

## **SEQUENCE STRATIGRAPHY**

**Geol. 5315-005 CRN:25889**

**Geol. 6336-001 CRN:27888**

**Lecture/Lab:** Tue & Thurs 11:00-12:20pm, Geological Sciences Rm. 302

**Instructor:** Kate Giles – GS 201A; Office phone: 747-7075; email: kagiles@utep.edu

Office Hours: Wed. 9:00-11:00am or by appointment.

### **Required Text:**

Coe, A. L. (Ed.), 2005, The Sedimentary Record of Sea-Level Change, Cambridge University Press. 287p. ISBN-10 0 521 53842 4

### **Suggested Additional Reference Texts:**

Catuneanu, O., 2006, Principles of Sequence Stratigraphy, Elsevier. 375p.

Van Wagoner, J. C., Mitchum, R. M., Campion, K. M., and Rahmanian, V. D., 1990, Siliciclastic Sequence Stratigraphy in well logs, cores, and outcrops: Concepts for high-resolution correlation of time and facies: A.A.P.G Methods in Exploration Series, No. 7, 55p.

### **Class Format:**

Each week a different topic will be covered with reference to the assigned readings. The assigned readings should be completed prior to the lecture date listed in the syllabus and a quiz will be given each week at the beginning of the lecture hour. Lab will directly follow lecture and will consist of practical exercises and discussions related to the assigned topic for that week. Lab assignments will be turned in at the beginning of the lab period the following week.

### **Grading System:**

Grades will be based on:

- |                            |     |
|----------------------------|-----|
| 1) Weekly Quiz on Readings | 15% |
| 2) Weekly Lab Exercise     | 35% |
| 3) Mescal Canyon Project   | 20% |
| 4) Permian Reef Project    | 10% |
| 5) Research project        | 20% |

Research project presentations will consist of a 30 minute, power-point presentation of a sequence stratigraphic research project designed in consultation with Dr. Giles.

**Field Trips:** Two, one-day fieldtrips are required for the course.

#### **1. March 19 Mescal Canyon Fieldtrip**

The group will depart from the geology building at 7:30am in university vehicles and return approximately 5:00pm. The project will entail field observation of a measured stratigraphic section, review of depositional facies present, determination of important surfaces/package boundaries, stacking patterns, and sequence stratigraphic framework. A written report along with an annotated stratigraphic section will be turned in March 29. The written report format will be outlined later in the semester.

#### **2. April 9 Permian Basin Fieldtrip**

The group will depart from the geology building at 7:00am in university vehicles and return approximately 6:00pm. The fieldtrip will focus on field review of depositional facies and sequence stratigraphic architecture of the platform and basal facies of the Permian Basin. The written report format will be outlined later in the semester.

## **LECTURE and LAB TOPICS**

- Jan. 19**            **Overview of Course; Sedimentary Rocks as a Record of Earth Processes & Division of the Stratigraphic Record and Geological Time**  
**Readings:**  
Coe, A, 2005, Chapter 1, p. 9-17 and Chapter 2, p. 18-34.
- Jan. 21**            **Accommodation, Stratal Surfaces, Units, & Geometries**  
**Readings:**  
Vail, P. R. and R. M. Mitchum (1977) Seismic Stratigraphy and global changes of Sea level Part 1: Overview; and Part 2: The depositional sequence as a basic unit for stratigraphic analysis: *In* Payton, C. (Ed) Seismic Stratigraphy-Applications to Hydrocarbon Exploration: AAPG Memoir 26, p. 51-62.  
Coe, A, 2005, Chapter 4, p.57-87 and 90-92.  
Catuneanu, O., 2006, Principles of Sequence Stratigraphy, Elsevier. p. 105-109.
- Jan. 26**            **Lab 2: Seismic Stratigraphy Exercise**  
**Jan. 28**            **Special Lecture: Dr. Janok Bhattacharya, McMaster University**  
**Title:** *Glacio-eustatic versus tectonic origin of high-frequency sequences in the mid-latitude Cretaceous foreland basins of North America*
- Feb. 2 & 4**        **Stratal Units, Facies Concept and Stratigraphic Completeness**  
**Readings:**  
Catuneanu, O., 2006, Principles of Sequence Stratigraphy, Elsevier. p. 17-21.; p.40-48.  
Campbell, C. V., 1967, Lamina, laminaset, bed, bedset: Sedimentology, V. 8, p. 7-26.  
Dott, R.H., Jr., 1983, 1982 SEPM Presidential Address: Episodic sedimentation-- How normal is average? How rare is rare? Does it matter?: Journal of Sedimentary Petrology, v. 53, p. 5-23.
- Lab: Walther's Law in Well Logs Exercise**  
Refer to: Van Wagoner, J. C., Mitchum, R. M., Campion, K. M., and Rahmanian, V. D., 1990, Siliciclastic Sequence Stratigraphy in well logs, cores, and outcrops: Concepts for high-resolution correlation of time and facies: A.A.P.G Methods in Exploration Series, No. 7, 55p.
- Feb. 9 & 11**      **Unconformities: Definition and Recognition of**  
**Readings:**  
Blackwelder, E.A., 1909, The valuation of unconformities: Journal of Geology, v. 17, p. 289-300.  
Catuneanu, O., 2006, Principles of Sequence Stratigraphy, Elsevier. p.15, 21-40.  
**Lab: Wheeler Diagram and Significance of Unconformities Exercise**
- Feb. 16 & 18**    **Regression, Subaerial Exposure Surfaces, and Incised Valleys**  
**Readings:**  
Posamentier, H.W., Allen, G.P., James, D.P., and Tesson, M., 1992, Forced regressions in a sequence stratigraphic framework: Concepts, examples, and exploration significance: American Association of Petroleum Geologists Bulletin, v. 76, p. 1687-1709.

