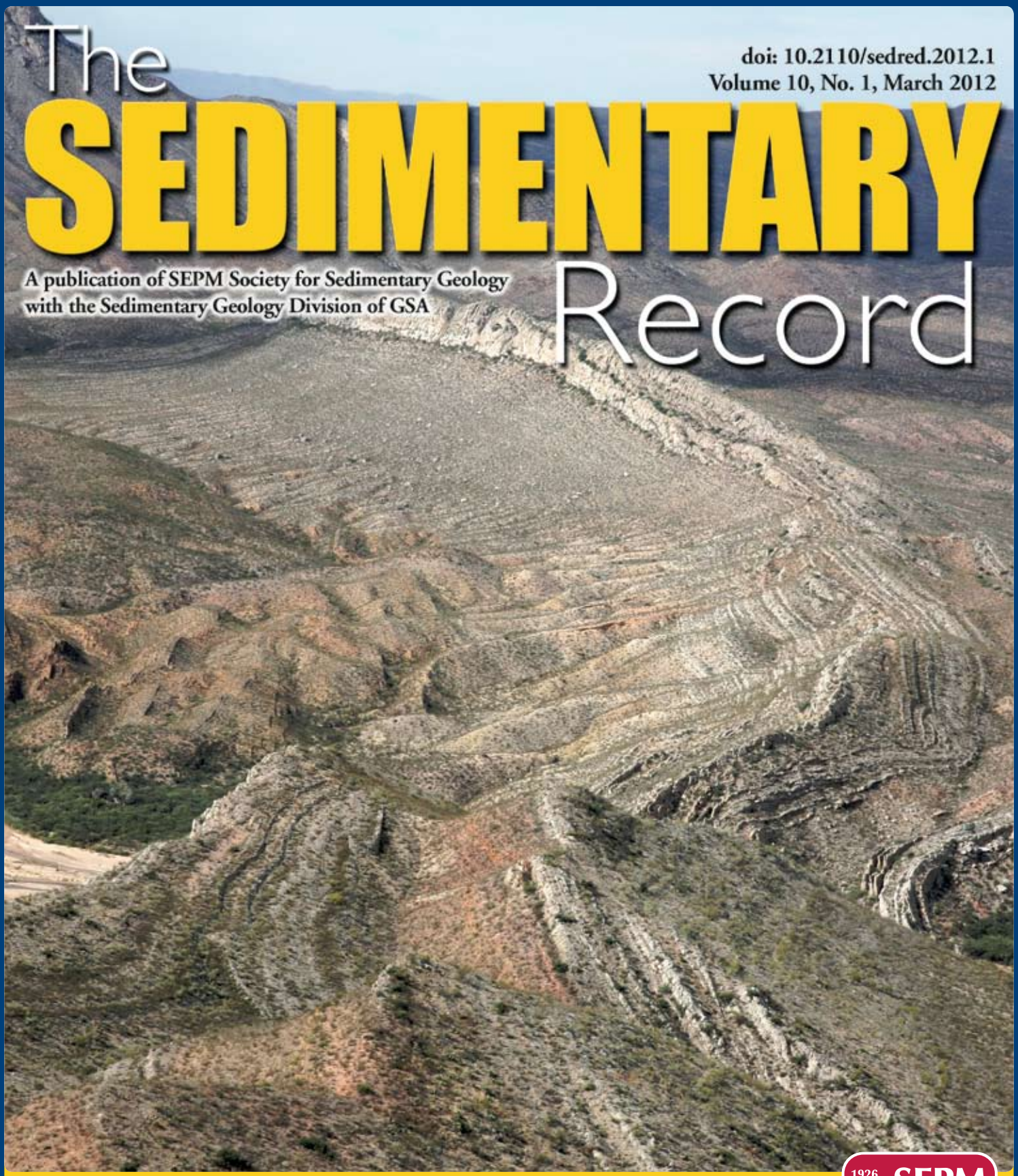
doi: 10.2110/sedred.2012.1
Volume 10, No. 1, March 2012

The SEDIMENTARY Record

A publication of SEPM Society for Sedimentary Geology
with the Sedimentary Geology Division of GSA



INSIDE: STRATIGRAPHIC HIERARCHY AND SHELF-TO-BASIN ARCHITECTURE OF APTIAN-ALBIAN MURAL SHELF, CERRO CALOSO RANGE, SONORA, MEXICO

PLUS:
SGD NEWS, PRESIDENT'S COMMENTS, SEPM ANNUAL MEETING EVENTS

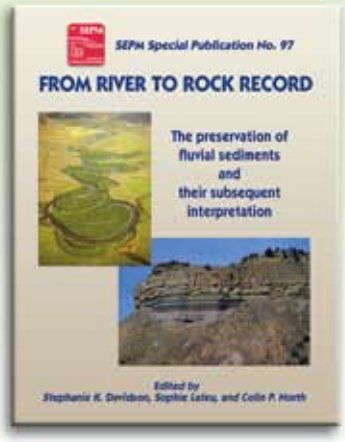
1926 SEPM
Society for Sedimentary Geology

SEPM BOOKSTORE

Special Publication #97

From River to Rock Record: The Preservation of Fluvial Sediments and their Subsequent Interpretation

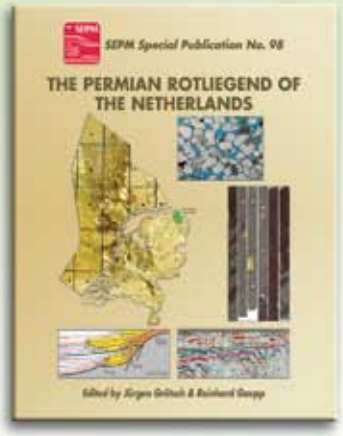
Edited by: Stephanie K. Davidson, Sophie Leleu, and Colin P. North



Over the last couple of decades, fluvial geomorphology and fluvial sedimentary geology have been developing in parallel, rather than in conjunction as might be desired. This volume is the result of the editors' attempt to bridge this gap in order to understand better how sediments in modern rivers become preserved in the rock record, and to improve interpretation from that record of the history of past environmental conditions. The catalyst for the volume was a conference with the same that was hosted at the University of Aberdeen School of Geosciences, in Aberdeen, Scotland, on 12-14 January 2009. The conferences brought together a broad spectrum of geomorphology and sedimentology researchers, from academia and industry. This interdisciplinary mix of experts considered and discussed ideas and examples ranging through timescales from the annual movement of individual river bars to sequence stratigraphic analysis of major sedimentary basins spanning millions of years. The articles in this volume are a mixture of novel concepts, new evaluations of the perceived wisdom about rivers and their sediments, and improved understanding derived from recent experience in interpreting the rock record. This volume usefully illustrates the current state of knowledge and will provide a stimulus for further research, particularly work that integrates geomorphological and sedimentological approaches and emphasizes cross-disciplinary communication.

Catalog #40097 • SEPM Member Price: $140.00 • Print with color plus DVD with additional materials and full color digital book version

Special Publication #98



The Permian Rotliegend of the Netherlands

Edited by: Jürgen Grötsch and Reinhard Gaupp

More than 50 years ago, the discovery of the giant Groningen Gas Field in the subsurface of the Netherlands by NAM B.V. marked a turning point in the Dutch and European energy market initiating the replacement of coal by gas. Despite the fact that the Rotliegend dryland deposits in the Southern Permian Basin are one of Europe's most important georesources, no sedimentological overview is available to date for the subsurface of the Netherlands. This SEPM Special Publication presents for the first time such a summary of the present-day knowledge, including a comprehensive core atlas from on- and offshore wells. The latter is closely linked to the series of papers in the volume itself, essentially providing a reference handbook for "The Permian Rotliegend of the Netherlands". Progress as a result of many scientific and consultancy studies in the Rotliegend reservoirs is summarized in this volume, with contributions covering paleogeography, depositional environment, stratigraphy, diagenesis, structural geology as well as pressure and fluid distribution in the subsurface.

