Texas A & M University – Corpus Christi

Geology 4415  Economic Geology (and Mining)  Fall 2013

Instructor  Lance Pape
Geology 4415.001 and lab 4415.101


Class Schedule  Lecture Tues./Thur. 5:30-6:45 pm. CS 226: Lab Tues. 7:00 – 8:50 pm
Field lab 11/7 thru 11/10, 2013 to Viburnum, Missouri

Office Hours  Tues./Thur. 3:30-4:30 pm., or by appointment

Course Description
This is an upper division geology course in Economic Geology for students majoring in geology or environmental science. Prerequisites for the class include college-level Physical Geology, Chemistry and Mineralogy. The course will cover Economics, Exploration, Development, Production, Marketing and Global Politics of Non-fuel, Natural (Mineral) Resources.

Laboratory studies are an integral part of this course and will include (as a course requirement) a four-day field lab to the Viburnum-trend Mines of South-central Missouri. Your course fees will cover round trip transportation to Missouri. Personal student expenses will be used to cover lodging/meals for the trip. Students will prepare a report covering mining operations at Viburnum, as well as an additional report on specific topics assigned re mining/economic geology.

Student Learning Outcomes
After successfully completing this course, you will have obtained a good understanding of

- The economic parameters involved in the exploration, development, production and marketing of natural resources
- The formation and character of mineral deposits
- Mineral exploration and exploitation on the worldwide stage, including the geology, geophysics and geochemistry of ore finding and assessment, grade control, mining factors and extraction of resources
- Mining methods and practice
- The future of mining natural resources in a synthetic, technologically-advanced market.

Evaluation and Grade Assignment
Your course grade will be based on the following 1000 point distribution:

Lecture:  Section Exams 200 points
Final Exam 100 points
Class Project (written and oral) 100 points

Lab:  Section Exams 200 points
Field lab participation and written reports 400 points
Exams, Quizzes and Class Projects

Exams/assignments can only be taken during the scheduled time, except in cases of personal or family emergencies. Documented proof is required of such emergencies. There will be NO make up exams or quizzes for unscheduled or unexcused absences – it’s not fair for you, me or your fellow students. If you know ahead of time that you’re going to miss an exam or a class and have a valid excuse, let me know BEFORE the fact, NOT after. Urgency to experience Christmas Break is NOT a valid excuse, so let’s not go there. Once an exam is returned to the class, NO make-ups will be given – NO exceptions. Chapter quizzes will be given at the whim and will of the instructor. The odds of a quiz occurring on any given day are inversely proportional to the number of students present in class that day. Quizzes may be given in lecture or lab, and may cover material given within the last week of the course.

Class and Lab Policies

You’re in college now. No one is going to make you come to class. But you can pretty well be assured that your success in this class will be a function of your time and effort made, both in and out of the classroom. Lab instruction, in particular, can not and will not be repeated outside of the scheduled laboratory time. You can not pass the course without completing the lab, including the lab field portion of the course.

Treat your co-students (and instructor) with respect. The college catalog contains the university statement on academic integrity. Cheating and/or plagiarism will not be tolerated and will result in a failing grade for the course and possible disciplinary action by the university. The use of cell phones, pagers, MP3 players, headphones and similar electronic devices is not allowed in class. If your cell phone goes off during lecture, I will assume it is an emergency and that you will be leaving class to take care of same. Also, in CS226, by safety regulations, no food (or drink) and no chewing tobacco will be permitted, especially during lab.

Notice to Students with Disabilities

Texas A&M University – Corpus Christi complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. If you suspect that you may have a disability to be considered (physical impairment, learning disability, psychiatric disability, etc.) please contact the Services for Students with Disabilities Office, located in Driftwood 101, at 825-5816. If you need disability accommodations in this class, please see me as soon as possible, so accommodations may be arranged.

