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INSIDE: THE PROSPECT OF COMPACT ESTUARINE LAGERSTÄTTEN

PLUS: PRESIDENT'S COMMENTS
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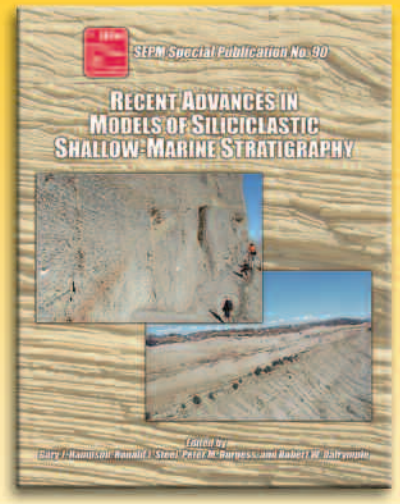

Edited by: Gary J. Hampson, Ronald J. Steel, Peter M. Burgess

Siliciclastic shallow-marine deposits record the interface between land and sea, and its response to a variety of forcing mechanisms: physical process regime, the internal dynamics of coastal and shelfal depositional systems, relative sea level, sediment flux, tectonic setting, and climate. These deposits have long been the subject of conceptual stratigraphic models that seek to explain the interplay between these various forcing mechanisms, and their preservation in the stratigraphic record. This volume arose from an SEPM research conference on shoreline-shelf stratigraphy that was held in Grand Junction, Colorado, on August 24-28, 2004. The aim of the resulting volume is to highlight the development over the last 15 years of the stratigraphic concepts and models that are used to interpret siliciclastic marginal-marine, shallow-marine, and shelf deposits.

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Edited by: Andrea Fildani, Stephen M. Hubbard, and Brian W. Romans
With contributions from: J.A. Covault, W.H. Crane, A. Bernhardt, Z.R. Jobe, D.A. Armitage, J.C. Fosdick, M.R. Shultz, J. Clark, D.R. Lowe, and S.A. Graham

This large format (11 x 17 inch) all color outcrop atlas and field guide was produced for the SEPM Research Conference held in Chile in February, 2009. It contains a wealth of information on the world class deep water outcrops of the Cretaceous of the Magallanes Basin in the Ultima Esperanza District, Chilean Patagonia. These outcrops have been the object of intense study for many years beginning with the early Chilean pioneer geologists, petroleum company researchers and most recently Stanford University, among others. With an introductory and overview section and then a more detailed contribution section, this book covers the significant outcrops in the region, including the Punta Barrosa Formation, CerroToro Fm., and the Tres Pasos Fm. Color photo mosaics, diagrams and maps show channel complexes, channel margin details, clastic injectites, sheet complexes, slope deposits, mass transport deposits and slope minibasin fills. With the detailed descriptions and overviews, the authors communicate how the deposits fit into the basin and the complex deep water architecture of this basin.

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Cover Illustration: Outcrop of the Ingersoll shale lens (between dashed lines), a compact estuarine lagerstätte (CEL) in the Cretaceous Eutaw Formation (eastern Alabama), and examples of fossil plants, amber, and fossil feathers contained therein.

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The Prospect of Compact Estuarine Lagerstätten

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ABSTRACT

A thin, laterally restricted but exceptionally fossiliferous clay lens–informally dubbed the Ingersoll shale–within the Upper Cretaceous Eutaw Formation, eastern U.S. Gulf coastal plain, provides insights regarding the origins of a class of fossil conservation lagerstätten we call compact estuarine lagerstätten (CELs). The Ingersoll shale accumulated in a restricted channel wherein preservation of a diverse paleoflora, amber with fossil inclusions, and feathers was favored by rapid tidal deposition of clay-rich carbonaceous sediments, anoxic pore waters, early diagenetic pyrite mineralization, and perhaps microbial sealing and/or replacement. Although potentially easily overlooked, similar compact lagerstätten formed by comparable taphonomic factors may be common in other estuarine successions. Exploration for additional CELs, guided by sequence stratigraphic principles, may yield other small but spectacular glimpses of life in the past.

COMPACT LAGERSTÄTTEN

Fossil conservation lagerstätten are sedimentary deposits that contain unusually well-preserved fossil biotas, commonly including soft parts (Seilacher et al., 1985; Allison, 1988). Given their importance to paleontology and sedimentary geology, it is critical to understand the processes by which they form and to develop criteria that can be used to prospect for additional exceptionally preserved fossil biotas (Bottjer et al., 2002; Allison et al., 2008).

Many conservation lagerstätten accumulated over extended time periods in sizeable depocenters–meromictic lakes (e.g., Allison et al., 2008), stratified marine basins (e.g., Seilacher, 1982), anoxic or hypersaline lagoons (e.g., Papazzoni and Trevisani, 2006), or large estuaries (e.g., Baird et al., 1986)–and, hence, are relatively thick and/or laterally extensive. However, conditions conducive to exceptional fossil preservation may develop in small and transient depocenters as well, forming relatively compact lagerstätten that, due to limited breadth and thickness, may go unnoticed. We posit that transgressive estuarine sequences hold particularly high potential for discovery of new compact lagerstätten, and we term these deposits compact estuarine lagerstätten (CELs). As demonstrated by the recently discovered Ingersoll shale, a small yet extraordinarily fossiliferous deposit in the Cretaceous (Santonian) Eutaw Formation of eastern Alabama (Bingham et al., 2008), the various processes that lead to exceptional preservation may act synergistically in certain restricted estuarine environments. Because associated facies typically occur as components of incised valley fills, the distribution of CELs formed in these settings can be predicted in the context of sequence stratigraphy.

INGERSOLL SHALE

Fossil Biota

The Ingersoll shale is characterized by a mainly terrestrial fossil biota, the most important elements of which are fossil plants, amber, and feathers. Plant remains are abundant and diverse (Fig. 1). Angiosperms are represented by forty-one leaf morphotypes as well as by rare flowers, seeds, and purported fruits, whereas gymnosperms and ferns are represented by leaves (seven morphotypes each), cones, and megaspores. Commonly, leaves are preserved intact and attached to stems, and cones and megaspores are preserved in three dimensions. Amber occurs as *in situ* rods within plant parts and as isolated detrital clasts. Amber clasts entomb plant debris, fecal pellets, fungal hyphae, and terrestrial arthropods, including mites, scale insects, and spiders (e.g., Fig. 2). The deposit has yielded the largest collection of feathers (cover photo and Fig. 3) derived thus far from North American Mesozoic strata; all are contour feathers, some with detailed anatomical features such as barbules and barbicels. The wealth of paleontologic information contained in this fossil assemblage is quite remarkable, especially when the limited volume of the host sediment is considered.

