EDITORIAL:
INTRODUCTION TO CAVE CLIMATOLOGY SPECIAL ISSUE

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Guest Editor

This issue presents a series of articles intended to highlight some recent investigations focusing on cave climatology with the intent of generating or renewing interest in research of this subdiscipline.

Climatological conditions inside caves are immensely important for diverse processes such as the formation of minerals at the cave`s walls, their corrosion, the formation of diverse speleothems, the presence of permanent ice, and for the specific existence of several organisms from bacteria to bats. Nevertheless, the research field of cave climatology still does not attract enough attention.

Both peleometeorology and the speleoclimatology differ from their corresponding counterparts of the free atmosphere significantly. While the weather events and the climatological characteristics of an environment at the earth's surface are strongly influenced by short-term and regional changes, as well as medium-term and global changes, the speleoclimate can be traced back almost solely to the given local conditions affecting the coherent cavities and skylights. So-called constant conditions such as lasting high relative humidity, weak temperature fluctuation, as well as slow or absent air currents are characteristic of numerous cave systems.

At first sight, this might sound monotonous or even boring, which certainly is a reason why speleoclimatological research has lacked interest for several years, and why for many caves, only information about the internal temperature is available. But these special conditions, together with permanent darkness, have led to the development of unique and very sensitive ecosystems. By taking a closer look and considering long term measurements of air temperature, humidity, and air flow in different parts of a cave reveal unimagined and exciting dynamics of the cave climate. This has already been established and described in detail for two barometric caves in South Dakota - Wind Cave and Jewel Cave – by Herb Conn. At the openings of these two cave systems in the Black Hills high air flow velocities appear in a quite spectacular way and have been known for a long time.

One of my numerous field trips with my students brought me especially to the Black Hills in 2000, where I got to know Rod Horrocks and Marc Ohms, who were working at Wind Cave National Park and pretty soon Mike Wiles and Rene Ohms at Jewel Cave National Monument. The following year, I started my first measurements in Wind Cave, which were followed by further measurements in Jewel Cave. Through this work, I received further notice and requests from colleagues, who brought me to numerous fascinating cave systems throughout the US, some of which is already published.

After an invitation of Stan Allison, I also got to the just as interesting Carlsbad Caverns in the Guadalupe Mountains in New Mexico, where I studied the climate conditions in numerous caves of the park. First results will be presented in two articles in this journal.

As a climatologist I was immediately fascinated by the climatological diversity, but also by the lack of research done in this impressive field of study. In some caves, I could start further measurement programs in cooperation with the local National Parks or colleagues that continue until today and are constantly extended. Those measurement series of greater or lesser duration include caves in the pseudokarst of New Hampshire, barometric caves in New Mexico and South Dakota, ice caves in Wyoming, Oregon, Idaho, Hawaii and Alaska, lava tubes in Hawaii and glacier caves in Oregon and Washington.

To finally publish parts of the data and to encourage other scientists in the US to start conducting research in this field of study we will present some topics in this special issue exemplarily. More publications will follow in the upcoming years.

No high wind velocities, like in the barometric cave systems, are needed to discover exciting aspects. Even rather static cave systems without considerable air currents can provide interesting phenomena. Those caves have not only always fascinated people by their unique and fragile ice forms, but also been useful for early settlements. Ice caves containing ice bodies of greater or lesser thickness year round have provided ice for cooling. Today those caves play an interesting role in studies on global warming as the ice inside the cave is continuing to melt. Consequently, many former ice caves do not contain permanent ice any more. In this context, we have first considered the historical development in Europe and the US to build the foundation for detailed investigations.

A completely new discipline, which has only been pursued seriously for three years, is the exploration of the climate of glacier caves. No importance had been attached to those caves before Eduardo Cartaya and Brent McGregor presented first and surprising single measurements on the ice cave conference in Idaho Falls in 2014. Their presentation

was followed by a lively discussion about temperatures far above freezing inside of glacier caves, which led to the beginning of very interesting research with surprising results and to the start of long term measurements on three volcanoes of the Pacific Northwest. The results of a climatology focused expedition to Mt. Hood will first be presented in this Journal.

I would like to give special thanks to my numerous wonderful colleagues in the United States, without whose support and strong commitment I could have never conducted this research. Their company in the field, the construction of mounts for measuring devices, accommodation of myself, my students as well as my equipment, the organization of my stays, teaching of several techniques, the transportation of batteries in the heat, snow and ice and much more were a huge help for me. Especially I would like to thank alphabetically:

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