SEPM President’s Reception and Awards Ceremony

DATE: TUESDAY, APRIL 20
TIME: 7:00-9:30 P.M.
LOCATION: THE FAIRMONT HOTEL REGENCY BALLROOM

SEPM President John B. Anderson and his wife Doris invite you to an evening of celebration to honor the 2004 awardees of the Society for Sedimentary Geology (SEPM).

THE AwarDEES ARE:

Twenhofel Medal
Emiliano Murti
Pettijohn Medal
H. Edward Clifton
Moore Medal
Isabella Premova-Silva
Shepard Medal
Richard Sternberg
Wilson Medal
not awarded in 2004
Honorary Membership
John M. Armentrout
Distinguished Service Award
Gerald M. Friedman
Outstanding Paper in JSR, 2002:
Eugene C. Rankey
Outstanding Paper in PALAIOS, 2002:
C. Dupraz, and A. Strasser
Excellence of Oral Presentation, 2003:
R. Meyer
Excellence of Poster Presentation, 2003:
E. du Fornel, P. Joseph, F. Guillocheau, T. Euzen, and D. Granjeon

SEPM will also be recognizing the members of the 2003 Local Organizing Committee, student travel grant recipients and Student Section Grant winners.

The reception will begin at 7:00 p.m., with cocktails available at cash bars. The awards ceremony will start at 7:30 p.m.

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Scheduled Activities

RESEARCH GROUPS
Sunday, April 18
2pm-4pm
Quantitative Stratigraphy
Clastic Diagenesis
Monday, April 19
7pm-10pm
Carbonates
Marine Micropaleontology
Sequence Stratigraphy
Turbidite & Deep Water

OTHER ACTIVITIES
Friday, April 16
8am-5pm
Open Forum: Research in the Upper Crust-Sedimentary Geology
Saturday, April 17
12pm-5pm
Geosystems Committee
Sunday, April 18
8am-5pm
SEPM Council Mtg
9am-11am
Foundation Investment Committee Meeting
11:30am-12:30
SEPM Investment Lunch
12:30-2:30pm
SEPM Investment Meeting
3pm-5pm
NAMS Board Meeting
Monday, April 19
10am-11am
Foundation Bd or Dir./Members
4pm-5pm
Research Concepts
6pm-7pm
SEPM Student Reception
7pm-10pm
Earth Science Cyber-Infrastructure
Tuesday, April 20
11:30am-1:30pm
Annual Business Mtg. Luncheon
6pm-7pm
Foundation Donor Reception
6:30pm-7pm
Pictures of Awardees/Council
7pm-9:30pm
President’s Rec. & Awards Ceremony

SEPM Thanks its Sponsors (as of 2/26/04): Anadarko Petroleum Corporation; BP Amoco; Conoco Phillips; Eby Petrography & Consulting, Inc.; Energy & Geoscience Institute; ExxonMobil; Unocal Corporation; Ventex Oil & Gas, Inc.

We look forward to seeing you in Dallas!
Cover art: Outcrop photo from the Elk Basin, Wyoming, showing the Lance Formation and related Cretaceous strata (see Wegweiser et al., this issue).

Open Forum: Research in the Upper Crust – Sedimentary Geology

Friday, April 16, 2004
8:30 am – 6:00 pm
Parisian Room, Fairmont Hotel
Dallas, Texas

Who should attend?
Anyone with a stake in the future of sedimentary geology: Academic, Industry and Government Researchers, Technology Consultants, and Students at all levels

Presentations
• Introduction and Charge
  The current perception of “Sedimentary Geology” as a science and how the sedimentary geology community needs to communicate its own perception.
• Grand Challenge Problems in Sedimentary Geology
• Infrastructure Status and Needs
  Current projects in infrastructure and an overview of data (existing, available, new)
• Overview of Current Complementary Programs
  Existing programs and projects within the upper crust arena.
• Break Out Group Discussions
  Small groups meet and discuss the information and ideas shown to determine practical next steps in determining and communicating this community’s perception of its science
• Presentation of Group Ideas
  Whole group discussion of breakout group presentations
• Next Steps
  Discussion and selection of “best” next steps and selection of a synthesis committee for production of a summary report from the workshop.
For more information: hharper@sepm.org or www.nced.umn.edu/Sedimentology_Stratigraphy_Initiative.html

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Quo Vadis?

