

Fall 2014 Tentative Class Schedule
Geol. 5315/6315-8 Carbonate Petrology and Depositional Systems
Lecture: T & Th 11:30 - 12:20pm Geological Sciences 201
Lab: T 12:30 - 3:20pm Geological Sciences 320A

August 26 Tuesday

Lec: Overview of class organization; Introduction to carbonate sedimentation.

Readings:

Wilson, J. L., 1975, Carbonate Facies in Geologic Time: New York, Springer-Verlag, p.1-7.

Lab: Assign microscopes. Review basics of microscopes.

Research Project: Overview of Research Project

August 28 Thursday

Lec: Carbonate mineralogy & chemistry

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S., 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 372-407, 417-425.

Tucker, M. E. and Wright, V. P., 1990, Chapter 6- Carbonate mineralogy and chemistry: *in* Carbonate Sedimentology: London, Blackwell Scientific Pubs, p. 284-294.

Milliman, J. D., 1974, Chapter 1- Carbonates and the ocean: *in* Marine Carbonates: New York, Springer-Verlag, p. 3-12.

August 30 Saturday

Field trip 1: Overview of research project at field area. Data collection: measure stratigraphic section and collect samples as a group. Depart Geology Department parking lot at 8:00am, return by 5pm.

September 2 Tuesday

Lec: Carbonate precipitation-the subtidal CO₃ factory and precipitation rates.

Readings:

Burton, E. and Walter, L., 1987, Relative rates of aragonite and Mg-calcite from seawater: Temperature or carbonate-ion control?: *Geology*, v.15, p. 111-114.

Lab: Determination of carbonate and commonly associated minerals in thin section and hand sample.

Research Project: Tour of rock saw lab. Cut rock sample billets.

September 4 Thursday

Lec: Constituents of carbonate rocks - Skeletal grains (algae types; oncolites and stromatolites)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S., 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 1-28, 60-63.

Bathurst, R., 1976, Chapt 1- Petrography of carbonate grains: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 58-70. Chapt. 5 - Recent carbonate algal stromatolites: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 90; 217-230.

September 9 Tuesday

Lec: *No formal lecture, Giles in Turkey, but Evey will provide an introduction to computer drafting of measured sections.*

Lab: Skeletal grains - algal, oncolites and stromatolites).

September 11 Thursday

Lec: *No formal lecture; Giles in Turkey.*

Research Project: *Thin section billets due in class.*

September 16 Tuesday

Lec: Constituents of carbonate rocks - Skeletal grains (invertebrates-molluscs, brachiopods, echinoderms, ostracodes and trilobites)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S, 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 141-205.

Bathurst, R., 1976, Chapt 1- Petrography of carbonate grains: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 2-25, p. 50 -57: p. 73-75.

Lab: Skeletal grains I (invertebrates-molluscs, brachiopods, echinoderms, ostracodes and trilobites)

Research Project: *Polished slabs due in class.*

September 18 Thursday

Lec: Constituents of carbonate rocks - Skeletal grains (invertebrates-corals, sponges, stromatoporoids)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S, 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 83-121.

Bathurst, R., 1976, Chapt 1- Petrography of carbonate grains: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 25-38.

September 23 Tuesday

Lec: Constituents of carbonate rocks - Skeletal grains (invertebrates-bryozoans, forams, worm tubes, misc.)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S, 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 123-141, 33-48, 75-80.

Bathurst, R., 1976, Chapt 1- Petrography of carbonate grains: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 39-50; 70-73.

Lab: Skeletal grains (invertebrates-corals, sponges, stromatoporoids, forams, worm tubes, misc.)

Research Project: *Turn in copy of computer drafted measured section. Augment descriptions of measured section lithofacies using polished slabs.*

September 25 Thursday

Lec: Constituents of carbonate rocks - Non-skeletal grains (ooids and pisoids)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S, 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 227-245.

Bathurst, R., 1976, Chapt 2- Petrography of carbonate grains and Chapt. 7- Growth of ooids, pisolites, and grapestone: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 77-84; p. 295-319.

September 30 Tuesday

Lec: Constituents of carbonate rocks - Non-skeletal grains (peloids and intraclasts)

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S, 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 245-259.

Bathurst, R., 1976, Chapt 2- Petrography of carbonate grains: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 84-87.

Chafetz, H. S., 1986, Marine peloids: A product of bacterially induced precipitation of calcite: *Jour. Sed. Pet.*, V. 56, (6), p. 812-817.