Stratigraphic and Paleoenvironmental Context

The Ingersoll shale, comprising dark gray, carbonaceous, pyritiferous clay with subordinate sand and silt laminae towards the base, forms a lenticular body with maximum thickness and width of 80 cm and 30 m, respectively. This small lens occurs in the lower part of the Eutaw Formation, which in eastern Alabama and western Georgia accumulated in a mixed-energy estuarine system (Frazier, 1997; Savrda and Nanson, 2003), approximately 1 m above the disconformable contact with the underlying fluvial Tuscaloosa Formation (Fig. 4). Both the base and top of the Ingersoll shale are erosional. The base truncates *Ophiomorpha*-bearing, cross-stratified, coarse-grained sands and planar-bedded sands and clays deposited in tidal-channel and tidal-flat settings. The lens is overlain by highly bioturbated, carbonaceous sandy muds and muddy sands that accumulated in a proximal estuarine central bay. A firmground ichnofossil assemblage developed in the upper 5 cm of the lens reflects truncation at the top of the Ingersoll shale in response to bay-shoreline ravinement during transgression. Based on geometry, facies associations, and sedimentologic characteristics, we interpret the Ingersoll shale to have accumulated in a restricted tidal channel in the lower reaches of a bayhead delta.

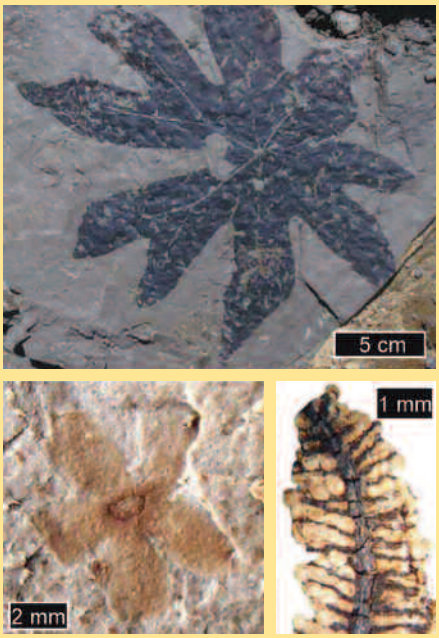

Figure 1. Examples of well-preserved fossil plants in the Ingersoll shale, including a large intact angiosperm leaf (top), small flower (bottom left), and a water-fern sporocarp containing mega- and microsporangia (bottom right).

Environmental and early diagenetic conditions and fossil preservation in the Ingersoll shale are addressed further in the following discussion of taphonomic factors. We refer the reader to Bingham et al. (2008) for details.

PRESERVATION MECHANISMS AND THEIR ROLE IN ESTUARIES

Factors that may contribute to exceptional preservation in conservation lagerstätten include (1) rapid burial, particularly by muds; (2) oxygen deficiency; (3) early diagenetic mineralization; (4) microbial processes, including replacement or sealing of organic remains; and (5) entombment in relatively sterile media (Seilacher et al., 1985; Allison, 1988; Bottjer et al., 2002; Briggs, 2003). These factors are not mutually exclusive, and their importance varies among lagerstätten. In the Ingersoll shale, all of five factors played a role in fossil preservation. Predictably, multiple preservation processes have similarly interacted to form as-yet unrecognized compact lagerstätten in estuarine settings comparable to that of the Ingersoll shale.

Rapid Burial

Rapid burial insulates organic remains from the destructive effects of bottom currents, scavenging, and bioturbation. For many lagerstätten, burial was caused by episodic deposition of tempestites, turbidites, other gravity flows, or volcanic ash (Brett et al., 1997). However, in some settings, including certain estuarine environments, steady background accumulation rates may be sufficiently high to bury and conserve organic remains.

Estuaries form by transgressive inundation of fluvially incised coastal plains (Dalrymple et al., 1992). Drowning of incised valleys creates accommodation space, which is then rapidly filled mainly by river-derived sediments. Although sediment-accumulation rates in estuaries are not everywhere adequate to enhance preservation, prerequisites may be met in environments characterized by both unusually high sedimentation rates and little or no reworking. Such environments include intertidal and shallow subtidal settings prone to accumulation of tidal rhythmites, which reflect continuous deposition of mm-scale graded packages in response to diurnal or semidiurnal tidal cycles (Kvale et al., 1999).

Tidal rhythmite deposition, previously implicated as a key control on fossil preservation in other conservation lagerstätten (e.g., see Feldman et al., 1993), played an important role in the small Ingersoll tidal channel. Well-developed tidal rhythmites in the lower, sandier parts of the Ingersoll shale (Fig. 5) indicate virtually uninterrupted sedimentation apace with diurnal tidal cycles at rates as high as 1 m/yr (Bingham et al., 2008). Deposition at these rates likely was the most important factor contributing to the preservation of delicate feathers and intact plant remains in the Ingersoll shale lagerstätte.

Preservation potential of fossil remains is greatest when the burial medium is mud, particularly clay. Clayey sediments more readily cast structural details of buried remains and may produce soupy substrate barriers that inhibit burrowing and scavenging by benthic organisms. Muds and mudrocks are also less permeable, limiting the extent of leaching and fossil degradation in deeper burial diagenetic and post-uplift weathering regimes.

Central zones of estuarine systems (e.g., central bays in wave-dominated or mixed energy estuaries) are characterized by energy minima (Dalrymple et al., 1992) and, hence, are most prone to the accumulation of muds. In the case of the Ingersoll shale, rapid filling of the tidal channel by clay-dominated sediment occurred in seaward parts of a bayhead delta when transgressive expansion of the central bay resulted in decreased hydraulic gradients and lower flow regimes in the channel. Not surprisingly, feathers and intact plant parts are most common in clay-dominated middle and upper parts of the Ingersoll shale.

