



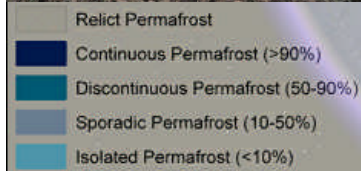
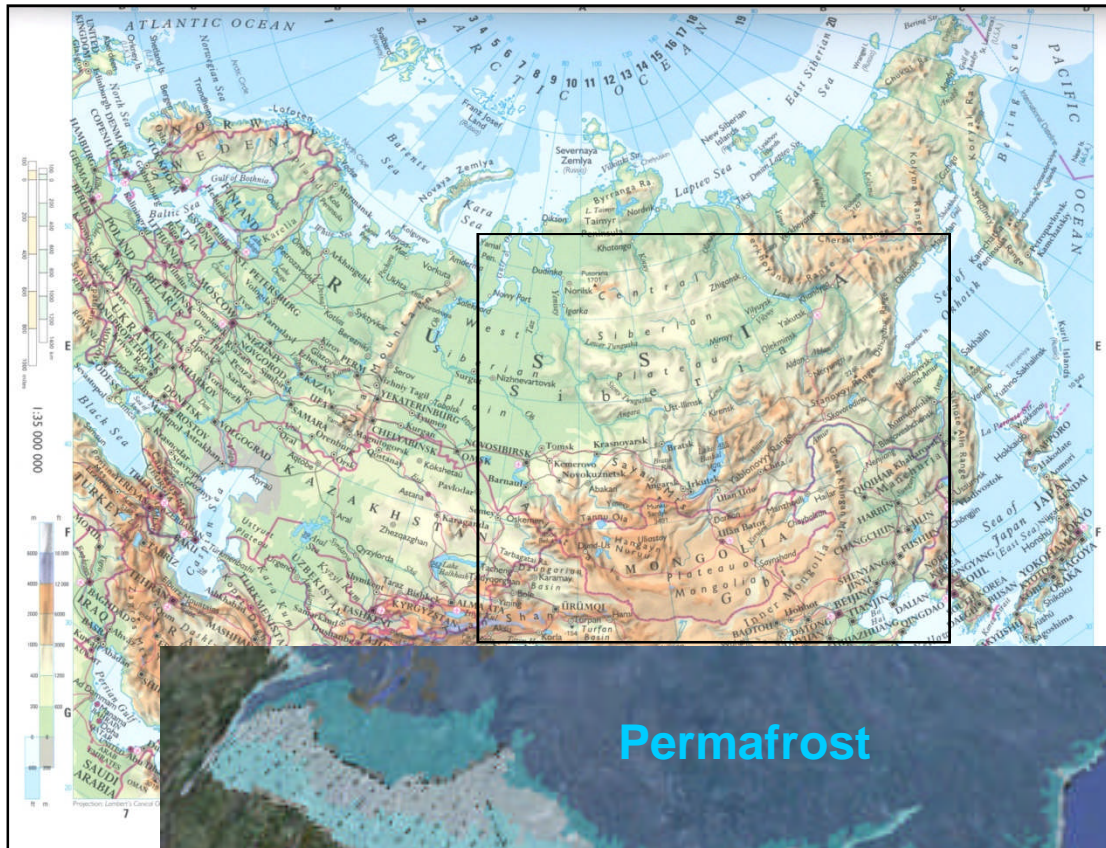
Siberian and Mongolian paleoclimate: New data from speleothems



Vaks A.,
Gutareva O. S., Breitenbach S. F. M.,
Avirmed E., Osinzev A. V., Mason A. J.
and Henderson G. M.

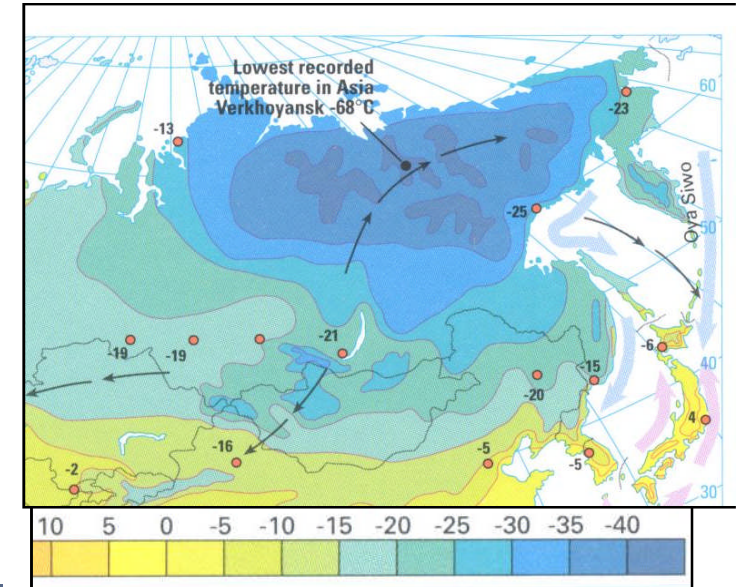


Research Area – Eastern Siberia and Mongolia

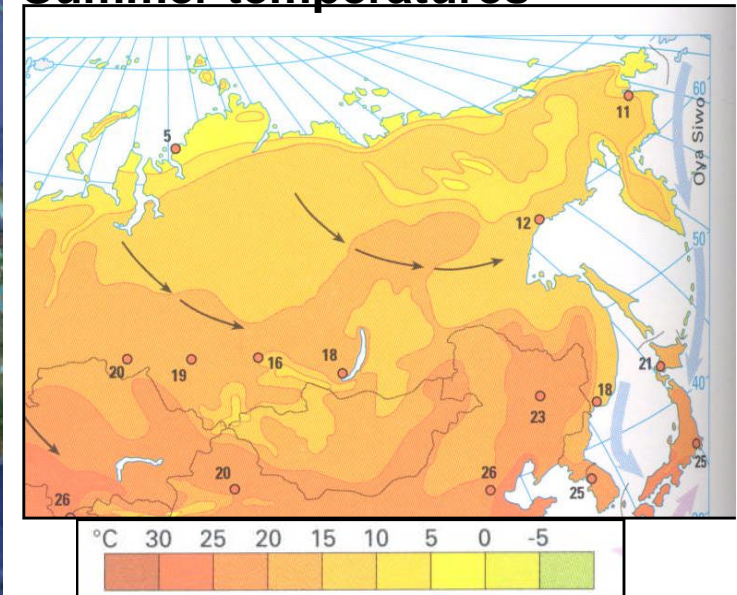


Desert

Winter temperatures



Summer temperatures



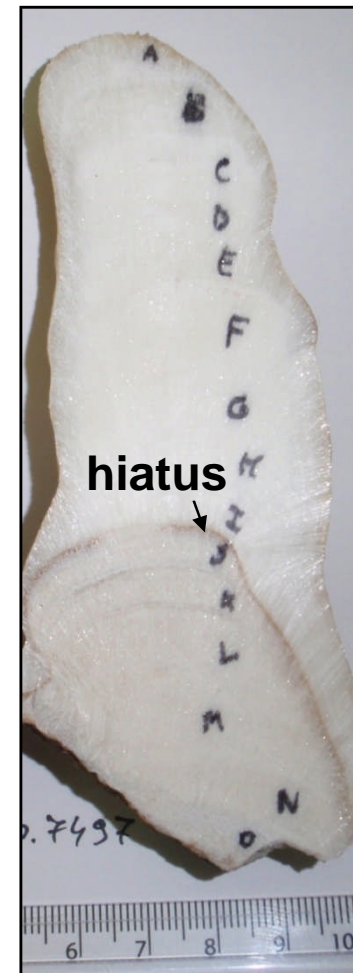
This study uses speleothem growth periods for paleoclimate reconstruction