Paleoenvironmental and Diagenetic Constraints on Late Cretaceous Dinosaur Skin from Western North America

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ABSTRACT
Upper Cretaceous sandstone deposits of the Western Interior Seaway include fossil skin (integument) associated with the skeletal remains of some dinosaurs. Skin preserves as thin pyrolusite (manganese oxide) coatings on sandstone molds and casts. Pyrolusite is an authigenic marine mineral used to map paleoshorelines, thus the dinosaur fossil is inferred to have been deposited in a nearshore marine environment. Rapid burial of the dinosaur remains in marginal-marine settings in the presence of seawater resulted in the inhibition of scavenging activity by other creatures. Seawater mixed with freshwater promoted the natural embalming of the corpse. Thus, it effectuated changes in the microbial consortia responsible for decay leading to an increase in pH allowing for preferential precipitation of pyrolusite as a replacement for dinosaur integument.

INTRODUCTION
Fossilization of non-biomineralized anatomy of terrestrial animals and the circumstances under which it occurred are of great importance to our understanding of the processes that have led to exceptional preservation. Fossilization processes provide proxy evidence in the interpretation of paleoenvironments. Evidence is provided of environmental toxins, salts, cold, or dry conditions and other principal factors aside from burial rate and early diagenesis that lead to soft tissue preservation in vertebrate animals (e.g., Briggs et al., 1997; Babcock, 1998; Babcock et al., 2000; Chamberlain and Pearson, 2001).

Paleoenvironmental and diagenetic processes combined during the Late Maastrichtian in Wyoming’s Lance Formation resulting in exceptional preservation of dinosaur skin. Instances of fossilized dinosaur skin impressions are usually explained by desiccation and subsequent burial in sediment (e.g., Cope, 1885; Osborn, 1912; Brown, 1916; Sternberg, 1925; Czerkas, 1997; Anderson et al., 1999; Murphy et al., 2002). This explanation requires rapid onset of desiccation because it assumes fossilization in an arid setting and presumes desiccation occurs mere hours to days after death to effectively restrict scavengers and microbes responsible for decay prior to burial. Whereas this argument could be compelling for corpses of relatively small mass, it is less convincing for corpses of large mass. New laboratory and field evidence associated with a corpse of large mass, namely a hadrosaur dinosaur found in the Lance Formation of Wyoming, suggests that paleoenvironmental settings combined with diagenetic processes to play key roles in the fossilization of soft tissues (Wegweiser et. al., 2003). Soft-part preservation occurred preferentially after the dinosaur was buried rapidly in sediments saturated with seawater in nearshore marine settings. Integument was replaced by beta-manganese dioxide (pyrolusite) mediated by activity of some marine-adapted microbial consortia occurring relatively soon after burial, and prior to extensive compaction and dewatering of the host sediment.

In this paper, we summarize results of field studies and laboratory analyses concerning the taphonomic history of dinosaur integument from a new occurrence in the Lance Formation from This Side of Hell Quarry located northwest of Pitchfork and Hell’s Half Acre, Wyoming. Questions addressed in this paper are: 1) How was dinosaur integument preserved? 2) What was the depositional environment in the Lance Formation that preserved dinosaur integument? 3) How rapidly did fossilization of dinosaur integument occur? Preservation of hadrosaur integument in the Lance Formation in northwestern Wyoming by pyrolusite provides new and intriguing paleoenvironmental evidence for the exceptional preservation of non-biomineralized tissue.

MATERIAL AND LOCATION
Material described here is from the Lance Formation (Upper Cretaceous, Maastrichtian)
and is found in This Side of Hell Quarry, located in the Elk Basin Anticline in the northwestern Bighorn Basin in Park County, Wyoming (Figure 1). Dinosaur skin and skin impressions associated with lambeosaurine dinosaur bone (Figure 2) described herein occur in the second sandstone interval of the Lance Formation in Park County, Wyoming (Wegweiser, 2002). Specimens of dinosaur skin casts and molds (Figures 3) are reposited in the collections of the University of Wyoming.