Academic Advising

The College of Science and Technology requires that students meet with an academic adviser to declare a major and set up a degree plan. The college’s Academic Advising Center is located in Faculty Center 178, and can be reached at 825-6094.
**Classroom/Professional Behavior**
Texas A&M University Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either a) the instructor’s ability to conduct the class or b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in Article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be required to leave the classroom. The use of cell phones, pagers, CD players, headphones, and any other electronic device as designated by the instructor is not allowed in class. Keep these devices in your bags or pockets and not on the tables. You may be required to refrain from using a laptop in class.
Cheating will not be tolerated and will result in a failing grade in the course and possible further disciplinary action by the university.

**Notice to Veterans and Students with Disabilities**
Texas A&M University Corpus Christi complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. If you are a returning veteran who experiences cognitive and/or physical access issues in the classroom or on campus or otherwise suspect that you may have a disability (physical impairment, learning disability, psychiatric disability, etc.), regardless of veteran status, please contact the Services for Students with Disabilities Office, located at Corpus Christi Hall 116, (361) 825-5816, http://disabilityservices.tamucc.edu/.

**Grade Appeal Process**
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Division of Student Engagement and Success.

**Dropping the Class**
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop, to be sure it is the best course of action. Should it be necessary to drop, you must initiate the process through the Registrar by filling out a course drop form. Simply stopping attendance and participation will not automatically result in your being dropped from the class. November 15, 2013, is the last day to drop a class with an automatic grade of “W” for this term.

**Academic Advising**
The College of Science and Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. The College’s Academic Advising Center is located in Center for Instruction 350, and can be reached at (361) 825-6094.
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Student Affairs.

**Course Outline and Schedule**

**Date**

<table>
<thead>
<tr>
<th>Date</th>
<th>Subject- Lecture</th>
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<tbody>
<tr>
<td>Sept. 5</td>
<td>Introduction, Syllabus, Safety, Field Lab</td>
</tr>
<tr>
<td>10</td>
<td>History and development of the mining industry</td>
</tr>
<tr>
<td>12</td>
<td>The economics of Economic Geology. Global resources, marketing and global demands</td>
</tr>
<tr>
<td>17</td>
<td>The origin and history of ores and mining. The relationship of ores to magmas. Ore fluid chemistry, the precipitation of minerals – cavity-filling and replacement.</td>
</tr>
<tr>
<td>19</td>
<td>Structural and mineralogical controls; rock preparation and ore genesis.</td>
</tr>
<tr>
<td>24</td>
<td>Wall rock interpretation, alteration, mineralization. Mineralogy, paragenesis, zoning.</td>
</tr>
<tr>
<td>26</td>
<td>Lindgren's classification of metallic ore deposits and industrial minerals.</td>
</tr>
<tr>
<td>Oct. 1</td>
<td>Type examples of ore systems and economic deposits.</td>
</tr>
<tr>
<td>3</td>
<td><strong>EXAM</strong></td>
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<tr>
<td>8</td>
<td>Exploration of earth's resources – geologic prospecting, geophysics, geochemistry.</td>
</tr>
<tr>
<td>10</td>
<td>Mineralogical guides to ore deposits – Economic parameters and assessments.</td>
</tr>
<tr>
<td>15</td>
<td>Gangue, oxidation, diffusion, supergene enrichment, protore, grade, configuration.</td>
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<tr>
<td>17</td>
<td>Mining exploration, claiming, property evaluation, drilling, defining mineralization/ore.</td>
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<tr>
<td>22</td>
<td>Mine format and development, calculating reserves. Mining methods.</td>
</tr>
<tr>
<td>24</td>
<td>Mining – physical and economic guidelines of mine development and production.</td>
</tr>
<tr>
<td>29</td>
<td>A case study – Exploration, development, production of a copper-porphyry deposit.</td>
</tr>
<tr>
<td>31</td>
<td><strong>EXAM</strong></td>
</tr>
<tr>
<td>Nov. 7-10</td>
<td>Field Lab to Mississippi Valley-type Lead-Zinc Deposits of the Viburnum Trend.</td>
</tr>
<tr>
<td>14</td>
<td>Presentation of student mine reports</td>
</tr>
<tr>
<td>19</td>
<td>Processing of raw materials, ore beneficiation, by-product separation, gangue tailings.</td>
</tr>
<tr>
<td>21</td>
<td>Smelting, refining, processing, marketing – uses of metallic and industrial minerals.</td>
</tr>
<tr>
<td>26</td>
<td>The politics of natural resources – mining in Texas.</td>
</tr>
<tr>
<td>Dec. 3</td>
<td>&quot;If it can't be grown, it's gotta be mined&quot;. A growing thirst for natural resources.</td>
</tr>
<tr>
<td>5</td>
<td>Course review. Student economic geology papers due.</td>
</tr>
<tr>
<td>10</td>
<td><strong>EXAM</strong></td>
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</tbody>
</table>
**Economic Geology – Lab**