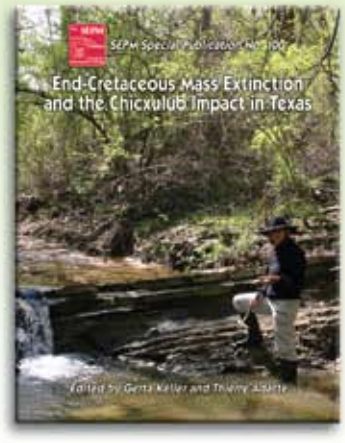
The title page illustrates a typical subsurface workflow to arrive at a conceptual geological model for hydrocarbon reservoirs. As a backdrop to the map of the Netherlands, a satellite image from Lake Eyre Basin in Australia is used, one of the closest present day analogues to the Southern Permian Basin depositional environments, albeit, much smaller in size (satellite image courtesy of Google Earth). Seismic cross section, depositional model, core photo, and thin section microphotograph of a good quality reservoir sandstone in the Rotliegend depict essential sources of information to develop reliable conceptual reservoir models for the subsurface. Supporting this is one of the objectives of SEPM SP 98.

Catalog #40098 • SEPM Member Price: $87.00 • Print with color

Special Publication #100

The End-Cretaceous Mass Extinction and the Chicxulub Impact in Texas

Edited by: Gerta Keller and Thierry Adatte



One of the liveliest, contentious, and long-running scientific debates began over three decades ago with the discovery of an iridium anomaly in a thin clay layer at Gubbio, Italy, that led to the hypothesis that a large impact caused the end-Cretaceous mass extinction. For many scientists the discovery of an impact crater near Chicxulub on Yucatán in 1991 all but sealed the impact-kill hypothesis as proven with the impact as sole cause for the mass extinction. Ever since that time evidence to the contrary has generally been interpreted as an impact-tsunami disturbance. A multi-disciplinary team of researchers has tested this assertion in new cores and a dozen outcrops along the Brazos River, Texas. In this area undisturbed sediments reveal a complete time stratigraphic sequence containing the primary impact spherule ejecta layer in late Maastrichtian claystones deposited about 200–300 thousand years before the mass extinction. About 60 cm above this level is a submarine channel with lithified spherule-rich clasts at the base followed by two to three reworked impact spherule layers and topped by sandstones. Above this channel deposit late Maastrichtian claystone deposition resumed followed by the KT boundary mass extinction. Brazos River sections thus show three events separated by time—the Chicxulub impact, the reworked spherule layers in a submarine channel, and the KTB mass extinction. In this volume a multi-disciplinary team of researchers from the USA, Switzerland, Germany, and Israel carefully documents this evidence based on paleontology, sedimentology, sequence stratigraphy, mineralogy, isotope geochemistry, trace and platinum group element geochemistry. The results are presented in a series of twelve articles with data tables and supplementary material.

Catalog #40100 • SEPM Member Price: $120.00 • Print with color plus CD with additional materials and full color digital book version

Cover photo: Aerial photo looking north along this classic outcrop band showing sequences three through five in the Bisbee Group

CONTENTS

The Sedimentary Record (ISSN 1543-8740) is published quarterly by the Society for Sedimentary Geology with offices at 4111 S. Darlington, Suite 100, Tulsa , OK 74135-6373, USA.

Editors

SEPM Staff

SEPM Council

Stratigraphic Hierarchy and Shelf-to-Basin Architecture of Aptian-Albian Mural Shelf, Cerro Caloso Range, Sonora, Mexico

S. Hiebert, C. Kerans, and J. Ballí
John A. and Katherine G. Jackson School of Geosciences, Department of Geological Sciences,
The University of Texas at Austin, Austin, Texas 78712, U.S.A
email: samuelhiebert@utexas.edu
doi: 10.2110/sedred.2012.1.4

ABSTRACT

The Mural-Caloso Shelf in Sonora, Mexico is one of only a limited number of outcrops that provide continuous shelf-to-basin profiles of reef-rimmed carbonate platforms with well-defined lowstand deposits and documentable downward shifts in coastal onlap. This paper examines the shelf-to-basin transition across three third-order sequences at the Cerro Caloso outcrop. Four parameters: reef framestone lateral and vertical dimensions, fore-reef slope lateral and vertical dimensions, evolution of platform interior facies, and presence or absence of lowstand systems tract siliciclastic wedges with or without mixed oolitic grainstone were used as the basis for the characterization of the shelf to basin profile evolution. The lower two sequences (S3 and S4) are mostly aggradational with broad coral-rudist reef rimmed margins and thick platform interiors dominated by carbonate facies. The uppermost sequence (S5) is progradational and downstepping with a narrow coral-rudist reef rimmed margin and a thin siliciclastic-rich platform interior. A lowstand wedge of fine-medium grained sandstone and cross-bedded oolitic grainstones that onlaps the S4 coral-rudist margin documents downstepping and a minimum of 20 m of downward shift in coastal onlap. The lower sequence wedge is relatively thin compared to the thickness of the S5 wedge. The long-term progradation and increased clastic component observed in the latter stages of shelf evolution indicate a large second order relative sea level fall during the deposition of the Lower Albian age Mural-Caloso Shelf. The continuous outcrop provides a good reference model for facies patterns and stratigraphic architecture for the time equivalent Cretaceous platforms that develop similar geometries such as the Shuiba shelf in the Middle East.

INTRODUCTION

The Mural Limestone extends from southeastern Arizona into northeastern Mexico and is an extension of the Comanche Shelf; a broad carbonate platform that rimmed the northwest Gulf of Mexico during Albian time (Scott and Warzeski, 1993) (Figure 1). The Mural-Caloso Shelf is one of only a limited number of outcrops that provide continuous shelf-to-basin profiles of reef rimmed carbonate shelves during Cretaceous Greenhouse settings in the northern Gulf of Mexico region. During the Lower Cretaceous, several low angle shelves developed during the 2nd order highstand (Yurewicz et al, 1993; Scott, 1993). The continuous exposure of the Mural Shelf allows detailed investigation of similar shelf architecture, especially the nature of the shelf-to-basin transition in terms of its lateral facies distribution and extent, slope angles and margin trajectory, and response of the platform margin to siliciclastic input across the shelf into the Chihuahua Trough.

The principal objective of this study was to establish a modern sequence stratigraphic framework by outlining the facies transitions and stratal geometries associated with third-order sequences proximal to the platform margin for the upper portion of the Lower Albian age Mural-Caloso Shelf system. Furthermore the data and analysis of facies transitions and stratal geometries associated with third order sequences on the Caloso Shelf margin may be used for subsurface geometric and facies comparisons with similar Aptian/Albian-age reservoirs including examples from the Shuiba Formation in Abu Dhabi (Yose et al, 2006; van Buchem et al, 2010).

PREVIOUS WORK

Lower Cretaceous formations in Arizona were first studied by Dumble (1900) and Ransome (1904). The equivalent rocks in Sonora, Mexico were subsequently examined by Dumble (1902). The Mesozoic structures of the region were described by Taliferro (1933), Gilluly (1956), Viveros (1965), and Hayes (1970). Scott (1979) studied the lower Cretaceous patch -reef developments on the shelf interior in Arizona.

Warzeski (1983) provided the most extensive study on the upper Aptian to Albian outcrops in both southern Arizona and Northern Mexico. He collected detailed measured sections for the Montes Canova and Cerro Caloso ranges in northern Sonora as well as for the Grassy Hill-Paul Spur area in southeastern Arizona (Figure 1). Warzeski (1983) described seven depositional facies and measured seven vertical sections at the Cerro Caloso outcrop (Figure 2). Scott and Warzeski (1993) later developed a regional depositional model for the Mural Shelf that serves as the basis for the present study. The most recent work of Lawton and Gonzalez (2004), and Gonzalez and Scott (2008) have focused on improving the stratigraphy of the Mural Shelf mostly in Arizona.

REGIONAL SETTING

The Mural Limestone that crops out in northeastern Sonora and southern Arizona was deposited on a broad carbonate shelf with land to the north and west (Warzeski, 1983). During Early-Middle Cretaceous time northeastern Sonora was at the northern edge of the Chihuahua Trough which curved east and southeast through the modern Mexican states of Chihuahua and Durango to join the ancestral Gulf of Mexico (Cordoba et al, 1970; Rangin and Cordoba, 1976). The Mural Limestone is one of the four formations that comprise the Bisbee Group.