**SEM-EDX ANALYSIS**

Samples of dinosaur skin, dinosaur skin impressions, associated bone, and associated matrix were examined using the JEOL JSM-820 scanning electron microscope with Oxford eXL energy dispersive X-ray analyzer of the Microscopic and Chemical Analysis Research Center (MARC) of The Ohio State University (Figure 4). The samples were left uncoated and subjected to an acceleration voltage of 10 keV. SEM-EDX analysis shows significant evidence of Mn on the dark portions of the skin impression, but effectively none on portions that lack this material. Bone material lacks any evidence of Mn, while the surrounding matrix contains only an isolated, small trace.

**STRATIGRAPHY AND SEDIMENTOLOGY**

The Lance Formation in Elk Basin Anticline, Wyoming, consists of coastal dune deposits and fluvial to marginal-marine deposits (Wegweiser, 2002). Fine-grained overbank deposits are interbedded with delta lobe deposits that were at times subaerially exposed. The Lance Formation in Elk Basin is dominated by pale orange, bentonitic, silty arenaceous sandstone interbedded with silty sandstone, sandstone, silty shale, and occasional beds of siderite containing trace fossils (such as inferred arthropod dwelling traces) and nodules exhibiting desiccation cracks. Lenticular and vertically stacked sandstone, shale, and siltstone bodies are interbedded with sheet-flood sandstones.

Bedding plane exposures of sheet sandstones, back-barrier deposits, coastal dune deposits, and lagoonal deposits, some with organic lags containing charcoal, iron-carbonate beds, and thin lenses of conglomerate are present near the This Side of Hell Quarry. In the quarry, strata range through beds of mudrock, silty mudrock, bentonitic muddy siltstone, and bentonitic silty fine-grained sandstone. Flaser bedding and very fine-grained clay drapes occur in the quarry. Flaser bedding is an indicator of fluctuating hydraulic conditions with transport and traction followed by periods of quiescence. Flasers are thus commonly considered to be indicators of tidal flat settings. Sandstone containing dinosaur skin impressions is fine-grained bentonitic litharenite containing abundant mica and volcanic fragments punctuated by micaceous flasers and almost white clay drapes. Micro-ripple marks occur in the quarry in the finer grained intervals. In general, the region contains stratigraphic units that imply deposition in a low topographic area, such as on a delta lobe consisting of sandy braidplain fluvial deposits interspersed with shallow intertidal bays that were occasionally subjected to volcanic ash-falls, channel abandonment, and regular marine incursions.

Fluvial deposits in the Lance Formation in Elk Basin consist of large-scale, wedge-shaped cross-trough bedded sands exhibiting intermittent very thin narrow conglomerate lenses and large-scale soft sediment deformation structures. These deposits interfinger with marginal-marine deposits characterized by thin, laminar fine-grained bentonitic sandstone beds exhibiting reactivation surfaces, mud drapes, and flaser bedding. Fine-grained overbank units are interbedded with these delta lobe braid-plain deposits.

Thin (1 to 2 mm) clay drapes and truncated lenses of light gray shale occur in direct associ-
The paleochannel and paleoshoreline record of the Lance Formation (Connor, 1992) is characterized by elongate log-like concretions with distorted bedding. These structures are composed of strata containing siderite, manganese nodules, and fossils replaced with pyrolusite. Approximately 15 percent are finer grained interfluve deposits. Another 5 percent of the outcrop are composed of strata containing siderite and manganese nodules, and fossils replaced with pyrolusite. Approximately 15 percent are finer grained interfluve deposits.

