

ABSTRACT
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Quantitative Annual Speleothem Records of Temperature and Precipitation in the Past – A new tool for Reconstruction of past karst denudation rates

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Calcite speleothem luminescence depends exponentially upon soil temperatures that are determined primarily by solar infrared radiation in the case when that cave is covered only by grass or upon air temperatures in case that cave is covered by forest or bush. In the first case, microzonality of luminescence of speleothems can be used as an indirect Solar Insolation (SI) index, but in the second - as an paleotemperature proxy. So, in dependence on the cave site we may speak about "solar sensitive" and "temperature sensitive" paleoluminescence speleothem records like in tree ring records, but in our case record may depend either only on temperature or on solar irradiation (SHOPOV et. all, 1996 a,b).

In case of Rats Nest cave, Alberta, Canada we reconstructed annual air temperatures for last 1450 years at the cave site with estimated error of 0.35 0C, while the error of the direct measurements is 0.1 0C. For this purpose we obtained a stacked 66000 data points paleotemperature record from Rats Nest cave, Kananaskis karst region, Alberta, Canada. It covers last 1450 yrs with resolution of about 8 days for most of the time span. Paleoclimatic records has been derived from speleothem luminescence, calibrated by actual climatic records from near climatic station in Banff, Alberta. The sample was dated by two¹⁴-C dates, U/Th dating, autocalibration and annual bands counting dating. All produced consistent age, best estimated as 1450 +/- 80 years.

A reconstruction of the past annual precipitation rates for the last 280 years has been obtained from speleothem annual growth rates, derived from the distance between annual luminescence bands, calibrated by actual precipitation record from near climatic station in Banff, Alberta, Canada

We demonstrated the potential of the quantitative theory of solubility of karst rocks (SHOPOV et. al, 1989,1991a) in dependence of the temperature and other thermodynamic parameters to make reconstructions of past carbonate denudation rates.

Obtained data are important for estimations of the significance of the contribution of karst denudation to global CO₂ amount and cycle.