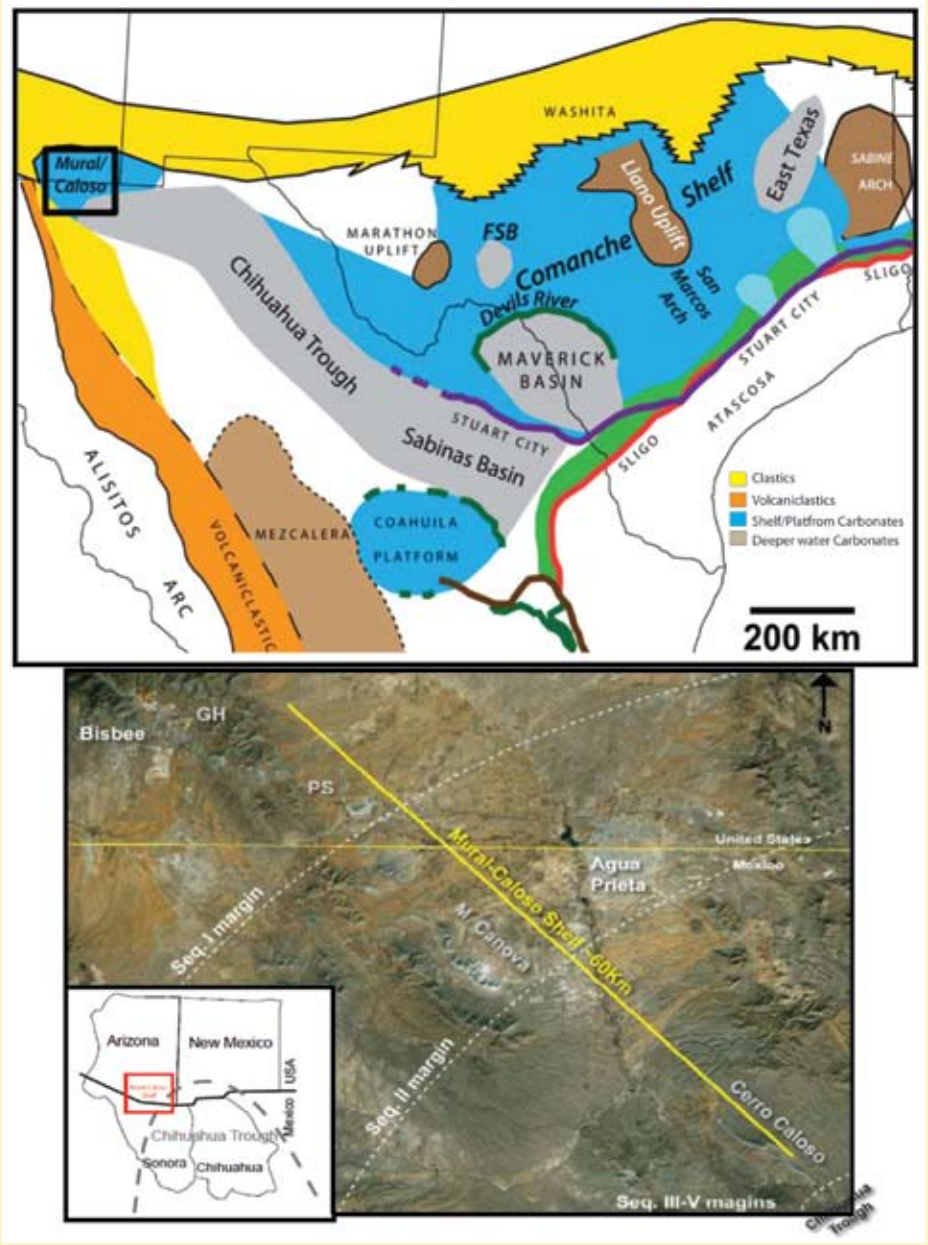


Figure 1: Top Paleogeographic map showing the Mural-Caloso Shelf as an extension of the expansive Comanche Shelf located to the southeast. During Albian time the deepwater Chihuahua Trough ran southeast through present day northern Mexico to the open ocean. Highlands to the north of the Mural-Caloso Shelf are the likely source of the lowstand sand wedges mapped at the outcrop. After Winkner and Buffler (1988), Goldhammer and Johnson (2000), McFarlan and Menes (1991), and Kerans (pers. Comm.). Bottom Google Earth image shows Mural Caloso Shelf and regional outcrop pattern including the position of the main outcrop areas, GH-Grassy Hill, PS-Paul Spur, M.Canova-Montes Canova, and Cerro Caloso the focus of this study. Progressive shelf margins are dashed in white. Inset is the regional location map.

The oldest formation of the Bisbee Group is the Glance Conglomerate which is overlain by the Morita Formation, Mural Limestone, and Cintura Formation respectively (Figure 2). The age of the Bisbee Group extends from the lower Aptian through the Albian. It is time-equivalent to the Trinity and Fredericksburg Groups of the Comanche series in Texas (Hayes, 1970) and corresponds to the Albian sequences 6-8 of Loucks and Kerans (2003). Regional northwest-southeast thrust faults strike in the direction of Mural Limestone depositional dip to expose large thicknesses of the Mural-Caloso Shelf (Scott and Warzeski, 1993).

DATA AND METHODS

Three vertical sections were measured and tied to aerial photopans in order to link stratal geometries observed on photopans and in the field with small-scale facies variability. Ten facies were identified that describe depositional environments ranging from low-energy shelf interior, through reef core, fore reef, and deeper-water slope/basin. Facies tract dimensions are quantified using the measured sections, lateral tracing of units, and qualitative assessment of bedding patterns on aerial photopans.

FACIES AND DEPOSITIONAL MODEL

The ten depositional facies identified at the Cerro Caloso outcrop are detailed in Table 1. Figure 3 shows the vertical facies organization along section 1-1 located at the shelf margin. Based on the vertical and lateral facies transitions mapped on the outcrop we developed a conceptual depositional model the 3 sequences observed in the outcrop (Figure 4).

SEQUENCE DEFINITION

Vertical stacking patterns, stratal geometries, and changes in dip-parallel facies tract dimensions were used to define the depositional sequences and the progradational versus aggradational long term evolution of the Mural-Caloso Shelf. Sequence boundaries are placed at the base of basin-restricted sand wedges that onlap the slope and shelf margin. The turnaround from increasing to decreasing accommodation corresponds to the furthest landward position of the lowest energy facies (Figures 4 and 5) (Cantuneanu et al. 2009). Only sequences 3-5 were detailed in this study. Sequences 1-3 in the Bisbee/Paul Spur area were recently studied in detail by Aisner (2010).

SEQUENCES: S3 AND S4

The thin LST of S4 consists of a sandstone (F10) wedge that onlaps the S3 outer shelf facies (F1-4). Following established sequence stratigraphic convention (Vail et al, 1977; Cantuneau et al. 2009) a sequence boundary is placed at the base of the sand wedge (Figures 4 and 5). The transgressive systems tracts in S3 and S4 are relatively thick successions of low energy open shelf and deep water facies (F9, F1-4). The maximum flooding surface is placed at the surface that marks the furthest landward position of the deeper water low energy facies.

The early highstand system tracts of S3 and S4 are characterized by strongly prograding successions of middle shelf facies (F3,F4) that grade upward into a broad aggradational coral-rudist boundstone rimmed margins (F6, F7, F8). During the S3 and S4 highstands there was sufficient accommodation to develop a broad aggradational shelf interior dominated by carbonate facies.

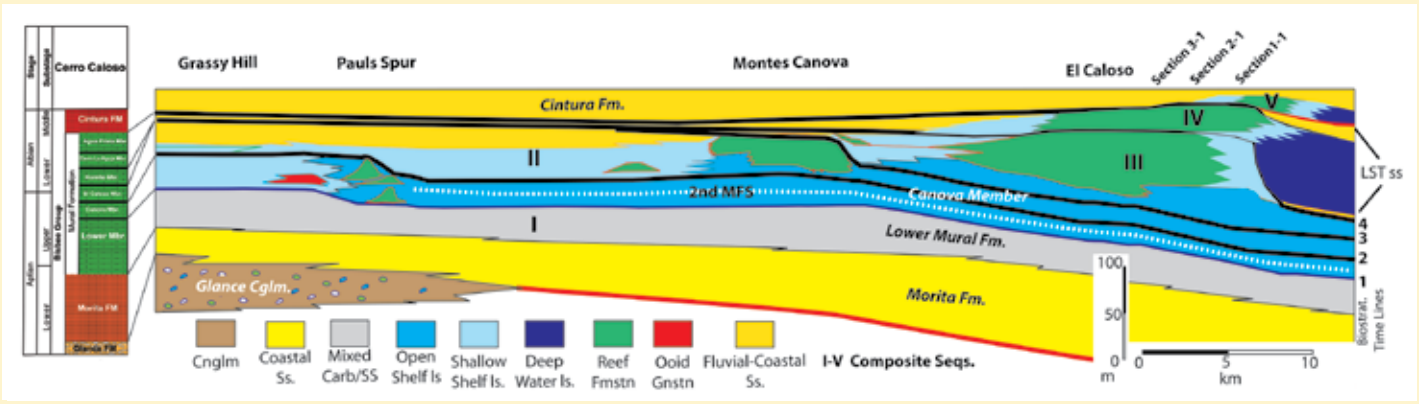


Figure 2: Generalized sequence stratigraphic model of the Mural-Caloso Shelf succession of the latest Aptian through early Albian age. Locations of measured sections of this study are identified. Figure adapted from Kerans (pers. Comm.).