Carbonate speleothems cannot form in frozen or arid conditions;

Siberia: permafrost formation

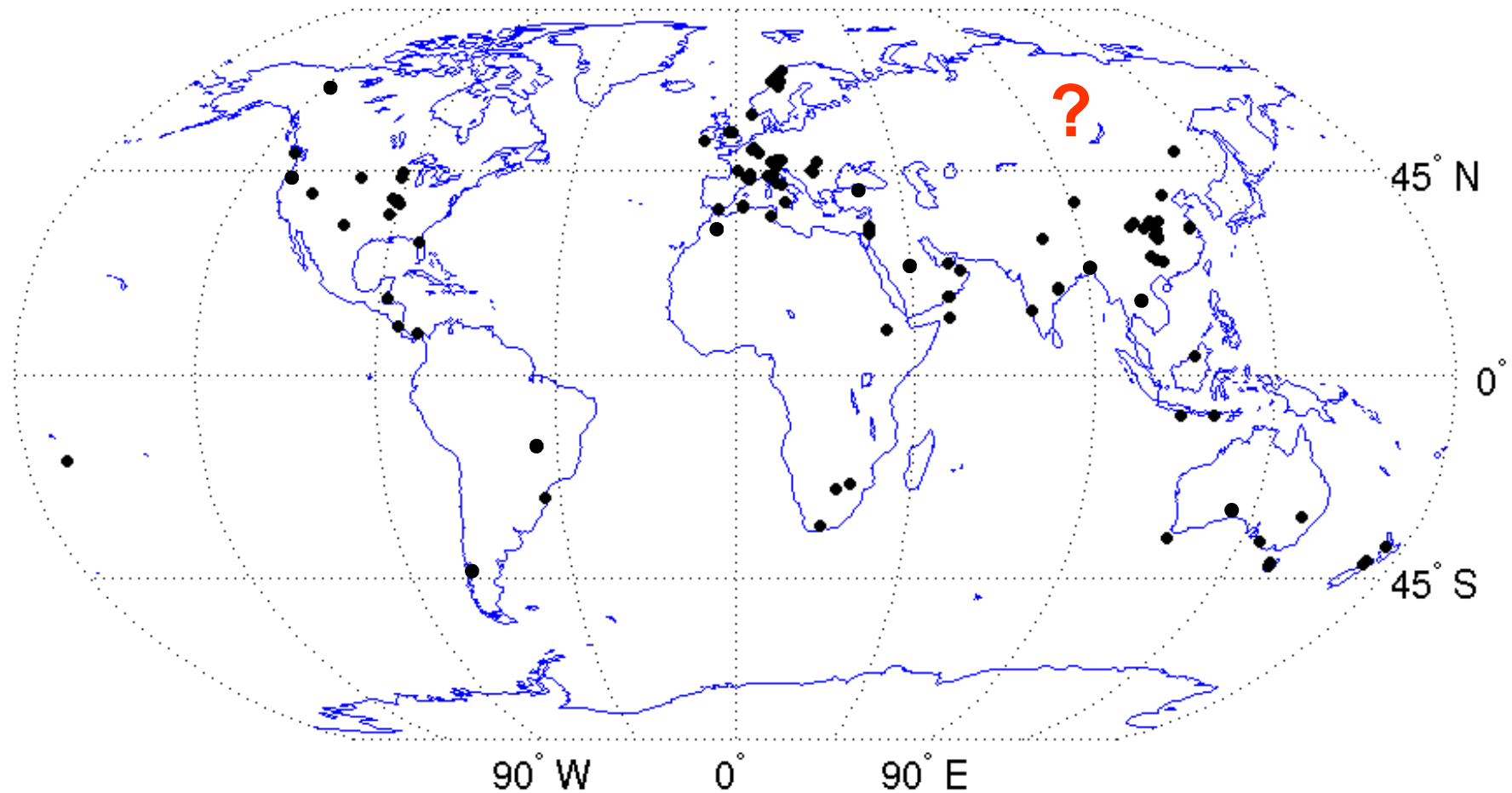
Mongolia: desertification

Growth breaks
(hiatuses)

