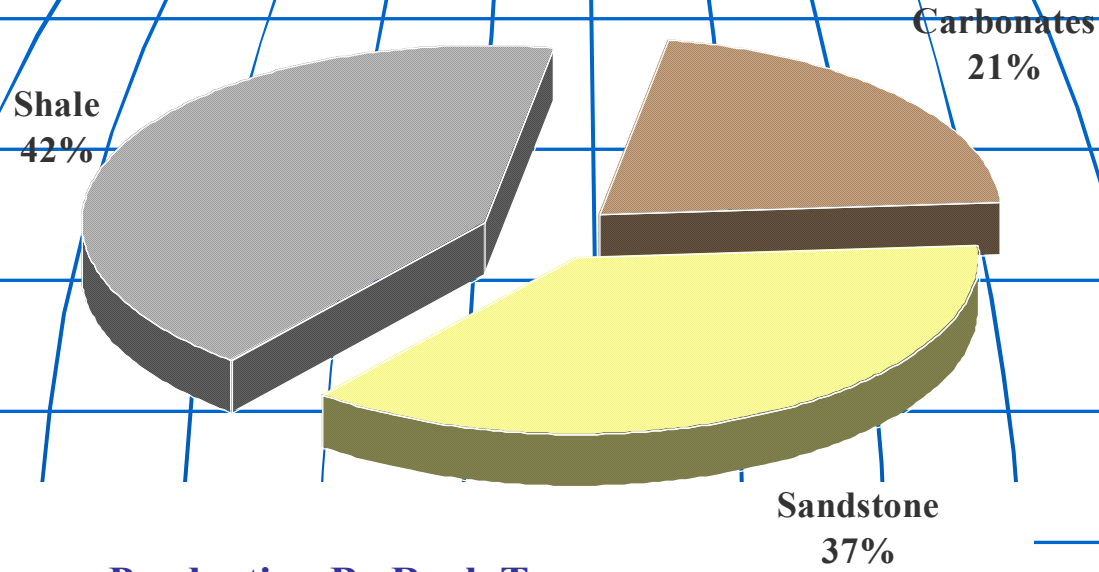


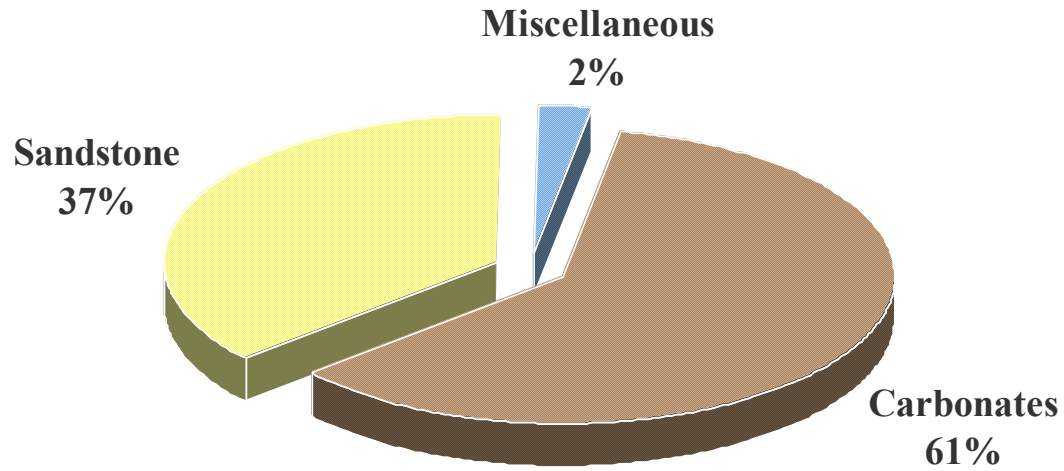
**Earth Sciences Department  
GEOL 533 Carbonates Evaporites**