Lab: Non-skeletal grains (ooids, peloids, & intraclasts)

Research Project: Read Kues & Giles (2004), The Late Paleozoic Ancestral Rocky Mountain System in New Mexico: *in* Mack & Giles (eds.) The Geology of New Mexico, A Geologic History, NMGS Spec. Pub. 11, p. 95-136. Write introduction & geologic setting for research paper.

October 2-4 Thursday, Friday, Saturday

Optional joint fieldtrip with ConocoPhillips to look at basinal facies of Delaware Basin, Cretaceous lacustrine carbonates, Indio Mountains, & rift tectonics, Not overnight.

October 7 Tuesday

Lec: Constituents of carbonate rocks - Carbonate mud (matrix) and the origin(s) of mud
Constituents of carbonate rocks – Cement versus replacement spar

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S., 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 265-273; p. 313-371.

Bathurst, R., 1976, Chapt 2- Petrography of carbonate grains and Chapt. 6- Origin of Bahamian aragonite mud; Chapt. 10- Cementation: *in* Carbonate Sediments and Their Diagenesis: New York, Elsevier, p. 87-89; p. 276-291.; p. 415-457.

Lab: Matrix mud, cements, and neomorphic and replacement spar.

Research Project: Demonstration of taking photomicrographs. Identify grain types, matrix, cements & estimate percentage of each in research samples.

October 9 Thursday

Lec: Classification of carbonate rocks - Grabau, Folk, Dunham, Embry & Klovan; Porosity types and generation.

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S., 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p. 283-302.

Tucker, M. E. and Wright, V. Paul, 1990, Chapter 1-Limestone classification: *in* Carbonate Sedimentology: London, Blackwell Scientific Publications, p. 18-22.

Moore, C. H., 1989, Chapt. 2- The classification and nature of carbonate porosity: *in* Carbonate Diagenesis and Porosity: Amsterdam, Elsevier, p. 21-40.

October 14 Tuesday

Lec: Dolomite and dolomitization models.

Readings:

Scholle, P. A. and Ulmer-Scholle, D. S., 2003, A Color Guide to the Petrography of Carbonate Rocks: AAPG Memoir 77, p.371-392.

Tucker, M. E. and Wright, V. Paul, 1990, Chapter 8-Dolomites & dolomitization models: *in* Carbonate Sedimentology: London, Blackwell Scientific Publications, p. 365-400.

Lab: Classification of CO₃ rocks, porosity and dolomite classification.

Research Project: Classify research samples and write description of lithofacies.

October 16 Thursday

Lec: Carbonate diagenetic environments

Readings:

Tucker, M. E. and Wright, V. Paul, 1990, Chapter 7- Diagenetic processes, products and environments: *in* Carbonate Sedimentology: London, Blackwell Scientific Publications, p. 314-364.

October 21 Tuesday

Lec: *No formal lecture Giles at GSA*

Lab: Review Labs 1-10 in preparation for Lab Practical Exam: Tuesday, October 28

Research Project: Continue classifying research samples and writing description of lithofacies.

October 23 Thursday

Lec: Carbonate depositional environments- profiles (ramp, rimmed margin/platform, offshore banks)

Readings:

- Wilson, J. L., 1975, Chapt. 2- The stratigraphy of carbonate deposits; *in* Carbonate Facies in Geologic Time: New York, Springer-Verlag, p. 20- 42
- Enos, P., 1983, Chapt. 6- Shelf Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 268-295.

October 28 Tuesday

Lec & Lab Practical Exam- Constituents of Carbonate Rocks

October 30 Thursday

Lec: Tidal flat environment.

Readings:

- Shinn, E. A., 1983, Chapt. 4-Tidal Flat Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 172-210.

November 4 Tuesday

Lec: Tidal flat environment.

Readings:

- Shinn, E. A., 1983, Chapt. 4-Tidal Flat Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 172-210.

Lab: Recognition of tidal flat facies assemblages and shallowing-upward cycles.

Research Project: *Hand-in classification of research samples, Table of sample characteristics, & lithofacies description.*

November 6 Thursday

Lec: Shelf environment.

Readings:

- Enos, P., 1983, Chapt. 6-Shelf Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 268-295.
- Wilson, J.L. and Jordon, C., 1983, Chapt. 7-Middle Shelf Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 298-343.

November 11 Tuesday

Lec: Bank margin environment.

