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# The SEDIMENTARY Record

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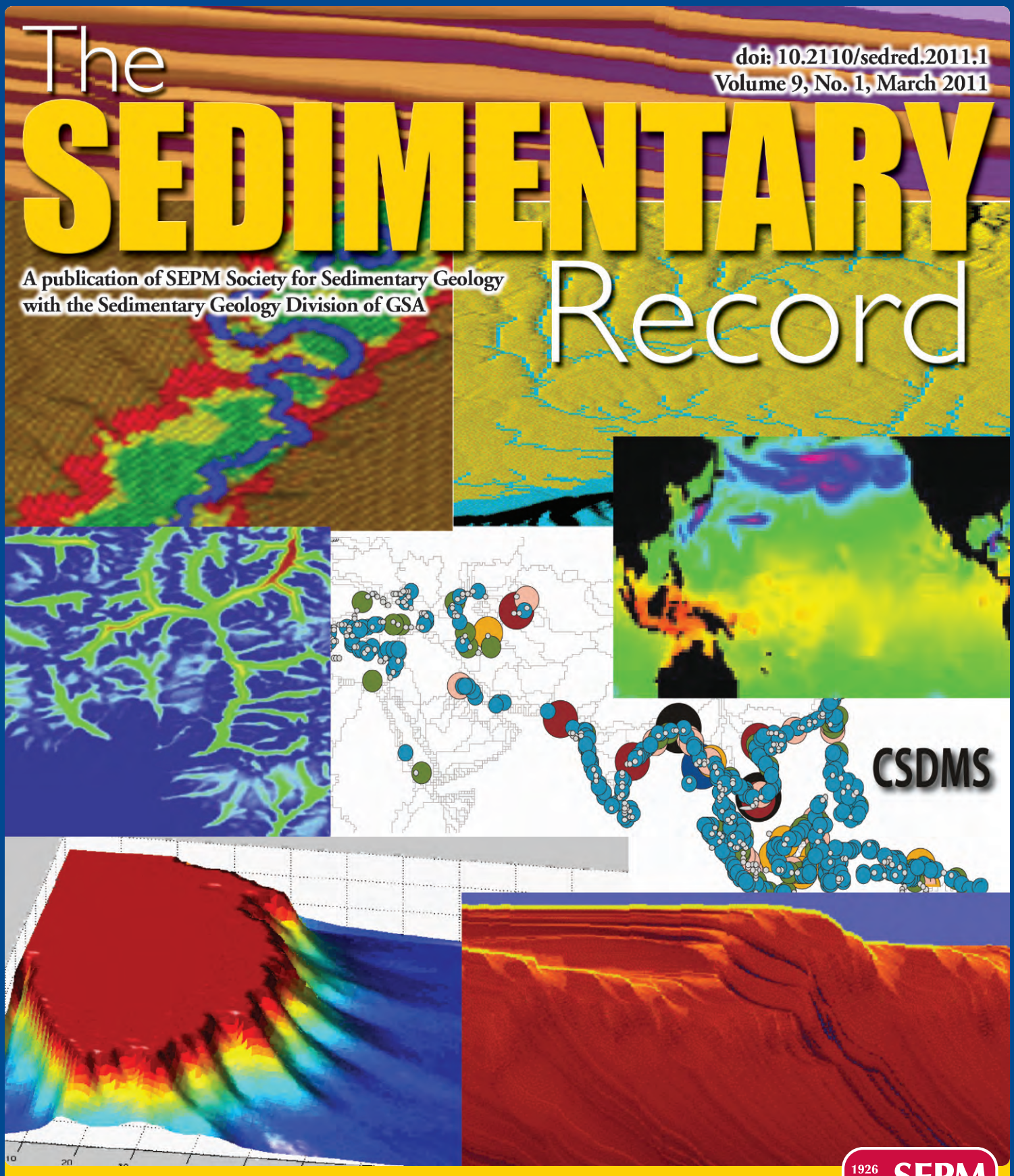


**INSIDE:** CSDMS - A MODELING SYSTEM TO AID SEDIMENTARY RESEARCH

PLUS:
SGD NEWS
COUNCIL'S COMMENTS
NEXT SEPM RESEARCH CONFERENCE

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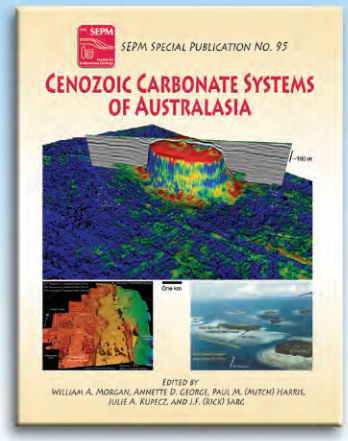
# SEPM BOOKSTORE

**Special Publication #95**

## Cenozoic Carbonate Systems of Australasia

*Edited by: William A. Morgan, Annette D. George, Paul M. (Mitch) Harris, Julie A. Kupecz, and J.F. (Rick) Sarg*

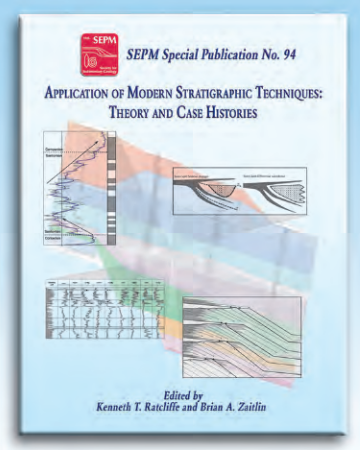



The Cenozoic carbonate systems of Australasia are the product of a diverse assortment of depositional and post-depositional processes, reflecting the interplay of eustasy, tectonics (both plate and local scale), climate, and evolutionary trends that influenced their initiation and development. These systems, which comprise both land-attached and isolated platforms, were initiated in a wide variety of tectonic settings (including rift, passive margin, and arc-related) and under warm and cool-water conditions where, locally, siliciclastic input affected their development. The lithofacies, biofacies, growth morphology, diagenesis, and hydrocarbon reservoir potential of these systems are products of these varying influences.

The studies reported in this volume range from syntheses of tectonic and depositional factors influencing carbonate deposition and controls on reservoir formation and petroleum system development, to local studies from the South China Sea, Indonesia, Kalimantan, Malaysia, the Marion Plateau, the Philippines, Western Australia, and New Caledonia that incorporate outcrop and subsurface data, including 3-D seismic imaging of carbonate platforms and facies, to understand the interplay of factors affecting the development of these systems under widely differing circumstances.

This volume will be of importance to geoscientists interested in the variability of Cenozoic carbonate systems and the factors that controlled their formation, and to those wanting to understand the range of potential hydrocarbon reservoirs discovered in these carbonates and the events that led to favorable reservoir and trap development.