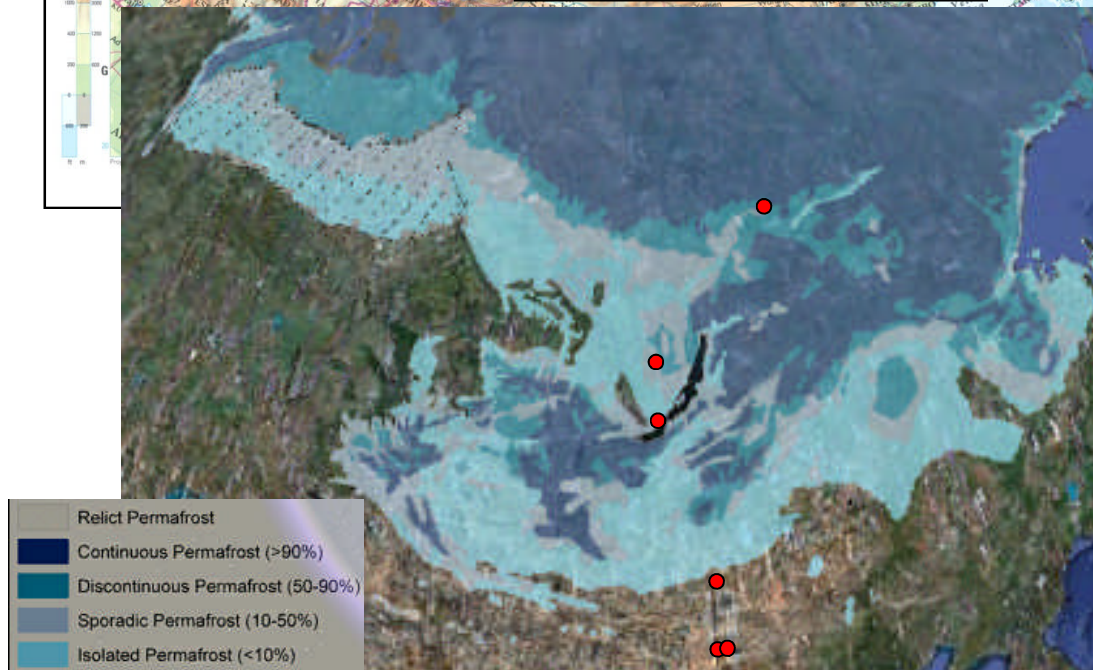


No published speleothem records from Russia and Mongolia

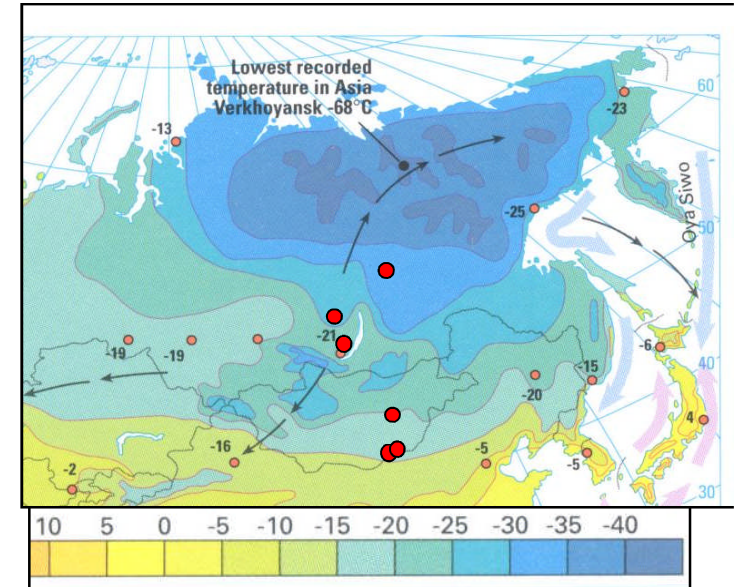
Speleothem record locations (all periods)



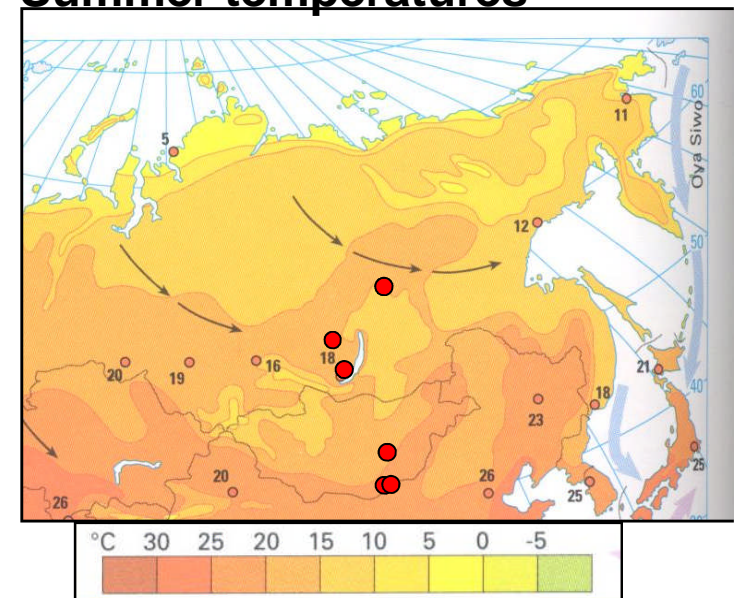
Six caves on north-south transect of Eastern Siberia and Mongolia



Winter temperatures



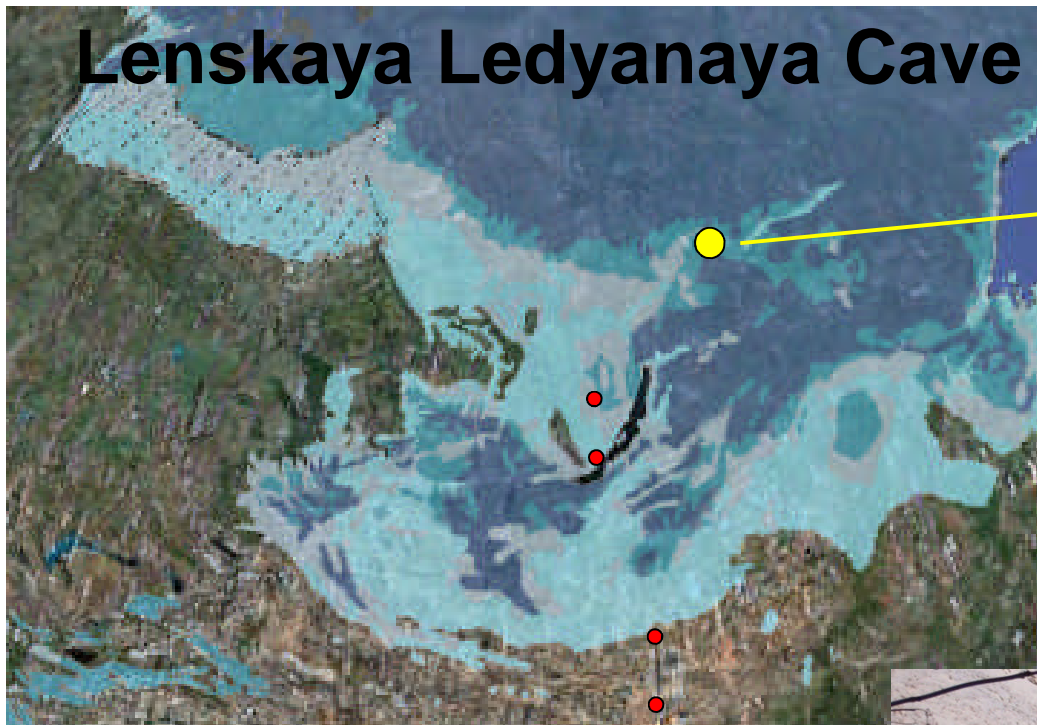
Summer temperatures

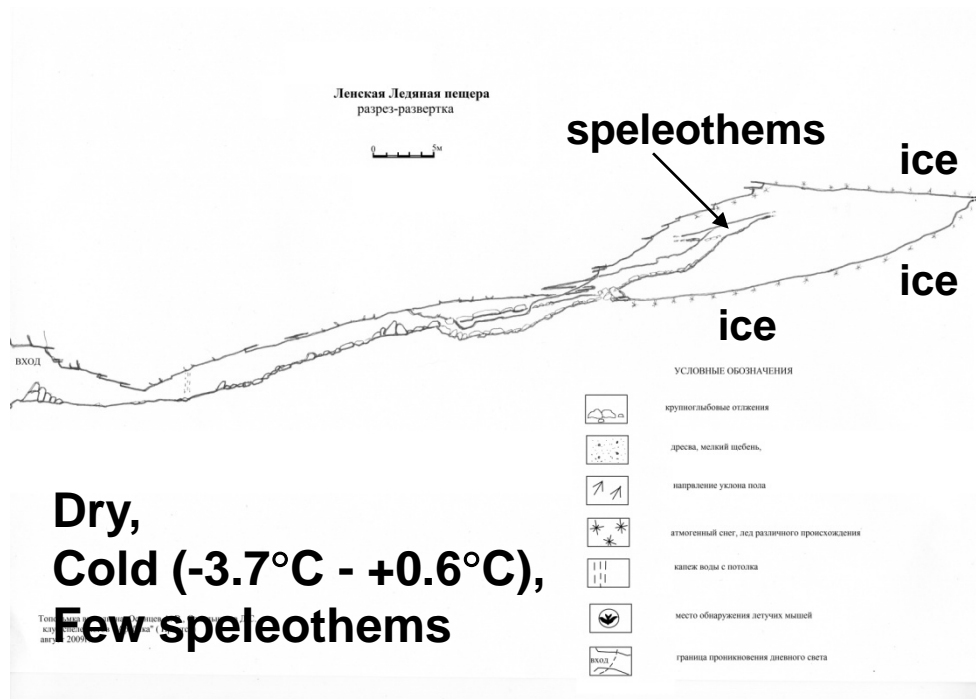


Objectives:

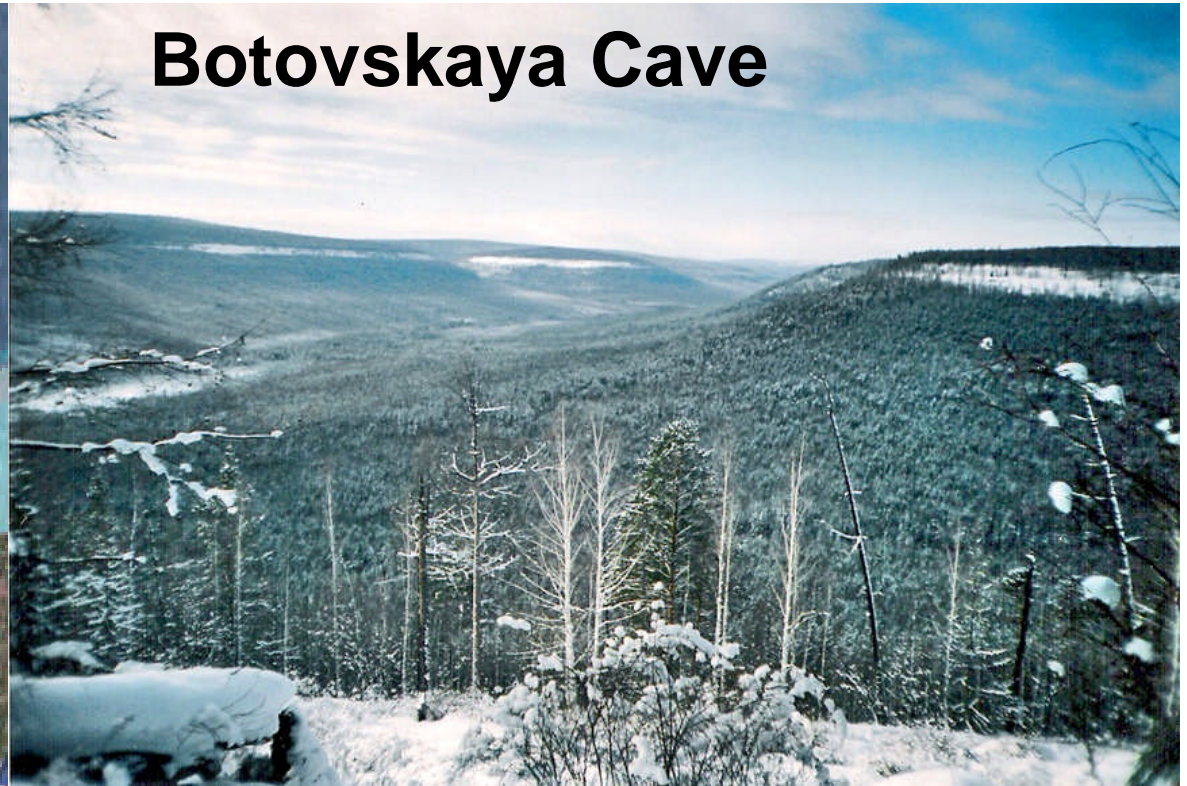
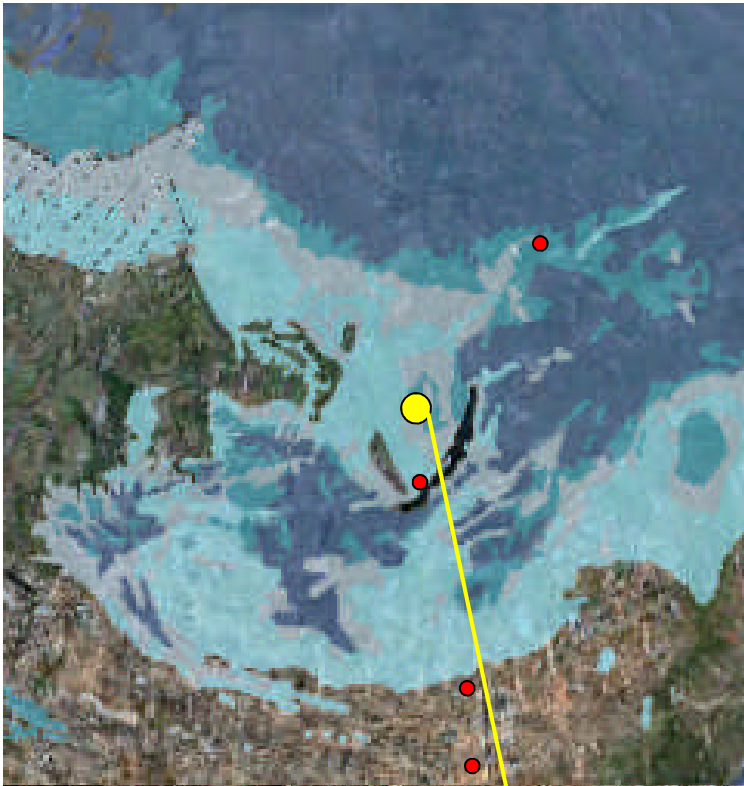
- 1. Assessing when Siberia was unfrozen and when the Gobi Desert was humid by timing of speleothem growth during the last 450 ky;**
- 2. Understanding the relationship between global glacial / interglacial cycles and the extents of the permafrost and the desert.**