Readings:

- Halley, R. B., Harris, P. M., and Hine, A.C., 1983, Chapt. 9-Bank Margin Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 264-506.

Lab: Thin section analysis of depositional facies of the Pennsylvanian phylloid algal mound complexes.

Research Project: Depositional facies analysis of research measured section.

November 13 Thursday

Lec: Ancestral Rocky Mountains Basins, Glacio-eustasy, Phylloid algal mound complexes

November 16 Sunday

Fieldtrip 2: Pennsylvanian bank margin phylloid algal mound complexes, Sacramento Mountains. Depart Geology Department parking lot at 8:00am and return by 5:00pm.

November 18 Tuesday

Lec: Reef and foreereef environment

Readings:

James, N. P., 1983, Chapt. 8-Reef Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 346-462.

Enos, P. and Moore, C. H., 1983, Chapt. 10- Fore-reef Slope Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 508-537.

Lab: Overview and facies of the Permian Reef Complex, Guadalupe Mtns. & karst processes. Thin section analysis of Permian Reef complex facies.

Readings: To be assigned

Research Project: Write-up depositional facies descriptions and interpretation of depositional facies model for research section.

November 20 Thursday

Lec: Slope, basin margin or toe-of slope, basinal environment.

Readings:

Cook, H. E. and Mullins, H. T., 1983, Chapt. 11- Basin Margin Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 540-617.

Scholle, P. A., Arthur, M. A., and Eckdale, A.A., 1983, Chapt. 12-Pelagic Environment: *in* Scholle, P. A., Bebout, D. G., and Moore, C. H., eds., Carbonate Depositional Environments: A.A.P.G. Memoir 33, p. 620-691.

November 21-23 Friday - Sunday

Field trip 3: Permian Reef Complex, Guadalupe Mtns/ Carlsbad Caverns. Examine depositional facies of Permian Reef complex. Study diagenetic alteration of reef system at Carlsbad Caverns. Depart Geology Department parking lot 1:00 pm on November 16 and return late afternoon on November 18.

November 25 Tuesday

Lec: Cool water carbonates? Heterozoan versus Photozoan biofacies associations

Readings:

Mutti, M. and Hallock, P. 2003, Carbonate systems along nutrient and temperature gradients: some sedimentological and geochemical constraints: International Journal of Earth Science (Geol. Rundsch), v. 92, p. 465-475.

November 27 Thursday

Lec: No lecture or lab; Thanksgiving Holiday

December 2 Tuesday

Lec: Shallowing-upward cycles and large-scale cyclicity. Models of cyclicity.

Readings:

James, N. P., 1984, Shallowing-upward sequences in carbonates: *in* Walker, R. G., ed., Facies Models, Geoscience Canada Reprint Series 1, Second Ed., p. 213-244.

Read, J. F., Grotzinger, J. P., Bova, J. A., and Koerschner, W. F., III, 1986, Models for generation of carbonate cycles: Geology, V. 14, p. 107-110.

Soreghan, G. S. and W. R. Dickinson, 1994, Generic types of stratigraphic cycles controlled by eustasy; Geology, v. 22, p. 759-761.

December 4 Thursday

Lec: Sequence stratigraphy of carbonate platforms & Permian Reef Complex.

Readings:

Sarg, J. F., 1988, Carbonate sequence stratigraphy: *in* Wilgus, C. K., Hastings, B. S., Kendall, C., Posamentier, H. W., Ross, C. A., and Van Wagoner, J. C., Sea-level Changes: An Integrated Approach, S.E.P.M. Spec Pub. No. 42, p. 155-181.

Lab: Sequence stratigraphic analysis of the Permian Reef Complex.

Research Project: Cycle and depositional sequence analysis of research section.

December 9 Tuesday

Lec: Lacustrine Carbonates, Brazilian and Angolan Pre-salt Lacustrine Systems

Readings:

Tucker, M. E. and Wright, V. Paul, 1990, Chapter 4- Lacustrine Carbonates: *in* Carbonate Sedimentology: London, Blackwell Scientific Publications, p. 164-190.

Harris, N. B., Toca Carbonate, Congo Basin: response to an evolving rift lake; in M. R. Mello and B. J. Katz, eds., Petroleum systems of South Atlantic Margins: AAPG Memoir 73, p. 341-360.

Lab: Lacustrine carbonate facies

Research Project: Finish writing research paper.

December 11 Thursday

Lec: **Turn in carbonate research paper to Dr. Giles's office by 1pm.**