**Coming Soon**




**Special Publication #94**

## Application of Modern Stratigraphic Techniques: Theory and Case Histories

*Edited by: Kenneth T. Ratcliffe and Brian A. Zaitlin*

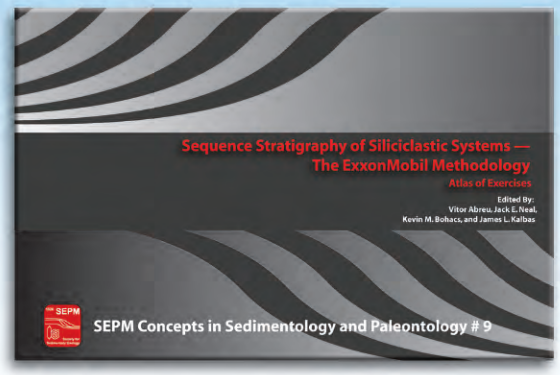
Much has been written and debated about the various methodologies applied to modern stratigraphic analysis and the ever increasing complexity of terminologies. However, there exist numerous stratigraphic techniques that are reliant upon precise, quantitative, reproducable data, rather than qualitative interpretative stratigraphic methodologies. Such stratigraphic techniques are applied in an entirely pragmatic non-biased manner within the petroleum industry to provide enhanced stratigraphic understanding of petroleum systems. The petroleum industry is a key driver behind the development of new stratigraphic techniques and a major provider of new stratigraphic data, which has resulted in several of these new techniques having been developed as a requirement to the industry. Furthermore, because techniques, such as isotope chemostratigraphy, elemental chemostratigraphy, magnetic susceptibility stratigraphy, numerical biostratigraphy and heavy mineral stratigraphy are based around precise, quantified and reproducible analytical data, they provide an independent means to test the more interpretative stratigraphic methodologies. This volume attempts an overview of stratigraphic methodologies, but largely focuses on data-generative stratigraphic techniques such as chemostratigraphy, magnetic susceptibility stratigraphy, numerical biostratigraphy and heavy mineral stratigraphy. Where appropriate, each paper discusses data generation methods including sample preparation and analytical methods as well outlining data interpretation methods. This is followed by case histories that demonstarte how those data are used to resolve stratigraphic problems, commonly using material derived from petroleum basins around the World.

**Catalog #40094 • SEPM Member Price: $80.00**

**Concepts in Sedimentology and Paleontology #9**

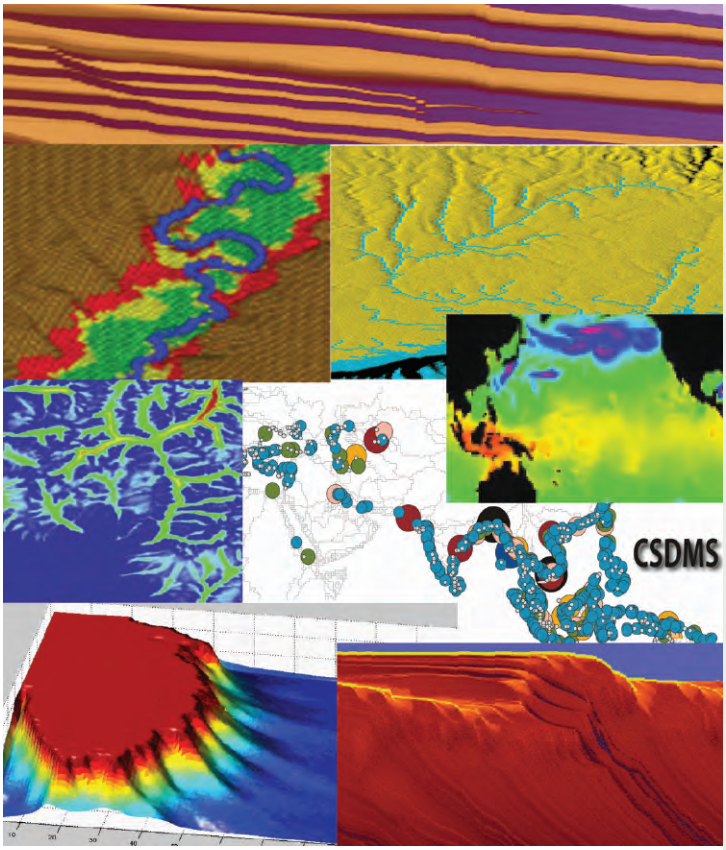
## Sequence Stratigraphy of Siliciclastic Systems – The ExxonMobil Methodology

*Edited by: Vitor Abreu, Jack E. Neal, Kevin M. Bohacs and James L. Kalbas*




The stratigraphic concept of a depositional sequence was introduced to the scientific literature by Exxon Production Research Company (EPRco) in the late 70s, building on the shoulders of giants like Chamberlain, Sloss and Wheeler. Since then, several papers compared and contrasted the original Exxon (and later, ExxonMobil) sequence-stratigraphic school with other approaches to subdivide the geologic record, as well as, debating the ExxonMobil model validity and impact on the community. At its core, the ExxonMobil "model" is really a stratigraphic interpretation method, which was never explicitly documented in the literature. The objective of this book is to present the ExxonMobil sequence stratigraphic method in its current form in an attempt to clarify its usage and application in diverse geologic data and depositional environments. This publication is the result of more than 3 decades of sequence stratigraphy research and application at EPRco and at the ExxonMobil Upstream Research Company (URC). The objective is to emphasize the most important aspects of Sequence Stratigraphy – a method to guide geologic interpretation of stratigraphic data (seismic profiles, well-logs, cores and outcrops) across scales (from local to regional and global) and depositional environments (from continental to deep marine).

**Catalog #85009 • SEPM Member Prices: Hardbound $100.00, Softbound $60.00**




*Cover art: Potpourri of simulation cutouts generated by models within the CSDMS Repository. Top: 2D-SedFlux, over CHILD (L) and MarsSim (R), over GC2D (L) and WBM-Sed (M) and WAVEWATCH III® (R), over SedFlux-3D (L) and 2D-SedFlux (R).*

# CONTENTS



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# CSDMS — A Modeling System to Aid Sedimentary Research

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doi: 10.2110/sedred.2011.1.4

Have you ever tried to gain access to someone else's sediment transport or stratigraphic numerical model before 2007? To look inside the source code and investigate how its formulations were implemented? Did you ever want to couple two or more models but could not because they were written in different languages? Have you ever desired to test out some interesting hypothesis but knew a particular model needed to run on a supercomputer, and you did not have access to a high performance computing cluster? Was access to gridded data for model initializations a bother? Have you considered building intuition in your students by employing "what-if" model runs, or developing case studies that integrate field data and model simulations?

For these and other reasons the National Science Foundation together with other environmental agencies and companies have been supporting a community effort called CSDMS to address two long-range goals:

- *Develop a modular modeling environment capable of significantly advancing fundamental earth-system science*
- *Develop fully functional and useful repositories for models, supporting data and other products for educational and knowledge transfer use.*

For Sedimentary Record scientists, these CSDMS goals could offer the following:

- Improve our predictive capability at all scales of stratal architecture;
- Improve our ability to discover, use, and conserve natural resources, and to characterize and mitigate natural hazards;
- Aid our understanding of chemical processing within the hydrologic cycle;
- Help recover evidence of global and regional environmental change and better understand the role of humans during the Anthropocene.
- Track surface dynamics through glacial cycles

For further insight into these goals we refer readers to the Millennium overview by Paola (2000) that surveys the use of models in sedimentary research, and highlights critical research questions such as: How do self-organized patterns mediate surface fluxes and evolution? How do material fluxes and surface evolution vary across time and space scales? How are physical and biological processes coupled in surface systems? How do changes in one part of the global surface system affect other parts?

Below we describe this international program by employing a Question & Answer style to maximize information content and orient SEPM readers towards areas of interest.

## WHAT IS CSDMS?

CSDMS (pronounced 'systems') is the Community Surface Dynamics Modeling System, a 500-person community effort to create models that predict the transport of fluids, sediment and solutes through landscapes, seascapes and sedimentary basins. As a modeling environment, CSDMS offers open-source, ever-improving software modules, developed and shared by those concerned with earth-surface dynamics. The CSDMS Model Repository offers a growing library of community-generated models to streamline the process of idea generation and hypothesis testing through both stand-alone and linked models. The CSDMS modeling environment enables the rapid creation and application of models tailored to specific settings, scientific problems, and time scales. CSDMS activities are funded through a cooperative agreement with the National Science Foundation with additional support provided from other U.S. agencies and industry.