Oxygen Deficiency

Low dissolved oxygen concentrations favor fossil preservation in aquatic settings by limiting or precluding destructive activities of benthic organisms (scavenging, bioturbation, substrate irrigation), and by mediating early diagenetic mineralization. For many lacustrine and marine lagerstätten, deposition occurred beneath anoxic *bottom waters* formed by long-term thermohaline basin stratification. Although some estuarine systems may experience periodic stratification and hypoxia (e.g., Officer et al., 1984), they normally are not prone to development of stable anoxic bottom-water masses. Nonetheless, estuarine subenvironments may be characterized by anoxic *pore waters*, which can enhance preservation.

Development of reducing substrate pore waters beneath a shallow, oxygenated water column requires high organic influx. Organic production in estuaries is typically high, particularly in climatic regimes that support coastal marsh and swamp

Figure 2. Amber clasts (top) and a scale insect entombed in amber (bottom) from the basal part of the Ingersoll shale.

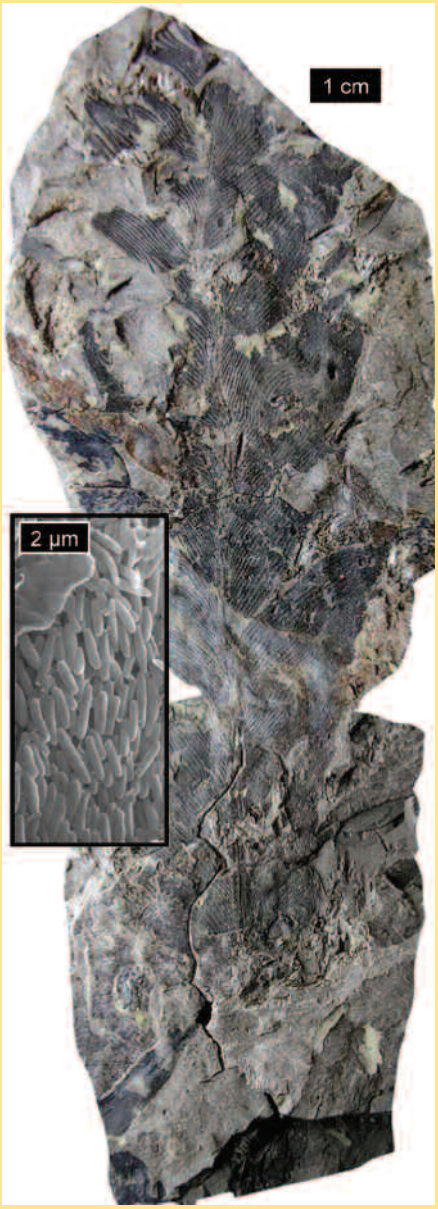

Figure 3. Composite image of the largest feather recovered from the Ingersoll shale. Inset (SEM of feather) shows minute, carbonized rod-shaped bodies. Do these reflect sealing/replacement by bacteria? Or, are they preserved feather pigment bodies?

vegetation, and organic accumulation rates can be considerable in relatively low-energy, mud-dominated subaqueous settings. Consequently, microbial degradation of sedimentary organic matter may result in anoxic pore waters that inhibit infauna and limit bioturbation (Feldman et al., 1993).

The impact of high organic supply on substrate redox conditions in estuarine subenvironments is manifest in the Ingersoll shale. Organic contents are high (1.16 to 3.62%), reflecting input of mostly terrestrial plant detritus from adjacent swamps but also a contribution from marine plankton (e.g., dinoflagellates). Consequent development of anoxic conditions at or just below the sediment-water interface is indicated by abundant early-formed pyrite and general lack of bioturbation. The bulk of the Ingersoll shale contains only narrow (1-2 mm), shallowly emplaced (<1 cm), flattened burrows produced by sediment-swimming worms. These ill-defined ichnofossils locally penetrate and disrupt leaf fossils. However, sulfidic pore waters in concert with highly fluid clay substrates precluded colonization of the channel bottom by a deeply burrowing and destructive infauna.

Diagenetic Mineralization

Exquisite preservation in conservation lagerstätten is commonly tied to precipitation of early diagenetic minerals–e.g., phosphate, silica, carbonates, or pyrite–that entomb, replace, or permineralize organic remains (Briggs, 2003). The nature of early diagenetic mineralization depends on water chemistry (e.g., salinity, redox conditions) and availability of reactive organic matter. Mineralization of fossils in estuarine lagerstätten commonly entails sideritization or pyritization, the relative importance of which is controlled by salinity. Preservation of soft parts within siderite nodules, such as those in Mazon Creek-type deposits, is commonly attributed to the influence of relatively fresh, Fe-rich waters and limited sulfate supply (e.g., Baird et al., 1986). In contrast, pyritization is more prevalent in substrates overlain by marine waters and characterized by open diagenetic systems that provide an unlimited supply of sulfate for microbial sulfate reducers (Brett and Allison, 1998).

Ingersoll shale substrates clearly were most influenced by sulfate-rich marine waters. Siderite has not been detected, but pyrite occurs throughout the Ingersoll shale as nodules and disseminated framboids. Compaction of clay around pyrite nodules, along with pyrite sulfur isotopic evidence (see Bingham et al., 2008), indicates that sulfide precipitation occurred very rapidly at shallow substrate depths in open connection with normal marine channel waters. Although pyritization of fossils in the Ingersoll shale is not pervasive, early mineralization was important locally in conserving three-dimensional aspects of plant reproductive bodies (cones and megaspores) and parts of some feathers.

Microbial Processes

Microbial processes are generally required to induce anoxia in bottom and pore waters, and they govern precipitation of early diagenetic minerals. Moreover, microbes may play more direct roles in fossilization. Bacterial or algal mats, formed atop substrates or in the water column before descending to the bottom, may coat organic remains and thus form protective barriers or seals against physical and chemical degradation (e.g., Seilacher et al., 1985; Harding and Chant, 2000).