Elongate log-like and ribbon-like lenticular structures are interpreted as the upper parts of transverse bars found in non-braided, low sinuosity streams of lower delta plains. The Lance Formation contains one of the best-known and diverse Late Cretaceous vertebrate faunas from North America (Cope, 1872; Clemens, 1964, 1966, 1973; Estes, 1964; Breithaupt, 1982, 1985, 1997, 2001; Whitmore, 1985; Whitmore and Martin, 1985; Derstler, 1994; Archibald, 1996; Webb, 1998). Remains of cartilaginous and bony fishes, amphibians, champsosaurs, turtles, lizards, snakes, crocodilians, pterosaurs, dinosaurs, birds, and mammals are known from this unit. In addition, the Lance Formation is the source of some of the best-known Cretaceous dinosaurs from North America (e.g., Triceratops, Thescelosaurus, Ankylosaurus, Edmontonia, Edmontosaurus, Pachyrhinosaurus, Ornithomimus, Troodon, and Tyrannosaurus). Most vertebrate fossils from the Lance Formation are biomineralized bones and teeth. Reported instances of exceptional preservation of skin surrounding skeletal material are rare. These occurrences have been primarily reported as coming from hadrosaur dinosaurs (e.g., Sternberg, 1909; Osborn, 1912; Lull and Wright, 1942; Derstler, 1994; Czerkas, 1997).

**TIMING AND STYLE OF INTEGUMENT PRESERVATION**

Dinosaur integument (Figure 3) in the Lance Formation has been preserved through a combination of molds and casts in sandstone and thin (1 to 2 mm) voids filled by pyrolusite (MnO2). Skin impressions consist of small (1 to 2 mm) to large (5 to 10 mm) diameter polygonal, primarily hexagonal, non-overlapping scales. Grooves between the scales range in depth from 1 to 4 mm. Skin relief ranges from 2-5 mm in thickness. Skin fossils and impressions come from the area of the quarry surrounding the scopula of a lambeosaurine (hadrosaur) dinosaur. Pyrolusite preferentially covers moldic integument, and has not been observed to coat either adjacent bones or adjoining sediment. This indicates that the mineral is an early replacement product that affected only the integument.

Precipitation of pyrolusite occurs in environments that became more strongly alkaline through a combination of microbial decay (Kothny, 1983) and mixing of slightly acidic fresh water with more alkaline marine water. Fresh and marine water would be expected to mix in marginal-marine environments where streams enter the ocean. In order for manganese oxides to precipitate, Fe and Al ions must first be preferentially removed from the sediment, pH must be at least 8.0, and Eh must be at least 0.75 (Figure 5). Once formed, pyrolusite is virtually insoluble (Krauskopf, 1957). Manganese commonly precipitates in nearshore and marine paleoenvironments, recording such events as periods of transgression, delta-lobe abandonment, or storm breaching (Curtis and Coleman, 1986; Guilbert and Park, 1986; Blatt et al., 1991; Connor, 1992). Even small amounts of foreign ions (e.g., Fe, Al) present in soils from the weathering of minerals prevent the formation of pyrolusite (McKenzie, 1976).

Ion exchange of MnO2 is strongly controlled by Eh and pH (Guilbert and Park, 1986). Anions of manganese are commonly released and precipitate when river waters reach oxic marine conditions with higher pH values (generally exceeding 8.0). The isoelectric point for common colloidal particles of manganese is 4.0 to 4.5. As groundwater interacts with seawater within the phreatic zone, pyrolusite precipitates (Curtis and Coleman, 1986). Burial of organic remains under these conditions results in deposition of...
manganese into voids left by the biological material within the paleo-phreatic zone (Curtis and Coleman, 1986). Fe and Al are removed first by the movement of groundwater in different Eh and pH conditions (Figure 5), leaving Mn that will precipitate given the appropriate oxidizing conditions.

**DISCUSSION**

Preservation of soft tissue in the fossil record is a relatively rare occurrence globally, requiring a narrow set of paleoenvironmental and diagenetic conditions. Preservation of soft parts can begin to occur once the decomposing animal is buried below the taphonomically active zone. Occurrence of pyrolusite in the voids where the dinosaur skin decomposed after burial in the Lance Formation is indicative of extraordinary geochemical conditions in the sediment shortly after burial.