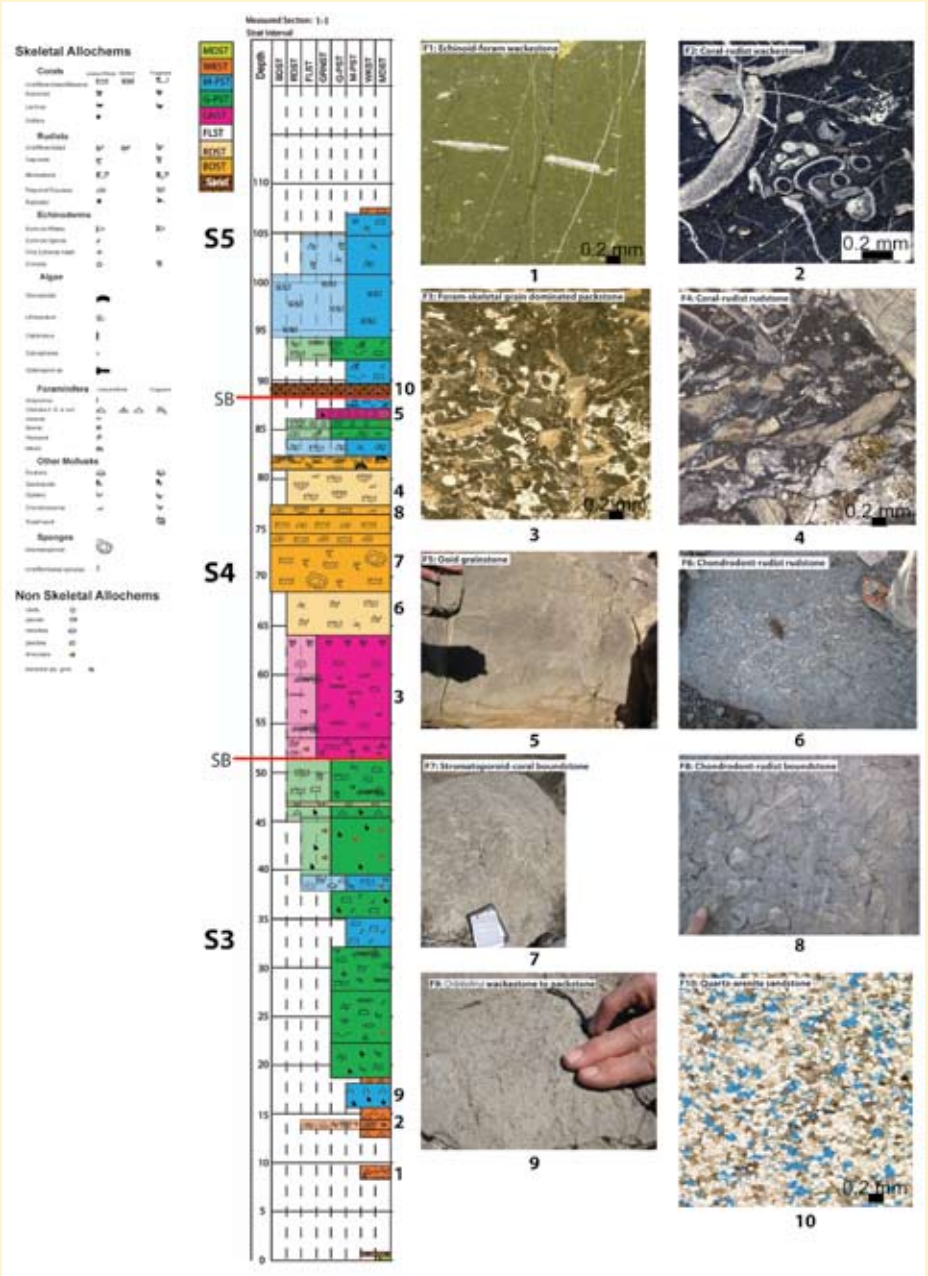


Figure 3: Measured section 1-1 (see figure 2 for location) and photomicrographs and outcrop images of depositional facies identified at the Cerro Caloso outcrop.

SEQUENCE: S5

The S5 lowstand sand wedge is significantly thicker than the lowstand wedge of S4 indicating increased lowstand shelf margin bypass during S5. The sequence boundary is placed at the base of the wedge. During the ensuing transgression a beautiful cross bedded oolitic grainstone belt (F5) develops on top of the sand wedge. The grainstone belt onlaps the coral-rudist boundstone margin of sequence IV. The geometric facies relationship observed at this surface is an example of a downward shift in coastal onlap.

The early highstand system tract of S5 contains a thin progradational belt of middle shelf facies (F3, F4) that quickly evolves to the narrow progradational coral-rudist boundstone rimmed margin (F6, F7). The thin siliciclastic-rich shelf interior of S5 reflects a decrease in accommodation from the highstands of S3 and S4 to the ensuing S5.

DISCUSSION

The measured sections were used in conjunction with the aerial photopans to determine facies belt dimensions for the lowstand sand wedges, the forereef, reef margins, and shelf interiors (Table 2). The lowstand sand wedge of S4 is significantly thinner and laps out farther downdip relative to the shelf margin facies compared to the S5 wedge (Figure 5). The fore reef slope of S3 and S4 have similar dimension, and the S5 fore reef slope is considerable less expansive and thinner. The S3 and S4 reef margins have similar dimensions while the S5 reef margin is narrower and slightly thicker. The shelf interiors of S3 and S4 are significantly thicker and more expansive compared to the thin narrow interior of S5. The difference in dimension

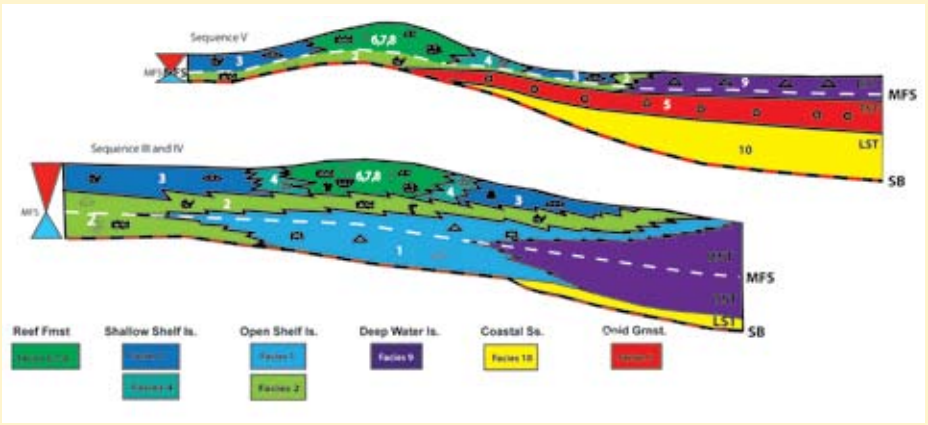


Figure 4: Conceptual depositional models for sequences three through five showing facies tract geometry and thickness variability between sequences. See symbol key of Figure 3 for reference.

and facies association between the lower 2, mostly aggrading sequences, and the uppermost sequence is interpreted as being the result of a regional decrease of accommodation that not only limited the space available to build vertically aggrading robust shelf margin buildups, but also brought more siliciclastics onto the carbonate shelf resulting in sand rich shelf interior and thicker slope and basin sand accumulation during the LST. The increasing influx of siliciclastics also probably prevented the full development of the reef margin buildups.