**Course Instructor: Mahbub  
Hussain, Ph.D.  
Tel: 860-2620; e-mail:  
mahbub@kfupm.edu.sa**

### Abundance of Rock Types



### Production By Rock Type



## **Objectives**

**Provide students an in-depth knowledge and understanding of the principles of carbonate and evaporite sedimentology, stratigraphy and diagenesis as applied to hydrocarbon exploration and development.**

## **Approach**

**Development of original depositional, stratigraphic or diagenetic models by highlighting process-response relationships on a facies scale and basin dynamics on the scale of carbonate platforms.**

## **Methods of Instruction**

**The course consists of two 1:15-hour lecture sessions every week during the tenure of the semester. On occasions, lecture sessions will be substituted with appropriate videos or hands-on exercises. Contingent upon the university approval, a weekend field trip has been planned to study some classic carbonate outcrops in the Riyadh area.**

## **Class Attendance Policy**

**Attendance in class is necessary and required. If you are going to miss a lecture or laboratory session for a legitimate reason, you must notify your instructor well ahead of time and make necessary arrangement to make up the session.**

# Grading

**The course grade will be distributed as follows:**

<b>Quiz (3)</b>	<b>15%</b>
<b>Final Examination</b>	<b>20%</b>
<b>Assignments (2)</b>	<b>10%</b>
<b>Class Project</b>	<b>50%</b>
<b>Attendance &amp; Attitude</b>	<b>05%</b>

# **Topics to be Covered**



## Topics Covered at UG Level

- ✓ **Geologic background to Carbonate Sedimentation**  
(Tucker & Wright, pp. 28-34)
- ✓ **Carbonate Sediments and Limestone: Constituents**  
(Tucker & Wright, pp. 1-27)
- ✓ **Carbonate Mineralogy and Chemistry**  
(Tucker & Wright, pp. 284-299)
- ✓ **Precipitation of Carbonates from Sea Water**  
(Morse & McKenzie, pp. 217-239)
- ✓ **Classification of Carbonates**  
(Morse and McKenzie, pp. 189-193; Greensmith, pp. 124-155)
- ✓ **Introduction to Carbonate Facies Models**  
(Walker, pp. 209-211; Tucker & Wright, 34-69)

- ✓ **Shallowing-upward Sequence in Carbonates**  
(Walker, pp. 213-228)
- ✓ **Reefs**  
(Walker, pp. 229-244)
- ✓ **Carbonate Slope**  
(Walker, 245-257)
- ✓ **Diagenetic processes, products, and environment**  
(Tucker & Wright, pp. 314-364)
- ✓ **Dolomite and Dolomitization Models**  
(Tucker and Wright, pp. 365-400)
- ✓ **Evaporites**  
(Walker, pp. 259-296.)