The extent to which bacterial sealing or replacement contributed to preservation of Ingersoll shale fossils is still under investigation. Previously, we reported evidence indicating that bacteria played a role in preservation of Ingersoll feathers (Bingham et al., 2008). SEM studies show that feather barbules and barbicels are now composed of small (~1 µ long), carbonized, elongate ovate structures (Fig. 3 inset). Following interpretations made for similar structures observed in feathers from the Eocene Messel Shale (Davis and Briggs, 1995), we inferred that Ingersoll feathers were coated or replaced by bacterial mats. The affinity of these structures, however, requires further consideration in light of the recently demonstrated resemblance between bacteria and melanosomes (pigment-bearing organelles) in modern and fossil feathers (Vinther et al., 2008).

Amber Accumulation

Amber serves as an excellent medium for preservation of any small organic feature that happens to be trapped in viscous and sticky plant exudates. Resins exuded in subaerial environments may preserve the remains of plants, microbes, insects, and other arthropods, terrestrial or aerial vertebrates, and traces of organism activity, such as fecal pellets, spider webs, and nests (e.g., see Poinar, 1993, 1998; Grimaldi et al., 2000). Fossils mummified in amber are typically rendered in three dimensions, and their microscopic anatomical detail, including labile tissues (e.g., Henwood, 1992), is commonly retained.

Formation of amber-rich deposits requires (1) a terrestrial plant community that includes common resin-producers and (2) a mechanism for transport and hydraulic concentration of resin clasts or resin-bearing plant parts in depositional settings that are conducive to amber preservation (see Martínez-Delclòs et al., 2004). Both of these requirements likely were met with

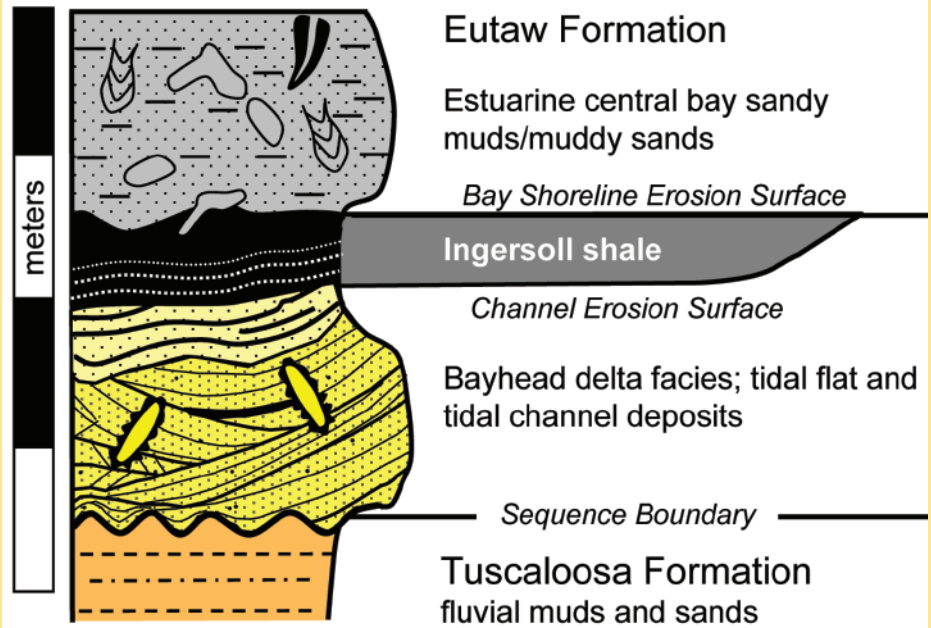

Figure 4. Schematic representation of the Ingersoll shale lens and bounding facies in the lower part of an incised valley fill, Eutaw Formation. The Ingersoll shale accumulated in a restricted tidal channel in a lower bayhead-delta setting during transgressive expansion of an estuarine central bay. Amber clasts are most abundant in the basal, sandier part of the lens, whereas intact plant parts and feathers are prevalent in overlying clays.

some frequency in Cretaceous and younger estuarine environments, particularly in bayhead-delta settings. Depending on age, climate, and vegetation type, coastal swamp vegetation could have produced copious amounts of resin, and resin masses could have been concentrated as bed load in the fluvial and/or tidal channels. Preservation of accumulated resin masses would be enhanced by rapid burial beneath organic-rich sediments.

Requirements for amber accumulation and preservation were satisfied in the Ingersoll estuarine system. Resin-producing trees, most likely conifers in the family Cupressaceae, in coastal swamps supplied amber clasts and amber-bearing plant parts that subsequently were transported to the tidal channel. Amber clasts, typically in the size range of 1 to 15 mm (Fig. 2), are most abundant on or within sand laminae in the lower parts of the lens, reflecting transport and concentration on the channel bed during relatively high-energy phases of tidal cycles. Most Ingersoll amber clasts are transparent and lack chalky crusts that form by weathering and oxidation. This reflects rapid burial by clay-rich laminae and the development of reducing conditions in pore waters during later phases of channel filling.

Amber clasts in some deposits have experienced a complex history of transport and may be age and facies incongruent (Martínez-Delclòs et al., 2004). In contrast, amber clasts that accumulated in small estuarine channels such as that filled by the Ingersoll shale likely had relatively simple and short transport histories. Consequently, amber and fossil inclusions more reliably reflect the plants and terrestrial organisms that occupied contemporaneous neighborhoods in the estuarine system.

The Five Processes Combined

As shown above, estuarine systems provide mechanisms for rapid deposition of fine-grained, organic-rich sediment. Resulting oxygen deficiency limits biological disruption and promotes microbial growth and early diagenetic mineralization. These coastal settings also may add preservation traps in the form of land-plant generated amber, also preserved by rapid burial and reducing conditions. The fortuitous cooperation of these processes in small ephemeral depocenters results in CELs.

PROSPECTING FOR COMPACT ESTUARINE LAGERSTÄTTEN

The Ingersoll shale exemplifies how conservation lagerstätten of limited areal extent and thickness can be formed in relatively isolated, transient estuarine depocenters. Another example of a compact lagerstätte formed in comparable settings is provided by the Triassic Grès à Voltzia (NE France). Therein, fossils are well preserved in small carbonaceous and pyritiferous clay lenses that record rapid deposition in stagnant temporary tidal pools formed during a fluvial-to-marine transition (Briggs and Gall, 1990). Unlike the Ingersoll shale, the latter clay bodies, which may qualify as CELs, contain arthropods, fish, and wholly soft-bodied organisms, reflecting the potential variability of biotas preserved in estuarine deposits.

