IN-SITU METEOROLOGY AND ELEMENTAL COMPOSITION OF CAVE ATMOSPHERES IN TEXAS.

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Introduction: The atmospheric environment of caves can differ significantly from that at the Earth's surface and plays an important role in hydrogeology and the ecosystem of the cave. Although relatively stable in terms of temperature, the cave atmosphere is a harsh environment that is often corrosive or even toxic and can have very high humidity. Many caves exhibit unusually high concentrations of carbon dioxide (CO_2), while others may have gases indicative of speleogenetic processes, such as hydrogen sulfide (H_2S). By surveying the meteorlogy and composition of cave atmospheres, we can better understand current dissolutional processes for a particular cave and the interaction of the external atmosphere, the cave atmosphere and the cave catchment (aquifer). Speleothem deposts in caves present a long-term record of past climatic information but their growth patterns have been shown to be affected by variations in the cave microclimate and air constituents [1] [2]. Moreover, variations in cave microclimates can have a significant effect on the endemic species [3]. Notably, some evidence suggests that meteorological conditions in affected caves may play a role in transmission and susceptibility of bats to the devastating fungal disease known as White-Nose Syndrome (WNS) [4] [5].

Caves and karst-like geology have been observed on other bodies in the solar system including Mars and Titan. Subsurface environments may provide a potential abode for microbiology, being sheltered from hostile surface conditions, and may also provide a record of past climatic conditions. Study of these environments on Earth may provide a better understanding of their characteristics on other planetary bodies and also a platform for development of instrumentation for future planetary missions. The variations in atmospheric constituents in caves over time may yield information about outgassing from microbiological organisms, the presence and movement of subsurface fluids, and local mineralogy.

Although there have been limited studies on cave meteorology and the concentration of particular gases [6] [7], to the authors' knowledge there have been no real-time, in-situ measurements of multiple atmospheric constituents via mass spectrometry nor how they may vary over time.

Methods and Results: Investigators will relate their efforts to perform meteorological and composition measurements in Texas cave atmospheres. Mass spectrometer data will be collected in real-time over several hours inside several central Texas caves under both rising (inflow) and falling (outflow) barometric pressures. Meterological conditions in the cave will be simultaneously logged for comparison. Preliminary results of data obtained will be presented.

References: [1] Baldini, J.U.L. et al. (2008), *Earth and Planetary Science Letters, 272*, 118-129. [2] Banner, J, L., et al. (2007) J*ournal of Sedimentary Research, 77*, 615-22. [3] Bull, E and Mitchell, R.W. (1972) *International Journal of Speleology 4*, 365-393. [4] Grieneisen, L. et al (2010), *2010 White-nose Syndrome Symposium*, Presentation. [5] Boyles, J. G., and Willis, C. K. R. (2010) *Frontiers in Ecology 8:2*, 92-98. [6] Mitchell, J. N. and E. J. Mitchell. (2009) *Proceeding of the 15th International Congress of Speleology, 3*, 1613-1619. [7] Troester, J.W. and W.B. White (1984), *Water Resources Research, 20:1*, 153-156.