## WHAT NEED DOES CSDMS SERVE?

Prediction, as opposed to cataloging, is a major step in the evolution of a science. Quantitative modeling provides a framework in which researchers express their predictive ideas in a precise, consistent format. However, new coders often reinvent the wheel as they attempt to enter the modeling world. A community-based modeling environment, built of tools created by and provided for a broad spectrum of users with diverse skills and interests offers the flexibility required by those who will benefit from its products. A community approach allows efficient development of models that are more powerful than could be developed by any single group. Redundancy is reduced, models are better vetted, and the capability for innovations expanded. Importantly energy can be focused towards earth-surface dynamic domains that are poorly represented, or controversial.

## WHAT IS IN THE CSDMS MODEL REPOSITORY?

There are more than 160 models and tools affiliated with the Repository (Table 1): 72% are available for download through the CSDMS web site (e.g. CHILD, SedFlux), 28% are available after separately registering with other community efforts (e.g. ROMS, NearCOM). Of the 4 million lines of code already in the repository, 53% of the CSDMS models are written in C or C++; 30% are written in Fortran, with Python and MATLAB code comprising most of the remaining models.

| Model Category | Domain | Example models in the CSDMS Repository |
|---|---|---|
| **Terrestrial** | landscape evolution | CHILD, SIBERIA, Caesar, Erode, GOLEM, MARSSIM, WILSIM |
| | fluvial morphodynamics | LOGPRO, BEDLOAD, MIDAS, TISC, SUSP, YANGs |
| | eolian transport | Eolian Dune Model |
| | cryosphere | GC2D, ISGR, Ice ages |
| | geodynamics | TAo, TISC, LavaFlow2D |
| **Hydrology** | reaches | STVENANT, SWMM, FLDTA |
| | basins | DR3M, TopoFlow, GEOtop, HydroTrend, PIHM, ParFlow, MFDrouting, MODFLOW |
| | continental | ANUGA, CREST, DHSVM, PIHM |
| | global | WBM-WTM, VIC |
| | biogeochemistry & water quality | QUAL2K, OTEQ, OTIS, SPARROW, GNE, HSPF, LOADEST, RHESSys, SWAT |
| **Coastal** | flow dynamics | 2DFLOWVEL, ADCIRC, NearCoM, ROMS |
| | wave dynamics | REF-DIF, STORM, STWAVES, SWAN, WAVEREF, WINDSEA, FUNWAVE, ROMS |
| | coastal evolution | CEM, Delta, XBeach, CrevasseFlow, Avulsion, AquaTellUs |
| **Marine** | physical oceanography | FVCOM, ROMS, POM, Symphonie, WAVEWATCH-III |
| | sediment transport | Diffusion, Plume, SedPlume, SedBerg, Sedtrans5, WSGFAM, SedFlux, Sakura, Hyper, Bing, Bio |
| | geodynamics | Subside, SedFlux |
| | stratigraphy | cyclopath, SedFlux |
| **Climate, Weather** | | WRF, WACCM+, and MITgcm |
| **Tools** | | ADI2D, LOGDIST, TopoToolbox, TauDEM, Zscape, TURB, TOPOG, Parker Ebook, SVELA, SETTLE, PsHIC, FTCS, Compact |

*Table 1. Example of named models within the CSDMS Model Repository, sorted by environment and domain. Modeling tools are also identified.*

This alphabet soup of models and tools has the underpinnings of thousands of peer-reviewed papers associated with them. Metadata describing each model, along with key references are available through the CSDMS web site. CSDMS-hosted models are expected to double in the next few years. But not all earth-surface domains and physics are covered.

## WHAT SURFACE DYNAMIC MODELS ARE MISSING?

Missing models include lacustrine and reservoir models, 2D debris flow and 3D sediment failure models, and full-ocean geostrophic and thermohaline circulation models. There are presently few eolian-domain models. We look forward to receiving ocean circulation models that can interact with hyperpycnal current, turbidity current and contour current models. We are missing advanced tidal flat models. Unfortunately some of these models are written, but their source code is not freely available.

## WHY OPEN SOURCE?

Code transparency is important because source code provides the scientific hypotheses embodied in a numerical model, and reveal their implementation. Within the world of software, details are important. A solution to a set of equations can take numerous forms, and each solution has its pyramid of assumptions and limitations. Code transparency allows for full peer review and replication of results - the foundation of modern science. Code transparency also allows for reuse, often in new and clever ways, and reduces redundancy. In some cases, missing domains simply reflect that model development often lags behind observational or theoretical developments.

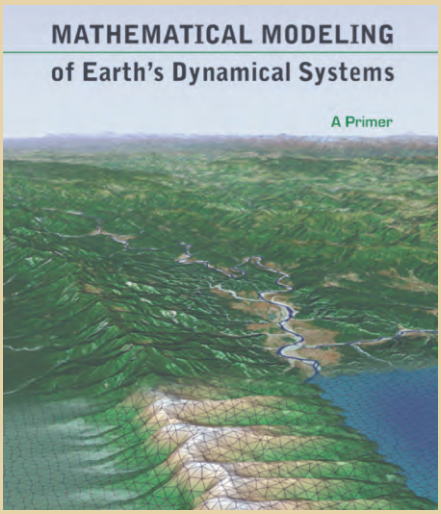


*Figure 1. Book Cover image from the new instructional text (Slingerland & Kump, 2011) shows a topographic representation of the foothills of the Himalayas (Google Earth) in the upper part of the image, and a numerical simulation based on a modified version of the CHILD model. The CHILD model became open source with the launch of CSDMS, and has since been made into a plug and play component in the CSDMS Modeling Tool.*

## WHY COMMUNITY MODELING?

Large codes by their nature involve multiple environmental domains and thus a diversity of experts - the birthplace for community modeling. Community modeling involves the collective efforts of individuals that code, debug, test, document, run, and apply models often within modeling frameworks. Community modeling relies on code transparency to address the practical need of developers to examine and modify the code. Without access to source code, a model could not be converted into a 'plug and play' component (see below). Community modeling effectively allows for code vetting so as to determine whether: 1) the model behaves as advertised; 2) the code meets community specifications and protocols; and 3) the model provides for an acceptable depiction of nature.

## WHAT IS THE ROLE OF FIELD OR LABORATORY SCIENTISTS WITHIN CSDMS?

Models are the encyclopedia of what we know, and importantly, what we cannot yet quantify. The CSDMS community includes application specialists, and those who conduct field and laboratory experiments, where individual modules and integrated models can be tested under a range of conditions. The CSDMS Data Repository has initially focused on well-described and well-vetted gridded data useful for model initializations: topography, bathymetry, climate, hydrography, discharge, cryosphere, soils, land cover, substrates, human dimensions, sea level, and oceanography.

The CSDMS Data Repository will begin to host laboratory data for the purposes of benchmarking model performance. Flume experiments have known boundary conditions and input. Even with scaling issues between laboratory experiments and field observations, models can still be rigorously tested. Laboratory experiments can be set up to test the entire range of models from those set up to describe landscape evolution to single event processes where computational fluid dynamic models can be tested (e.g. Direct Numerical Simulation models).