Pyrolusite ($\beta$-MnO$_2$) replacement of the Lance Formation dinosaur skin from the This Side of Hell Quarry in Elk Basin, Wyoming resulted in 3-D preservation and suggests that precise oxidizing Eh and pH conditions existed in the sediments around the dinosaur during decomposition. Such conditions had to occur almost immediately after burial and were sustained during diagenesis and the fossilization process. A sustained pH of at least 8.0 and an Eh of at least 0.75 (Figure 5) was reached. These constrained conditions had to be sustained in pore waters surrounding the dinosaur carcass during diagenesis for a few weeks to at least a few months (see Lynn and Bonatti, 1965; Burns and Burns, 1979; Curtis and Coleman, 1986; Guilbert and Park, 1986; Blatt et al., 1991; Connor, 1992).

Replacement of integument by pyrolusite probably began within hours to days of burial and continued over a period of weeks to months (see Mackenzie, 1976). Integument is usually preserved three-dimensionally, meaning that skin diagenesis occurred before the occurrence of significant compaction and dewatering of surrounding sediment. Cobalt and nickel commonly occur in association with other manganese oxides and sometimes with pyrolusite formed in soils, but cobalt and nickel are not associated with material analyzed by SEM-EDX from the Lance Formation. These results suggest that replacement of dinosaur skin by pyrolusite did not likely occur in a soil horizon. Furthermore, the ratio of Mn/Fe is higher when acidic groundwater percolates through soils depositing much of the ferric oxide in the B soil horizon, thereby enriching the B-horizon in manganese (Krauskopf, 1957). A near lack of Fe in the EDX Lance Formation material suggests that replacement of the dinosaur skin took place below the B-paleosol horizon.

Replacement of skin probably occurred after the carcass was buried in a marginal-marine setting, possibly in the marine phreatic zone. Paleosols in the Lance Formation would have formed regionally during emergent conditions within deltaic complexes, and being naturally rich in Fe, Al, Mn, and CO$_2$, would have become leached as a consequence of net downward movement of acidic water during deposition, provided Eh and Ph conditions combined properly. Thus, the paleosols could have provided a source of Mn and eventual precipitation of pyrolusite.

**SUMMARY AND IMPLICATIONS**

The dinosaur in This Side of Hell Quarry in the Lance Formation fossilized in tightly constrained paleoenvironmental conditions resulting in replacement of integument by pyrolusite. Sediments provided an environment in which sustained contact between the marine-fluvial interface and dinosaur integument occurred during diagenesis and fossilization. This suggests dinosaur skin replacement occurred near to a source of marine water that mixed with fluvial water. Replacement of integument was relatively rapid, having to occur prior to total dissolution by decay and prior to the invasion of carrion eating meiofauna. The apparent preferential preservation of hadrosaur dinosaur skin and the association and partial articulation of the skeleton (Figure 2), suggests that this dinosaur lived close to the environment in which exceptional preservation of soft tissue could occur (Figure 6). It further suggests rapid and nearly complete burial that occurred in this instance in fine-grained sandstone. The presence of pyrolusite is proxy evidence that the environment in which fossilization and diagenesis occurred was influenced by the marine-fluvial interface.

This Side of Hell Quarry is located relatively far to the west of the generally accepted Maastrichtian paleogeography, which places the ancient shoreline well to the east (Figure 7). Other Maastrichtian dinosaur skin occurrences (Figure 7) should be examined and investigated for the mineralogy of the skin and
Figure 7: Generalized partial Late Maastrichtian paleography map of North America. The “This Side of Hell, Wyoming Quarry” with pyrolusite replacement of dinosaur skin is shown in a red asterisk. Representative localities of additional Maastrichtian dinosaur skin occurrences are shown in blue asterisks (e.g., Sternberg, 1925; Horner, 1984; Gillette, 2002).

Acknowledgments

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SIMMONS, B., 1946, The presence of a reptile in a marine sedi- mentary environment surrounding the fossils. In the Lance Formation, in This Side of Hell, Wyoming Quarry. L.E. Babcock, S.A. Leslie, and K. Polak provided help in excavating the This Side of Hell Quarry. L.E. Babcock, S.A. Leslie, and K. Polak provided editorial assistance in the preparation of this paper. We would like to thank M. E. McMilla for her review of this paper.

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INTRODUCTION

Deepwater exploration geologists use sedimentology to develop and mature oil and gas prospects. The goal of exploration is to economically find significant hydrocarbon reserves. Properly assessing the risk and reserve potential of prospects is critical to making sound business decisions to achieve that goal.