The best evidence for measurable downward shift in coastal onlap is the cross bedded ooid belt of the early highstand in S5. In modern settings, cross-bedded ooid grainstone belts are found in high-energy shallow water environments with water depths generally less than 5m (Rankey ad Reeder 2011). This well-developed ooid belt onlaps the S4 reef margin. The top of the S4 reef margin lies ~15m above the lapout termination of the coastal wedge. This stratal geometry as well as the facies relationship is not possible without shifting the shoreline down towards the basin at the end of S4 deposition.

This outcrop-based facies tract dimensional analysis can be applied as a predictive reference for subsurface exploration in similar time equivalent Cretaceous reservoirs. If lowstand sands are a desirable target, this work has found the thicker lowstand sand wedge associated with the transition from a more aggradational margin trajectory to a strongly to downstepping progradational margin trajectory. Conversely, if prospecting for the thicker shelf interior and margin accumulations the earlier S3 and S4 aggradational margin morphology would be a key feature to look for.

CONCLUSIONS

This field-based analysis of the continuously exposed shelf-to-basin profile of the greenhouse Lower Albian Mural-Caloso Shelf has documented the stratigraphic response of a low-angle reef-rimmed shelf to base-level forcing. The mostly aggradational reef-rimmed shelf margin with a aggradational carbonate shelf interior during S3 and S4 shifted to a strongly progradational reef-rimmed margin with a thin siliciclastic dominated shelf interior associated with a baselevel (eustatic?) fall of a minimum 20-30m. The geometric and facies evolution observed at the Cerro Caloso outcrop are consistent with a long-term second order fall during the deposition of the Lower Albian age Mural-Caloso Shelf. This fall is coeval with less-well-constrained Glen Rose 2nd order fall observed in the Gulf of Mexico margin. This study is one of only a few that can document a minimum estimate of likely eustatic fall associated with a greenhouse 2nd-order sequence.

ACKNOWLEDGMENTS

I would like to thank the Barra family: Doña Alicia, Don Jesus and their son René for all of their help in Mexico. I would also like to thank my advisor Charlie for making this opportunity available and for his continued support of my studies in carbonate geology. Finally I would like to thank Xavier Janson; he spent considerable time with me preparing this manuscript (my first publication). Funding for this project was provided by the Undergraduate Honors Research Program at the Jackson School of Geosciences and the Robert K. Goldhammer Chair in Carbonate Geology.

REFERENCES

ACATUNEANU, O., ABREU, V., BHATTACHARYA, J.P., BLUM, M.D., DALRYMPLE, R.W., ERIKSSON, P.G., FIELDING, C.R., FISHER, W.L., GALLOWAY, W.E., GIBLING, M.R., GILES, K.A., HOLBROOK, J.M., JORDAN, R., KENDALL, C.G.St.C., MARCUDA, B., MARTINSEN, O.J., MIALL, A.D., NEAL, J.E., NUMMEDAL, D., POMAR, L., POSAMENTIER, H.W., PRATT, B.R., SARG, J.F., SHANLEY, K.W., STEEL, R.J., STRASSER, A., TUCKER, M.E. and WINKER, C., 2009, Towards the standardization of sequence stratigraphy. Earth-Science Reviews, 92, 1-33.

DUMBLE, E.T., 1902. Notes on the geology of southeastern Arizona: Am. Inst. Mining Eng. Trans., v. 31, p. 676-715.

GOLDHAMMER, R. K., and C. A. JOHNSON, 2001, Middle Jurassic – Upper Cretaceous paleogeographic evolution and sequence stratigraphic framework of the northwest Gulf of Mexico rim, in C. Bartolini, A. Cantu-Chapa, and R. T. Buffler, eds., The western Gulf of Mexico Basin: Tectonics, sedimentary basins and petroleum systems: American Association of Petroleum Geologists Memoir 75, Tulsa, Oklahoma, p. 45-81.

GONZÁLEZ-LÉON, C.M., SCOTT, R.W., HANNES LÖSSER, LAWTON, T.F., 2008. Upper Aptian-Lower Albian Mural Formation: Stratigraphy, biostratigraphy and depositional cycles on the Sonoran shelf, northern Mexico, Cretaceous Research 29, 249-266

HAYES, P.T., 1970b, Cretaceous paleogeography of Southeastern Arizona and adjacent areas: U.S. Geol. Survey, Prof. Paper 658-B, 42 p.

LAWTON, T.F., GONZÁLEZ-LÉON, C.M., LUCAS, S.G., SCOTT, R.W., 2004. Stratigraphy and sedimentology of the upper Aptian-upper Albian Mural Limestone (Bisbee Group) in northern Sonora, Mexico. Cretaceous Research 25, 43-60.

LOUCK, R.G., KERANS, C., 2003, Lower Cretaceous Glen Rose "patch Reef" Reservoir in the Chittim Fiel, Maverick County, South Texas, GCAGS Transactions, v. 53, p.490-503.

McFARLAN, E., Jr., and L.S. MENES, 1991, Lower Cretaceous, in A. Salvador, ed., The Gulf of Mexico Basin: Decade of North American Geology: Boulder, Geological Society of America, p. 181-204.

RANGIN, C., and CORDOBA, D.A., 1976, Extension de la Cuenca Cretacica Chihuahuaense en Sonora Septentrional y sus deformaciones 9abs): III Congreso Latino Americano de Geologia, Resumenes, Acapulco, p. 114.

RANSOME, F.L., 1904, The Geology and ore deposits of the Bisbee Quadrangle, Arizona: U.S. Geol. Survey, Prof. Pap. 21, 168 p.

SCOTT, R.W., WARZESKI, E.R., 1993. An Aptian-Albian shelf ramp, Arizona and Sonora., Cretaceous carbonate platforms, In: Simo, J.A.T., Scott, R.W., Masse, J.-P. (Eds.), Cretaceous carbonate platforms. AAPG Memoir 56, 71-79.

SCOTT, R.W., 1979, Depositional models of early Cretaceous coral-algae-rudist reefs: Am. Assoc. Petroleum Geologists Bull., v. 63, p.183-190

VAIL, P. R., R. M. MITCHUM, Jr., and S. THOMPSON III, 1977, Seismic stratigraphy and global changes of sea level, part 3: relative changes of sea level from coastal onlap, in C. E. Payton, ed., Seismic stratigraphy--applications to hydrocarbon exploration: AAPG Memoir 26, p. 63-81.