Isolated environments predisposed to rapid accumulation of organic-rich, reducing clayey sediments undoubtedly have recurred in many ancient estuarine systems. Hence, we contend that CELs may be common in estuarine successions but, due to their small volume and superficially unremarkable field expression, they easily escape detection. Notably, the Ingersoll shale lagerstätte may have gone unrecognized were it not for the few curious hammer blows by one of us (PSB) that serendipitously yielded the first Ingersoll feather.

How can we prospect for as-yet undiscovered CELs? A regional sequence stratigraphic framework should provide a starting point for exploration. Efforts should be directed at lowstand incised valley fills (IVF), wherein transgressive estuarine facies are most commonly represented. Within IVF, the search likely will be most fruitful if focused on bayhead facies associations, which predictably would be

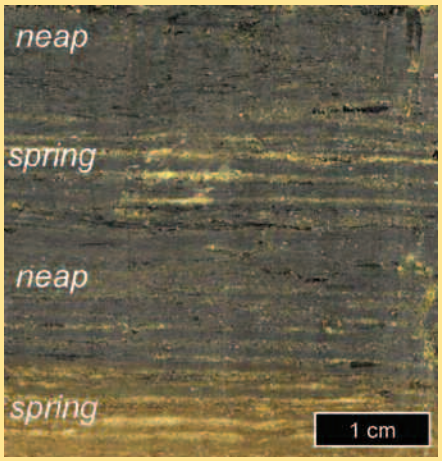

Figure 5. Tidal rhythmites in the lower part of the Ingersoll shale. Systematic variations in sand-clay couplet thickness reflect neap-spring tidal cyclicity in a diurnal tidal system.

more common and better preserved in lower and landward parts of estuarine packages. Carbonaceous muds and mudrocks within these associations obviously represent the most interesting targets. Our own search for hidden CELs in other Gulf coastal plain Cretaceous successions has already begun. Find those estuarine carbonaceous clay bodies, draw your hammers, and dig in…..carefully!

ACKNOWLEDGEMENTS

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SEPM ELECTION RESULTS

2009 - 2010 Council

President-Elect: Paul (Mitch) Harris, Chevron-Energy Technology, California
Councilor for Sedimentology: Evan Franseen, University of Kansas, Kansas
Councilor for Paleontology: Nancy Engelhardt-Moore, Devon, Texas
Co-Editor Special Publications: Brian Ricketts, New Zealand

...and thanks to the outgoing Council members for their service
Dale Leckie, (Nexen), Canada
James A. MacEachern, (Simon Fraser University) Canada
Lynn Soreghan, (University of Oklahoma) Oklahoma
Don McNeill, (University of Miami), Florida

…and to the other candidates who consented to run
Vitor Abreu, ExxonMobil, Texas
John-Paul Zonnefeld, University of Alberta, Canada
Morgan Sullivan, Chevron, California

...and a continuous welcome to all potential volunteer members who serve to make SEPM the best it can be. These new council members will officially take office in June at the Denver Annual Meeting.

PRESIDENT'S COMMENTS

Thank You!

Thank-you to the SEPM members who responded to my letter that accompanied the December *Sedimentary Record* and the accompanying Membership brochure for distribution. Several of you appear to have taken heed and gone out to encourage other geologists to join our society. The accompanying graph shows a doubling of new members for January. One would like to believe that this doubling of new members is directly due to your efforts of soliciting fellow colleagues and students. Keep it up. If you need more brochures, Howard Harper will send them to you.

Year	New Members in January
2006	32
2007	32
2008	26
2009	50

Another outcome of the mail out is that Herman Darman from Shell in the Netherlands has offered to act as an SEPM promoter at Dutch Petroleum Geological Society meetings. This is being co-coordinated with André Strasser, SEPM's International Councilor. SEPM, working with Andre and Howard Harper, is also looking into having a strong presence at the SEPM Central European sections (Section President Matthias Hinderer) in Krakow, Poland, and a booth in China in October at the YES (Young Earth Scientists) Chinese Earth Science Conference. SEPM is also considering, with its China Ambassadors, Daidu Fan at Tongji University, Shanghai and Xiumian Hu at Nanjing University, Nanjing, holding a smaller China research conference or activity which might attract the Young Earth Scientists and/or something at the next AAPG ICE in Brazil. What other global initiatives such as this can Membership assist with?

Along the same lines, and mentioned in an earlier editorial, Abhijit Basu, from Indiana University, has made contact with several colleagues in geological societies from India. The India Global Ambassador, Santanu Banerjee, Department of Earth Sciences at IIT Bombay in Mumbai and Abhijit have contacted several individuals who are interested in establishing relationships with SEPM and holding future joint conferences. Howard and I are pursuing these. Santanu has been promoting SEPM at several meetings across India. As a consequence, membership has already increased significantly in 2008 and he has committed to 100 members for 2009.

In January, SEPM struck an ad-hoc SEPM Book Business Committee with responsibility to evaluate SEPM's full cycle publishing, evaluating all components of its publishing and sales efforts. John Snedden, who is currently SEPM Secretary Treasurer, chairs the committee, which is to last only one year.

SEPM Special Publications used to consistently generate positive net revenue for the society, yet this is not the case anymore. Some questions that the committee will address include:

1. Should SEPM focus more on digital publishing and produce more CD's?
2. For academics to publish in SEPM publications, how can the Society ensure that they get maximum recognition for their contributions as fully refereed publications?
4. Can we be more proactive in the process of soliciting publications? Is the process anticipating the needs of the society?
5. How should SEPM publication selection/media adjust to generation X and Y (and eventually Z) raised in the Age of the internet?
6. Should sponsorship extend to publications on a more regular basis? Does that disturb the perceived intellectual purity of our publications?

SEPM runs very efficiently, looking after the needs of its ~3500 members because of Headquarters staff. Dr. Howard Harper, a career geologist, is our Executive Director. Theresa Scott is the Society's Business Manager and Associate Director. Michele McSpadden makes sure that our book publications get produced and co-ordinates online access for members. This is an expanded role for Michele, taking over some of Bob Clarke's duties so he can concentrate on the graphical type setting and copy editing end of the book publishing. Melissa Lester and Jill Hardesty are the journal (*JSR* and *PALAIOS*) Managing Editors, respectively. New to SEPM, Janice Curtis is the Membership Services Coordinator and Edythe Ellis continues as SEPM's Administrative Associate, handling book orders and making sure things run seamlessly in the background. Be sure to contact any of SEPM's staff for your society needs or questions in general.

