

Isotopic signals from speleothems of Postojna cave, Slovenia

Early stage of the project

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Motivation

Investigations of speleothems and cave environment can provide insights into climate and environmental changes. Postojna cave (Slovenia) is one of the most famous karst caves in South Eastern Europe. Numerous carbonate deposits (flowstone, speleothem) formed during last 50 ka can be used to investigate climate changes during the last Glacial and Holocene because variations in their growth rate and isotopic composition reflect climate changes on the land surface above the cave.

There is also evidence that vegetation above the cave was changing during the past. Currently, the land area is covered by forest but 150 years ago there was a bare pasture, meadow. These recent changes in land use may additionally effect the cave environment. In planned work we will asses to which extent these changes can be reflected in isotopic composition of flowstone in the cave system.

Additionally, there was also a change in cave structure itself **through** time. Some parts of the recent cave system were isolated at about 30 ka before present. These changes can be detected by isotopic investigations of speleothems also. We will test the hypothesis that changes in isotopic composition of speleothems on the path from the cave entrance to the deep and stable cave environment are related to seasonal changes in air circulation. There are pronounced winter and summer types of circulations with condensation of water in summer and evaporation in winter time. These seasonal variations should cause distinct differences in the isotopic composition of recent precipitated carbonates in young speleothem formation.

Field sampling

In order to investigate enviromental conditions in the cave different sampling site (locations) were chosen (**Map**). The locations are placed through all the cave for beter spatial resolution of the observed physical processes. For some locations (1, 7, 9) stable conditions are suspected and for the others (1, 3, 4, 5, 6, 8), unstable. Locations 10 and 11 are places where influences of river Pivka to the cave interior is dominant. Regardingind this facts processes of the carbonate deposition will be investigated.

Map of Postojna cave with chosen sampling locations

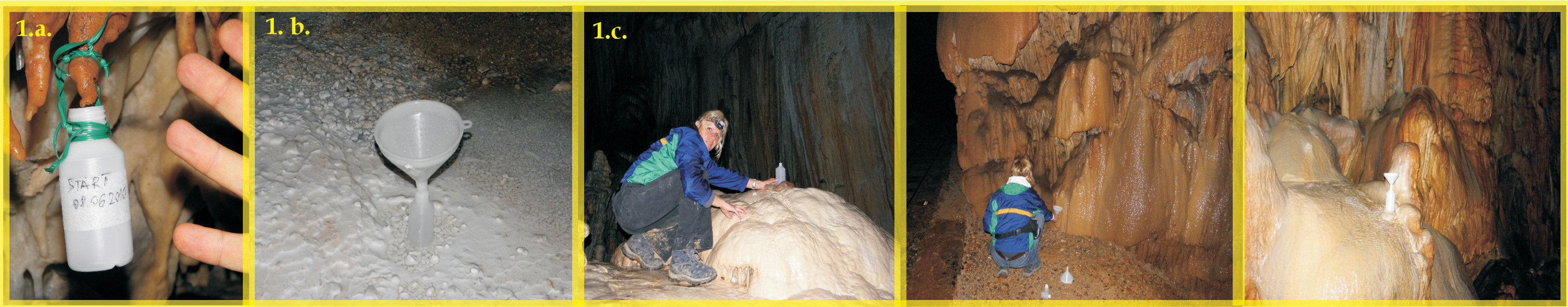
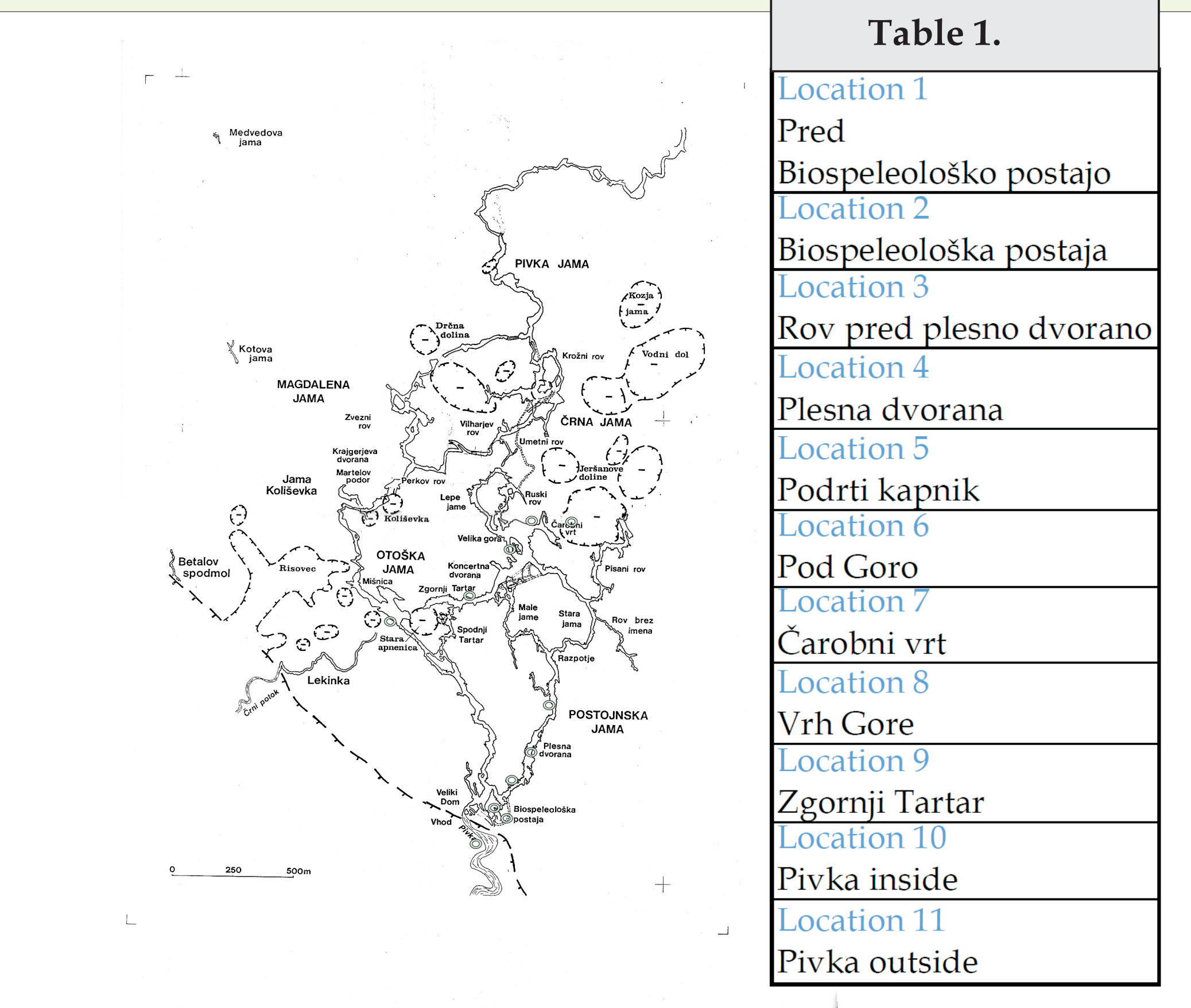