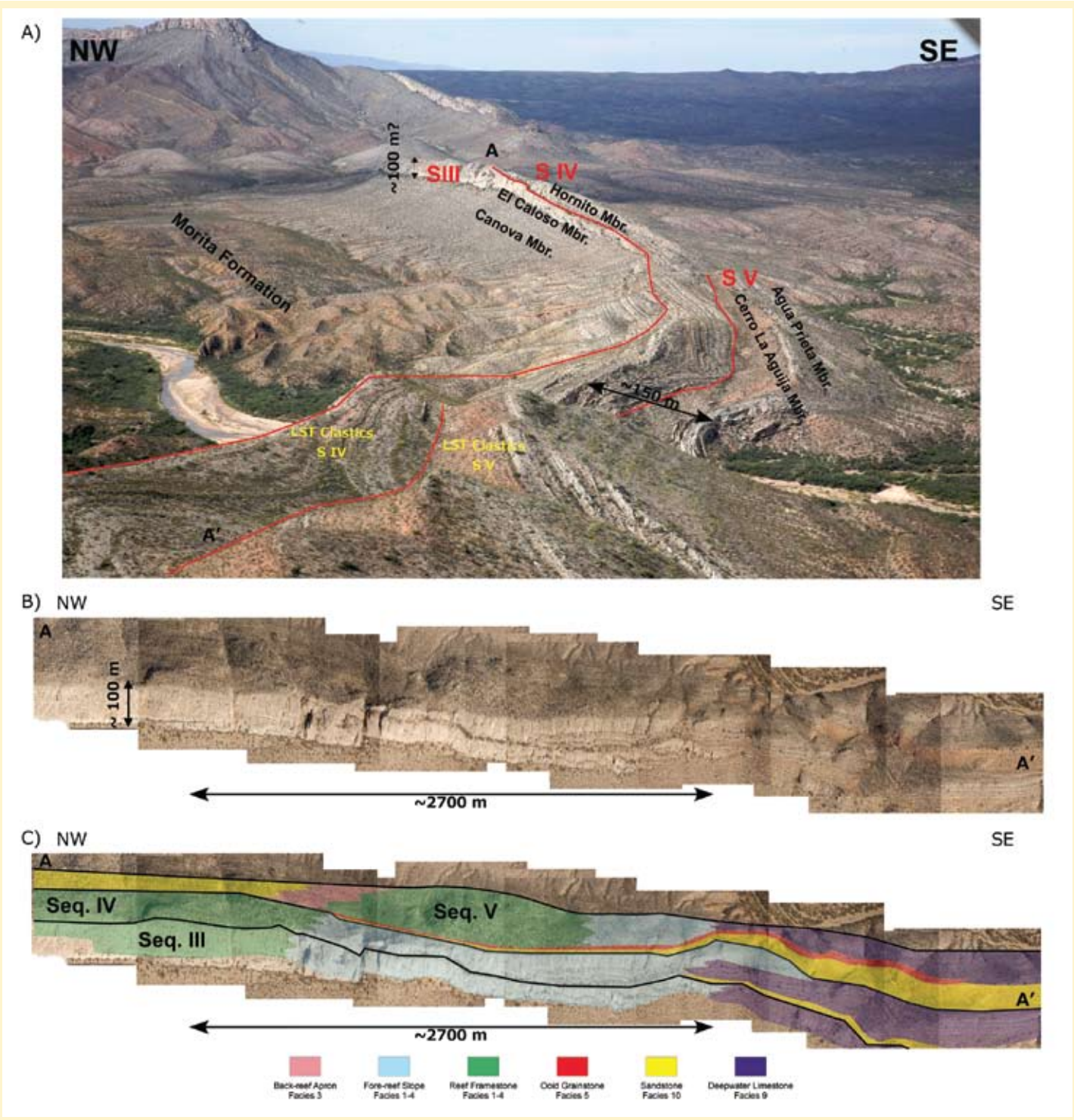


Figure 5: A: Aerial photo looking north showing sequences three through five tied into the Bisbee Group stratigraphic nomenclature. Sequence boundaries are marked in red. B: Aerial oblique photo the studied outcrop. C: Interpreted aerial photo from B showing the shelf margin facies tract geometry.

VAN BUCHEM F.S.B., M.I. AL-HUSSEINI, F. MAURER, H.J. DROSTE and L.A. YOSE, 2010, Sequence-stratigraphic synthesis of the Barremian-Aptian of the eastern Arabian Plate and Implications for the Petroleum Habitat. In F.S.P van Buchem, M.I. Al-Husseini, F. Maurer and H.J. Droste (Eds.), Barremian-Aptian stratigraphy and hydrocarbon habitat of the eastern Arabian Plate. GeoArabia Special Publication 4, Gulf PetroLink, Bahrain, v. 1, p. 9-48

YUREWICZ, D.A., CHUCHLA, R.J., RICHARDSON, M., POTTORF, R.J., GRAY, G.G., KOZAR, M.G., FITCHEN, W.M., 1993. Early Cretaceous Carbonate Platform, North Rim of the Gulf of Mexico, Mississippi and Louisiana: Chapter 8: AAPG Special Volumes., Volume M56: Cretaceous Carbonate Platforms, p.81-96

WARZESKI, E.R., 1983, Facies patterns and diagenesis of a Lower Cretaceous carbonate shelf: northeastern Sonora and southeastern Arizona: Ph.D. dissertation, State University of New York at Binghamton , 401 p.

WINKER, C. D., and R. T., BUFFLER, 1988, Paleogeographic evolution of early deep-water Gulf of Mexico and margins, Jurassic to middle Cretaceous (Comanchean): AAPG Bulletin, v. 72, p. 318-346

YOSE, L. A., A. S. RUF, C. J. STROHMENGER, J. S. SHUELKE, A. GOMBOS, I. AL-HOSANI, S. AL-MASKARY, G. BLOCH, Y. Al-MEHALRI, and I. G. JOHNSON, 2006, Three-dimensional characterization of a heterogeneous carbonate reservoir, Lower Cretaceous, Abu Dhabi (United Arab Emirates), in P. M. Harris and L. J. Weber, eds., Giant hydrocarbon reservoirs of the world: From rocks to reservoir characterization and modeling: AAPG Memoir 88/ SEPM Special Publication, p. 173-212.

Accepted February 2012

#	Facies Name	Texture	Grain-size	Sorting	Composition	Depositional Environment
F1	Echinoid-foram wackestone	Pervasively bioturbated, mud rich, rare oyster shell fragments to 2.0cm.	Fine grained matrix with oyster shell fragments 2.0cm	Poorly sorted	Disarticulated irregular echinoid fragments along with both uniserial and biserial forams are common. Type A Orbitolina are rare.	Open Shelf
F2	Coral-rudist wackestone	This mud rich facies is extensively bioturbated and devoid of sedimentary structures	Fine grained matrix with rudist shell fragments to 0.8cm	Poorly sorted	Abundant coral and rudist fragments with minor echinoid and oyster fragments. Miliolid, uniserial, biserial, and type A *Orbitolina* are present.	Open Shelf
F3	Foram-skeletal grain-dominated packstone	Parallel current stratified to weakly developed parallel lamination. *Thalassinoides* galleries.	Upper fine to lower medium sand sized matrix	Moderately-well sorted	Moderate mud component with prevalent echinoid plates and spines, thin valve oyster shell fragments, and forams: miliolids, biserial, type A *Orbitolina*, and rare *Dictyoconus*.	Shallow Shelf
F4	Coral-rudist rudstone	Minor mud component, beds are structureless, and successive beds exhibit depositional dips that define foreset geometries	Matrix is medium to coarse sand size with coral fragments to 5cm.	Moderately sorted	Caprinid and requinid rudists along with corals are dominant. Peloids, calcispheres and type B *Orbitolina* are common.	Shallow Shelf
F5	Ooid grainstone	Trough cross-stratified	Medium sand sized grains	Well sorted	Prevalence of superficial ooids with dominantly quartz nuclei. Rare oncoids and lithoclasts.	Shallow Shelf
F6	Chondrodont-rudist rudstone	Large skeletal fragments are coated with *Lithocodium*. Depositional mud, as well as microbial micrite is present.	Medium to coarse grain matrix with rudist shell fragments >2cm.	Poorly sorted	Dominant skeletal allochems include caprinid and requinid rudists, undifferentiated corals, and oysters. Non-skeletal components include oncoids, peloids, and calcispheres.	Reef margin
F7	Stromatoporoid-coral boundstone	Corals and stromatoporoids are bored. *Lithocodium* is the dominant binder. The red algae *Solenopora* is present.	Individual corals reach 35cm length.	No sorting	Massive irregular in situ *Actinastraea* and platy *Microsolena* corals are dominant. Miliods and type B Orbitolina are present.	Reef Margin
F8	Chondrodont-rudist boundstone	Massive 1x1 meter clusters of chondrodont oysters and requinid rudists are bored and algal bound	Individual chondrodont oysters may reach 20cm.	No sorting	*Lithocodium* is the dominant binder of massive chondrodont oysters and requinid rudists. Minor faunal elements include monoplurid rudists and undifferentiated corals.	Reef Margin
F9	*Orbitolina* wackestone to packstone	Thinly bedded with moderate bioturbation.	Matrix if fine grained with type A *Orbitolina* to 1.5cm.	Poor	This facies is predominantly fine grained mud with moderately abundant type A *Orbitolina* and other pelagic microfossils.	"Deepwater"
F10	Quartz-arenite sandstone	Overall upward coarsening with poorly-defined horizontal and cross laminations	Very fine lower to fine sand	Well sorted	This mud free sand has 10-20% interparticle porosity and rare undifferentiated rudist fragments.	Shallow Shelf

Table 1: Facies description table

	Lowstand System Tract	Fore Reef	Reef Margin	Platform Interior
S3		Lateral Dimensions: 750m Thickness: ~35m Facies: F1, F2, F3, F4	Lateral Dimensions: 400m Thickness: 40m Facies: Facies 6,7, and 8	Lateral Dimensions: >1000m Thickness: ~35-50m Facies: F3,F4
S4	Lateral Dimensions: >1000m Thickness: ~5-10m Facies: F10	Lateral Dimensions:800m Thickness:40m Facies:F1, F2, F3, and F4	Lateral Dimensions:350m Thickness:35m Facies: F6, F7, and F8	Lateral Dimensions: >1000m Thickness: ~35-50m Facies: F3, F4
S5	Lateral Dimensions: >1000m Thickness: ~70-100m Facies: F10	Lateral Dimensions: 100m Thickness: 25m Facies: F2, F3, and F4	Lateral Dimensions: 100m Thickness: 45m Facies: F7 and F8	Lateral Dimensions: 100m Thickness: 15m Facies: F3

Table 2: Systems tract dimension table

Sedimentary Geology Division

Geological Society of America

Sedimentary Geology Division (SGD) Members!