Four geologic risk elements are useful in characterizing the risk of drilling exploration prospects: 1) trap (closure), 2) seal (containment), 3) hydrocarbons (source, timing, and migration), and 4) reservoir (stratigraphy and diagenesis) (e.g. Rose, 2001). One of the common causes of failure in deepwater exploration is insufficient reservoir. Deepwater wells (water depths greater than 1,500 ft) cost tens of millions of dollars, making the ability to accurately predict thick, high-quality pay sands a critical factor for project success.

Subsurface exploration and development utilize biased data that make understanding depositional systems very important. Wellbores are biased as they sample only a minute fraction of the reservoir. Seismic is biased because such data is limited by its resolution, typically 200 ft or more depending on frequency content. In subsalt reservoirs, areas of poor illumination can obscure seismic reflectivity. Understanding outcrop analogs is important to provide models that help predict reservoir heterogeneity, a difficult factor to characterize with subsurface data sets (e.g. Slatt, 2000). Exploration, therefore, commonly requires that we be model driven in predicting the distribution of deepwater turbidite sands.

Regional work is a key to better understanding the spatial and temporal distribution of turbidite sands. Characterizing sequences along sediment fairways, understanding shifting deltaic sources, and utilizing sea-level curves are important for developing predictive models. Mapping of sediment fairways shows pathways for sediments from the deltaic source to a prospect. It is very important to map the geometry of salt bodies at a given time interval, as they commonly form topographic highs that may deflect sands away from or pond sands at a prospect. Changes in sea-level not only affect sand deliverability to deepwater prospects, but sea-level highstands can create regional highs that can hold large columns of hydrocarbons.

Gulf of Mexico Turbidites

In this overview I will briefly discuss three turbidite depositional settings: 1) bypass, 2) confined/ponded, and 3) weakly confined. It is important to understand these depositional settings to properly focus exploration efforts. Deposition in these settings has complexities that are beyond the scope of this brief paper, but such details can be found in the selected references below.

Regions of steeper slope gradient that lack significant slope accommodation space define slope bypass settings. Slope gradient affects if bypass is partial (less steep) or complete (e.g. steeper pre-existing topography). Slopes are commonly marked by erosional channel or constructional channel-levee complexes. Basin-margin sands are typically channelized sheets that pass basinward to sheets, with deposition resulting from a decreasing gradient. Slope reservoirs typically have smaller reserves than base-of-slope reservoirs. Examples of slope turbidite systems are part of the Lower Tertiary of the western Gulf of Mexico and the middle Miocene of the eastern Gulf of Mexico. The Ram-Powell Field (Kendrick, 2000) is an example of base-of-slope reservoirs, and the sinuous channel-levee complex of the Main Pass 108 Field is an example of smaller slope reservoirs.

Intraslope basins that produce accommodation space that can trap turbidite sands on an otherwise bypass slope define confined/ponded depositional settings. Deposition in ponded settings has been described by the well-known fill-and-spill model (Prather et al, 1988; Beaubouef and Friedmann, 2000). Salt movement results in lower gradients and topographic highs that cause turbidity flows to slow and deposit. Sedimentation works to heal this topography, commonly resulting in successions of ponded sheet sands overlain by bypass channel-levee complexes. In some cases, depositional lows are later structurally inverted to create structural highs with very thick sands. The thick sands of inverted structures may contain large reserves, such as the turtle structure of the Thunder Horse discovery (Yielding et al., 2002) in Mississippi Canyon.

Slope topography that is not high enough to completely confine turbidity flows defines weakly confined depositional settings. Contractual tectonics of the Mississippi Fan Foldbelt produced structures that correspond to minor depositional thinning, but these topographic highs did not completely block flows. Sands were deposited as turbidity currents slowed as they ran up and over such positive features. Flow stripping may occur on some topographically higher contractual structures, where only the upper, lower-concentration portion of turbidity currents pass across the structure. The Mad Dog Field (Apps et al., 2002) in southeast Green Canyon is an example of a reservoir in a weakly confined system in the Mississippi Fan Foldbelt.