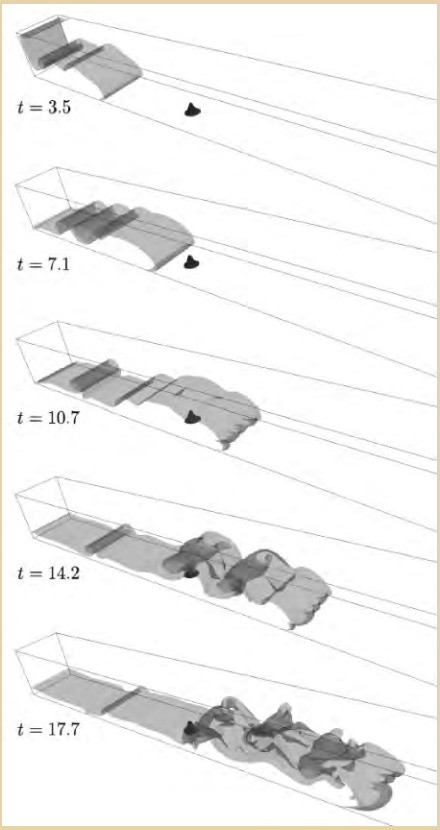


***Figure 2. TURBINS is a DNS immersed boundary, Navier-Stokes code for the simulation of turbidity currents interacting with complex topographies. Shown is the evolution of a concentration isosurface for a lock-exchange gravity current at Re = 2828. As the current interacts with a Gaussian bump shown in black, Span-wise instabilities and three-dimensional vertical structures appear in the frontal and wake regions of the current (from Nasr-Azadani & Meiburg, 2011). Simulations are from one of the many projects conducted on the CSDMS-dedicated high-performance computing cluster Beach.***

A valuable contribution that field campaigns can offer CSDMS would be to organize and grid their field data in a manner that allows for more direct comparison to a model's simulations. This also requires the provision of all input environmental values/files that a model would require. A full error analysis related to field observational grids would allow for a determination of both the spatial and temporal capabilities of a model. Most published papers within the Journal of Sedimentary Research or Marine Geology do not contain adequate error analysis. Three-dimensional deposit shapes, sequences of chronostratigraphic 2-D surfaces, dynamic observations of flow properties, and spatial properties within a sediment volume, are all examples highly valued by modelers. Different or future models could be tested later against these field data and also against the earlier model simulations. Benchmark testing is a prime task for the CSDMS community. CSDMS will post field or experimental data useful for model comparisons, as a recognized venue satisfying data requirements of the U.S. National Science Foundation.

## HOW DOES CSDMS INCREASE THE EASE OF LEARNING NEW MODELS?

CSDMS addresses this issue with four approaches. Firstly, CSDMS models are being converted into components that can be run as standalone models within the CSDMS Modeling Tool (CMT) GUI. Users will thus find a similar feel about running each model, even though models may have been written by different authors and with different user interfaces. Submitted models without a GUI will automatically gain one when they become a CSDMS component. Secondly, each CSDMS component includes a help system that offers information on a model's main algorithms, and input/output files. Tools associated with CMT will also offer post-processing visualization services. Thirdly, components receive an initial pedagogical evaluation. There is often a "built" example with a loaded input file and an output file from which model runs can be compared. Faculty and students provide feedback on these built model systems. Fourthly, CSDMS component protocols adopt community standards for handling data (e.g. NetCDF, WML). Standards reduce the wide range of available data formats and their inherent complexity. Further, CSDMS organizes instructional courses and workshops to familiarize its community with contributed models and modeling tools. The CSDMS Education Repository posts videos and PowerPoint or PDF presentations of lectures related to CSDMS components.

## WHAT IS A MODELING FRAMEWORK?

When a model grows large and complex, as might be needed for example, to handle multiple environmental domains, it often transitions into a modeling framework that provides for an environment where components can be linked to form a more complex application. Frameworks deal with modeling complexity: data transfer, grid meshing, up- or down-scaling, time stepping, computational precision, multi-processor support, cross language interoperability, and visualization. Frameworks save time, reduce costs, provide quality control, re-purpose model components, ensure consistency and traceability of model results, and offer scalability to solve complex modeling problems.

## WHAT IS A PLUG-AND-PLAY COMPONENT?

Components are functional units that once implemented in a particular framework are reusable by other units/models within the same (or other) framework with little migration effort. Component-based modeling offers the advantages of "plug and play" technology based on interface standards that allow different models to communicate. In essence, plug-and-play means that a user is able to swap components in and out without needing to recompile. Thus, a user builds a model from components, not a developer. CSDMS components differ from ordinary subroutine software, for example, in that they can communicate with other components written in different programming languages.

Component-based modeling recognizes the utility of subdividing a model's code into three separate functions: Initialize, Run (one or a few steps) and Finalize, otherwise known as an IRF interface. Such an interface provides fine-grained access of a model's capabilities to a calling program so that it can be used in a larger application. The calling program "steers" a set of components and is referred to as a driver. Components also require information on data exchange with other components, i.e. 'getter'

| Framework Architecture | Start Year Year | Principal Domain | Principal Languages | Models | Model Coupling | Platforms | HPC oriented |
|---|---|---|---|---|---|---|---|
| CSDMS | 2007/08 | Ice, Terrestrial, Hydro, Coastal, Marine, + | C, C++, F77, F90, F95, F2003, Python (java) | >160 small to large codes | Interface components | OSX, Linux, (CMT can run on Windows) | yes |
| CCSM/CESM | 1980's | Global climate | Fortran | 4 large codes | Couplers | Linux | yes |
| ESMF | 2002 | Global climate | Fortran (C, C++) | 15+ large codes | Couplers | OSX, Windows, Linux | yes |
| MMS/OMS | 1990's | hydrologic, agricultural and soil erosion | Fortran (C, C++) | >100 small to medium codes | Annotated Components | Windows, Linux | no |
| OpenMI SDK | 1990's | Hydrology | C# (java) | 25 medium codes | Interface Components | Windows | no |

***Table 2. Framework architectures in the environmental domain: CSDMS - Community Surface Dynamics Modeling System; CCSM/CESM - Community Climate System Model / Community Earth System Model; ESMF - Earth System Modeling Framework; MMS/OMS - Modular Modeling System / Object Modeling System; OpenMI - Open Modeling Interface.***

and 'setter' functions, so that connected components can query generated data as well as alter data and settings from the other model.

## HOW HAS CSDMS ADAPTED TO PLUG-AND-PLAY TECHNOLOGY?

CSDMS has adopted, integrated and advanced powerful open-source tools to build its modeling framework. These services are largely invisible to users of the CSDMS Modeling Tool (CMT), a GUI based in part on the Common Component Architecture *Ccaffeine* a service for interactive model coupling. CMT offers: (1) language interoperability (C, C++, Java, Python, Fortran) using *Babel*; (2) component preparation and project management using *Bocca*; (3) low level model coupling within a HPC environment using *Ccaffeine*; (4) single-processor spatial regridding (OpenMI *Regrid*) or multi-processor spatial regridding (ESMF *Regrid*); (5) component interface standards advanced by OpenMI; (6) self-describing scientific data format (*NetCDF*) and the water markup language (*WMF*); (7) visualization of large data sets within a multiple processor environment (e.g. *VisIt*); (8) message passing within the HPC environment using *MPI* and *OpenMP*, along with *PETSc* a Portable, Extensible Toolkit for Scientific Computation.