In this SGD newsletter, we'll discuss the SGD and SEPM sponsored events at the last GSA Annual Meeting in Minneapolis in October 2011, and set the stage for the upcoming 2012 meeting in Charlotte, NC.

2011 GSA Annual Meeting

The Sedimentary Geology Division had a strong presence at the 2011 GSA Annual Meeting in Denver, with the 22 theme sessions, and three short courses. The Sedimentary Geology Division also hosted the "Seds & Suds" Forum and Icebreaker, cosponsored by SEPM on Saturday, October 8, and the Joint Sedimentary Geology - Limnogeology Division Business Meeting and Awards Reception, also sponsored by SEPM, on Tuesday, October 11.

Seds & Suds

The Seds and Suds open forum continues to grow into an SGD/SEPM tradition, and drew approximately 85 people. The event saw a good mix of students and professionals, who stayed well into the evening. The topic of the reception was the Future of Sedimentary Research Funding. Speakers presented information on a variety of aspects of research funding. Judith Parish (University of Idaho), and Rich Lane (NSF) talked about initiatives to fund large scale interdisciplinary research projects in Sedimentary Geology and Paleobiology. They and others in the audience discussed the importance of "deep time" research in global science, especially in climate change studies and as a potential area of future funding. Individuals interested in understanding and participating in this initiative should contact Judith at jparrish@uidaho.edu. Howard Harper (SEPM) discussed an initiative by GSA, SEPM and PS (Paleontological Society) to form a communications and collaboration office for sedimentary geology research across all disciplines (STEPPE). The three societies have sent in a proposal to NSF to help fund the effort. The funding would not come from 'research' designated monies but from other NSF sources and is designed to help bring the community together.

Gene Rankey (University of Kansas), co-editor of *JSR*, described the overall future of online publishing and how it might proceed. One aspect was the potential for government mandated Open Access articles for any federally funded research. As the current financial models for open access require authors to pay for publication this can be a considerable new expense for authors, if funds are not included in the research grant itself. Discussions showed that this is one factor that many of us had not considered. To round things out, John Holbrook played devil's advocate and noted the many present day financial pressures on the US and world economies that constrain science funding.

SGD/Limnology Business Meetings and SEPM Reception

The Joint Sedimentary Geology Division/Limnogeology Division Business Meeting and Awards Reception

welcomed approximately 100 attendees, with some free drink and free food, until the graduate students finished everything off. The Sedimentary Geology division allowed the Limnology Division to go first to build suspense for the Sloss Award presentation to John Grotzinger of the California Institute of Technology.

Sloss Awardee John Grotzinger and Andy Knoll

Among his noteworthy achievements, Dr. Grotzinger has been instrumental in dating the evolutionary environmental changes that occurred during the Proterozoic, and has been instrumental in describing and interpreting the sedimentary record of Mars.

The SGD Student Research Award this year was presented to **Theo Mlynowski**, of the University of Northern British Columbia.

Four students received Outstanding Poster Presentation Awards with cash prizes of $500 each. One sponsored by SGD and three from SEPM. The four students presented their posters in T37 (SGD-SEPM Student Research Poster Session) and were judged by a committee of SEPM and SGD officers.

The awardees were:

- **Amber Conner** (Central Michigan Univ.)
- **Sen Esmeray-Senlet** (Rutgers Univ.)
- **Kelli Moran** (East Carolina Univ.)
- **Vishnu Srinivasaraghavan** (Purdue Univ.)

John Holbrook and Laubach Awardee Veerle Vandeginste

This year, along with the Structural Geology Division we presented the Stephen E. Laubach Award for Structural Diagenesis to **Dr. Veerle Vandeginste** of Imperial College, London. The SGD and the Structural Geology and Tectonics Division give this award in alternate years.

GSA Charlotte 2012

SGD and SEPM technical program chairs and the sedimentary geology community have come up with a continued expansion of the sedimentary geology program a GSA. The Charlotte meeting (November 4-7, 2012) includes fourteen proposed technical sessions sponsored by SGD (T15;T21;T111;T121; T126;T127;T140;T158;T160;T161;T165;T168;T171; T176) and seventeen sponsored by SEPM (T22;T30; T111;T114;T116;T119;T127;T134–T136;T159; T160;T162;T163;T165;T167;T168) for a total of 26 focused sessions (5 sessions are co-sponsored). One of the SEPM Sessions is a Special Session - **Recent Advances in Carbonate Sedimentology and Stratigraphy: In Memory of Gerald M. Friedman.**

As usual, SGD will team with SEPM for a Seds & Suds and their annual business meeting and reception. SGD welcomes sponsors for the next event at the 2012 GSA Annual Meeting in Charlotte, NC.

PRESIDENT'S COMMENTS

My Final Column

This is my final column for the *Sedimentary Record* as outgoing President, and I would first like to thank the Executive Director Howard Harper, Associate Director/Business Manager Theresa Scott, together with Edythe, Janice, Michele, Jill and Melissa and all the members of the SEPM Council and Headquarters Business Committee (HBC) for their sterling work over the course of my Presidency. Although this does not represent a large number of people, the amount of work this team gets done is impressive. It has been a most enjoyable and uplifting experience for me, and the Society will be in good hands with my successor David Budd.

The Society is evolving rapidly, and there are a number of initiatives in progress aimed at keeping SEPM both at the forefront of its scientific mission and also relevant to the broad geographic and disciplinary range of its members. We are seeking to expand our international reach by appointing ambassadors in a number of additional nations around the world and by providing better avenues for communication among members. We are also in the process of reviewing all aspects of our membership structure, with some possible changes in the pipeline. We are also expanding the breadth of the Council, looking at adding positions representing students, young professionals and internet applications. Our journal and book publication processes are constantly being reviewed, with a view to establishing changes in format to reflect current trends in the digital scientific publishing arena. This is an exciting, and challenging time, and the Staff, Council and HBC are working hard to keep SEPM at the vanguard. We will begin using online surveys to make sure to capture membership input on many of these issues and opportunities, so keep an eye out for announcements and please participate.

I also want to make a pitch to both existing members and potential new members, particularly graduate students, to please renew or initiate your membership in the Society. Societies such as ours are an important part of the professional scientific landscape, and there is much to be gained from membership in SEPM for both established and aspiring geoscientists. The membership fee structure has been modified recently so as to allow a basic level of membership (without journal subscription) that is very inexpensive. Please consider joining (or rejoining) us, and once joined consider volunteering - SEPM is always in need of reviewers, committee members and of course officers to help to make the Society more successful and active and evolving.

Chris Fielding
Lincoln, NE, February 9th, 2012

SEPM Society for Sedimentary Geology
"Bringing the Sedimentary Geology Community Together"
www.sepm.org

New Sedimentary Record Book Reviews – find them at www.sepm.org

San Juan Basin gas field and reservoirs
by Donald E. Owen & Charles F. Head, 2011.

The battle for North Carolina's Coast -
Evolutionary History, Present Crisis, & Vision for the Future,
by Stanley R. Riggs, Dorothea V. Ames, Stephen J. Culver & David J. Mallinson, 2011.

Please welcome the newest SEPM Council members for the 2012-2014 Council.

- **Evan Franseen (Kansas Geological Survey/University of Kansas) – President-Elect**
- **Maya Elrick (University of New Mexico) – Secretary/Treasurer**
- **Rick Sarg (Colorado School of Mines) – President SEPM Foundation**
- **Beverly DeJarnett (Texas Bureau of Economic Geology) – Research Councilor**
- **Stephen Flint (University of Liverpool) – International Councilor**
- **James MacEachern (Simon Fraser University) – Co-Editor JSR**

Please congratulate these people and also thank Tom Dignes, Alex Simms, Gary Hampson and Harald Stollhofen who all volunteered to oversee the Society.

