EVAPORITE SEDIMENTOLOGY 7780
Course Outline Fall Term

Instructor:

William M. Last (office: 228 Wallace Bldg.; office hours: 8:30-9:30 Tuesday, Thursday, or by appointment; Office telephone: 474-8361; E-mail: WM_Last@UManitoba.ca)

Meeting time:

First term; Tentatively scheduled for 8:30-9:20, MWF; 243 Wallace Building

Laboratory:

There is no formal organized laboratory session, however individual research projects may be assigned which will require use of basic and advanced level sedimentological laboratory equipment and facilities, either as a group or on individual basis.

Field Trip:

This component of the course will be required of all participants. Dates of the field trip are (tentative; weather dependent) **September 7-12**. PLEASE SEE WML FOR DETAILS. All field trip costs, including vehicle rental, lodging, food and supplies are to be covered by the participants.

Course Format:

This course involves weekly seminar/discussion meetings and/or lectures. Depending on the number of participants, there will normally be two student-presented seminars per week followed by extended discussion of the particular topic. Details about the seminar format and topics will be discussed at the first organizational meeting. A comprehensive 'term project' will be required. Samples and data collected in the field will form the basis of this term project.

Textbook:
There is no formally required textbook for this course. I will assume everyone is *already* reasonably familiar with the contents of *Sedimentary Environments: Processes, Facies and Stratigraphy* (H. G. Reading, editor; 3rd Edition; 1996) and *Facies Models: Response to Sea Level Change* (R. G. Walker & N. P. James, editors; 1992).

Grading:
The grade for this course is based on weekly assignments (25%), term project (50%), and seminars & seminar discussion participation (25%).

The last date for voluntary withdrawal from the course without academic penalty is *November 16, 2005.* I am instructed by ROASS policy to advise you to read the academic regulations and policies in the 2005-2006 University Graduate Calendar. In particular, be aware of the policies regarding academic dishonesty, including "plagiarism and cheating", "examination impersonation", and "attendance and debarment".

Policy for Late Assignments & Projects
Late assignments, projects, and reports will <u>not be accepted</u>.

TENTATIVE Course Content & Topic Outline:
(not in order of coverage; the specific topics covered during 2005 may vary depending on the interest of the participants)

1. Genesis of Evaporites

1.1 Introduction

Facies relationships and statistical analyses; associations and sequences
Facies modelling of chemical sediments
Pitfalls of interpreting depositional settings/environments using wireline logs
Sedimentary structures: use and interpretation in cores; in outcrop; review of nature of stratification in evaporites; classification of internal structures, organic structures, deformational structures, inorganic structures

1.2 Review of Process Controlled Genetic Units in Evaporite Sedimentology

Lateral versus vertical accretion
Classic versus modern stratigraphic principles
Classification of environments and processes

1.3 Brines

Origin and migration of sedimentary brines
Geochemical complications and thermodynamics
Chemical and physical properties of brines
Flow regimes and fluid mechanics of high salinity brines
Brine evolution

1.4 Continental Settings

Lacustrine evaporites
Groundwater-generated evaporites & pedogenic deposits
Other continental settings (e.g., evaporites in caves, surface

efflorescences)

1.5 Marine & Marginal Marine Settings

Sabkhas
Marine marginal lagoons
Other marine marginal settings
Deep water evaporites
The saline giants

1.6 Other settings

Martian evaporites

2. Composition of Selected Evaporites

2.1 Evaporitic carbonates

'mesosaline'/vitasaline carbonates
evaporitic & microbial dolomite formation & models
aragonite, Mg-calcite, monohydrocalcite
magnesite, hydromagnesite and other Mg-carbonates
Na-carbonates
other important evaporitic carbonates

2.2 Halides

Halite
Sylvite

2.3 Sulfates

Simple sulfates
Compound sulfates
The sulfate problem in marine evaporites

2.4 Borates

2.5 Nitrates

2.6 Silicates

The magadiite/sepiolite dilemma

2.7 Trace element & Isotopic considerations

3. Diagenesis of Evaporites

Primary versus secondary precipitation
Role of pore fluids
Secondary sulfates
Salt inclusion studies
Texture and fabric studies
Salt tectonics

4. Evaporites as a Resource

Salt
Potash
Gypsum and anhydrite
Other sulfates and carbonates

Borates
Zeolites
Hydrocarbons and evaporites
Ore forming solutions, geothermal systems and evaporites
Salt dome mineral resources

5. Basin Analysis

Basin-wide evaporites
Models of evaporite basins
Depth estimates
Sequence stratigraphic considerations