SYLLABUS
GEO 660A & B – FIELD GEOLOGY
SUMMER 2011

DESCRIPTION: The capstone six-week summer field course for undergraduate geoscience majors in several Jackson School degree options. Taught annually at sites in west Texas, New Mexico, Colorado, Wyoming, Montana, Idaho and Utah by up to ten faculty/research scientists. The course consists of ~ 15 single or multi-day projects that focus on aspect of field description and interpretation. Products generated include measured sections, reports, photopan interpretations, cross sections, maps and stereonets. Geo660A and Geo660B are two separate three week courses; students may enroll for one or both halves.

INSTRUCTORS: Field Camp Director: Dr. Mark Helper, JGB 4.112
helper@mail.utexas.edu
Phone: Office - 471-1009
Cell – 512-924-2526
Teaching Faculty: See attached.

TEACHING ASSISTANTS: See attached.

GRADING: Field Projects, Field Tests, Presentations…….. 100%

Project scores are weighted by number of days in the field. The number of projects varies by instructor, locality and year. Single day individual exercises (field tests) are weighted double. See the attached course schedule and calendar for details.

This course carries the Independent Inquiry flag. Independent Inquiry courses are designed to engage you in the process of inquiry over the course of a semester, providing you with the opportunity for independent investigation of a question, problem, or project related to your major. You should therefore expect a substantial portion of your grade to come from the independent investigation and presentation of your own work.

PREREQUISITES: A grade of C or better in Geo. 420K and Geo. 428, or permission of field camp director.

OTHER ITEMS: **Announcements and course information will be posted on the 660 website at** http://www.geo.utexas.edu/courses/660/default.htm**.** ***Check it often*** **prior to departure for updated information about the travel schedule, lodging addresses, a calendar of projects, sign-up details, etc.**

Academic dishonesty will not be tolerated. Anyone in violation of University policy (see Student Handbook) will receive a failing grade and is subject to additional punative measures, which may include expulsion from the University. Expectations concerning academic integrity during group work will be clearly stated by all instructors prior to commencement of projects. If you are unclear on what constitutes dishonesty or unsanctioned collaboration, ASK. Do not assume that one instructor's rule apply to all projects.

REQUIRED TEXT: Compton, R. R., 1985, Geology in the Field. John Wiley and Sons, 378 pp.

REQUIRED ITEMS: See attached list.

Course Objectives

Why a capstone course in field geology? Geology is first and foremost a field science. Field geology and field geologists provide literally the ground truth for geologic concepts and theories of how the earth works. *The degree to which we, as geologists, are successful observers and interpreters of rocks in the field depends in large measure on what we are prepared to see and record.* The old adage "I wouldn't have believed it if I hadn't seen it" is, in the case of field geology, more truthfully "I wouldn't have seen it if I hadn't believed it". We explore. We discover. Unfortunately, without sufficient experience and preparation we also frequently ignore what we don't recognized or understand. This class is part of that preparation.

Successful field work also depends greatly on how well we can formulate and test ideas while in the field. Without proper preparation, including a strong grounding in field methods, we are little better than rock hounds out for a day of casual collecting. Field geology is not merely collecting data and samples; it is about making sense of the geology around you, about making geologic interpretations. Landscapes are histories, with time marked by boundaries in the rocks, soil and sediment. A geologic map or a measured section is the articulation of that history, with each line marking a before and after, a hiatus that might last a second or a billion years. Through our maps and graphical logs, we represent time as space. *The ability to create, read and interpret such product is best developed from training and practice in a field setting*. It all begins by making and recording observations. An accurate record in the form of a map, measured section, photograph, sketch, a carefully documented sample, field notes, etc. provides a permanent, solid basis upon which to develop testable ideas and interpretations – the plot of the story. Without such evidence, interpretations are fanciful fables; there is no scientific basis to objectively evaluate them.

Field proficiency has long been a distinguishing characteristic of our science. As a geoscientist, you are expected to be a proficient scientific observer and recorder. Your unique skills and training in this area separate you from lawyers, engineers, chemists and other professionals with whom you might one day work. Geology is rooted in the scientific method, so the processes of formulating and testing hypotheses through careful data collection are fundamental skills that need to be mastered in a field setting.

Our principal objectives this summer are to: 1) learn and apply geologic field methods to *describe, measure*, *map, sample* and *report on* rocks in the field. Like all sciences, geology has its own vocabulary and its own set of techniques by which we learn to read the rock record. There is no better way to learn than by being totally immersed in a subject. Three or six weeks of field experiences, away from Austin and life's distractions, provides that immersion.

Some of you will find this an uncomfortable experience. Unlike many subjects, field work can not be mastered by studying hard, nor is there a set formula for successfully interpreting the rocks you will study. You will learn largely by doing and making mistakes. Get comfortable with this idea now and you'll be less anxious in the long run.

Finally, it is often said "The best geologist is the one who has seen the most rocks" and there is much truth to it. With field experiences we develop "professional vision" – the ability to quickly recognize important field relationships and ignore or set aside those that are not. Three or six weeks of field immersion provides the substantial beginnings of a mental catalog of rocks and field relationships, a framework to build upon in future classes, later field work and a future career in the geosciences.