The new Council members will officially take office at the SEPM April Long Beach annual meeting. They will be replacing the outgoing Council members: Chris Fielding, Diane Kamola, Tim Carr, Sam Bentley, Maria Mutti and Paul McCarthy, who have served SEPM well over the last few years.

JSR and PALAIOS go to a Continuous Online Publishing Process

Now, as requested, authors will have the shortest time possible from approved manuscript to official publication.

Continuous online publishing means that when an article has been fully processed by peer review, formatting and proofing procedures, it will be uploaded to the journal website in its final form and will be officially published at that time. The manuscript will include a month and year date stamp to indicate when it was published. There will no longer be any waiting period for the rest of the articles assigned to an issue to go through the same processes, or for a print queue. A printed version will still be created at the end of each bi-monthly period but the official version of record is the online version.

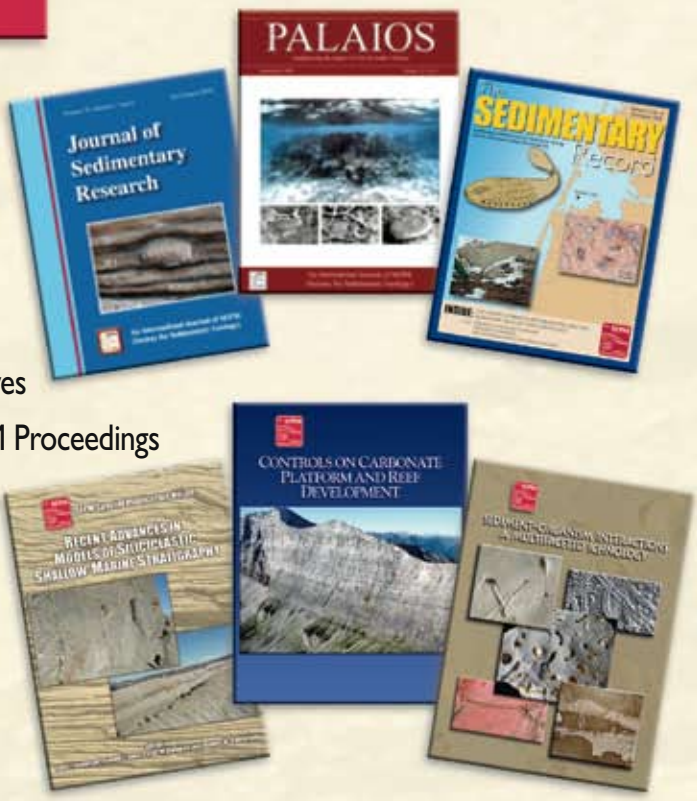
Online, articles will start filling each journal issue all through the month until that online issue is closed. The next month's issue will then begin with articles uploaded as they are finalized. Both *JSR* and *PALAIOS* have been going through a transition from the old full issue uploading method to the new continuous publishing method during the first part of this year. Continuous publishing should be fully functioning by April, so check out the journal websites often, as new articles are added to each issue more frequently.

SEPM Sustaining Members 2011-2012

Vitor Abreu
Donna Anderson
John Anderson
Hisao Ando
Jan Andsbjerg
Michael Ashton
A. Paul Baclawski
David Bajek
Arthur Berman
Sue Bilbey
Kevin Bohacs
David Bottjer
Alton Brown
David Budd
Joseph Castillo
Kenneth Ciriacks
Marshall Crouch
Robert Dalrymple
Steven Driese
John Dunham
Gregor Eberli
David Eby
Nancy Engelhardt-Moore
Thomas Ewing
Michael Fawcett
Jeffrey Geslin
Robert Ginsburg
Eberhard Gischler
Carolyn Green
Daniel Guillette
Pamela Hallock-Muller
Suchit Hart
Chuck Howell
Jean Hsieh
Robert Hulse
Hironobu Kan
Wladyslaw Karpeta
Scott Kelley
Mary Kraus
Erik Kvale
Robert Lander
H. Lane
Patrick Lehmann
James Levy
Alan Lord
Jeff Lukasik
James Markello
Peter McCabe
Teri McGuigan
Donald McNeill
Thomas Missimer
William Morgan
Colin North
Asep Nugraha
H. Peace
S. Pemberton
Edward Picou
Christopher Prince
Walter Pusey
John Robinson
Earl Rodman
Edward Simpson
Keegan Stoyles
Morgan Sullivan
Michael Sweet
Jon Thompson
Michael Velbel
Gregory Wahlman
Ron Waszczak
John Webb
Lawrence Weber
Neil Wells
Andromeda Werdaya
Winfried Werner
Dominic Yap
Neng-Ti Yu

RENEW OR JOIN NOW

Membership Benefits include:



- Join a network of worldwide sedimentary geologists - professionals and students from academia, industry, and government.
- Special online access to research journals - *Journal of Sedimentary Research*, *PALAIOS*
- Special online access to SEPM online book archives
- Special online access to Gulf Coast Section SEPM Proceedings
- Discounted pricing for the latest SEPM books
- Discounted pricing for SEPM Research Conferences
- Discounted registrations at AAPG, GSA, and other specialty meetings.
- Participation in Research Groups on focused topics such as Carbonates, Clastic Diagenesis, Sequence Stratigraphy and more.

2012 Basic Memberships start at:

- Students - $10
- Developing Country Students - $5
- Professionals - $50
- Developing Country Professionals - $10

Renew or join online (www.sepm.org) or contact SEPM Headquarters.

1926 SEPM
Society for Sedimentary Geology

SEPM Events at the Annual Meeting

April 21-25, 2012

Long Beach, CA

Saturday

- SEPM Council Meeting - Westin Hotel: 8 am - 5 pm
- Short Course #4 - ***Sequence Stratigraphy for Graduate Students*** - Westin: 8 am - 5 pm
- Short Course #5 - ***Analyzing Facies Patterns of Modern Carbonate Sands and their Potential as Analogs for HC Reservoirs*** - Westin: 8 am - 5 pm

Sunday

- Ice Breaker - Exhibit Hall: SEPM Booth #857 5:00 pm - 7:30 pm
- Short Course #4 - ***Sequence Stratigraphy for Graduate Students*** - Westin: 8 am - 5 pm
- Short Course #5 - ***Analyzing Facies Patterns of Modern Carbonate Sands and their Potential as Analogs for HC Reservoirs*** - Westin: 8 am - 3 pm
- Short Course #6 - ***Seismic Geomorphology and Seismic Stratigraphy: Extracting Geological Insights from 3-D Seismic Data*** - Westin: 8 am - 5 pm
- Field Trip #8 - ***The Great Debate: Seq. Stratigraphic and Tectonic Evolution of the Deltaic Facies in the Ridge Basin, CA***: 7 am - 6 pm

Monday

- AAPG/SEPM Student Reception - Renaissance Long Beach: 6pm - 8 pm
- SEPM Research Group Meetings - Westin: 7 pm - 10 pm

Tuesday

- SEPM Research Symposium - ***Deposits, Architecture and Controls of Carbonate Margin, Slope and Basin Settings*** - Convention Center: 8:00 am -5:00 pm
- SEPM Luncheon - ***Impact of Sea-Level Change and Regional Subsidence on Coastal Evolution: Prospects for the Mississippi Delta*** - Convention Center: 11:30 am - 1:30 pm
- SEPM President's Reception and Awards Ceremony - Westin: 7:00 pm - 9:00 pm

Wednesday

- Field Trip # 14 - ***Terrestrial Microbial Limestones in the Miocene Horse Spring Formation, Lake Mead Area, Southern Nevada***: 7 pm (Las Vegas) until Saturday 4 pm (Las Vegas)

Thursday

- Short Course #11 - ***Deltas: Processes, Stratigraphy and Reservoirs*** - Renaissance Long Beach Hotel: 8 am - 5 pm.

Friday

- Short Course #11 - ***Deltas: Processes, Stratigraphy and Reservoirs*** - Renaissance Long Beach Hotel: 8 am - 5 pm.

Contact AAPG Registration at http://www.aapg.org/longbeach2012/ for details or to register for Short Courses or Field Trips.

1926 SEPM Society for Sedimentary Geology