

# Le Centre belge d'Études karstologiques (CBEK)<sup>1</sup>

## Groupe de contact du FNRS en collaboration avec



a le plaisir de vous inviter aux conférences données par le  
**Prof. Chris Groves de la Western Kentucky University**  
Crawford Hydrology Laboratory

**Vendredi 4 mai 2018 à 14 h :**

### **Measuring impact of Karst Systems on the Carbon Cycle**

UNamur auditoire D1 (Faculté de Droit)  
Rue de Grandgagnage  
5000 Namur

- 14:00 Conférence Prof. Chris Groves CO<sub>2</sub> et discussion
- 15 :30 Coffee break
- 16:00 Brainstorming CBEK
  - Présentation des nouveaux membres
  - Présentation de posters ou exposés (contact : [vincent.hallet@unamur.be](mailto:vincent.hallet@unamur.be))
- 18:00 Drink

**Samedi 5 mai 2018 à 19 h (Conférence tout public)**

### **The Mammoth Cave System : the World's Most Extensive Known Cave**

Domaine des grottes de Han (Ferme du Dry Hamptay)  
5580 Han-sur-Lesse

**Lundi 7 mai 2018 à 18 h**

### **Hydrogeology of Mammoth Cave National Park: Why is the World's Longest Known Cave Here?**

Université de Liège au Sart-Tilman  
Département de Géographie  
Bât. B11 (parking P 12)

**INFORMATION : <https://www.unamur.be/recherche/projets/fnrs/groupe-de-contact/cbek/index>**

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<sup>1</sup> The CBEK (Centre Belge d'Études Karstologiques) is a FNRS contact Group created in 1978. Its aim is to enable contacts between Belgian and non-Belgian specialists as geologists, hydrogeologists, geophysicists, archeologists, ... , belonging to the scientific domain that concerns all karstic environments (<http://www.fnrs.be/en/index.php/physics-chemistry-geophysics-and-earth-science>).

## **Measuring Impacts of Karst Systems on the Carbon Cycle**

Chris Groves, PhD (presenting author) and Autumn Turner, MS  
Crawford Hydrology Laboratory - Western Kentucky University

Karst landscape/aquifer systems are primarily developed within carbonate rocks such as limestone and dolomite. These rocks are very soluble in natural groundwater solutions of water and CO<sub>2</sub> gas, as carbonic acid. Most of this CO<sub>2</sub> comes from the atmosphere, either dissolved directly from the air, or from gas in the soil which is rich in CO<sub>2</sub> produced from decaying vegetation. That carbon also originally came from the atmosphere as this is the source of carbon in plants through photosynthesis.

Dissolution of carbonate minerals in carbonic acid consumes CO<sub>2</sub>, and thus represents a process by which CO<sub>2</sub> is being removed from the atmosphere and is transferred to the oceans. Though there has been relatively little study of the geologic processes related to the carbon cycle, the work goes back several decades. A notable pioneer is Belgian Professor Camille Ek (Université de Liège). In the past several years this work has markedly increased, motivated by the increasing urgency for more detailed understanding of rates and processes of atmospheric carbon cycling in the face of increasingly intense climate change.

The net removal of CO<sub>2</sub> from the atmosphere from mineral weathering depends on the rates at which it is removed by mineral weathering on the continents and added back through precipitation in the oceans. More accurate direct measurement of the relevant fluxes is required to resolve these questions. Our laboratory has been refining methods for such measurements both in small carbonate basins and very large river basins with complex geology. Through analysis of 11 sub-basins of the 490,000 km<sup>2</sup> Ohio River basin in the eastern United States, we have developed a tentative model by which the inorganic carbon flux from a river basin can be predicted from existing, mapped geologic and climatic data without direct field measurements of water flow or chemistry. The model works well for basins that have at least about 10% area of carbonate rock outcrop, and produces good estimates independent of detailed lithology, soil types, land use, and other more detailed factors.

## **The Mammoth Cave System : the World's Most Extensive Known Cave**

Chris Groves, PhD  
Crawford Hydrology Laboratory - Western Kentucky University

The Mammoth Cave System in southcentral Kentucky, USA, is the world's longest known cave. The area above the cave was designated as a national park in 1941 that has since been codified as globally significant by UNESCO as both a World Heritage Site and an International Biosphere Reserve, although continued exploration has shown that the cave extends far beyond the boundaries of the national park. About 20 km of passages are developed for tourists.

Mammoth Cave was known to Native Americans as early as 5,500 years ago, and within another thousand years they were adept at exploring deep into the cave as much as 5-6 km from the nearest entrances. No other cave in the world shows such deep ancient exploration and use. These expeditions took place for ritual purposes and mineral mining, and perhaps early on motivated by the same urge for discovery that drives explorers today. Many samples of preserved human feces from these explorers have been dated and examined for diet and have provided the best detail for dating the establishment of domesticated agriculture—considered the most fundamental reorganization of human society following the evolution of biologically modern humans—ever found in the Americas

With a current mapped length of more than 660 kilometers, and another 300+ km of nearby passages in other caves, Mammoth Cave is still being explored during monthly expeditions by the Cave Research Foundation in collaboration with the National Park Service. Fundamental karst science in hydrogeology, geomorphology, ecology, and other areas has been developed here.

Even with the great length, the cave is contained within only about 120 m of nearly horizontal, lower Carboniferous limestone that outcrops over a recharge area of several hundred km<sup>2</sup>. Unfortunately, much of this area is outside of the land use protection of the national park and some portion of water entering the cave's largest underground rivers is impacted by agricultural land-use.

## **Hydrogeology of Mammoth Cave National Park: Why is the World's Longest Known Cave Here?**

Chris Groves, PhD (presenting author) and Autumn Turner, MS  
Crawford Hydrology Laboratory - Western Kentucky University

South Central Kentucky's Mammoth Cave System, with a current known length of more than 650 kilometers, and still being explored, is the world's longest known cave. Another 300+ km of other passages are nearby. A "perfect storm" of hydrogeologic conditions for karst development occur here. These can be understood by analysis of a system of elements that include the rock type (lithologic element), the nature of the solvent (climatic element), the geometry of the incipient fracture network (the structural element), conditions resulting in the hydraulic gradient (the topographic element) and the one-way evolution of dissolution processes (the historic element). Other karst systems can also be analyzed through a similar framework, and results used to compare and contrast their properties.