660 STAFF, SUMMER 2011

Faculty	**Expertise/Interests**
[1] Dr. Ron Steel	Clastic sedimentology, depositional systems
[1] Dr. Lesli Wood	Clastic sedimentology, depositional systems
[1]Dr. David Mohrig	Clastic sedimentology, depositional systems
[1]Dr. Charles Kerans	Carbonate depositional systems
[1, 2] Dr. Mark Helper	Cordilleran geology, geology of crystalline rocks
[1, 2] Dr. Randall Marrett	Structural geology, brittle deformation
[2] Dr. Richard Ketcham	Low temperature thermochronology
[1,2] Dr. James Gardner	Volcanology
[1] Dr. Kirt Kempter	New Mexico geology, volcanology
[2] Dr. Timothy (Tip) Meckel	Tectonics
[1] Timothy Diggs	Petrography of sedimentary rocks, petroleum geology

Assistant Instructors

[1,2] Paul Betka, Ph.D. candidate	Structural geology (3 yr. 660 experience)
[1] Julio Leva Lopez, Ph.D. candidate	Clastic Sedimentology, Stratigraphy (2 yrs. 660 experience)

Teaching Assistants

[1]Nabiel Eldam, M.S. Candidate	Sedimentology, depositional systems
[1,2] Ethan Lake, Ph.D. Candidate	Igneous Petrology, Tectonics
[1] Meredith Bush, M.S. Candidate	
[1] Erica Powell, M.S.	Sedimentology, Stratigraphy
[1,2] Josh Dixon, Ph.D. Candidate	Clastic Sedimentology, Stratigraphy
[2]Jessica Erico, M.S. Candidate	Isotope Geochemistry
[2]Goodwin Wharton, M.S. Candidate	Structural Geology
[2]Ben Byerly, Ph.D. Candidate	Igneous Petrology
[2]Kathryn Huber, M.S. Candidate	Structural Geology, Tectonics
[1,2] Kenny Befus, Ph.D. Candidate	Volcanology, Igneous Petrology

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[1] Teaches all or part of 660A

[2] Teaches all or part of 660B

Geo660A Group Assignments

Group 1

Females (10)

Last name	First
Aldrich	Lindsay
Collins	Elizabeth
Cuda	Hillary
Dianiska	Kathryn
Flynn	Heather
Hinojosa	Jessica
Hutson	Margaret
Langston	Jasmine
Latimer	Ashley
Lamb	Julianne

Males (16)

Ardis	Russell
Basham	Jonathan
Bay	Thad
Bina	Cyrus
Boswell	William
Bowerman	Adam
Bryant	Stephen
Cahalan	Ryan
Camacho	Carlos
Cowan	Thomas
Crews	Dutch
Foy	Parker
Freidberg	Nick
Gohlke	Steven
Hawkins	Grant
Hutton	Trevor

Group 2

Females (9)

Last name	First
Miller	Erin
Pedersen	Anine
Perez	Jessica
Peters	Sarah
Pharr	Paige
Rowley	Jillian
Steel	Elisabeth
Sutton	Leslie
Wieweck	Emily

Males (17)

Jacobs	Caleb
Kaldis	Michael
Maher	Koby
Nieto	Michael
Ott	Bryan
Petersen	Grant
Pilgrim	Neil
Promrack	Wisit
Rashilla	Robert
Roush	Reed
Tabbert	Colin
Valencia	Daniel
Wagner	Evan
Wells	Russel
Williams	Matthew
Zinke	Robert
Ganser	Nathan

Geo660B Group Assignments

Group 1

Females (12)

Last name	First name
Aldrich	Lindsay
Collins	Elizabeth
Crooks	Elisa
Cuda	Hillary
Dianiska	Kathryn
Flynn	Heather
Forster	Rachel
Hinojosa	Jessica
Hutson	Margaret
Langston	Jasmine
Latimer	Ashley
Lamb	Julianne

Males (19)

Ardis	Russell
Basham	Jonathan
Bass	Benjamin
Bay	Thad
Bina	Cyrus
Boswell	William
Bowerman	Adam
Bryant	Stephen
Cahalan	Ryan
Camacho	Carlos
Cowan	Thomas
Crews	Dutch
Foy	Parker
Freidberg	Nick
Gohlke	Steven
Hawkins	Grant
Hutton	Trevor
Meyer	Kevin
Okafor	Brandon

Group 2

Females (13)

Last name	First name
Markovich	Katie
Miller	Erin
Pedersen	Anine
Perez	Jessica
Peters	Sarah
Pharr	Paige
Rinehart	Elizabeth
Rowley	Jillian
Steel	Elisabeth
Sutton	Leslie
Vinas	Keri
Wieweck	Emily
Wilkins	Sheila

Males (19)

Jacobs	Caleb
Kaldis	Michael
Maher	Koby
Nieto	Michael
Ott	Bryan
Petersen	Grant
Pilgrim	Neil
Pinkard	James
Rashilla	Robert
Reyes	Daniel
Rodriguez	Gerardo
Roush	Reed
Tabbert	Colin
Valencia	Daniel
Wagner	Evan
Wells	Russel
Williams	Matthew
Zinke	Robert
Ganser	Nathan

