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A 28-kyr record of environmental change in NE Japan inferred from the Lake Ichi-no-Megata sediments

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Continuous geochemical data of 37-m thin laminated sediment core from Lake Ichi-no-Megata (maar), northeast Japan provides a 28,000-year history of the response of the lake and its surroundings to global climate change in the northeastern Japan. Principle component (PC) analysis of 17 major and trace elements in the bulk sediment samples indicated that PC-1 score (explain 46.1% of all chemical variables) may reflect the paleo lake productivity and detritus inputs from the surrounding area caused by monsoonal-climate change. We interrupt this correlation that warm and humid climate leads to the high stand of lake productivity and the low input of detritus minerals when the PC-1 score is low (negative), and the vice versa.

On the other hands, seventy four AMS 14C dates enabled us to establish the detailed chronology agreed well with tephrostratigraphy. The event-free composite depth versus calendar plots indicates a stable deposition environment since after 28,000 cal yr BP.

In the last glacial after 28,000 cal yr BP, the PC-1 score has fluctuated with millennial scale and temporally increased at the periods of 27, 25-24, 22-21, 19-18, and 16 cal kyrs BP. These climate cool/dry events could be compared with the stadials in the North Atlantic region such as the Heinrich events.

During the last glacial-interglacial transition (the LGIT, 15-9 ka), the PC-1 score began to became negative gradually at 14,500 cal yr BP, that means the onset of the B/A warming interstadial. After that, the score temporally increased between 12,100 and 11,200 cal yr BP. This temporal climate deterioration seems to be the Younger Dryas (YD) stadial. However, the YD term is not simultaneous compared with the records in the North Atlantic region as well as the affected area of Asian monsoon activities and the Westerlies as China and Japan. It needs to discuss more about it.

In the Holocene, one large change of the PC-1 score was occurred at 1,100 cal yr BP. Compared with the pollen data on the same core, this change may be caused by the human impacts to the lake surrounding area that are forest tree cutting to make buildings. Except this, the score has fluctuated with millennial scale, suggested that Holocene climates in the northeastern may have fluctuated caused by a solar activity.

Keywords: Major and trace elements, Principal component analysis, Lake Ichi-no-Megata, LGIT, human impacts, monsoonal-climate change