framework for nearly a thousand years using  $^{137}\text{Cs}$ , and AMS  $^{14}\text{C}$  on Lake Dalzong sediment cores.

By analyzing the black carbon stratigraphic concentration and comparing the existing study sites with the same water vapor source, it was determined that the black carbon in Lake Dalzong was mainly accumulated by near-source wet deposition process; combined with the black carbon SEM morphology and energy dispersive spectroscopy results, it indicated that the black carbon in Lake Dalzong was the product of local biomass fuel.



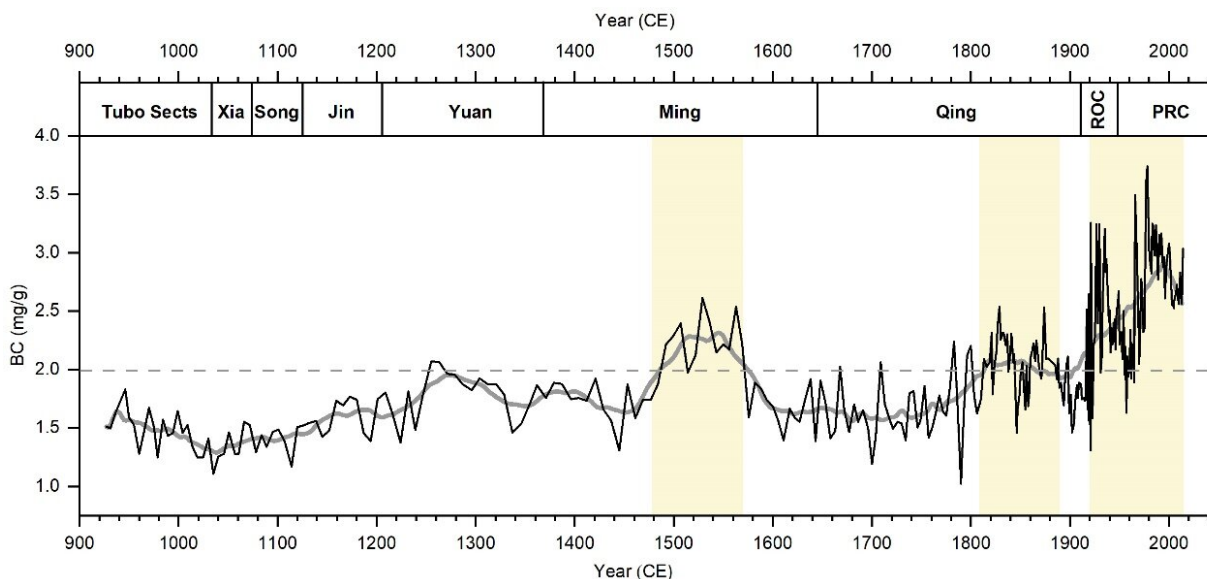
(a), (c), (d) Black Carbon (BC) sample at a depth of 83.5 cm (1917 CE); (b) BC sample in the topsoil of the lake after aromatic plant-burning; (1), (2) Energy dispersive spectral results of the corresponding BC samples. Credit: Science China Press

After comparing the regional climate change indicators, excluding the role of natural sources in controlling black carbon concentration changes, and discussing the influence of anthropogenic heating and lifestyle on black carbon changes, it is determined that regional religious activities dominate black [carbon](#) changes on interdecadal-centennial time scales.

Based on the above discussion, three periods of enhanced religious activity have been identified in the Xiahe region over the last millennium: 1490-1565CE (mid-Ming Dynasty), 1810-1890CE (late Qing Dynasty), and 1920CE to the present (since the Republic of China). The increase in religious activities in this centennial timescale is a response to [social development](#) in the same period.

During the mid-Ming Dynasty, wars often occurred in the Gannan region, and local people frequently performed religious sacrificial activities out of fear of war and turbulence. Since the establishment of the Labrang Monastery in 1710, religious activities have gradually flourished, while in the late 19th century of the Qing Dynasty, influenced by unreasonable ethnic policies, society was extremely unstable and BC showed significant fluctuations.

The unprecedented flourishing of religious activities since the Republic of China was established are due to the unprecedented development and construction of religious temples and the protection and support of policies; however, there was also a stagnation of religious activities as a result of historical events.



ROC is the abbreviation for the Republic of China and PRC is the abbreviation for the People's Republic of China. The shading indicates stages of significantly increasing BC concentration, the gray line is the smoothing result of 50 years, and the horizontal dashed line is the average BC concentration (2 mg/g) in the study period. Credit: Science China Press

This study is the first to extract information on the variation in religious activities from lake sediments on the Tibetan Plateau, which will help advance the study of the historical context of the Anthropocene on the Tibetan Plateau. It also reveals that human activities have a non-negligible impact on the ecological environment of the plateau.

The research is published in the journal *Science China Earth Sciences*.

**More information:** Xuyi Ma et al, Changes in regional religious activities in the last millennium recorded by black carbon in Lake Dalzong, northeastern Tibetan Plateau, *Science China Earth Sciences* (2022). [DOI: 10.1007/s11430-022-9982-1](https://doi.org/10.1007/s11430-022-9982-1)

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