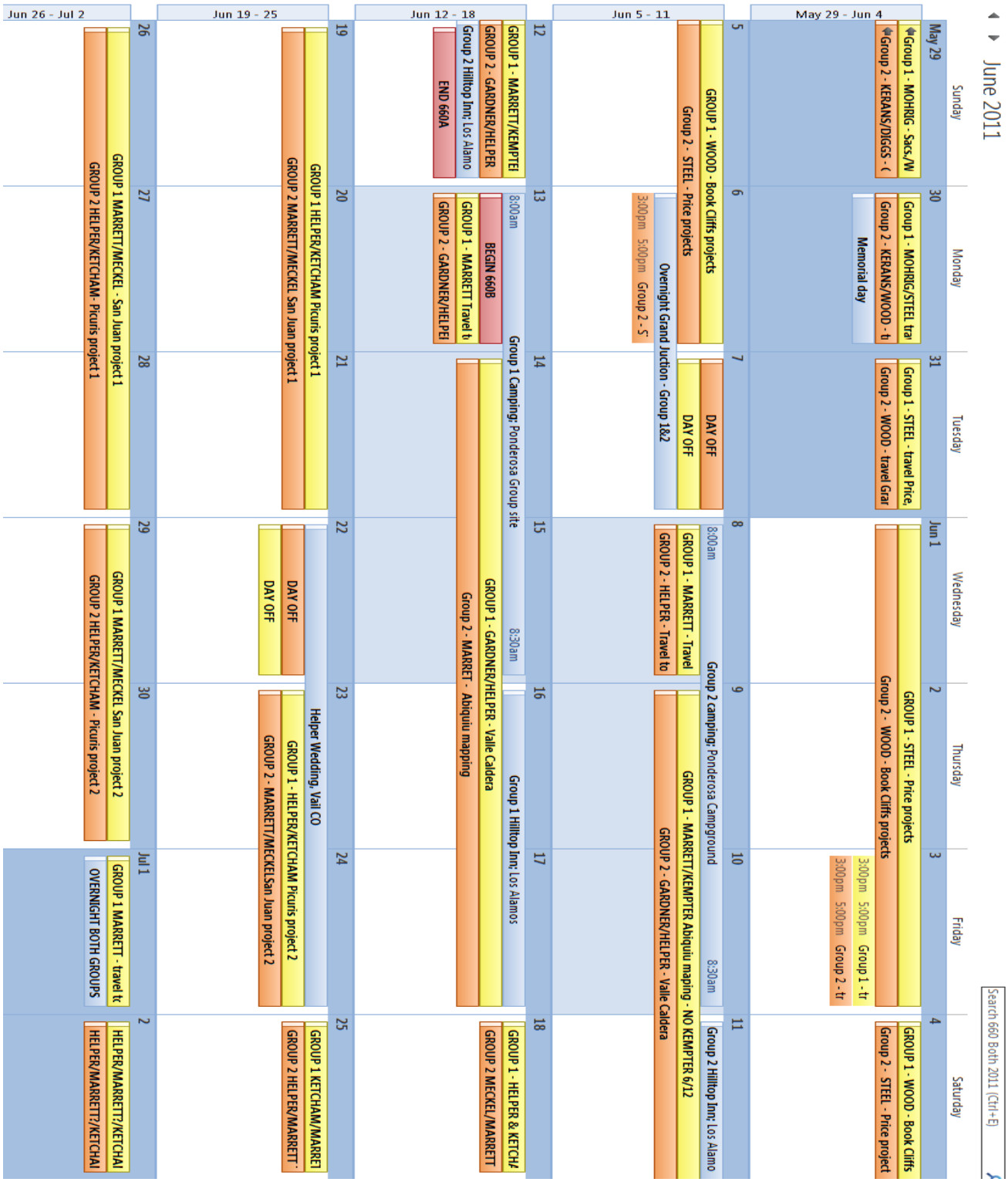
GROUP 1
SCHEDULE FOR GEO 660A&B, SUMMER 2011

May 22	Travel to Carlsbad, NM; **Dr. Kerans** (Americas Best Value Inn)
May 23-25	Carlsbad/Guadalupe Mountains projects; **Dr. Kerans** (Americas Best Value Inn)
	May 26 PM; Drive to Alamogordo, NM
May 27-29	White Sands/Sacramento Mt. projects; **Dr. Mohrig** (Holiday Inn Express)
May 30	Travel to Durango, CO; **Dr. Steel** arrives (Comfort Inn)
May 31	Travel to Price, UT; Price Project in PM. **Dr. Steel** (Nation 9 Inn)
June 1-2	Price Projects; **Dr. Steel** (Nation 9 Inn)
	June 3 PM, Travel to Grand Junction, CO
June 4-6	Book Cliffs Projects; **Dr. Wood** (dorms, Mesa State College)
June 7	Day Off –**Drs. Helper** & **Marrett** (dorms, Mesa State College)
June 8	Travel to Abiquiu, NM; **Dr. Marrett** (camping, Abiquiu Lake)
June 9-12	Mapping Project; **Dr. Marrett** (camping, Abiquiu Lake)
	June 12 - End 660A
	June 13 - Begin 660B
	June 13 AM, Travel to Los Alamos, NM
June 13-15	Valle Caldera Projects; **Drs. Helper & Gardner** (camping, Pondersa Campground)
June 16-17	Valle Caldera Mapping; **Drs. Helper & Gardner** (Comfort Inn, Los Alamos)
	June 18 AM, Travel to Vadito, NM
June 18-21	Picuris Mts. Mapping projects; **Drs. Helper & Ketcham** (Sipapu Ski Resort)
June 22	Day Off; **Drs. Helper & Ketcham** (Sipapu Ski Resort)
June 23-24	Field Test, Project; **Drs. Helper & Ketcham** (Sipapu Ski Resort)
June 25	Travel to Molas Lake, Silverton, CO(camping, Molas Lake)
June 26-30	Mapping, San Juan Mts.; **Drs. Marrett & Meckel** (camping, Molas Lake)
July 1	Travel to Vadito NM; **Drs**. **Marrett, and Meckel** (Sipapu Ski Resort)
July 2(end 660B)	Travel to Austin; **Drs**. **Marrett, Ketcham, Helper**