## WHAT HAPPENS WHEN A MODEL ENTERS THE CSDMS MODEL REPOSITORY?

After a model is received at the CSDMS Integration Facility, CSDMS software engineers determine if the code compiles on the CSDMS-dedicated supercomputer Beach. The model is exercised with whatever input files are provided and model results are compared with the provided output files. If the results are identical then the model is made available to the community for download. If a CSDMS working group prioritizes the model for componentization, the model is queued for becoming a component: 1) if necessary, the model is refactored with an IRF interface, and 2) getters and setters are added.

CSDMS components are then made operational with CMT. This includes ensuring that output can be visualized (e.g. VisIt) and conforms to CSDMS protocols (e.g. NetCDF or WML). Each component is given input configuration details and provided with help pages. The model is then made available to the community within CMT for standalone runs on Beach. If a working group desires that the model be coupled with other CSDMS components, integration staff will then ensure that the time-stepping and regridding and other data services and exchanges work properly. There must be a realistic match between one component and another. Often the style of getters and setters depends on the nature of other components in the suite. This integrated suite of models is then made available within CMT for download, and eventual community testing and vetting.

## WHAT IF MY MODEL IS NOT WRITTEN IN A CMT-SUPPORTED OPEN-SOURCE LANGUAGE?

CMT relies on the CCA-Babel language interoperability compiler. At present Babel supports most of the models contributed to the CSDMS Repository models (C, C++, Fortran, Python and Java). CSDMS has extended an IDL-to-Python converter for our community. This converter has successfully converted a refactored hydrological model TopoFlow. Code written in MATLAB code is converted to Python (e.g. GC2D). Visual Basic code is also converted to 'c' (e.g. Parker's E-book code).

## I DON'T HAVE ACCESS TO A SUPERCOMPUTER; WILL CSDMS MODELS OR CMT WORK ON MY COMPUTER?

CSDMS makes all contributed models available for free download. There is no guarantee however that the model will work on your computer. With more than 160 models and 30+ combinations of platforms and compilers, that is a task beyond our budget. Metadata provided with each model should allow you to determine compatibility issues and what platforms the model has been successfully run on. CSDMS does provide members with free access to its supercomputer Beach, where the model can be run. The University of Colorado together with the U.S. Geological Survey has purchased a CSDMS-dedicated High Performance Computing Cluster (HPCC). NSF covers computer system oversight costs, and remote data storage costs. There are more than 100 CSDMS members who run models on Beach. CMT allows Beach account holders to build (couple) and execute CSDMS models on Beach from their personal computers following cloud-computing principals. The CMT tool can be downloaded for later versions of Windows, OS X, and Linux.

CSDMS staff are examining convenient ways for members to run models without being subject to CU security protocols for such an open yet dedicated computing cluster. One

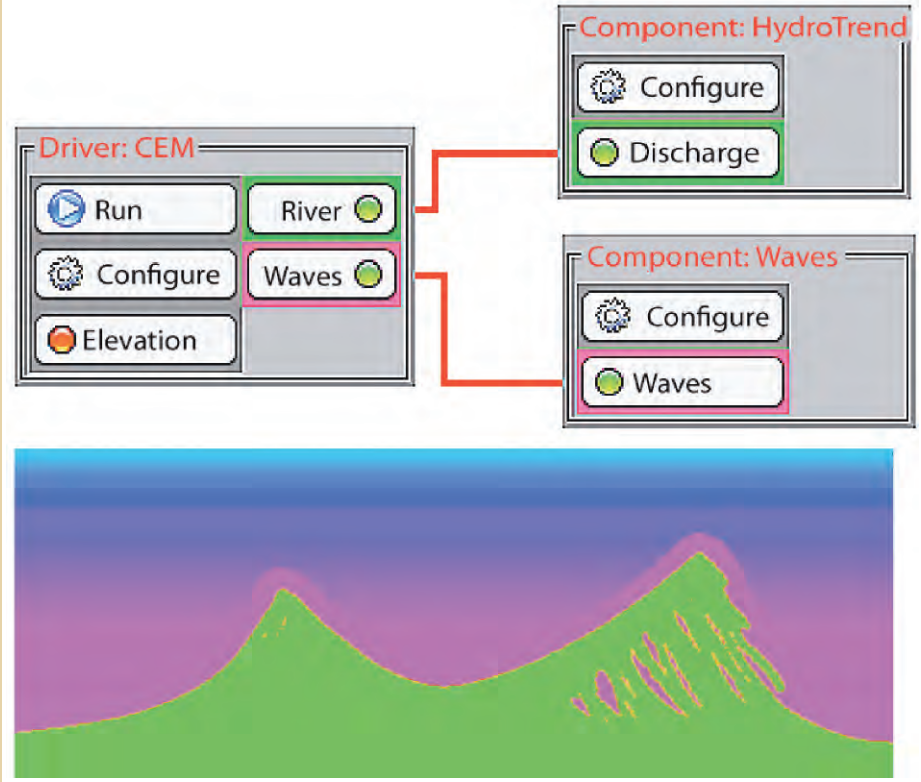


*Figure 3. CMT Wiring diagram of the coupling of three of CSDMS many models: HydroTrend, CEM (Coastline Evolution Model) and Waves. Simulation shown below is from a student assignment designed to investigate delta morphodynamics.*

future way might allow a CSDMS account holder to build 'coupled executables' on Beach and then freely make these executables available for use on other computers. This would allow students to manipulate input files and examine model simulations without a Beach account. The source code for model components remains available for examination. CSDMS staff have also discussed with CCA staff, the development of DVDs for multiplatform operation of models, a distant goal.

Most high performance codes (e.g. ROMS, WRF) have versions that can be run, albeit more slowly, on single processor computers. High performance codes are often poor performers on single processor machines, and are demanding with countless libraries to enable. Our experience has shown that some HPC models can take a couple of months to work out all the library compatibility issues and become fully operational on a new platform.

## WHAT ARE THE CSDMS WORKING GROUPS (WGS), AND HOW ARE THEY DIFFERENT FROM CDSMS FOCUS RESEARCH GROUPS (FRGS)?

There are five WGs: Terrestrial, Coastal, Marine, Education & Knowledge Transfer (EKT), and Cyberinformatics & Numerics (C&N), and CSDMS members align themselves with one or more groups. The Terrestrial WG with more than 235 members concerns itself with weathering, hillslopes, rivers, glaciers and ice sheets, deserts, lakes, hydrology, geodynamics and human dynamics. The Coastal WG (>170 members) studies Earth's coastlines, deltas, estuaries, bays, lagoons, and the impact of humans. The Marine WG (>130 members) focuses on continental shelves, slopes, carbonates, and the deep marine. The EKT WG (>60 members) equips researchers with model and visualization tools, planners with decision-making tools, educators with pre-packaged models, course material and tools to help illustrate surface processes and build intuition. The C&N WG (>90 members) focuses on high performance computing, visualization, and software protocols. Chairs of these working groups form the CSDMS governing body along with Steering Committee and Integration Facility representation.

CSDMS FRGs differ from WGs in that they serve a unique subset of our surface dynamics community, usually represent an already functioning community co-sponsored by another organization. Chairs of FRGs report directly to the CSDMS Executive Director, and to the Chair or Director of the co-sponsoring organization. The >145-member Hydrology FRG is co-sponsored by CUAHSI and deals with models of the hydrological system. The 47-member Carbonate FRG is developing a numerical carbonate workbench. The Chesapeake FRG is the first 'geographically-focused' effort co-sponsored by the 32-member Chesapeake Community Modeling Program, with their unique collection of models and field data set.