# Topics to be Covered

## Carbonates

**Carbonate mineralogy, components and classification**

**Controls on carbonate deposition**

**Carbonate depositional environments**

**Carbonate platform models**

**Porosity & Diagenesis**

**Dolomite & Dolomitization models**

## Evaporites

**Depositional environments of evaporite deposits**

**Evaporites of coastal sabkhas**

**Descriptive petrography of evaporites**

**Evaporites and well logs**

# **Textbook and References**

## **Textbook**

**Scoffin, T.P., 1986, Carbonate Sediments and Rocks: Blackie, England.**

**(the official text is now out of print; substitute is the following text by Tucker and Wright, 1990)**

**Tucker, M.E., and Wright, V.P., 1990, Carbonate Sedimentology: Blackwell Scientific Publications, London, 482p.**

## **Relevant References**

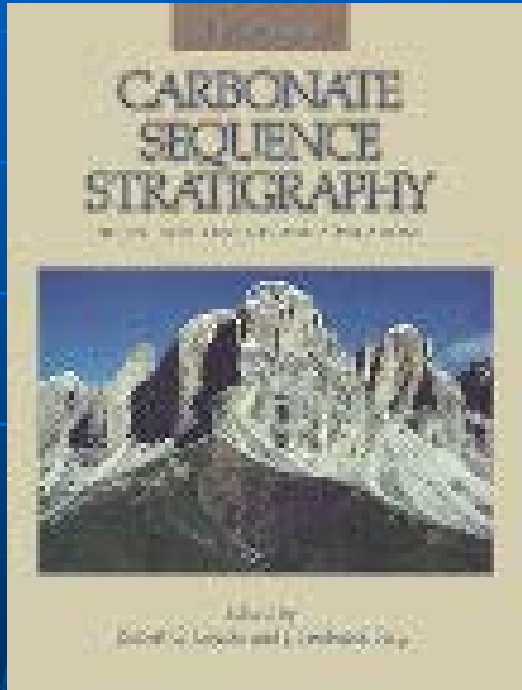
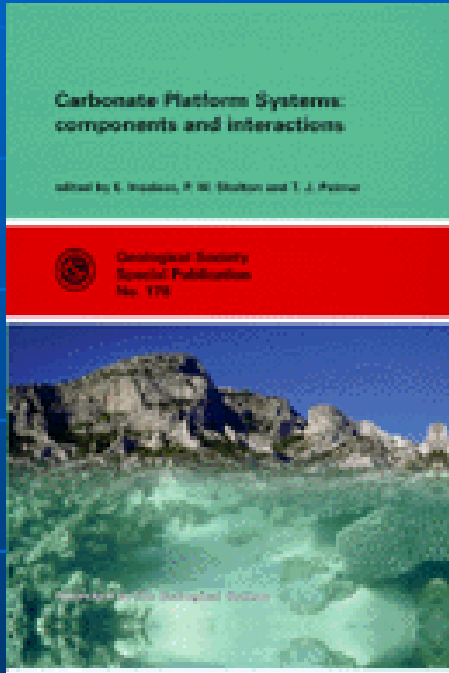
**Scholle, P.A., Bebout, D.G., and Moore, C.H., (edt.), 1983, Carbonate Depositional Environments: AAPG Memoir 33, American Association of Petroleum Geologists, Tulsa., USA.**