GROUP 2
SCHEDULE FOR GEO 660A&B, SUMMER 2011

May 22	Travel to Alamogordo, NM; **Dr. Mohrig** (Holiday Inn Express)
May 23-25	White Sands/Sacramento Mt. projects; **Dr. Mohrig** (Holiday Inn Express) May 26 PM; Travel to Carlsbad, NM
May 26-29	Carlsbad/Guadalupe Mountains projects; **Dr. Kerans** (Americas Best Value Inn)
May 30	Travel to Durango, CO; **Dr. Wood** arrives (Comfort Inn)
May 31	Travel to Grand Junction CO; **Dr. Wood** (dorms, Mesa State College)
June 1-2	Book Cliffs Projects; **Dr. Wood** (dorms, Mesa State College) June 3 PM; Travel to Price, UT
June 3-6	Price Projects; **Dr. Steel** (Nation 9 Inn) June 6 PM; Travel to Grand Junction, CO
June 7	Day Off –**Drs. Helper** & **Marrett** (dorms, Mesa State College)
June 8	Travel to Los Alamos, NM; **Dr. Helper** (camping, Pondersa Campground)
June 9-10	Valle Caldera Projects; **Drs. Helper & Gardner** (camping, Pondersa Campground)
June 11-12	Valle Caldera Mapping; **Drs. Helper & Gardner** (Comfort Inn, Los Alamos) June 12 - End 660A June 13 - Begin 660B June 13 AM, Travel to Abiquiu, NM
June 13-17	Mapping Project; **Dr. Marrett** (camping, Abiquiu Lake)
June 18	Travel to Molas Lake, Silverton, CO **Dr. Marrett**
June 19-21	Mapping, San Juan Mts.; **Drs. Marrett & Meckel** (camping, Molas Lake)
June 22	Day Off; **Drs. Marrett & Meckel** (camping, Molas Lake)
June 23-24	Mapping, San Juan Mts.; **Drs. Marrett & Meckel** (camping, Molas Lake)
June 25	Travel to Vadito, NM; **Drs. Marrett & Meckel** (Sipapu Ski Resort)
June 26-28	Picuris Mts. Mapping projects; **Drs. Helper & Ketcham** (Sipapu Ski Resort)
June 29-July 1	Field Test, Project; **Drs. Helper & Ketcham** (Sipapu Ski Resort)
July 2(end 660B)	Travel to Austin; **Drs**. **Marrett, Ketcham, Helper**

Instructor and Project Calendar, 2011



MONEY FOR MEALS

- All meals while camping *and all lunches, except on travel days*, will be provided.

- All hotels during the trip will provide at least a continental breakfast (bread, pastry, juice, coffee) and some may have hot food. If you eat a hardy breakfast you may want to purchase addition breakfast food – it will not otherwise be provided.

- You will need money to purchase dinner during hotel stays. We are presently evaluating how much fee money we have to reimburse students for dinners. SAVE YOUR DINNER RECEIPTS, we may be able to reimburse at least part of the cost.

Ice chest/refrigerators will be available to store food/medicine during hotel stays. You will be able to make a lunch from food we purchase for this purpose before going into the field, provided you are leave yourself time to do so before departure. *All lunch food is put away at 7:45 AM*.

Geo660A&B Trip Addresses, Summer 2011

660A

May 22-25 (Group 1)
May 26-29 (Group 2)
Americas Best Value Inn
3706 National Park Hwy.
P. O. Box 5037
Carlsbad, NM 88220
1-800-321-2861

May 22-25 (Group 2)
May 26-29 (Group 1)
Holiday Inn Express
100 Kerry Avenue
Alamogordo, NM 88310
575-434-9773

May 30 (Group 1 & 2)
Comfort Inn
455S. Camino del Rio
Durango, CO 81303
970-259-7900

May 31-June 2 (Group 1)
June 3-5 (Group 2)
National 9 Inn
641 Price River Dr.
Price, UT 84501
435-637-7000

May 31-June 2; June 6, 7 (Group 2)
June 3-7 (Group 1)
Mesa State College
Grand Junction, CO 81501-3122
(970)248-1020

Riana Campground Group Site 1
Abiquiu Lake
PO. Box 290, Abiquiu, NM 87510
No Phone or mailing address
Emergency Calls - 505-685-4647

June 8-10 (Group 2)
Ponderosa Group Campsite #2
Bandelier National Monument
Los Alamos, NM
No phone or mailing address
Emergency Calls - 505-672-3861

June 11-12 (Group 2)
Comfort Inn
2455 Trinity Dr.
Los Alamos, NM 87544; 505-661-1110

660B

June 13-15 (Group 1)
Ponderosa Group Campsite #2
Bandelier National Monument
Los Alamos, NM
No phone or mailing address
Emergency Calls - 505-672-3861

June 16-17 (Group 1)
Comfort Inn
2455 Trinity Dr.
Los Alamos, NM 87544
505-661-1110