S-04  Review and pre-test on minerals with emphasis on non-silicates.

S-05  Economic associations with igneous, metamorphic and sedimentary rocks


S-22  Magmatic ores – Stillwater Complex (Montana) magmatic segregation study.
      Ferrous and ferrous-alloy ores, Pt group/precious metals.

O-03  Hydrothermal deposits – Burgin-Trixie (Utah) E. Tintic study
      Base metal sulfides.

O-08  Copper Porphyry deposits – Morenci-Metcalf (Arizona) and Butte, Montana.
      Disseminated Supergene-enriched and oxidized Copper Sulfides

O-10  Mississippi Valley-type Lead-Zinc deposits. The Viburnum Trend.

O-20  Industrial mineral deposits.

N-10  Viburnum field lab

O-26-30 Field lab

N-3-17 Field Lab reports

O-22  Non-ferrous, non-sulfide ores and mineral deposits
Gold – Native, Electrum, Calaverite-Sylvanite
Silver – Native, Argentite, Cerargyrite, Pyrrargyrite-Proustite, Stromeyerite, Polybasite
Platinum – Native
Mercury – Native, Cinnabar
Copper – Native, Azurite, Malachite, Chrysocolla, Aurichalcite, Brochantite, Turquoise
Tenorite, Cuprite, Chalcocite, Covellite, Enargite, Bornite, Chalcopryite,
Tetrahedrite-Tennantite, Digenite, Dioptase (Stromeyerite)
Carbon – Graphite, Diamond
Lead – Galena, Cerussite, Anglesite, Boulangierite-Jamesonite, Mimetite-Vanadinite-Pyromorphite
Zinc – Sphalerite (Zincblende), Smithsonite, Hemimorphite, Zincite, Willemite
Tin – Cassiterite, Stannite
Tungsten – Scheelite, Wolframite, Hubnerite
Aluminum – Bauxite-Gibbsite, Cryolite, Corundum
Iron – Limonite (Goethite), Jarosite, Hematite, Magnetite, Pyrite, Siderite, Pyrrhotite
Manganese – Manganite, Pyrolusite, Psilomelane, Rhodochrosite, Rhodonite
Titanium – Ilmenite, Rutile, Titanite (Sphene), Benitoite
Nickel – Pentlandite, Nickélite, Millerite, Garnierite, Annabergite
Chromium – Chromite, Crocoite, (Annabergite)
Molybdenum – Molybdenite, Wulfenite, Ferrimolybdate
Cobalt – Cobaltite-Smalite, Skutterudite, Eurythrite
Antimony, Arsenic, Bismuth – Stibnite, Arsenopyrite, Orpiment, Realgar, Bismuthinite
Vanadium – (Vanadinite)
Beryllium – Beryl, Bertrandite
Uranium, Radium – Carnotite, Uraninite, Pitchblende, Autunite, Samarskite
Rare Earth Elements – Bastnasite, Monazite, Tantalite-Columbite
Borax, Colemanite, Topaz, Tourmaline, Talc, Witherite, Barite, Strontianite, Spodumene,
Lepidolite, Celestite, Magnesite, Fluorite, Apatite, Dolomite, Gypsum, Kaolinite, Calcite