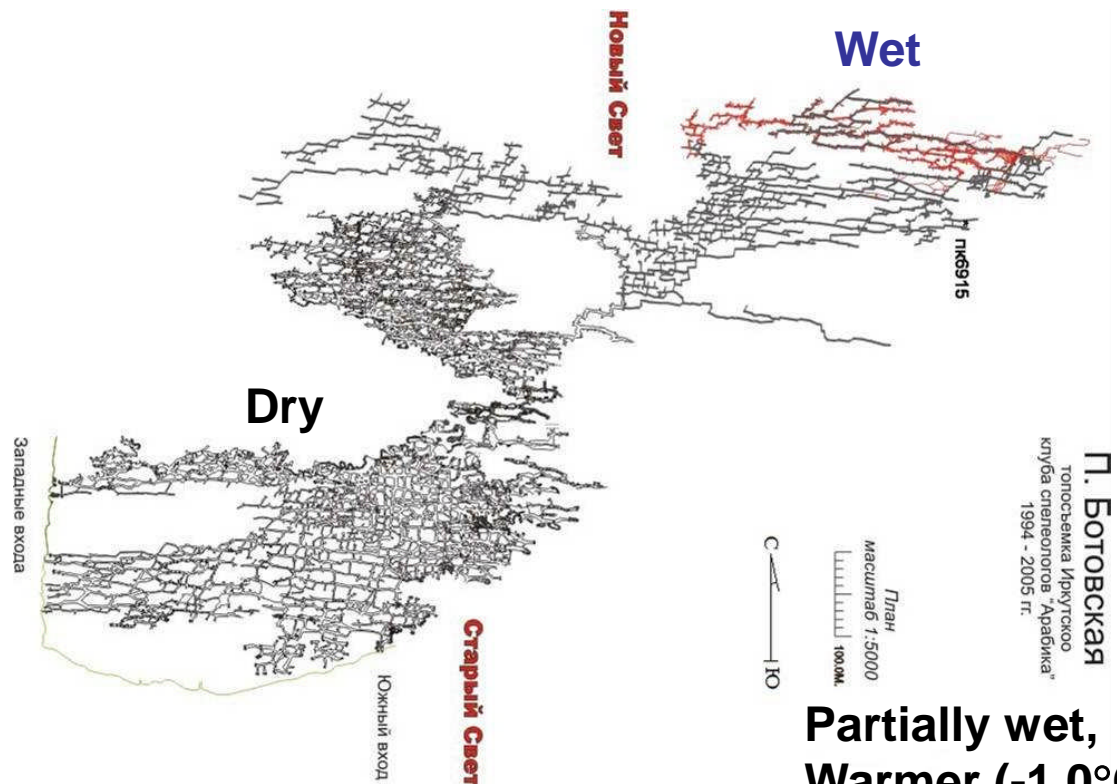
Lenskaya Ledyanaya Cave





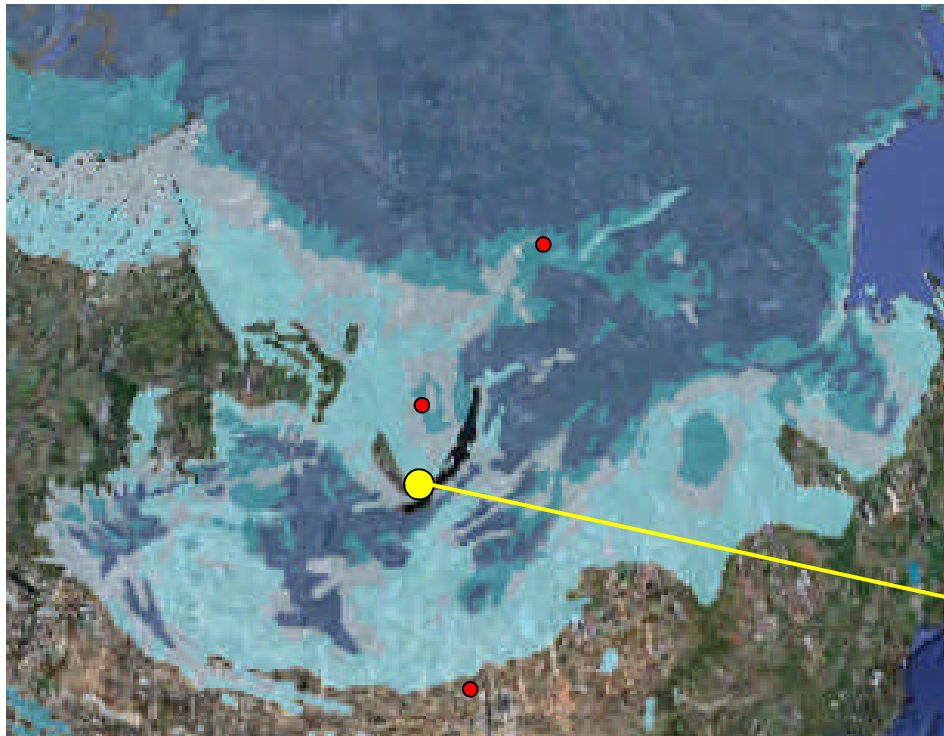
Botovskaya Cave





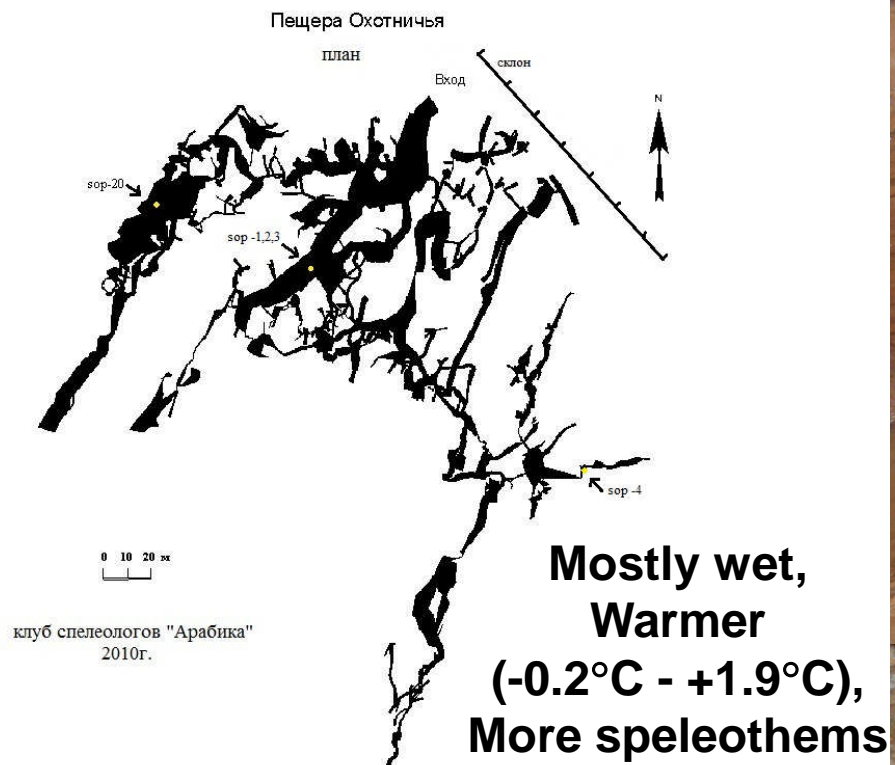
Partially wet,
Warmer (-1.0°C -
 $+1.5^{\circ}\text{C}$),
More speleothems



