Cave Survey and Cartography
June 14-20, 2020
GEOG 475, GEOL 475, and GEOS 510

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Course Description:
This class covers the fundamentals of in-cave field mapping and digital cartography with a series of short lectures, demonstrations and displays, mapping exercises, and hands-on instruction in digital field mapping, basic map design and digital cartography. The level of instruction will at the beginning and intermediate experience levels. Instruction on survey techniques will be provided with a strong emphasis on recording field data and sketching both manually, digitally and a combination. Class work will include learning to process survey data, transforming field notes to cave maps using digital cartography and producing basic 3-d models of cave passages. By the end of the course, students will be able conduct basic cave mapping including in-cave sketching, transform survey data into line plots, construct and digitally draft cave maps, and make topographic overlays of cave data with digital topographic maps and Google Earth imagery Optional instruction will be available on constructing simple geographic information systems using cave survey and inventory data.

The course will take place at Mammoth Cave International Center for Science and Learning at Hamilton Valley Field Station located just outside of Mammoth Cave National Park. See http://karstfieldstudies.com/logistics.php for additional information about housing.

Participants must be in reasonably good physical condition to negotiate the cave passages and surface hikes which are a major component of this course. Much time will be spent conducting cave surveys in various caves in the area and in producing cave maps from the data.

Required Text:
- Manual of course material, reports, and articles covered in class to be provided by WKU at the start of the course. Students are encouraged to bring their own laptops.
Equipment and Supply List:

Note, to avoid potential transmission of white-nose syndrome to bats in the cave, the Park Service requires that clothes and equipment used in one part of Mammoth Cave be thoroughly cleaned before being used in another part. A disinfectant will be available to treat helmets and equipment, but for cave clothes it is easier to change to fresh items kept in a separate sealed plastic bag. White-nose syndrome has been identified in Mammoth Cave National Park, but it is still necessary to follow these precautions. WNS, caused by a fungus, is fatal to hibernating bats but does not affect humans. For details, visit www.caves.org and click on WNS.

1. Students are encouraged to bring their own laptops.
2. **Helmet** (for caving trips) with non-elastic chin strap, quick-release buckle, and three- or four-point suspension. The helmet should stay on during a fall but be easily released if it should become wedged. The helmet will also be the mounting point for your primary light source, so any accommodation for attaching a headlamp is a plus.
3. **Two (2) lights that can be helmet mounted.** REI or other outdoor outfitters carry suitable lights for caving. Bring extra batteries.
4. **Flashlight** with extra batteries and extra bulb (ex. Mini-Maglite)
5. **Sturdy boots with non-skid soles** (comfortable, hiking, water resistant is good).
6. **Caving coveralls are ideal, but a suitable alternative is rugged clothing** that can withstand outdoor activity. These include comfortable pants or jeans that you can afford to get dirty. To keep you warm in the 56°F, almost 100% humidity, underground environment you’ll need to dress in layers. It is strongly advised that you have a thermal layer top (polypro or equivalent) and a bottom. If you are not using coveralls, then a long-sleeve shirt is strongly recommended. You will be underground most days, so be prepared with some clean changes of clothes. There will not be enough time to do laundry each day.
7. **Gloves** (garden type is ok, to protect hands and for gripping)
8. **Knee pads** (These are very helpful in protecting your knees). Basketball or other athletic-type knee pads are good.
9. **Small to moderate size day-pack** to hold batteries, jacket, clothing, supplies. A large backpack will be too bulky for narrow cave passages.
10. **Water Bottle** (fill before going on trips, to keep hydrated)
11. **Snack foods suitable for long underground hiking trips**—such as granola-type bars, small cans of fruit, dried fruit, trail mixes, beef or other jerky – similar to what you would take on a long day hike on the surface.
12. **Rain Gear** (layers of clothing for severe weather, umbrella, rain jacket, etc.)
13. **Food** if you are staying at Hamilton Valley Facility, which has a fully equipped kitchen, showers and restrooms.
14. **Bedding** (If staying at Hamilton Valley -sleeping bag or sheet or blanket, pillow). Hamilton Valley has 10 rooms with 4 bunks each.
15. **Toiletries and Towels** (If staying at HV—Towels, toothbrush, toothpaste, shampoo, etc).

**Attendance:** Morning class sessions begin at 8:30 am and break around noon for lunch. Afternoon sessions will begin at 1:00 pm and will typically return from field sites by 5:00 pm. There will be a two-hour break for dinner after which will be instruction on data processing and digital cartography. Participants enrolling for academic credit will be expected to participate in all in-class and field sessions. Participants who participate in the majority of class activities will receive a Certificate of Participation.
**Grading:** This course may be taken as a non-credit workshop or for academic credit. Those wishing to earn academic credit will be expected to complete a survey/cartography related project which will be due by August 31, 2019 and will be graded according to a rubric which will be distributed in class. A standard grading system will be used in the class (90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, below 60% = F).