June 13-17 (Group 2)
Riana Campground Group Site 1
Abiquiu Lake
PO. Box 290, Abiquiu, NM 87510
No Phone or mailing address
Emergency Calls - 505-685-4647

June 18-24; July 1 (Group 1)
June 25-July 1 (Group 2)
Sipapu Ski and Summer Resort
Highway 518
Route Box 29
Vadito, NM 87579
800-587-2240

June 18-24 (Group 2)
June 25-30 (Group 1)
Molas Lake Campground
Sites 6, 7, 8
Silverton, CO 81433
no phone or mailing address

EQUIPMENT LIST - GEO 660

Required Materials:

- ☐ Field notebook (e.g., engineer's field book)
- ☐ Clipboard (8 1/2 x 11 size) **with cover**
- ☐ Geologic hammer
- ☐ Hand lens (10x)
- ☐ Small squirt bottle of dilute (approx. 10%) HCl
- ☐ Grain size card
- ☐ Six-inch ruler (best is the Post ruler with protractor on it)
- ☐ Protractor (bring spare rulers & protractors; many students lose several)
- ☐ Pencils and erasers (again, the number depends on how many you lose)
- ☐ 2 or 3 drafting (mechanical) pencils (recommend Pentel or equivalent 0.5 mm or 0.3 mm lead, hardness F or 3H) and spare leads
- ☐ Colored pencil set that will keep a point (at least 10 colors); pencils with hard, water-fast lead are preferred
- ☐ Pencil sharpener or pointer, and/or sandpaper – for colored pencils
- ☐ Technical pens with fine-line points and black ink (Sizes 00, 0, 1, are desirable)
- ☐ Tablet of 8 1/2 x 11" tracing paper
- ☐ Tablet of 10 square to the inch of 8 1/2 x 11" graph paper
- ☐ Liquid paper (optional)
- ☐ The textbooks and lab manual from GEO 420K and GEO 428
- ☐ Calculator
- ☐ Watch
- ☐ Carrying bag (shoulder bag or daypack)
- ☐ Proper field clothes, long pants, long-sleeve shirts, jacket (see note on gear)
- ☐ Sun screen/block lotion
- ☐ Hat, wide brim
- ☐ Hiking boots, broken in (avoid non-lace boots; see note on gear)
- ☐ Rainwear (it will rain; see note on gear)
- ☐ Canteen (2 or 3, one-quart water bottles, a Camel-Back or some other water storage container)
- ☐ Warm sleeping bag and pad** (see note on gear)
- ☐ Towels, washcloth
- ☐ Flashlight and/or headlamp
- ☐ Plate, cup, silverware

Desirable Materials:

- ☐ Digital Camera
- ☐ Masking tape
- ☐ Scotch tape
- ☐ Tweezers (important for run-ins with cactus)
- ☐ Insect repellent (usually essential)
- ☐ Minor first aid kit for bug bites, thorns, blisters (moleskin), etc.
- ☐ Small pair of binoculars (not necessary but useful for "long-range" mapping)
- ☐ Whistle (if you are prone to getting lost and have a weak voice)
- ☐ Safety goggles or other eye protection (see field course policy handout regarding this and hard hats)

- Sharpie markers to label rocks

Prohibited Items:

- Firearms
- Illegal drugs
- Consumption of alcoholic beverages in University vehicle

What a Student Should Know Before GEO660

Sedimentary Geology

Below are listed some general aspects of sedimentary geology that you will be expected to have mastered by the time you leave for Geo 660. All of this material was covered in Geo 416M and Geo 420K. The best sources for your review are your notes, the text, and the web sites for these courses.

1. **Classification of rocks and sediment by texture.**

You must be able to classify terrigenous sediments and rocks by texture (e.g., poorly sorted, immature, fine-grained sandstone). This means that you must be able to identify the mean grain size, estimate the grain sorting, recognize the four stages of textural maturity, and recognize grain shape and roundness. You should be able to tell if the sorting reflects a unimodal, bimodal or polymodal grain distribution. Impact scars on pebbles and larger grains are important to identify. Rock color also reflects important aspects of the rock. You must have an understanding of the factors that control these sediment/rock characteristics. For sandstones and conglomerates be able to estimate the abundance of framework grains, matrix, cement, and porosity using your hand lens.

You must be able to distinguish those rock aspects that are depositional in nature from those that result from weathering. For example, weathering commonly results in the oxidation of pyrite and other ferrous minerals, differential dissolution of minerals, hydration, oxidation, and case-hardening of joints. Precipitation of travertine crusts and soluble white salt crusts (efflorescence), as well as Liesegang bands, are post-depositional products. In addition, it is usually possible on outcrop to recognize basic lithology (e.g., sandstone, limestone, shale) by weathering habit.

Be able to classify carbonate rocks according to the Dunham classification, including identification of major grain types. Know the major taxonomic groups of invertebrate fossils and their environmental significance. Know the marine evaporite mineral sequence.

2. **Classification of rocks and sediment by mineralogy.**

Be able to classify sediment and rocks by mineralogy (e.g., arkose). For sandstones be able to estimate the type of common cements (quartz, calcite, dolomite, siderite, iron oxides, kaolinite), the abundance of QFR components, and clan name using the Folk classification. Understand the relationship between mineralogy, source area, and other controls such as climate, tectonism and nature of transport.