**Wilson, J.E., 1975, Carbonate Facies in Geologic History: Springer-Verlag, New York, USA.**

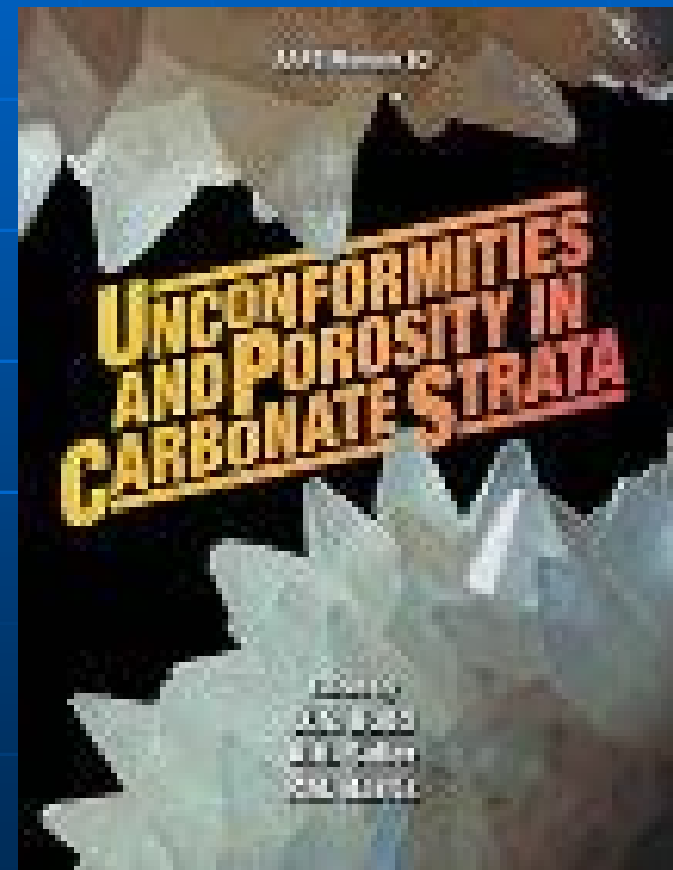
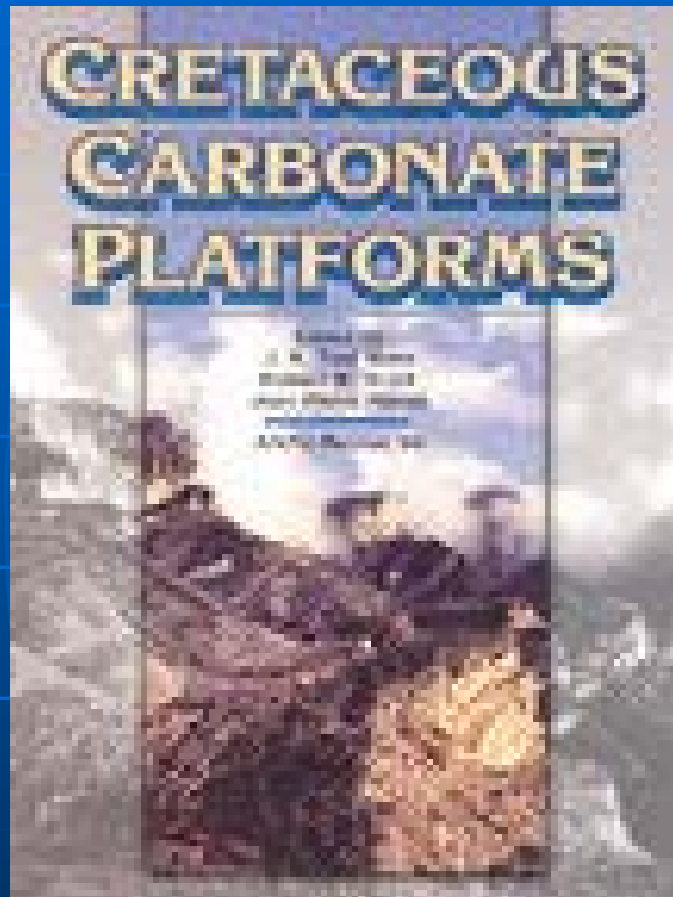
**Walker, R.G., (edt.), 1984, Facies Models: Geoscience Morse, J.W., and MacKenzie, F.T., 1990, Geochemistry of Sedimentary Carbonates: Elsevier, Amsterdam, Netherland.**

# Miscellaneous References

**Please also see the handout  
distributed in the class**

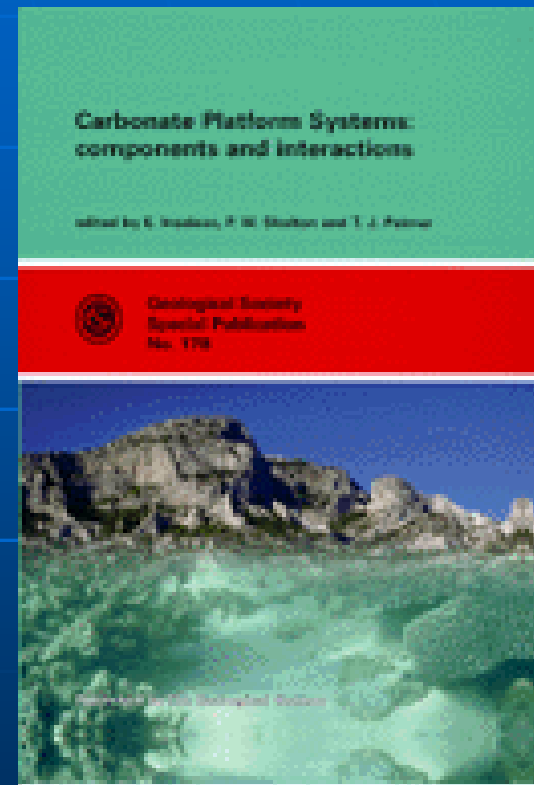






**This volume is a collection of 13 papers, plus an introduction, concerning the effects of organism-environment interactions in modern and ancient carbonate platforms, arising from the Lyell Meeting on ‘Organism-Environment Feedbacks in Carbonate Platforms and Reefs’ held at the Geological Society, UK.**