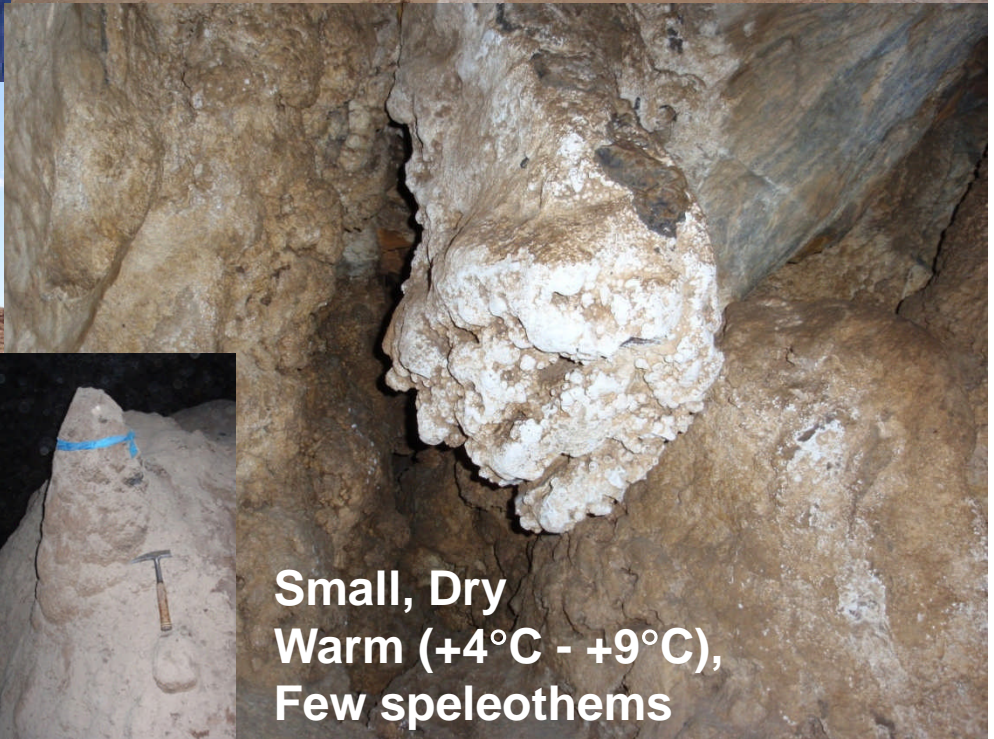
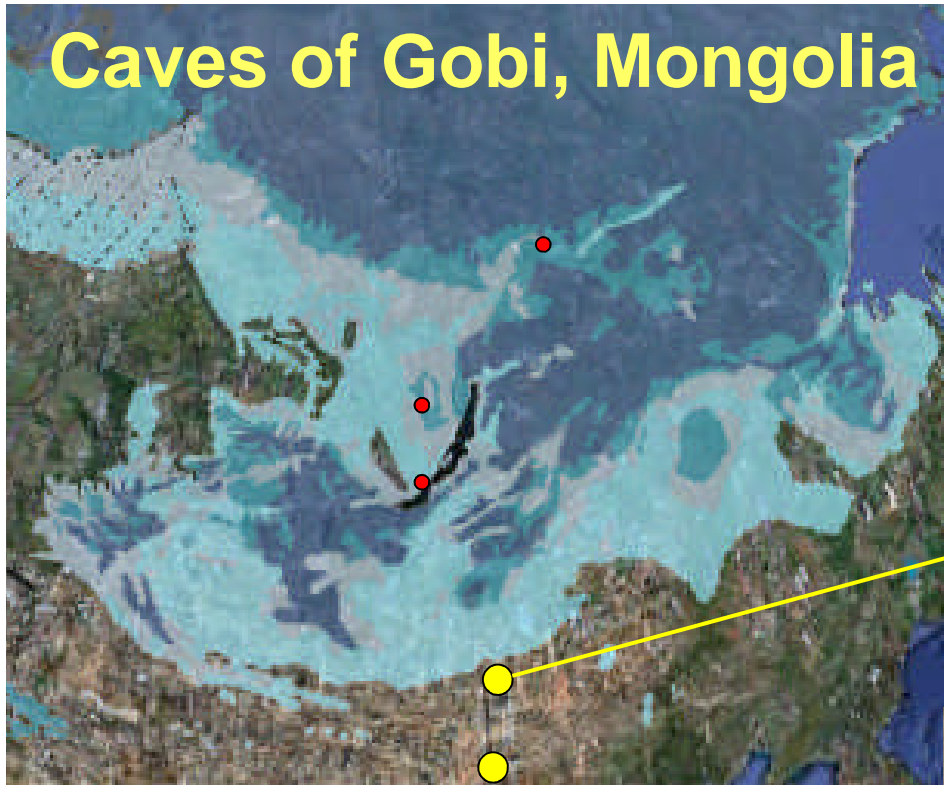