Finally, in the current economic climate, SEPM Headquarters and the HBC, are being watchful and have taken some actions to ensure SEPM operating assets and equity are invested as judiciously and safely as possible. Theresa Scott, SEPM's Associate Director and Business Manager, is effectively managing this. Currently, SEPM utilizes several different banks to hold the operating cash. This allows SEPM to stay within the FDIC (Federal Deposit Insurance Corporation) insured amount. Should any of the banking institutions close, then SEPM will still have sufficient ready cash to operate and all funds are insured by the federal government. SEPM HQ has also acquired an SEPM purchase card (credit card) that pays back cash for purchases and some new technology that lets SEPM HQ scan in received checks to directly process and deposit them without physical trips to the bank.

Dale Leckie, President

Sedimentary Geology Division

Geological Society of America

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

I hope 2009 is starting off on a positive note for all you. In this issue of the SGD Newsletter, I want to highlight events sponsored by SEPM and SGD at the 2008 GSA Annual Meeting in Houston and look forward to events of interest to sedimentary geologists on the 2009 calendar, review the state of the Sedimentary Geology Division and call for nominations for SGD management board officers in 2009, and present other news and information pertinent to the sedimentary geology community.

2008 GSA Annual Meeting and Looking Forward to 2009

The 2008 GSA Joint Annual Meeting was well attended by sedimentary geologists. I hope you were there to enjoy it! The Sedimentary Geology Division hosted two events: the "Seds and Suds" Forum and Icebreaker, co-sponsored by SEPM and Nexen, Inc. on Saturday, October 4, and the Joint Sedimentary Geology Division and Limnogeology Division Business Meeting and Awards Reception, also sponsored by SEPM, on Monday, October 6. The Seds and Suds event drew approximately 70 people for beer and light snacks, which was followed by a spirited debate on the value of field data and computer simulations in addressing problems in sedimentary geology. A summary of the discussion is given below by John Holbrook. We thank the efforts of the two panelists, **Walt Snyder** and **James Syvitski**, who enlightened the audience with their respective perspectives. *If you have a topic in sedimentary geology that you would like to have discussed at an upcoming **Seds and Suds Forum***, please contact either **John Holbrook** or **Dan Larsen**.

Chair Dan Larsen and Vice-Chair John Holbrook "hamming it up" while awarding student door prizes. Photo courtesy of Kevin Bohacs.

The Joint Sedimentary Geology Division and Limnogeology Division Business Meeting and Awards Reception welcomed another 60 or so attendees, most of whom enjoyed a free beverage of their choice and munchies (many thanks again SEPM!) After the Limnogeology business meeting and announcement of the Kerry Kelts Research award winners, the Sedimentary Geology Division events transpired. The Sedimentary Geology Division was able to offer three Student Travel awards (see awardees below), three Student Poster awards (see awardees listed below), and the Student Research Award, which was presented to **Geoff Gilleaudeau** at the University of Tennessee at Knoxville. The Laurence L. Sloss awardee for 2008 is **Peter DeCelles**. In addition, door prizes were awarded to several students attending the awards reception. Many thanks are also extended to **John Holbrook**, **Paul Link**, and our JTPC representatives, **Julie Bartley** and **Mark Kulp**, for all of their help in making the Sedimentary Geology sessions and events a success.

Laurence L. Sloss Award winner Peter DeCelles.

We also welcome sponsors for the SGD and Limnogeology Divisions Joint Business Meeting and Awards Reception at GSA in Portland.

Student Travel Awards:

Efe Erukanure Jr., Montclair State University
Ron Tingook, University of Texas-Arlington and University of Alaska-Fairbanks
Abigail Langston, University of Florida

Student Poster Awards:

Catherine (Kate) MacLaurin, Simon Fraser University
Zishann Khan, University of Ottawa
Paul Knorr, University of South Florida

GSA SGD Student Research Award winner Geoff Gilleaudeau.

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, Paul Link at linkpaul@isu.edu.

The setting for the 2009 GSA Annual Meeting, Portland, Oregon, couldn't be better for sedimentary geologists interested in sedimentary processes in dynamic tectonic settings. The lists of proposed technical sessions, field trips, and short courses was not finalized at the time of press, but 17 topical session and 6 field trip proposals accepted sponsorship by SGD.

Downtown Portland with Mount Hood looming in the background.

Many field trip destinations will likely be of interest to sedimentary geologists, including Mount Hood, the Channeled Scabland, the John Day Formation, and sedimentary successions within and overlying accreted tectonic terranes. Please check the GSA web site over the next few months for information on sessions and field trips that are selected for the annual meeting, as well as events at section meetings.

Many other meetings and field conferences are slated for 2009. SEPM has two research conferences slated for early 2009 followed by their annual meeting in association with the AAPG annual convention and exhibition in Denver in June. Please visit www.sepm.org or www.aapg.org for more information.

Numerous field trips and sessions will be offered at the SEPM/AAPG meeting on classic Rocky Mountain locations and hot areas for oil and natural gas development. With the continued expansion of petroleum exploration and development, AAPG is also offering an impressive list of short courses, field seminars and research conferences. For international conferences of interest to sedimentary geologists, visit the International Association of Sedimentologists (IAS) website at www.iasnet.org. As always, this is our science, so get involved!

For more links to societies and organizations of interest to sedimentary geology, visit http://rock.geosociety.org/sed/SGD.html.

State of the Sedimentary Geology Division

The Sedimentary Geology Division is financially healthy with $13,721 in the account as of June, 30, 2008. Most of the expenses incurred on an annual basis by the SGD are for events at the Annual Meeting and awards. The membership of the SGD increased by 6% over 2007 membership to reach 1181 affiliates. Membership growth in recent years has been most dramatic among the professional and student affiliates, with increases of 11% and 21%, respectively, between 2006 and 2007. The increase in student membership seems to parallel recent hiring trends in traditional employment areas for sedimentary geologists, such as fossil fuels and mining (see Science, Aug. 8, 2008). The overall increase in SGD membership suggests that sedimentary geology is increasing in prominence amongst GSA membership, in general. I hope these positive trends energize the membership of SGD to propose and present more innovative and stimulating science at both the annual and regional GSA meetings, as well as driving awareness of sedimentary geology's significance in the Earth Sciences. The SGD would also like to get more involved with sponsorship of events at GSA section meeting; please contact **Mike Pope** (mcpope@wsu.edu) for more information.

