

APPLIED KARST HYDROGEOLOGY
GEO 391 & GEO 371C
Spring 2011

SYLLABUS

Course structure based 2 class meetings/week (2:00-3:30 PM Tuesday - Thursday) plus 6 additional weekend projects. Weekend dates are *still tentative* and will be overlapped so as to compete minimally with GEO 420K.

Instructors: Marcus Gary (marcus@zaraenvironmental.com)
Jack Sharp (jmsharp@jsg.utexas.edu)

Office Hours: TBD

Prerequisites: GEO 476K (for 371C) and GEO 391C (for 391) or instructor's consent

Text: Methods in Karst Hydrogeology, Goldscheider, N. and Drew, D., 2007, 264 p.
Available at the UT Co-Op or on Amazon.com

A maximum of 18 students for total enrollment.

Papers from the current literature and "classic" papers will be reviewed throughout the course and be related to each week's topic, and incorporated into an annotated bibliography.

Week 1 – Jan 17 - Course introduction (JS) (Chapter 1; p. 1-8)

Lecture – Introduction to Karst

Lab – Visit Barton Springs – discuss local karst development

Week 2 – Jan 24 – Geologic controls of karstification I (JS & MG) (Chapter 2; p. 9-24)

Lecture – How caves/karst form (soluble matrix, fluid flow, dissolution kinetics...)

Lab – Lab dissolution of limestone

Week 3 – Jan 31 – Geologic controls of karstification II (MG) (Chapter 3; p. 25-44)

Lecture – Epigene, hypogene, eogene settings, features, processes

Lab – Cave survey and mapping (map GEO building as if cave)

Field Trip 1 (Feb 5) – Cave mapping/geological mapping in local Austin caves.

Week 4 – Feb 7 – Karst aquifers and reservoirs as natural resources (JS) (Chapter 5; p. 65-91)

Lecture – Overview of karst aquifers and reservoirs in region, country, and globally;
Porosity/permeability-heterogeneous/anisotropic properties.

Lab – Potentiometric surface mapping in karst (e-line, pressure transducers in lab)

Week 5 – Feb 14 – Karst aquifer recharge and discharge (MG) (Chapter 4; p. 45-64)

Lecture – Mechanisms of discrete and diffuse recharge; karst springs
Lab – Discharge measurements in Waller Creek

Field Trip 2 (Feb. 19)– Install water well network in northern Edwards and Barton Springs Edwards

Week 6 – Feb 21 – Karst system evolution through geologic time (MG) (*Additional reading*)
Lecture – Examples of multi-phase karst development
Lab – pending

Week 7 – Feb 28 – Identification of recharge features (NH) (*Additional reading*)
Lecture – Methods of land surface karst survey; types and sensitivity of features
Lab – Karst survey at Austin area property (CoA with Nico Hauwert)

Field Trip 3 (Mar. 5) – Karst feature/geology mapping in San Antonio (evaluate Austin Chalk, Edwards, and Glen Rose caves and assess local karst development)

Week 8 – Mar 7 – Advanced methods in karst surveying (MG) (*Additional reading*)
Lecture – Sonar, Lidar, etc. - methods and applications
Lab – Laser scanner in geo building

Week 9 – Mar 14 – Spring Break (possible optional field trip to west Texas caves)

Week 10 – Mar 21 – Groundwater tracing in karst (MG) (*Chapter 8; p. 147-170*)
Lecture – Dye tracing principles
Lab – Dye trace in Waller Creek

Field Trip 4 (Mar. 26) – Dye tracing at Comal Springs with EAA

Week 11 – Mar. 28 – Karst geochemistry I (BM) (*Chapter 6; p. 93-122*)
Lecture – geochemical controls of various karst development settings.
Lab – Geochemical measurements of karst waters (Barton Springs system)

Week 12 – Apr. 4 – Karst geochemistry II (JB) (*Chapter 7; p. 123-146*)
Lecture – Isotopes in karst studies
Lab – Speleothems

Field Trip 5 (April 9) – Groundwater geochemistry (wells and springs) – collect pressure transducers

Week 13 – Apr. 11 – Karst geophysics I (JS) (*Chapter 9; p. 171-200*)
Lecture – Overview of geophysical methods used in karst
Lab – Electrical resistivity and gravimetry demonstration

Week 14 – Apr. 18 – Karst geophysics II (JS & MG)

Lecture – Case studies in karst geophysics

Lab – Prepare for final project

Field Trip 6 (Apr. 22-24) Integrated karst project at Camp Bullis (camping in S.A. area at Cascade Caverns)

Week 15 – Apr. 25 – GW modeling in karst (JS or guest) (Chapter 9; 201-222)

Lecture – Components of a good report

Lab – generating maps/reports

April 26-29 Optional field trip to USGS Karst Interest Group and Hydro Days meeting in Fayetteville, Arkansas (possible)

Week 16 – May 2 – Wrap up and Final Report Writing

Lecture – Q/A

Lab – Final exam – Final reports due (Friday)

Substitution field projects (may substitute for one or more of the above if a conflict arises):

- 1. Stream gauging of losing streams on the Edwards Aquifer recharge zone.**
- 2. Gravity and Total station survey of Flint Ridge Cave.**

Grading

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|-------------------------|-----|
| Field project reports: | 40% |
| Project participation | 10% |
| Annotated bibliography: | 20% |
| Bi-weekly quizzes | 15% |
| Final Exam: | 15% |

Field Projects: Two students will be assigned each field project as “project managers.” They will be responsible for organizing data collection and field note organization, data analysis, draft and final report preparation for each project. Draft project reports will be due two weeks following each weekend project. Course instructors will review and comment on draft reports, and final, revised reports are due at the end of the semester. The final, integrated field project will have two or three separate topics, each with a separate report. An additional opportunity to prepare the report component of the course for two students will be to prepare a field guide (with input from the course instructors) for the optional spring break field trip. Assignment for projects will be made primarily on a sign-up, volunteer process, and any duplicates will be determined with a lottery to distribute all project assignments.

Annotated Bibliography: Read and review 25 papers either from those provided by the course instructors or other related papers on similar topics. The annotated bibliography will include a proper citation of the paper and a brief summary of the high points. This will be useful in preparation of the project reports.

Optional Spring Break Field Trip: TCMA Deep/Punkin Cave Preserve; San Felipe Springs, Del Rio, Texas; Balmorhea Springs; Carlsbad Caverns; National Cave and Karst Research Institute; Artesia, NM Bottomless Blue Lakes (sinkholes); Gypsum caves of the Castille Fm.; “wild caves” in the Guads; etc.....

Classroom: GEO 3.104