## WHAT ARE CSDMS MEMBER RESPONSIBILITIES?

The Chairs of WGs and FRGs need members who are willing to roll up their sleeves and volunteer time to this community effort. If the burden falls on too few shoulders progress is slow. Participation is through annual meetings, workshops, electronic forums, or through individual hero efforts related to adding, modifying or vetting CSDMS models, data and educational material. After reading this article we encourage interested participants to take the plunge, offer energy, insight and talent to this important community effort.

## WHAT ARE MODELING CHALLENGES IN THE COMING DECADE FOR CSDMS?

1) Very few of the CSDMS models take advantage of today's high performance computers like Beach (teraflops) and there is no existing model able to scale up to petascale ($+10^{15}$ Flops) or exascale ($+10^{18}$ Flops) platforms of the future. Authors of models typically give up both spatial and temporal resolution and domain size (area covered, period simulated) in order to work on single processor systems. Most CSDMS model authors are not trained in MPI and OpenMP, the coding interfaces used to take advantage of multiple processors. NSF has recognized this lack of progress; CSDMS is addressing this shortcoming.
2) We are beginning to recognize the magnitude of human alteration of our landscape during the 20th century --- the Anthropocene epoch. Yet many of the measurements that we base or constrain our theories on contain the overprint of human interference. We need algorithms that can strip off human influences on the landscape (e.g. hardened river banks, hillslope terracing), or add them (e.g. accelerated wetland peat oxidation, mangrove removal).
3) We are further along in post-diction, then prediction, yet there is an urgent need to develop surface dynamics models that offer prediction capabilities, given our rapidly changing climate and landscape. Here the

resolution issue outlined in point 1) is particularly relevant, along with access to high performance code.

4) In deformed terrains, it is often difficult to interpret the rock record so as to recover the original depositional slopes of the rock units. Without the depositional slope it is often difficult to apply numerical models to constrain the transport dynamics that led to the deposit. This is a problem of too many degrees of freedom. Continental margin deposits are particularly problematic where individual beds might be deposited over a wide range of slopes (e.g. <1° to 15°). If crustal deformation is both spatially and temporally variable, then reconstruction of depositional slopes becomes nearly impossible. Monte Carlo set-up runs employing coupled geodynamic and sediment transport models might result in a series of believable matches to the deposit geometries. These results would then help develop statistical models for reservoir characterization.
5) CSDMS is helping to make environmental-domain coupling of models easier. Is enough research on hand to capture transition dynamics: terrestrial to coastal, coastal to marine processes, or perhaps reef dynamics with marine processes? If models do not include the appropriate transitional dynamics, there will remain a mismatch with observations.
6) Adding complexity to a model is a two-edged sword. Atmospheric models have always been better at getting temperature correct compared to precipitation, with early models needing better characterization of cloud physics. However, weather models often are so complex that predictions beyond a few weeks are near impossible. Climate models with simpler representations of atmospheric dynamics are more capable of predictions-of-state across decades. Thus earth scientists need to identify where complexity is needed and learn to scale this complexity over geologic time. Scaling of complexity will always remain the center of earth science.
7) The skin of the earth surface has become known as the **critical zone**. This zone represents the intersection between the hydrosphere, cryosphere, atmosphere, biosphere and the geosphere. Such complexity is not included in any single model. Model coupling offers a way forward in capturing the physics and chemistry of this complex zone, as long as components are developed to capture this complexity.

## ACKNOWLEDGEMENT:

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**Accepted March 2011**

NEWS FROM THE DIRECTOR

# Did you know that SEPM has three main websites?

I am using this small extra space to announce a new web site feature. I will be posting various news items about SEPM and sedimentary geology at a new webpage called "Director's News" under the Home menu. I will include here items that come to my attention, especially from SEPM's various connections with other organizations, such as AGI and NSF and other sister societies.

The first news item that I will discuss concerns SEPM's web presence. I want to bring to your attention that at the 2010 GSA meeting, SEPM President Mitch Harris with the approval of the SEPM Council held an SEPM Web Presence Workshop. The workshop included council members and fourteen invited students. Each student presented their view of the current SEPM websites (www.sepm.org; www.sepmonline.org and www.sepmstrata.org) and suggestions on how to improve it. Based on their input we are putting together a plan to enhance our web presence. The recommendations included:

- clean up www.sepm.org, reduce the number of menu items and remove old material and keep it updated
- add a rolling banner to the main page to highlight the latest activities
- add a site search function
- investigate the use of 'social' networking for online discussions (such as Google Groups or LinkedIn)
- investigate the use of online videos such as on YouTube
- make sure that members are made aware of SEPM's three main websites
  - www.sepm.org - the main home of the society
  - www.sepmonline.org - the home of the online publications (journals and books)
  - www.sepmstrata.org - home of Chris Kendall's site for free access to material for learning and teaching areas of sedimentary geology, initially focusing on stratigraphy and sequence stratigraphy

Be sure to keep coming back to the SEPM home site (www.sepm.org) to see the continuous changes taking place!

*Howard Harper*

# Sedimentary Geology Division

## Geological Society of America

## Greetings SEPM and GSA Sedimentary Geology Division (SGD) Members!

In this issue of the SGD Newsletter, we review some highlights from SEPM and SGD sponsored events at the 2010 GSA Annual Meeting in Denver and set the stage for the upcoming 2011 meeting in Minneapolis. We also relay some information about the state of the division.

## 2010 GSA Annual Meeting

SGD had a strong presence at the 2010 GSA Annual Meeting in Denver, with 18 theme sessions, eight field trips, and two short courses. The Sedimentary Geology Division also hosted the "Seds and Suds" Forum and Icebreaker, co-sponsored by SEPM on Saturday, October 29, and the Joint Sedimentary Geology Division and Limnogeology Division Business Meeting and Awards Reception, also sponsored by SEPM, on Tuesday, November 2.

The Seds and Suds event continues to grow into an SGD/SEPM tradition, and drew approximately 120 people. The event saw a good mix of students and professionals, many of whom stayed well into the evening. Everyone seemed to be having a good time. Because we had no invited speakers to inconvenience, we decided to opt out of the forum discussion. This decision met with mixed results. We discovered that many people tend to leave early if the discussion topic is not of their interest and would prefer the extra time to mingle. On the other hand, several people noted that they like the forum discussion. In particular, some faculty noted that they really like the way that the forum gives students the opportunity to interact in a debate involving scholars from around the world. They regard the opportunity as somewhat unique. Let us know what you think. To forum or not to forum? This is certainly an ever evolving process, and your feedback is much appreciated.

**The call is open for suggestions for future discussion topics at Seds and Suds. If you have a topic you feel would benefit from an open forum discussion, please contact Richard Langford at langford@utep.edu.**

**We also welcome sponsors for the next event at the 2011 GSA Annual Meeting in Minneapolis.**

The Joint Sedimentary Geology Division and Limnogeology Division Business Meeting and Awards Reception welcomed 100 or so attendees, most of whom enjoyed a free beverage of their choice and munchies. Particularly, the ice cream social seemed to go over well. After the Limnogeology business meeting, the Sedimentary Geology Division events transpired. The Sedimentary Geology Division presented the Student Research Award this year to Jennifer Cotton from the University of Michigan. In addition, we announced Christopher Thissen as the first winner of the Stephen E. Laubach Award for Structural Diagenesis. This award is given in alternate years by the SGD and the Structural Geology and Tectonics Division. Next year will be our turn. If you have an idea, be sure to enter the competition.