The call is open for suggestions for future discussion topics at Seds and Suds. If you have a topic you feel fits this bill, please contact John Holbrook at holbrook@uta.edu.
We also welcome sponsors for the next event at the 2009 GSA Annual Meeting in Portland.

Seds and Suds Icebreaker and Forum continues tradition at 2008 Houston GSA

Sponsored by: nexen

The third annual Seds and Suds icebreaker and forum continued to be a popular jumping-off point at the 2008 GSA Annual Meeting in Houston for friends of the sedimentary archives. Approximately 70 students, faculty, and members of industry attended the icebreaker, and conversed over free libations at this annual event jointly offered by GSA-SGD and SEPM. Once again, we sincerely thank NEXEN, Inc. for their generous, and much-appreciated, financial support for this gathering. Thanks to the sponsors and the interest of the sedimentary community, Seds and Suds remains a growing tradition.

The icebreaker was followed by our annual forum of hot topics. This year the forum topic was "Data and model results: Opposing views of the same problem?" Discussion centered about the means by which the applications of community computer models and shared databases are shaping the way we do science. The discussion included 35 participants and was led by two panelists who each have unique perspectives on both the data and modeling ends of this debate. The panelists were **James Syvitski** (Fellow and Former Director of INSTAAR; Executive Director of CSDMS; Professor of Geological Sciences, Univ. of Colorado at Boulder.) and **Walt Snyder** (Director of PaleoStrat data repository; former Division Director NSF; Professor of Geological Sciences, Boise State University). Below are brief minutes from the forum.

The forum began with statements from the panelists, followed by questions and answers from the group. Walt initiated by pointing to the growing geoinformatics effort to archive data from individual field projects into larger community databases (e.g., PaleoStrat). These community databases are the required feed supply needed to run large Earth-system models. Challenges to developing these community databases include: retention of credit for the collector of discrete data sets within larger community pools; retaining privacy for sensitive active data sets; getting archive/legacy and new data into consistent formats; and incorporating feedback from data collectors. Many of these issues are being addressed through improvements to database management computer codes and pressure by funding agencies to require digital archiving into public databases.

James followed with discussion of recent movements in the modeling world. He noted that the geosciences, in general, lag significantly behind the other physical sciences with regard to the use of high-speed computing to model systems. This is partly because of the manner in which we educate new students, but also because of the lack of open exchange for sophisticated models. Modelers in the past have kept codes they have written with public funding, and commonly used them for profit. New policies by funding agencies require that computer models created in the course of publically funded research must be made available to the public. The Community Surface Dynamics Modeling System (CSDMS) is an effort to generate a central digital storehouse for these and other available models that would serve the sedimentary community. James stressed that the intention is not to generate a single "ubermodel" for sedimentary systems, but instead to develop a system of discrete modules that can simulate various surface processes. The intention is to modify legacy and new computer codes into a language-neutral and user-friendly model collection from which field geologists and others could easily assemble the specific collective model needed to address their particular questions. The modeling process would thus become more transparent and more accessible to those collecting the field and lab data. This ability of the data collectors to access and run models will provide a new generation of critical model validation.

A series of questions and discussions ensued. These are broadly summarized and paraphrased here.

What are some examples of questions that require these new community databases and models?

James noted a sea-floor example. He commented that the topography of the sea floor is constantly changing because of sedimentation and erosion. The Navy, in particular, needs detailed and reliable models to predict these changes. Walt noted standing issues in sedimentology, such as the time relationship of sequence-stratigraphic surfaces, that may require community databases to fully address. Ethan Grossman of Texas A&M argued that well-developed databases already exist for the marine record.

How will evolution of these models and databases change the way we collect data?

James pointed out how the integration of community models generated numerous questions in the climate community that later drove data collection and funding, as well as raised the profile of this science to new levels. He would expect the same to occur for sedimentary geology. Likewise, projects that incorporate community models as a component may require more collection of metadata than previous efforts. Walt noted that the collection of data in standard formats that are more compatible with entry into community databases is an evolving process.

How is quality control managed in databases?

The database managers try to avoid being gatekeepers. More data in the databases generally are considered to make the existing data more robust.

At what stage is the CSDMS at this time?

James said they are mostly accumulating legacy codes and building toward the stage of making the codes more efficient.

What will drive continued growth of community models and databases?

Using them!

The call is open for nominations of officers for the Sedimentary Geology Division Managements Board:
Secretary-Treasurer
Vice Chair
Please submit nominations by June 1, 2009, to Paul Link at linkpaul@isu.edu.

SGD Personnel and Committee Assignments for the 2008-2009 Year.

- **Daniel Larsen** is the Chair.
- **John Holbrook** is the Vice-Chair.
- **Paul Link** is the Secretary/Treasurer.
- The Joint Technical Program Committee (JTPC) representatives for SGD are **Troy Rasbury** and **Mark Kulp**.
- **Kelly Dilliard** is the web manager.
- The Sloss Award Committee comprises: **Mike Arthur**, **Peter DeCelles**, **Gerald Friedman**, **Bob Garrison** (chair), **Tom Hickson**, and **Teresa Jordan**.

Kelly Dilliard, our SGD webmaster, has done a great job updating the Division web site. If you have any suggestions for her regarding information that the SGD web site should contain or useful links for the sedimentary geology community, please contact her at kedilli1@wsc.edu.

SEPM Short Courses and Field Trips at the Denver Annual Meeting, June, 2009

For details and registration go to http://www.aapg.org/denver/

SHORT COURSES

Short Course #12 **3-D Seismic Interpretation for Geologists** - Instructor: Bruce Hart. Date: June 6-7

Short Course #13 **Introduction to the Petroleum Geology of Deepwater Settings** - Instructor: Paul Weimer. Date: June 6-7.

Short Course #14 **Seal and Reservoir Flow Barrier Analysis and Prediction** - Instructors: William Almon, William Dawson, Fabian Dque-Botero and Lisa R. Groggins. Date: June 6-7.

