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\textbf{Siberian and Mongolian paleoclimate: New data from speleothems}

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We have used speleothems from six caves along a north-south transect in Eastern Siberia and the Mongolian Gobi Desert to track the evolution of permafrost and desert aridity during the last ~500 ky. Meteoric waters can penetrate into caves and cause formation of speleothems only when cave temperature (which approximates the mean annual surface air temperature) is above 0˚C, and the effective precipitation during the humid season is positive. Periods of speleothem deposition therefore provide a tracer for presence or absence of the permafrost in Siberia, and of the arid conditions in the Gobi.

The northernmost cave used in this study, the Lenskaya Ledyanaya Cave, is located at 60˚22'N-116˚57'E, on the southern boundary of continuous permafrost zone, with no present-day water seepage in the cave and large amounts of ice partially filling its inner chambers. To the south, Botovskaya Cave (55˚18'N-105˚20'E) is located in discontinuous permafrost, with water seepage and speleothem growth occurring only in a limited area of the cave. Okhotnichya Cave at 52.08˚N-105.29˚E near southern Lake Baikal, is located in a zone of island permafrost, with water seepage and speleothem growth occurring in all parts of the cave. The mean annual temperatures vary from -7˚C in the area of Lenskaya Ledyanaya Cave, to ~0˚C in the Okhotnichya cave region, and the present-day vegetation in the area is sub-arctic taiga forest. Three caves of the Gobi Desert: Shar-Khan (45˚35'N-108˚20'E), Gurvan Ze'erd (42˚50'N-107˚45'E) and Lovon-Chombo (42˚59'N-107˚82'E) are located in the area receiving less than 150 mm of annual rain with mean annual temperatures ranging between +3˚C and +8˚C.

More than 90 horizons from 22 speleothems from these six caves were dated by U-Th method. The youngest speleothem age in the Lenskaya Ledyanaya Cave was 404 ± 32 ky, corresponding to interglacial Marine Isotopic Stage (MIS) 11, whereas other 11 horizons in 6 additional speleothems from this cave were older than the U-Th dating limit (550 ky). In Botovskaya and Okhotnichya caves, speleothem ages clustered into the warmest intervals of interglacial periods at 420-370 ky (MIS-11), 340-300 ky (MIS-9), 210-190 ky (MIS-7.1), 131-120 ky (MIS-5.5) and 10-0 ky (Holocene). No speleothem deposition younger than 550 ky was found in the Gobi Desert.

These results suggest that MIS-11 in Eastern Siberia was warmer than today, and that permafrost at 60˚N was discontinuous, allowing speleothem deposition. Later the climate became colder, leading to formation of continuous permafrost at 60˚N latitude, and causing permanent cessation of speleothem growth in this region. Further to the south, between 56˚N and 52˚N, the climate was warmer and permafrost melted intermittently during the warmest periods of interglacials. This data provides some of the first constraints on the evolution of permafrost in the central and southern parts of Eastern Siberia. Meanwhile, in the Mongolian Gobi Desert, arid conditions with negative water balance were continuous during the last 550 ky.