**Jennifer Cotton accepting the 2010 Sedimentary Geology Division Student Research Grant Award from John Holbrook. Photo courtesy of Kelly Dilliard.**

Mike Arthur gave a citation and accepted the 2010 Laurence L. Sloss awardee for **Hugh Jenkyns** who was unable to attend. In addition, door prizes were awarded to several students attending the awards reception. Many thanks are extended to webmaster **Kelly Dilliard**, and our JTPC representatives, **Troy Rasbury** and **Brenda Beitler Bowen**, for all of their help in making the Sedimentary Geology sessions and events a success.

**Do you know a colleague who is particularly deserving of receiving the Laurence L. Sloss Award for Sedimentary Geology? Please forward nominations to the SGD Secretary/Treasurer, Linda Kah at lckah@utk.edu.**

## Coming this year to the 2011 GSA Meeting in Minneapolis?

The SGD executive committee met at GSA 2010 to discuss ways to even better improve our presence at the GSA Annual Meeting. We decided to become more proactive regarding theme sessions. This of course meant some kind cajoling of a few of you to propose theme sessions in hot topic areas to better showcase the good work of you and your colleagues. We have an excellent slate of sessions coming for the 2011 meeting. The final posting of sessions will come in April to the GSA website. So stay tuned! Sessions will be waiting to be filled with good science. Consider this your invitation to participate by giving a talk. Please pick a session you like, and submit an abstract. The abstract deadline is July 26.

## State of the Sedimentary Geology Division

The Sedimentary Geology Division is financially healthy with approximately $14,800 in the account as of December 31, 2010. Most of the expenses incurred on an annual basis by the SGD are for events at the Annual Meeting and awards -we are enormously proud of the number of student awards that we present each year, and we continue to enjoy the great challenge of determining the most deserving member of our community for the Sloss Award. The 2010 membership of the Sedimentary Geology Division remains generally stable. Although we have experienced slight losses in student memberships, our professional memberships remain strong. We attribute some of these losses to increased activity and exposure of geological divisions that also involve a strong sedimentological component (e.g., Quaternary Geology, Limnology). In the coming year, the SGD will continue to discuss potential efforts to increase our membership and find ways of stressing the breadth and relevance of Sedimentary Geology in the Earth Sciences. Immediate efforts include getting more involved with sponsorship of events at GSA section meetings. If you have ideas regarding membership and exposure of the Sedimentary Geology Division, please contact John M. Holbrook (Holbrook@uta.edu).

**Doing research or education in at the intersection of structural geology and diagenesis? Compete for the Stephen E. Laubach Award.**
**Proposals are due by April 15, 2011.**
**Look for details on the SGD website.**
**http://rock.geosociety.org/sed/SGD.html**

## SGD Personnel and Committee

### Assignments for the 2009-2010 Year:

- **John Holbrook** is the Chair.
- **Richard Langford** is the Vice-Chair.
- **Linda Kah** is the Secretary/Treasurer.
- The Joint Technical Program Committee (JTPC) representatives for SGD are **Brenda Beitler Bowen** and **Tracy Frank**.
- **Kelly Dilliard** is the web manager.
- The Sloss Award Committee comprises: **Janok Bhattacharya, Peter DeCelles, Maya Elrick, Ray Ingersoll, Hugh Jenkyns,** and **Judy Parrish.**

# SEPM Research Conference
# Deciphering Paleoclimatic Signals from Continental Successions

## Truro, Nova Scotia • August 2 - 6, 2011

There is now an increased awareness of the potential of continental stratigraphic archives (fluvial, lacustrine, eolian, glacial, paleosol, etc.) for providing highly resolved records of environmental change over geological timescales. This meeting brings together researchers from the various cognate disciplines to review the state of the art, consider the potential for future advances and discuss potential applications of this area of research to resource exploration. We anticipate that papers presented at the meeting will form the basis for an SEPM Special Publication.

The conference will combine oral and poster presentation sessions with field excursions to facilitate discusssion on a wide range of topics. The meeting's field trips with focus on the Carboniferous Maritime Basin and Mesozoic Fundy Basin in mainland Nova Scotia, where there are spectacular exposures of successions germane to the conference theme. These include the World Heritage listed Joggins Cliffs. Truro is centrally located ot the outcrops of interest and is within 60 minutes drive from Halifax International Airport.

**For further information contact:**

Chris Fielding (cfielding2@unl.edu) or Jon Allen (jonathan.allen@chevron.com).

Registration will open in May, 2011.

Estimated Professional Registration fee $1,000

COUNCIL'S COMMENTS

# The "Business" of SEPM – Some Background, Issues and Challenges

SEPM works very hard to disseminate scientific results through our two journals, Special Publications, research conferences and symposiums, awards, student grants, and the Sedimentary Record. Behind the scenes a lot goes on that most members are unaware of... and for the most part that's a good thing! The "business" side of SEPM is mostly hidden unless you join the SEPM Council or one of the standing committees in some role, then you get to see the considerable efforts and planning of Headquarters staff, the Executive Director, the Headquarters and Business Committee (HBC), the SEPM Foundation, the member-elected Council, and the annual meeting committee.

SEPM is on a sound financial footing, but the financial challenges that we face as a Society are ever changing and evolving. For example, at any quarterly HBC, any biannual Council meeting, or by email the following topics are constantly being evaluated and discussed: yearly budget, budget projections, mid-year budget adjustments, membership changes, recruiting student members, dues structure, book publications, journal pages, digital publishing, open access, annual meetings, meeting sponsorship, managing editors, headquarters' staffing and goals, strategic goals, and more recently the Society website. These all have fiscal impacts on our Society. Fortunately, Executive Director Howard Harper and Business Manager Theresa Scott stay on top of these issues on a daily basis and assist us part-time volunteers. Some of these issues have already been addressed in recent columns, but several key issues are likely to become more prominent with direct impact on how our Society functions.

The SEPM budget is one of the most fascinating and challenging aspects of "behind-the-scene" work, and is almost a year-round process. The budgeting process starts with a draft budget created by Staff, reviewed and approval by HBC in October, and ready for Council evaluation at their Fall meeting (usually at GSA). The budget is based partly on the previous year, the ongoing budget year, and then adjusted for real or expected changes in income or expenses related to many factors. Some of these factors include the change to an all-digital (paperless) publishing model, the transition to electronic subscriptions with web portal access, the projection of book sales, membership renewals, attendance of research conferences and fieldtrips, and the evolving needs for a multi-functional website. All of these factors contain some degree of uncertainty.

Of these budget uncertainties, the most challenging is the transition to all digital publishing. The costs of printing and postage along with the demand for easy electronic access of publications are driving SEPM publications to an all-digital, paperless mode. There are inherent financial risks that the Society faces during this transition but Council, HBC, and Staff have been actively planning this transition for years. In fact, we should use this as an opportunity for global exposure of SEPM.

Open Access is the concept that federal (and soon state?) funded research should be freely accessible to everyone. Two main issues of open access affect the Society. First is how to provide an accessible venue for select open access papers, the second is determining the real cost of publication to SEPM. Right now we charge $2,000 per paper for open access, but the average cost per paper likely exceeds $3,500. Business planning for open access is underway within SEPM, as this is a quickly developing issue that could have major impact on SEPM budgets.

Intertwined with budget and publication changes is the SEPM website. To some, especially students, the website is rapidly becoming the face of SEPM, their main point of frequent contact. The webpage will continually become more important as we transition to the paperless digital world, and it will be a major revenue stream for our Society. SEPM must maintain a viable and dynamic website that serves the members with up-to-date easy access to publications, member news, career opportunities, teaching resources, digital archive, outreach materials, and upcoming events. Toward that end, this past November a website workshop was convened to deal with this evolving issue. Student input largely drove this workshop, and this input will continue to be key to a modern and robust website.