**The papers presented here provide an integrated view of carbonate platforms, emphasizing dynamic interactions at all hierarchical levels and revealing the limitations of uniformitarian analogy in biotically influenced sedimentary systems. Selected case studies from around the world illustrate aspects ranging from the genesis of growth fabrics to changing patterns of carbonate platform development.**



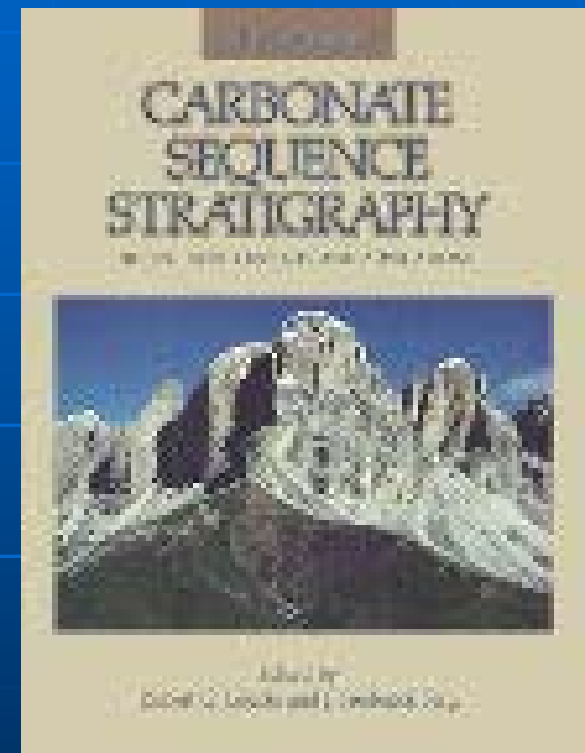
**Carbonate Ramps**  
**V. P. Wright and T. P. Burchette**

**Carbonate Ramps provides an up to date understanding of the most widespread platform type in the geological record. It contains a series of papers on the sedimentology and modelling of ancient and modern tropical to temperate environments where shallow water carbonate-rich sediments are formed. Carbonate Ramps includes new reviews of southern Arabian Gulf shallow water deposits, the Brazilian coast, northern UK shelf, as well as, studies of Tertiary to Ordovician ramp systems. With contributors coming from 8 countries and examples discussed from 13 countries this is a particularly comprehensive book.**



**Carbonate Sequence Stratigraphy - Recent  
Developments & Applications**  
**Robert G. Loucks, J. Frederick Sarg**

**Derived from the 1991 Research Symposium on Carbonate Sequence Stratigraphy, the authors have brought together in one volume a representative sampling of pivotal research in this important topic. Its three sections describe (1) sequence concepts and sedimentologic principles, (2) seismic sequence case studies involving seismic and outcrop interpretations, and (3) examples of high-frequency, meter-scale cycle deposition and stacking patterns.**



## **Carbonate Depositional Environments**

**Peter A. Scholle, Don G. Bebout, and Clyde H. Moore**

**Companion to Memoir 31, this classic reference volume aids the specialist and nonspecialist in interpretation of carbonate depositional environments in facies reconstructions. Illustrated with hundreds of color diagrams and photographs of sedimentary structures and facies assemblages.**

**AAPG Memoir 33**  
***hardbound, 708 pages, color illustrations, indexed***

# **Carbonate Platform Systems: Components and Interactions**

**E. Insalaco, P.W. Skelton, and T.J. Palmer**

**This volume is a collection of 13 papers, plus an introduction, concerning the effects of organism-environment interactions in modern and ancient carbonate platforms, arising from the Lyell Meeting on 'Organism-Environment Feedbacks in Carbonate Platforms and Reefs' held at the Geological Society, UK.**