3. **Sedimentary structures.**

You must be able to identify sedimentary structures and understand under what conditions they form. Be able to identify common fossils, know their age ranges, and environmental significance. Below are listed some common sedimentary structures and other features of sedimentary rocks. You should be able to recognize these, understand how they form, and interpret their genetic significance.

Laminations
Wind-ripple laminations
Trough cross-strata
Tabular cross-strata
Current ripple and climbing ripple cross-strata
Wave ripple cross-strata
Hummocky cross-strata
Textural mottled bedding
Structureless (massive) bedding
Graded and reverse graded bedding
Contorted bedding
Nodular bedding
Flaser and lenticular bedding
Herringbone cross-strata
Scour-and-fill structures
Channel walls and channel-fills
Cryptalgal laminations, stromatolites (laterally linked and stacked hemispheres)
Bouma sequence
Wave and current ripple marks
Trace fossils: burrows, tracks, and trails
Flute casts, groove casts, load casts
Parting lineation
Mud cracks
Stylolites
Liesegang bands
Chert and other nodules, calcite-cemented concretions (and other types)
Cone-in-cone structure
Adhesion structures

Breccia
Paleokarst
Evaporite molds
Inter vs. intraparticle porosity
Boundstone
Geopetals
Fenestral fabric

4. **Depositional and diagenetic environments and processes**

You must be able to make a basic interpretation of environment of deposition (e.g., deep-sea turbidite sequences, meandering fluvial channel). You should be able to determine whether the seafloor was well oxygenated, suboxic, anoxic. Clues are TOC (reflected in rock color), presence of absence of trace fossils, abundance of pyrite, etc. Most information is derived from the larger-scale geometry of the strata. You should always scan an outcrop for the continuity of beds, the overall strata arrangement, faults, channel structures, and vertical trends before studying the rock up close.

For carbonate and evaporite environments, review the shelf to basin facies tract, the environmental factors important for carbonate/evaporite production, the different styles of carbonate shelf architecture as a function of changes in sea level, climate, time in geologic history. Review the principal mechanisms proposed for (1) changing sea level, (2) dolomitization, (3) subaerial and subaqueous evaporite deposition, (4) cyclic sediment deposition.

5. **Field methods.**

You must be able to perform basic field procedures including (1) measuring a section with a staff and Brunton compass or similar instrument, (2) identifying textures and mineralogies with a hand lens, and (3) using a Brunton compass or similar instrument to measure bedding and foreset orientations, (4) operate a hand-held GPS instrument.

6. **Data presentation.**

You must be able to display geological information in various formats including (1) vertical sections, (2) scaled field sketches, (3) cross-sections, (4) neatly drafted maps, (5) stereonets.

7. **Basin-scale processes.**

You must have a basic understanding of (1) tectonic basin types, (2) the types of environments associated with these, and (3) the types of sediments characteristic of the different types of basins and source areas.

8. **Global-scale processes.**

You must have a basic understanding of the depositional architectures and their scales as a function of cycles of sea level, climate and tectonism. Know the general history of Earth change (e.g., greenhouse/icehouse periods, first-order sea-level curve), and the basics of higher order processes such as orbital forcing of Earth's climate.

Structural Geology & Mapping

The topics and the skills outlined below were covered in GEO428, 426P, 420K, 416K and 401/303, particularly in labs and/or field trip exercises. Notes, texts, old labs and web sites for these courses are particular valuable resources for review.

1) Be able to read a topographic map, construct a topographic profile along a line of section, and have the ability to accurately locate yourself with a topographic map.

2) Have a good understanding of strike lines (structure contours), 3-point problems, the rule of V's, and how these are manifest on geologic maps by unit contacts, fault traces, fold axial traces.

3) Be able to correctly use a Brunton compass to measure the attitudes of linear and planar features.

4) Be able to construct stereographic projections of the attitudes of lines and planes, and determine a fold axis from attitude measurements of folded layers.

5) Be able to appropriately label maps and cross sections (and where these items belong on a finished product): title, author, date, north arrow, scale bar, contour interval, stratigraphic symbols, explanation of symbols, location of cross section; endpoints of cross section, orientation of cross section, vertical scale, and vertical exaggeration.

6) Be able to draw a structural cross section; know how to project data from a map into the plane of a cross section.

7) Know fold terminology and map symbols: fold axis, axial surface, hinge line, axial trace, plunge, fold limbs, cylindrical, overturned vs. upright, parallel vs. non-parallel, angular vs. curved.

8) Know fault terminology and map symbols: thrust, normal, strike slip, footwall, hanging wall, displacement, dip and strike separation, fault tip, fault ramp, detachment, listric, thin-skinned vs thick-skinned, releasing and restraining bends.

9) Be able to interpret a geologic map, including relative ages from superpositional or cross-cutting relationships, dip directions from map patterns, anticlines vs. synclines and directions of plunge, axial trace symbols, up vs. down sides of faults from map patterns.

Igneous Geology

1) Know how to classify igneous rocks using compositional criteria (intrusive rocks: granite, granodiorite, gabbro, peridotite; extrusive rocks: rhyolite, andesite, dacite, basalt) and textural criteria (tuff, welded tuff, vitrophyre, etc.), and apply appropriate adjectives (porphyritic, aphanitic, phaneritic, etc.).

2) Be able to identify common minerals in igneous rocks with a hand lens. These include, but are not limited to, quartz, plagioclase, k-feldspar, biotite, muscovite, clinopyroxene, amphibole (hornblende) and olivine.