The evolving needs highlighted above also dictate changes to our human resources, both at the staff and Council levels. The shift from paper to digital publication and the emergence of the website as the face of SEPM may eventually demand the need for a new Council-level coordinator and staff web manager. The financial viability of our Society will likely be tied to our internet presence and ability to provide revenue-generating member services.

We conclude with words of encouragement with regards to the "business" of SEPM and the excitement of voluntary involvement with the Society. We encourage you to participate and become involved with SEPM, the leading sedimentary geology society in the world!

***From:***
***Donald F. McNeill (Chair of SEPM Headquarters and Business Committee)***
***Paul (Mitch) Harris (SEPM President)***


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

# SEPM COUNCIL ELECTION RESULTS

PRESIDENT-ELECT (2011-2012): **David Budd, University of Colorado, Boulder, CO, USA**

SEDIMENTOLOGY COUNCILOR (2011-2013): **Janok Bhattacharya, University of Houston, Houston, TX, USA**

PALEONTOLOGY COUNCILOR (2011-2013): **Danita Brandt, Michigan State University, East Lansing, MI, USA**

SPECIAL PUBICATIONS CO-EDITOR (2011-2015): **Gary Nichols, Royal Holloway University of London, Egham, Surrey, UK**

PALAIOS CO-EDITOR (2011-2015): **JP Zonneveld, University of Alberta, Edmonton, AB, Canada**

Please remember to thank these people for volunteering their time to govern your Society.

Also thanks go to Bob Gastaldo, Murray Gingras and Sara Pruss for volunteering to run for office.

# SEPM BOOK REVIEWS

As a new feature of the *Sedimentary Record*, beginning in 2011, book reviews for topics on sedimentary geology will be listed in the quarterly *Sedimentary Record* and the full review will appear online here under the ***Sedimentary Record*** menu. Book Reviews prior to 2011, can be found under ***JSR*** menu and reviews on paleontological topics can found under ***PALAIOS*** menu accessible at www.sepm.org.

**Book Reviews uploaded as of March 1, 2010.**

- *The geology of sedimentary sequences* (2nd edition) by Andrew D. Miall, 2010.
- *Deserts and desert environments*, by Julie Laity, 2008.
- *Rocknocker - a geologist's memoir*, by George Devries Klein, 2009.
- *Petroleum geological atlas of the southern Permian Basin area*, edited by H. Doornenbal and A. Stevenson, 2010.
- *Geobiology - microbial mats in sandy deposits from the Archean era to today*, by Nora Noffke, 2010
- *Petrology of sedimentary rocks (2nd ed.)*, by Sam Boggs Jr., 2009
- *Inland drift sand landscapes*, edited by Josef Fanta & Henk Siepel, 2010
- *Vanished ocean - how Tethys reshaped the world*, by Dorrik Stow, 2010.

**To submit a book for potential review on a sedimentary geology topic except for paleontology contact:**

A.J. (Tom) van Loon, Geological Institute, Adam Mickiewicz University, Maków Polnych 16, 61-606 Poznan, Poland. e-mail: tvanloon@amu.edu.pl

**To submit a book for potential review on a paleontologic topic contact:**

Jill Hardesty, Managing Editor, *PALAIOS*. e-mail: palaios@ku.edu

## Did you know that *JSR* and *PALAIOS* offer an Open Access option?

The SEPM Open Access Option means that access to the full text of your published paper is available to anyone free of charge at www.sepmonline.org, instead of being available only to journal subscribers. Authors may utilize this option to broaden readership, or Open Access may be a requirement of the funding agency.

As with other journals, however, SEPM Open Access is available only if the author pays some of the cost of publication. The rates for the Open Access Option for 2011 are $2000 per article for both *PALAIOS* and *Journal of Sedimentary Research*.

**Several items are of note:**

- The acceptance or rejection of any manuscript is not influenced by authors choosing the Open Access Option.
- Open Access Option affects only the online (official) version of an article and does not supersede any print color page charges, which are additional.
- Due to licensing agreements, SEPM Open Access Articles are not open access at GeoScienceWorld (www.geoscienceworld.org) but solely at the SEPM site (www.sepmonline.org)

## ATTENTION: SEPM Best Presentation Awards - 2011

SEPM will again for 2011 give all the meeting attendees the opportunity to nominate presentations for the SEPM Best Oral and the SEPM Best Poster Presentation given at this meeting. This will apply only to the SEPM sponsored session (those with SEPM listed as the first sponsor). SEPM Session chairs will remind the audience about the process during the session and signage outside the main session door will also indicate which sessions apply.

People will be able to nominate as many presentations as they wish using several methods:

- Online using a special webpage located with a link from www.sepm.org,
- Texting using a special phone number (918-809-3037) or with
- Printed ballots available during the meeting and returned to the SEPM Exhibit Booth.

To identify the presentation you are nominating please indicate the -

**PRESENTER "first several words of the title"**

**So if you see an outstanding SEPM presentation be sure to nominate it right away.**

Note that the SEPM Student Awards Poster Session will be judged separately using a small committee of appointed judges.

# SEPM ACTIVITIES
# 2011 HOUSTON ACE

Status of Short Courses is as of February 22-Contact AAPG registration for current details.

Note that the usual times for many events is a little later due to some special AAPG events on Monday and Tuesday.

**SEPM Field Trips (various dates)**

FT01-Central Belize Mixed Margin - SOLD OUT

FT06-Nonconventional Mudstone Reservoirs Field Seminar - SOLD OUT

FT07-Quaternary Depositional Systems of the East Texas - OPEN

**Saturday, April 9**

SEPM Council Meeting -9:00 am - 5:00 pm, Hyatt

SEPM Short Courses - 8:00 am - 5:00 pm, Hyatt

SC05-Sequence-Stratigraphic Analysis of Shales -SOLD OUT

SC09-Sequence Stratigraphy for Graduate Students - SOLD OUT

SC10-Seismic Geomorphology and Seismic Stratigraphy - SOLD OUT

SC11-GIS Analysis of Facies Patterns of Modern Carbonate Sands - Prof Seats OPEN

**Sunday, April 10**

SEPM Short Courses - 8:00 am - 5:00 pm, Hyatt except SC13

SC09-Sequence Stratigraphy for Graduate Students - SOLD OUT

SC10-Seismic Geomorphology and Seismic Stratigraphy - SOLD OUT

SC11-GIS Analysis of Facies Patterns of Modern Carbonate Sands - Professional Seats OPEN

SC13-Utilization of Conventional Core for Reducing Geologic Uncertainty, Convention Center, -OPEN

SEPM Exhibit Booth - Ice Breaker 5:00pm-7:30pm: Convention Center

**Monday, April 11**

AAPG/SEPM Student Reception - 5:30 pm-8:00 pm, Hilton Americas

SEPM Research Groups - 8:00 pm-11:00 pm, Hyatt

**Tuesday, April 12**

SEPM Research Symposium, (all day), Source to Sink-Evaluating the Interdepence of Depositional Systems, Convention Center

SEPM Luncheon, ~ 12:00pm-1:00 pm, The Search for Source Rocks on Mars, J. Grotzinger, Hyatt

SEPM Presidents Reception and Awards Ceremony, 8:00pm - 9:30 pm, Hyatt

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