Dalrymple, R. W., Boyd, R., and Zaitlin, B. A., 1994, History of research, types and internal organisation of incised-valley systems: introduction to the volume. *in* Dalrymple, R. W., Boyd, R., and Zaitlin, B. A. (eds) *Incised-valley systems: Origin and Sedimentary Sequences*. SEPM Spec. Pub. 51, p. 3-10.

Leeder, M. R. and Stewart, M. D., Fluvial incision and sequence stratigraphy: alluvial responses to relative sea-level fall and their detection in the geological record. *in* Hesselton, S. P. and Parkinson, D. N., (eds), *Sequence Stratigraphy in British Geology*, Geological Society Special Publication n. 103, p. 25-39.

**Lab: Incised Valley Correlation Exercise**

**Feb. 23 & 25 Transgression and Flooding Surfaces**

Loutit, T. S., Hardenbol, J., Vail, P. R., and Baum, G. R., 1988, Condensed sections: The key to age determination and correlation of continental margin sequences, *in*: *Sea-Level Changes: An Integrated Approach*, Wilgus, C. K., Hastings, B. S., Kendall, C. G. St. C., Posamentier, H. W., Ross, C. A., and Van Wagoner, J. C., (eds.), SEPM Spec. Pub. 42, p. 183-213.

Kidwell, S. M., 1989, Stratigraphic condensation of marine transgressive records; origin of major shell deposits in the Miocene of Maryland: *Journal of geology*, V. 97, p. 1-24.

Kidwell, S. M., 1986, Models for fossil concentrations: paleobiologic implications; *Paleobiology*, v. 12, p. 6-24.

Hook, S.C., 2007, A condensed middle Cenomanian succession in the Dakota Sandstone (Upper Cretaceous), Sevilleta National Wildlife Refuge, Socorro County, New Mexico: *New Mexico Geology*, v. 29, p. 75-99.

**Lab: Recognition of Condensed Sections and Flooding Surfaces**

**March 1 & 3 Siliciclastic Case Study: Cretaceous Interior Seaway, NM, UT, & CO Readings:**

Lawton, T. F., 1994, Tectonic Setting of Mesozoic Sedimentary Basins Rocky Mountain Region, United States

Hook, S. C., 1983, Stratigraphy, paleontology, depositional framework, and nomenclature of marine Upper Cretaceous rocks, Socorro County, New Mexico, in NMGS Guidebook, 34<sup>th</sup> Field Conference, p. 165-172.

Coe, A, 2005, Chapter 7, p.135-157; Chapter 8, p. 158-178; Chapter 9, p.179-195 and Chapter 10, p. 198-208.

Weimer, R.J., 1984, Relation of unconformities, tectonics, and sea-level changes, Cretaceous of Western Interior, USA, *in* Schlee, J.S., ed. *Interregional unconformities and hydrocarbon accumulation: American Association of Petroleum Geologists Memoir 36*, p. 7-35.

Van Wagoner, J. C., Mitchum, R. M., Campion, K. M., and Rahmanian, V. D., 1990, *Siliciclastic Sequence Stratigraphy in well logs, cores, and outcrops: Concepts for high-resolution correlation of time and facies: A.A.P.G Methods in Exploration Series, No. 7*, 55p.

**Lab: Cretaceous Interior Seaway Well Log Correlation Exercise**

**March 8 & 10 No class-Spring Break**

**March 15 & 17 Sequence Stratigraphy in Basinal Shale/Mudstone Systems:**

**Readings:**

- Hemmesch, N. Harris, N., Mnich, C. and D. Selby, 2014, A sequence stratigraphic framework for the Upper Devonian Woodford Shale, Permian Basin, west Texas: AAPG Bull., V. 98, p. 23-47.
- Mack, G. H., S. Hook, K. A. Giles, and W. A. Cobban (*in press*) Sequence stratigraphy of the Mancos Shale, lower Tres Hermanos Formation, and co-eval middle Cenomanian to middle Turonian strata, southern New Mexico, USA: Sedimentology, p.

**Lab: Mancos Shale Outcrop Correlation in New Mexico**

**March 19 *Fieldtrip to Mescal Canyon, NM***

**March 22 & 24 Carbonate Case Study: Permian Basin Sequences**

**Readings:**

- Coe, A, 2005, Chapter 11, p.209-233 and Chapter 12, p. 234--249.
- Sarg, J. F., 1988, Carbonate Sequence Stratigraphy: *In* Wilgus, C. K. et al.) eds.) Sea-Level Changes: An Integrated Approach; SEPM Spec. Pub. No. 42, p. 155-181.
- Sarg, J. F, Markello, J. R. and L. J. Weber, 1999, The Second-order cycle, carbonate platform growth, and reservoir, source and trap prediction: *In* Advances in Carbonate Sequence Stratigraphy: Application to Reservoirs, Outcrops and Models: SEPM Spec. Pub, No. 63, p. 11-34
- Kerans, C. and S. W. Tinker, 1999, Extrinsic stratigraphic controls on development of the Capitan reef complex: *In* Saller, A. et al. (eds), Geologic Framework of the Capitan Reef: SEPM Spec. Pub, No. 65, p. 15-36.

**March 29 *Lab: Outcrop and Subsurface correlation in Permian Basin Turn in Cretaceous Interior Seaway project***

**March 31 *No Class- Colloquium.***

**April 5 & 7 *No Class Giles at AAPG ICE Barcelona***

**April 9 *Fieldtrip to Permian Basin, Guadalupe Mountains***

**April 12 & 14 *Research Project Presentations***

**April 19 & 21 *Research Project Presentations*  
*\*Turn in Permian Basin Project***

**April 26 & 28 *Research Project Presentations***