3) Have an appreciation for the geological settings in which different igneous rocks might be found.

Metamorphic Geology

1) Know how to classify metamorphic rocks (slate, phyllite, schist, gneiss, hornfels) and apply appropriate adjectives (granoblastic, porphyroblastic, foliated, etc.).

2) Be able to identify common metamorphic minerals with a hand lens. These include, but are not limited to: i) minerals common to most metamorphic rocks: quartz, plagioclase, k-feldspar, biotite, muscovite, chlorite, ii) pelites: garnet, aluminosilicates (andalusite,

kyanite, sillimanite), staurolite, iii) metabasites: clinopyroxene, orthopyroxene, amphibole (hornblende, tremolite/actinolite), and iv) metacalcsilicates/metacarbonates: calcite, dolomite, talc, tremolite, wollastonite, diopside.

3) Have an understanding of the concepts of metamorphic facies, P-T and T-X grids and isograds, including an appreciation of the dependence of mineral assemblages on rock composition, temperature, pressure and fluid composition/availability.

4) Understand the relationship of fabrics defined by metamorphic minerals to minor and major folds and faults/shear zones.

5) Know metamorphic index minerals for pelitic and mafic rocks.

SIGN-UP INFORMATION FOR GEO660: FIELD GEOLOGY

Please provide the following contact information (legibly, please):

Your Name: _____

UT EID:_____

Local Address: _____

Address (cont.) _____

City: _____

Work Phone: _____

Home Phone: _____

Cell Phone: _____

Email Address:_____

Person to Contact in an Emergency:

Name: _____

Street Address: _____

Address (cont.) _____

City: _____

State/Province: _____

Zip/Postal Code: _____

Country: _____

Work Phone: _____

Home Phone: _____

Cell Phone: _____

Email Address:_____

Place a check next to your present status/major:

_____B.S. General Geology
_____ B.S. Geophysics
_____ Special Student/NDC
_____ B.S. Geosystems/Engineering
_____ B.S.Hydrogeology
_____ B.A. Geology
_____ Graduate Student
_____ Other (please explain)

I will attend:

_____ Geo660A
_____ Geo660B
_____ Both Geo660A and B

N.B. Both Geo660A and 660B are required for B.S. students who do not otherwise have field/work credit in the form of an internship or credit for the Hydro. Field Methods class.

I **have passed the following prerequisite courses with a grade of C or better:**

_____Geo420K Introduction to Field and Stratigraphic Methods

_____Geo428: Structural Geology

Please indicate whether you are:

_____ Willing to drive on a regular basis

_____ Willing to be a relief driver

_____ Not interested in driving

Please provide your driver's license number (also state, if not TX). We need everyone's.

_____TX Other:_____

_____ I understand that I must have health insurance to participate in this course.

Enter the name of your health insurance provider and policy number in the space below. If you do not have health insurance now, write "no health insurance" and give your date of birth. Health insurance can be purchased for the class through an arrangement with the University.

Provider_____Policy #_____

UT AUTHORIZATION FOR EMERGENCY MEDICAL TREATMENT- ADULT

I. Medical Information (Please type or print legibly)

a. Name _____
(last, first, middle)

Address _____
(street or p. o. box, city, state, zip code)

Telephone Number: Day (___) _____ Night (___) _____

b. Name of Nearest Relative: _____
(last, first, middle)

Address _____
(street or p. o. box, city, state, zip code)

Telephone Number: Day (___) _____ Night (___) _____

c. Physician's Name: _____

Address _____
(street or p. o. box, city, state, zip code)

Telephone Number: Office(___) _____ Emergency (___) _____

d. Dentist's Name: _____

Address _____
(street or p. o. box, city, state, zip code)

Telephone Number: Office (___) _____ Emergency (___) _____

e. Health Insurance Company Name: _____

Policy Number:_____ Telephone (___) _____

II. Emergency Medical Authorization

I, the undersigned, do hereby authorize The University of Texas at Austin and its designated representatives to consent, on my behalf, to any medical/hospital care or treatment to be rendered upon the advice of any licensed physician. I agree to be responsible for all necessary charged incurred by any hospitalization or treatment rendered pursuant to this authorization.

The effective dates of this authorization are May 22 to July 2, 2011. I am eighteen years of age or older, have read the above authorization, and confirm that the information contained therein is true and accurate.

_____ Date_____, 20____
(Signature of Individual Providing Authorization)

Please list below any health concerns your instructors should know about, including any medications, allergies, allergies to medicine or any other medical problems. Be specific and thorough.

Current
Medications:_____

Allergies, including those to medicines: _____

Health Concerns:

RELEASE AND INDEMNIFICATION AGREEMENT

The University of Texas at Austin

PARTICIPANT: _____

Name (last name first- please print or type)

_____

Address

_____

City, State, Zip Code

DESCRIPTION OF ACTIVITY OR TRIP: *Field geology class, Geology 660A and Geology 660B*

MODE OF TRANSPORTATION: *University vehicles*

LOCATION(s) of activity or trip: *Various field sites in TX, NM, CO, and UT*

DATE(s) of activity or trip: FROM *May 22 2010* TO July *2 2011*

I, the above named student, am eighteen years of age or older and have voluntarily applied to participate in the above Activity or Trip. I acknowledge that the nature of the Activity or Trip may expose me to hazards or risks that may result in my illness, personal injury or death and I understand and appreciate the nature of such hazards and risks.