Okhotnichya Cave





Caves of Gobi, Mongolia

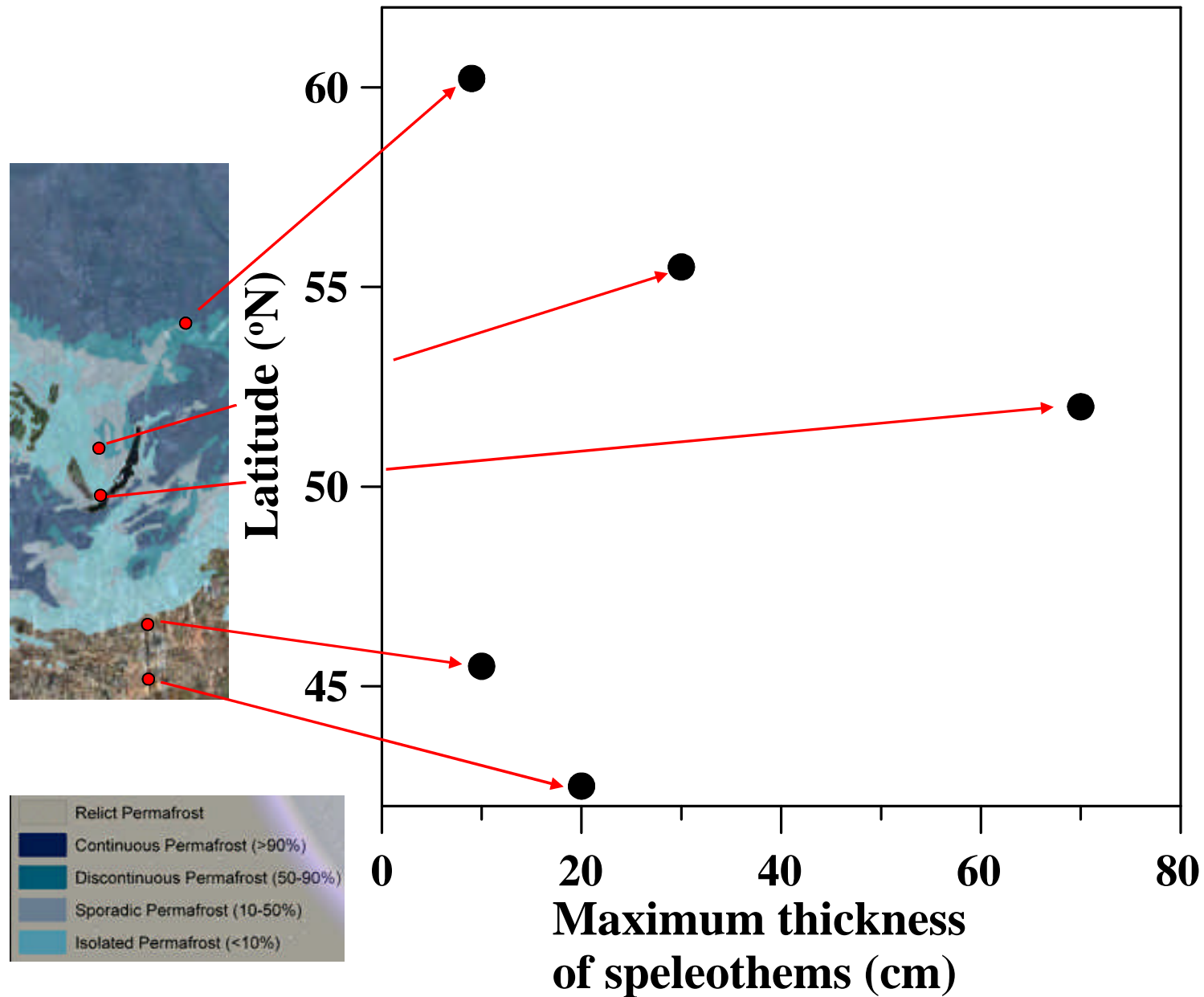


Small, Dry
Warm (+4°C - +9°C),
Few speleothems

Method: U-Th dating of speleothem horizons using MC-ICP-MS;

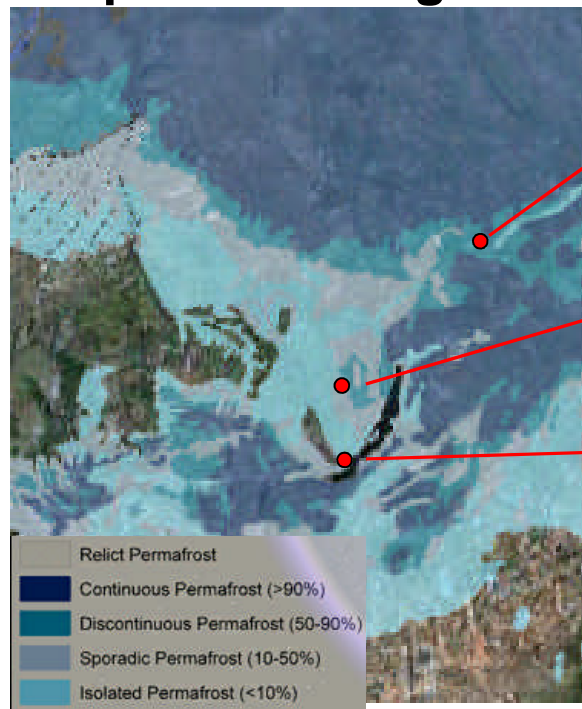


Speleothem thickness:

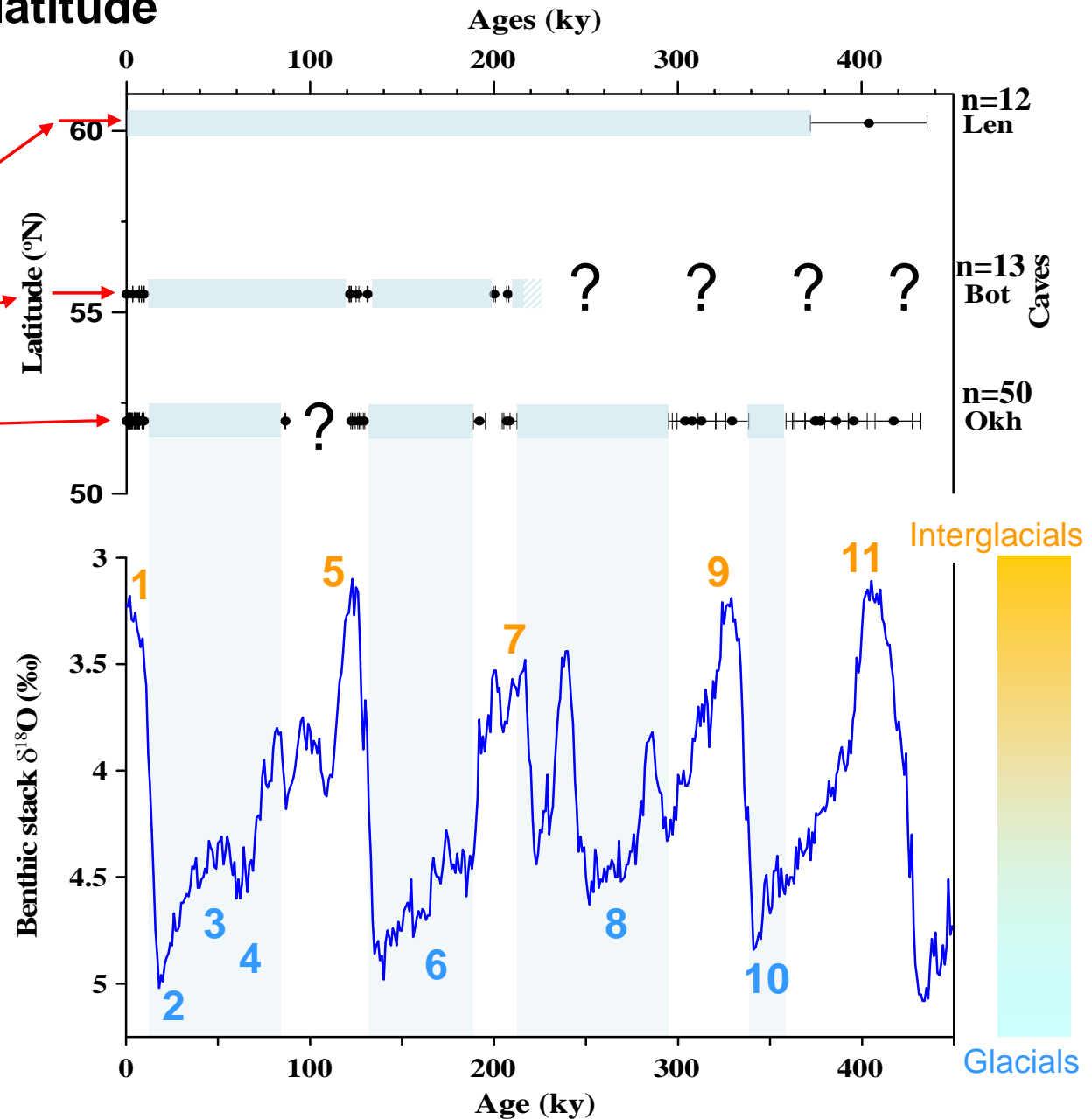


Dating results in Siberia vs glacial interglacial cycles:

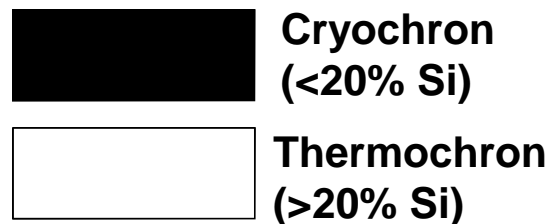
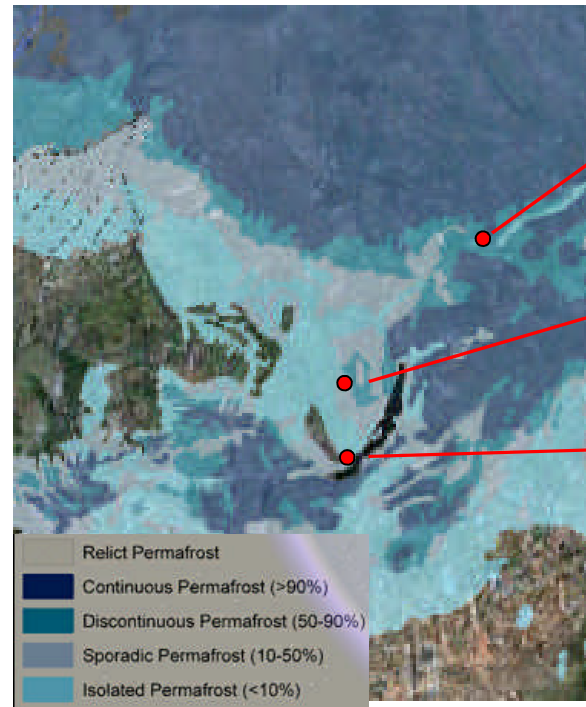
Speleothem ages vs latitude



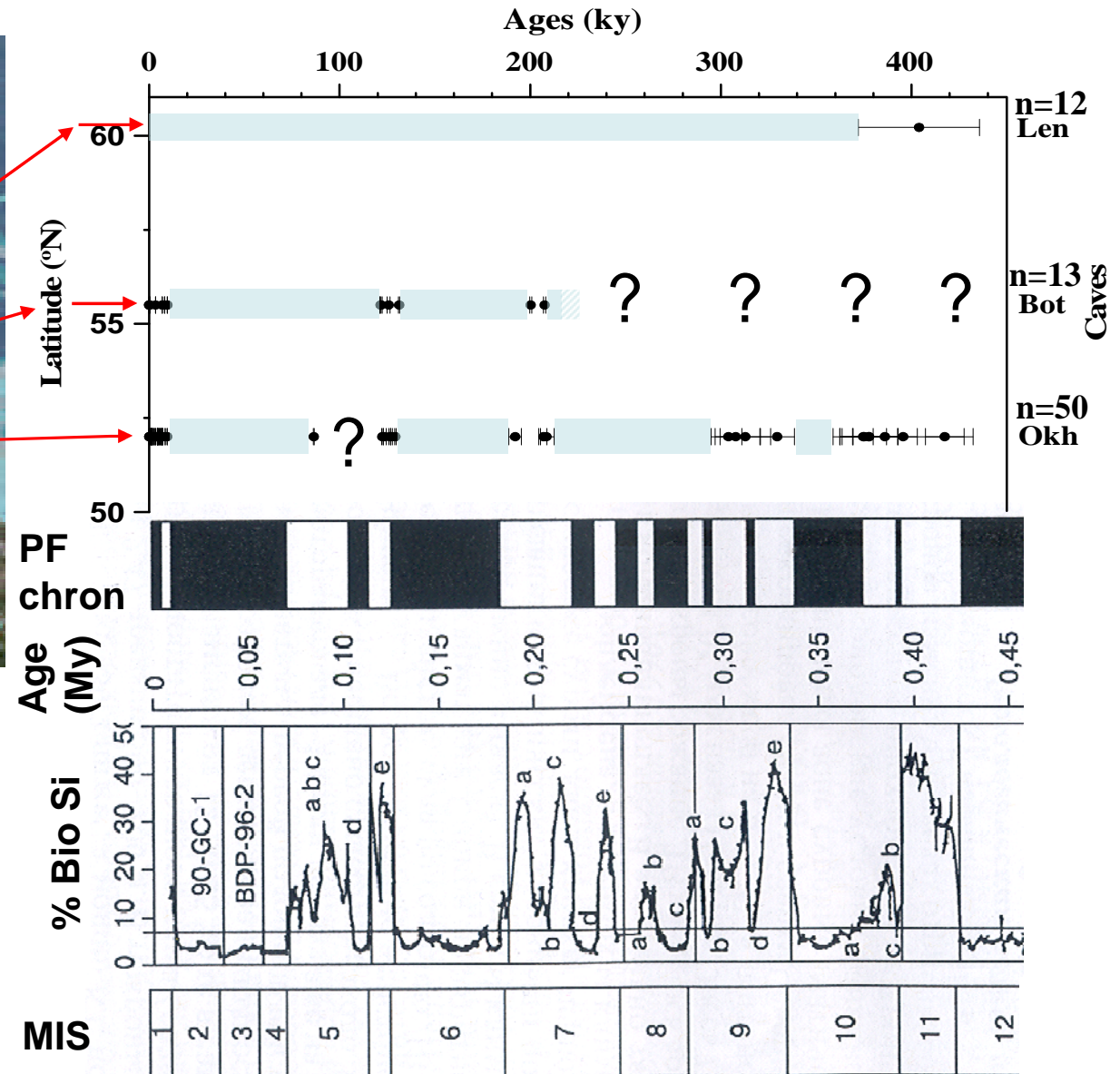
Glacial and interglacial cycles (Lisiecki & Raymo, 2005)



Speleothem deposition periods vs Lake Baikal biogenic silica temperature indicator (cryo-thermo chrons):



Prokopenko et al 2001;
 Fotiev 2005, 2006, 2009



**Mongolia – all 12 dated speleothems
are older than 500 ky**
Continuous desert conditions



Conclusions:

- 1) MIS-11 was the warmest period in Eastern Siberia during the last 450 ky, causing retreat of the continuous permafrost boundary further to the north than it is today (59-60°N);**
- 2) Between 56°N and 52°N extensive continuous permafrost formed only during the glacial and cool interglacial periods (Baikal cryo-chrons), but disappeared during the warmest interglacials (Baikal thermo-chrons);**
- 3) No speleothem growth occurred in Mongolian Gobi desert during the last 500 ky - continuous arid conditions.**

Thanks to:

**The members of Arabica Speleological Club, Irkutsk;
Vladimir Balaev and Vladimir Alexioglo in Lensk;
The members of Mongolia Caving Society.**

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Thank you!!!