**General Class Conduct and Policies:** During class periods, cell phones should be turned off and smoking is not allowed. While in cave, safety and conservation are primary concerns. We will move slowly and carefully to minimize danger and impact on the cave. On the surface, especially in the National Park, it is essential to drive carefully and to obey the speed limit. Beware of snakes, ticks, chiggers, and poison ivy. **Cell phones should be turned off during class!** Please treat your colleagues and their desire to learn with appropriate respect.

**ADA Statement:** Students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Director of the Karst Field Studies Program, Dr. Leslie North at leslie.north@wku.edu or (270) 745-5982 so proper accommodations can be considered and made as necessary.

**Schedule Change Policy:** The Department of Geography and Geology strictly adheres to University policies regarding schedule changes. It is the responsibility of the student to meet all admissions deadlines. Only in exceptional cases will a deadline be waived (you will be required to fill out an appeal form). The form requires a written description of the extenuating circumstances involved and the attachment of appropriate documentation. Poor academic performance, general malaise, or undocumented general stress factors are not considered as legitimate circumstances.
Tentative Class Schedule/Agenda

Subject to Change

Day 1 (Sunday)
6:00-6:45 Orientation: Mammoth Cave, WKU
Discuss course outline. Student experience survey.
6:45-7:00 Break:
7:00-8:00 Lecture: Why do we map caves? What is the purpose of the cave map?
Low impact cave mapping
Overview on software for data reduction and cartography
8:00-9:00 View displays of survey instruments, cave maps on display

Day 2 (Monday)
8:30-10:30 Lecture: Overview on data collection/survey standards for class
Basics of cave survey
Keeping book for survey
Importance of teamwork
Exercise: Collecting and plotting cave data
10:30-10:45 Break – 15 minutes
10:45-Noon Lecture: Introduction to cave map symbols
Sketching to scale
Surface and in-cave quality control techniques (includes marking survey stations)
Why and how to incorporate entrance GPS location in the survey notes
Noon-1:00pm Lunch at Hamilton Valley
1:00-4:30pm In-cave mapping at Adwell Cave
How to get started; importance of entrance location data
Novice: emphasis on plan view
Intermediate: cross sections with plan
5:00-6:30pm Dinner at Hamilton Valley
6:30-7:45pm Demonstration: Various plots and representations of cave passage
Lecture: Magnetic declinations
Entering data into Compass Cave survey Program (directed instruction)
Creating plots for cartography (from day’s field notes)
7:45-8:00 Break
8:00-9:30: Class work: Data reduction from field exercise
Elements of a good cave map
Draw map from notes
**Day 3 (Tuesday)**

8:30 – 10:30 Lecture: Introduction Cross sections and profiles  
  Sketching on a clipboard  
  Large Room sketching – Splay shots and floor detail  
  Mapping loops

10:30-10:45 Break

10:45-Noon First Digital Carto Lesson: Importing to Illustrator and Walls

Noon-1:00 Lunch

1:00-4:30 Map a large room to include two cross sections  
  Make a survey loop

4:30-4:45 Break

4:45-5:30 Data entry  
  Second Digital Carto Lesson: Symbols brushes and geology

5:30-6:30 Dinner at HV

6:30-7:45 Data reduction from days field exercise, create plot  
  Lecture: Cartographic representations from days field exercises

7:45-8:00 Break

8:00-9:30 Class Work: Draw day’s field exercise

**Day 4 (Wednesday)**

8:30-10:00 Lecture: Cross sections - continued  
  Triangulations  
  Plotting profiles  
  Introduction to digital sketching

10:00-10:15 Break

10:15-11:30 Third Digital Carto Lesson: Details

11:30 – 1:00 Lunch in Horse Cave

1:00-5:30pm In cave mapping in Hidden River Cave.  
  Use of laser disto for cross sections  
  Novice: Cross sections with triangulations  
  Intermediate: (plan, cross sections & profile)  
  Optional: Digital sketching practice

6:00-7:00pm Dinner at Hamilton Valley

7:00-8:15 pm Class work:  
  Four digital cartography Lesson – Cross Sections  
  Digital cartography using today’s field notes

8:15-8:30pm Break

8:30-9:30pm Continue working on cartographic projects
Day 5 (Thursday)
8:30-10:00 Lecture: Profiles (continued)
   Overview on resource inventories – data collection
   New Digital Mapping Lesson: Profiles and perspective
10:30-4:00 In-cave mapping (bring in-cave lunch): (Dogwood Cave) with plan, profile and cross sections, plan view, cross sections, Profiles
   Intermediate: resource inventory (optional)
5:30-7:00 Dinner at Hamilton Valley
7:00-9:00pm Class work: Digital cartography using today’s field notes
   Continue working on cave maps from previous days
   Optional – Resource inventory – data entry

Day 6 (Friday)
8:30 – 3:30 In-cave mapping exercise: Survey in Cathedral Domes area of Mammoth Cave
   Mapping complex passages, loops, triangulations
4:00-6:00 Break and dinner at Hamilton Valley
6:00-9:00 Data entry, cartography for day’s exercise
   Digital cartography continued – finish class projects

Day 7 (Saturday)
8:00-Noon Questions and discussion on survey and cartographic methods
   Discuss cartographic projects for those taking the class for credit.