In consideration of my participation in the Activity or Trip, I hereby accept all risk to my health and of my injury or death that may result from such participation and I hereby release The University of Texas at Austin, its governing board, officers, employees and representatives from any and all liability to me, my personal representatives, estate, heirs, next of kin, and assigns for any and all claims and causes of action for loss of or damage to my property and for any and all illness or injury to my person, including my death, that may result from or occur during my participation in the Activity or Trip, whether caused by negligence of The University of Texas at Austin, its governing board, officers, employees, or representatives, or otherwise. I further agree to indemnify and hold harmless The University of Texas at Austin and its governing board, officers, employees, and representatives from liability for the injury or death of any person(s) and damage to property that may result from my negligence or intentional act or omission while participating in the described Activity or Trip.

I HAVE CAREFULLY READ THIS AGREEMENT AND UNDERSTAND IT TO BE A RELEASE OF ALL CLAIMS AND CAUSES OF ACTION FOR MY INJURY OR DEATH OR DAMAGE TO MY PROPERTY THAT OCCURS WHILE PARTICIPATING IN THE DESCRIBED ACTIVITY OR TRIP AND IT OBLIGATES ME TO INDEMNIFY THE PARTIES NAMED FOR ANY LIABILITY FOR INJURY OR DEATH OF ANY PERSON AND DAMAGE TO PROPERTY CAUSED BY MY NEGLIGENCE OR INTENTIONAL ACT OR OMISSION.

_____ Date signed: _____ 2_____

Signature of Student

_____

Printed Name of Student

_____ Date signed: _____ 2_____

Signature of Witness

_____

Printed Name of Witness

Jackson School of Geosciences Department of Geological Sciences
Field Trip and Field Course Policies

The Department of Geological Sciences conducts numerous field activities (field trips, field geology courses, and field research). Because students are exposed to a variety of situations and experiences that are different from those found in the classroom, special rules of conduct are necessary. Traveling and field work involves hazards and risks, so each person must exercise care to avoid personal injury to others. Examples of dangers specific to field work are the use of geologic picks, poisonous snakes, tick bites, toxic plants, falling, and slippery rocks encountered when hiking on steep slopes or crossing streams. Other dangers, as well as damage to property, may be created by carelessness. The Department has access to certain private properties and use of private facilities whose future availability will depend upon proper consideration for these resources by everyone. Students who abuse University or personal property during a field trip, or who jeopardize the health and safety of other people, will be required to leave the field trip immediately. These persons will be subject to appropriate academic evaluation and possible disciplinary action by the Office of the Dean of Students.

The Department has the following rules and recommendations which apply to field activities.

1. **Liability and Waiver.** The University requires all students to sign a liability release form (this form). This form must be signed and returned before a student is allowed to participate in field activities.
2. **Medical Care**. A medical form must be filled out by all students. Any student who has medical problems (e.g. asthma, diabetes, metabolic disorders, allergies, trick knees) should inform the field trip leader or supervising professor. If you require special medications, it is your responsibility to insure that they are available when needed. Field activities are sometimes in very remote areas, and immediate medical assistance is not possible.
3. **Health Insurance**. Every student taking a *field course* must have medical insurance. Student health insurance is available at minimal cost through the Student Health Center (471-4955). Students taking field trips as part of normal classes who do not have health insurance will be provided with insurance for the field trips only.
4. **Clothing and protective cover**. Wear suitable clothes. We recommend wearing a hat, long pants, and good hiking boots in some areas. These help prevent sunstroke, insect bites, and bad encounters with cacti or thorny shrubs. You may want to bring insect repellent, and we also suggest the use of sunscreen. Consider significant possibilities of rain or cold weather.
5. **General field hazards**. Insects, poisonous snakes, and toxic plants may be found on any field trip or course. Wearing suitable clothing and boots helps reduce these hazards. Remember to check yourself for ticks which can transmit diseases such as Rocky Mountain spotted fever, Lyme disease, etc. Ticks should be removed immediately; be sure to remove the body with head intact. Do not use a match to kill the tick first. Watch for, don't play with, and avoid snakes. Five students on Department trips have been bitten by rattlers since World War II; try not to be the sixth. If you are allergic to such things as bee stings, you must bring appropriate medication. A few other common sense rules: stay out of the water if you can't swim; stay out of thunderstorms, particularly at high elevations, and out of flashflood-prone areas in any rain. Some field areas have steep cliffs that you are not required to and should not climb; use common sense and follow your instructor's advice in such areas.
6. **Head and eye protection**. We recommend eye protection when using, or around someone using, a geologic pick, hammer, or other tools. Hard hats should be used in mines, quarries, steep road cuts, or other areas where rock falls or blows to the head could occur; some sites may require these protective devices. Safety glasses and hard hats can be checked out from the Department storeroom.
7. **Firearms**. Possession of firearms or facsimiles at any time during any field course or field trip is forbidden.
8. **Drugs and alcohol**. Use or possession of illegal drugs at any time is forbidden. Alcoholic beverages may NOT be consumed at any time while traveling in a University vehicle.
9. **Department equipment**. Take care of Department property. Our equipment normally gets hard use and current budgets are tight, so treat it as you would your own.

I have read and agree to follow the Field Trip/Field Course Policies for departmental field activities.

_____

Your signature