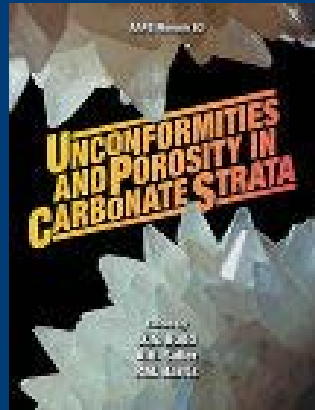
**The papers presented here provide an integrated view of carbonate platforms, emphasizing dynamic interactions at all hierarchical levels and revealing the limitations of uniformitarian analogy in biotically influenced sedimentary systems. Selected case studies from around the world illustrate aspects ranging from the genesis of growth fabrics to changing patterns of carbonate platform development.**

# **Dolomite Reservoirs: Geochemical Techniques for Evaluating Origin & Distribution**

## **J.R. Allan and W.D. Wiggins**

**This short, clear text is the first to lead the petroleum geologist through the various inorganic geochemical techniques as they apply to dolomite petroleum reservoirs. This state-of-the-art approach to the study of dolomitization will help geoscientists to critically evaluate geochemical data and to design their own geochemical studies of dolomite units.**

## **Unconformities and Porosity in Carbonate Strata** **David A. Budd, Arthur H. Saller and Paul M. Harris**



**Looking for insights and methods useful for predicting and identifying subaerial exposure surfaces and associated porosity? This memoir addresses four major topics: Detection of unconformities; Modification of porosity during exposure; Preservation of porosity during burial; and Influence of unconformities on subsequent depositional and diagenetic patterns.**

**AAPG Memoir 63**



**Petroleum Geochemistry and Source Rock Potential of  
Carbonate Rocks**

**Edited by: James G. Palacas**

**Binding: Paperback, 216 pages**

**Publisher: Books on Demand**

**Published Date: 01/01/1984**

**List: USD \$67.00**

**ISBN: 0608030198**

**Carbonate Reservoir Characterization: A Geologic-Engineering  
Analysis**

**Author: G. V. Chilingarian**

**Edited by: H. H. Rieke**

**Edited by: S. J. Mazzullo**

**Diagenesis of Carbonate Rocks: Cement-Porosity Relationships**  
**Edited by: G. M. Friedman**

**Binding: Paperback, 301 pages**  
**Publisher: Books on Demand**  
**Published Date: 01/01/1981**  
**List: USD \$93.40**  
**ISBN: 0608079316**

**Dolomites: A Volume in Honour of Dolomieu**  
**Edited by: Bruce Purser**  
**Edited by: Don Zenger**

**Binding: Paperback, 432 pages**  
**Publisher: Blackwell Publishing**  
**Published Date: 06/01/1994**  
**List: USD \$110.00**  
**ISBN: 0632037873**

# Videos

## **Arid Carbonate Coastlines**

**Peter A. Scholle, Eugene A. Shinn, Robert B. Halley,  
and P. "Mitch" Harris**

**Modern processes on today's arid carbonate tidal flats are shown along the Persian Gulf and compared to producing formations in West Texas. Excellent photography and animation show gypsum/anhydrite formation, storm cycles, algal accumulation, and accretion of a sabkha wedge, all of which enhance reservoirs. 31 min.**

## **Carbonate Facies and Reservoir Heterogeneity-The Value of Modern Analogs**

**Paul M. "Mitch" Harris**

**This 1987-1988 AAPG Distinguished Lecturer Tour presentation stresses the value of modern analogs in constraining interpretations and lending predictability to unraveling facies patterns in carbonate reservoirs. Shows application of detailed studies of modern carbonates to subsurface studies. 51 min.**

## **Carbonate Petrography**

**Peter A. Scholle and Eugene A. Shinn**

**Petrographic study provides answers to complex questions about the origin of sedimentary rocks. An excellent guide to classification of carbonate strata through light and electron microscope study of grains, cements, and fabrics. Useful guide to prediction of depositional trends and patterns of porosity distribution. 28 min.**