Short Course #15 **Sequence Stratigraphy for Graduate Students** - Instructors: Vitor Abreu and Jack Neal. Date: June 6-7.

Short Course #22 **Recognizing Continental Trace Fossils in Outcrop and Core: Implications to Interpreting Environments of Depositional and Significant Surfaces** - Instructor: Stephen T. Hasiotis. Date: June 11-12.

FIELD TRIPS

Field Trip #07 **Carbonate Reservoir Characterization: From Rocks to Models using Sequence Stratigraphy, Paradox Basin, Utah, U.S.A.** - Leaders: Rick Sarg, Jim Weber and Bob Clarke. Dates: June 2-5.

Field Trip #08 **Development of an Anomalous Clastic Wedge: A 400 km "Sink-to-Source" Transect through Upper Cretaceous Cordilleran Foreland Basin Fill, Utah and Colorado, USA** - Leaders: Jennifer Aschoff and Ron Steel. Dates: June 4-6

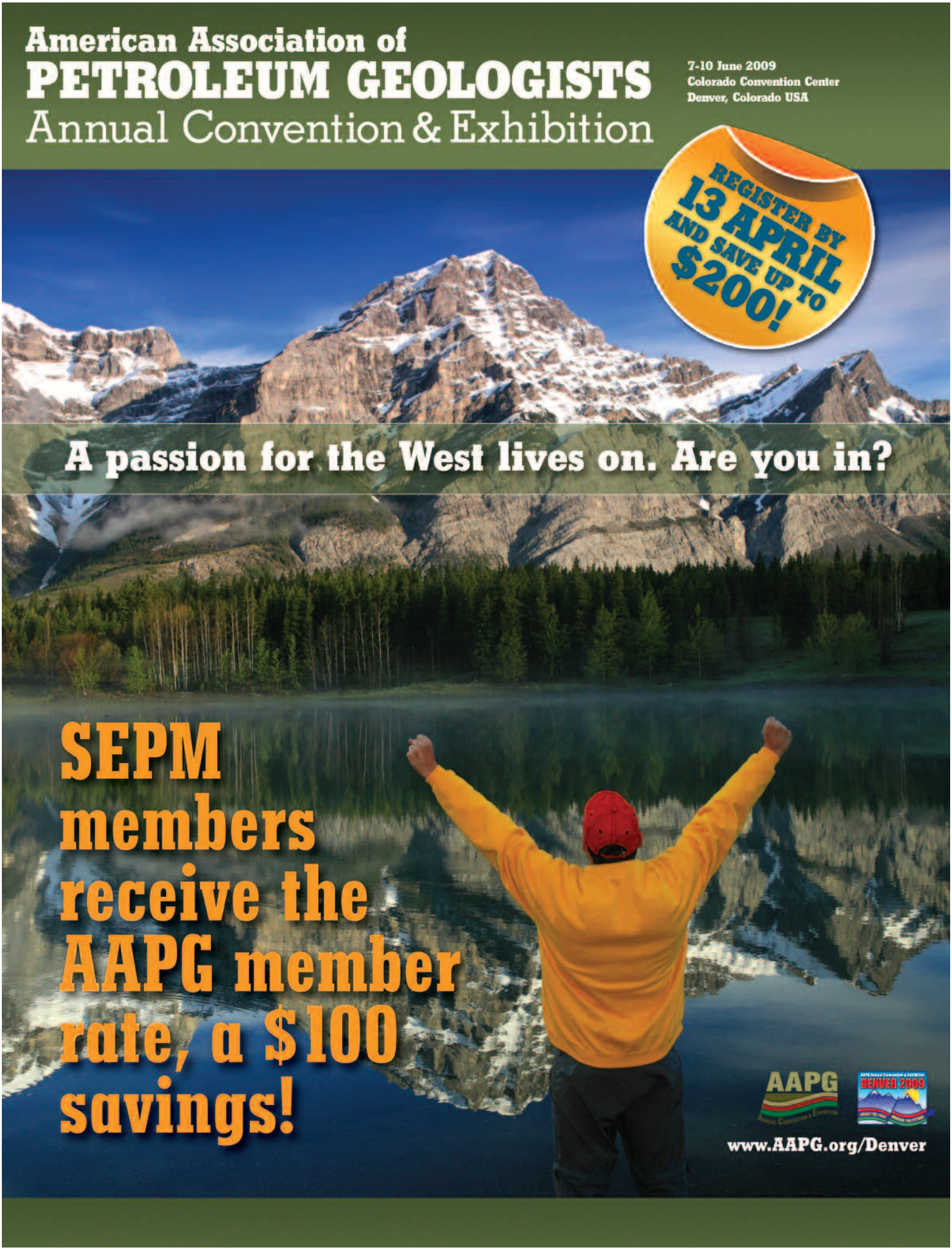
Field Trip #09 **Reconsidering sequence boundaries and reservoir architecture: A field and flume and source to sink look at emerging models for sequence development, Cretaceous Muddy/Dakota Group, Colorado** - Leaders: John Holbrook and Neal Alexandrowicz and Nikki Strong. Date: June 4-6.

Field Trip #10 **New Insights into the Climatic and Tectonic History of the Ancestral Rocky Mountains, late Paleozoic western tropical Pangaea** - Leaders: Lynn Soreghan, Dustin E. Sweet, Kristen R. Marra and Katherine D. Moore. Date: June 4-6.

Field Trip #11 **Shelf to basin changes in stratigraphic architecture of prograding shelf-slope-basin systems: Lewis Shale and Fox Hills Sandstone, Wyoming** - Leaders: David Pyles, Roger Slatt, and Charlie Rourke. Date: June 4-6.

Field Trip #12 **Iles-Williams Fork Field Trip, Southern Piceance Basin, Colorado** - Leaders: Rex Cole, Matt Pranter, Steve Cumella, and Mark Kirschbaum. Date: June 5-7.

Field Trip #18 **A Shore-to-Basin Transect Through the Mancos Shale Mud Belt: Sedimentological Controls on Lithofacies Variability in Unconventional Hydrocarbon Plays** - Leaders: Simon Pattison, Kevin Taylor, and Joe Macquaker. Date: June 11-13.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