Fig. 1. Water sampling



Fig. 3. Field parameters measurements

On the field sampling collection of the different water samples is done. The water (Fig. 1.) that is collected is stalakcite water (1), slow (1.a.) and fast (1.b.) drip water and pool water in one or more sites in the chosen locations. Parameters listed in table (2) are also measured (Fig. 3.). Collection of samples for Dislocated Inorganic Carbon (DIC) and $d^{13}C$ in air is sampled in to the He preflushed vials. In one location (Fig. 4.) all day monitoring of the wind speed and water chemistry is done. Because of the environmental conditions in th cave the instruments are broken often.



Fig. 4. Monitoring of the wind speed (4.1.), temperature and water chemistry parameters (4.2.)

Chemical Analysis of water samples	$Ca^{2+}, Mg^{2+}, HCO_3^-$
	$Na^+, K^+, Cl^-, SO_4^{2-}, NO_3^-$

Table 3. Chemical analysis of water

Chemical analysis (**Table 3.**) of water samples are going to be conducted in laboratory. Every two month waters are going to be analyzed for Ca^{2+} , Mg^{2+} and HCO_3^- . The other parameters (Na^+ , K^+ , Cl^- , SO_4^{2-} , NO_3^-) are suspected to be in low concentration and will be measured two times yearly.

Parameter	Measurement
$t_{air} / ^\circ C$	Field measurements
$t_{water} / ^\circ C$	
pH	
Conductivity / $\mu S\ cm^{-1}$	
CO_2 / ppm	

Table 2. Field measured parameters

Stable isotopes measurements
DIC [$\delta^{13}C$]
CO_2 [$\delta^{13}C$, $\delta^{18}O$]
Water [$\delta^{13}C$, $\delta^{18}O$, δ^2H]
Carbonates [$\delta^{13}C$, $\delta^{18}O$]

Table 4. Stable isotope measurements for different kind of samples

Mass spectrometry of stable isotope measurements is planed. The analysis are going to be done on different kind of samples (**Table 4.**)



Fig. 5. Recent carbonate samples



Fig. 6. Fossil carbonate samples



Fig. 7. Drilled carbonate profiles

Recent precipitated carbonates “soda straw” (**Fig.5**) and old “fossil” carbonates (**Fig.6**) were taken from each location. On chosen locations drilling of carbonate samples was done (**Fig 7.**).Taken samples will be prepared for stable isotope measurements.