SUMMARY

Sedimentology is an important aspect of deepwater exploration. Using geologic models to predict thick accumulations of reservoir sands will help target lower-risk prospects with higher reserves.

REFERENCES


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The deep history of the Earth, replete with shifting continents, fluctuating sea levels, and evolving life, is what sustains my fascination with geology. Unfortunately, this rich history is also what makes geology and paleontology particularly tempting targets for creationists of all kinds. Ironically enough, creationists have become highly skilled at adapting to the fact that the courts in this country have consistently ruled against the teaching of creationism in public school science classrooms. Their latest strategy involves lobbying state school boards to adopt watered-down science standards that de-emphasize or eliminate the teaching of evolution, as well as other key concepts such as the ancient age of the earth. This strategy uses a manifestation of old-earth creationism called Intelligent Design (ID) to claim that there is conflict in the scientific community regarding evolution. Playing to the need for "fairness," ID supporters argue that this conflict should be taught in science classrooms because ID is a legitimate scientific alternative to evolution. On the contrary, ID is simply an attempt to sneak creationism into the backdoor of our public schools.

Essentially, ID holds that some things in nature, such as vertebrate eyes or complex biomolecules, are "irreducibly complex," so complex that if you remove one part, then the entire mechanism fails to function (Behe, 1996). Such failure to function, the argument goes, indicates that natural selection could not have led to the evolution of such a structure, because any "intermediate" evolutionary forms would not be functional. Such "irreducibly complex" objects therefore defy our explanatory powers and so must then by default have been designed by some, presumably "higher", form of intelligence. Such arguments are nothing new. William Paley first promoted these ideas in his book Natural Theology nearly 200 years ago (Paley, 1836). Paley's arguments have been repeatedly tested and rejected by science ever since. So the current proponents of ID, rather than being the innovators they claim to be, are merely resurrectors of a stale idea from the dustbin of science.

Even if one ignores the failed history of ID, this re-born idea of ID ostensibly as a scientific theory has fatal flaws rooted in its simplistic view of biological evolution. We now know that form and function are fluid through time such that the same morphological feature or biomolecule can be used for different functions at different times in the evolutionary history of an organism. And there are abundant examples in biology of seemingly simple, or "partial", forms of organs working perfectly well for certain animals. ID also relies heavily on the fact that there are gaps in our scientific knowledge. But science requires such knowledge gaps as fuel for the development of testable hypotheses. The moment humanity acquires complete knowledge of the natural universe, which will never happen, then science, by definition, will cease to exist.

I happen to have quite a bit of first-hand experience with ID and its proponents because of a scientific meeting that I attended in China a few years ago. Unbeknownst to the organizers of this meeting, who did a wonderful job, it was sabotaged, if you will, by prominent ID supporters from the Discovery Institute in Seattle, a conservative think tank that funds much of the ID movement. The meeting provided a glimpse at their techniques and into their world. I learned that ID proponents are essentially trying to create their own alternative pseudoscientific universe, complete with "Senior Fellows" with advanced degrees, often in philosophy and religion, free-lance "science" writers whose job is to blatantly misquote scientists in later newspaper articles, and even a young-earth creationist paleontology graduate student who goes "deep undercover" at scientific meetings. Of course, the ultimate goal of everyone in this little universe is to get ID, and subsequently creationism, into the science classrooms of our public schools by whatever means necessary.

So what can students do to help defend science education against such insidious forces? I know that many students feel powerless to do anything, but that is not the case. First of all, students can support the National Center for Science Education (NCSE). They are on the front lines in the fight for science education. Among many other activities, NCSE provides crucial information for school boards approving new curricula and textbooks, conducts speaking tours, and keeps the scientific community aware of the latest creationist maneuvers. Go to their website (www.ncseweb.org) to learn more.

Aside from supporting the NCSE, students can also defend science by respectfully countering creationist propaganda wherever and whenever they encounter it. If this happens in the classroom, emphasize that people certainly have the right to believe in any form of religion, including those that teach strict creationism, but that this is a science class. As such, evolution, or deep time as may be the case, will be taught because it is the scientific perspective. They do not have to accept evolution or deep time, but they are responsible for learning it.

It is unfortunate that so much time and energy has to be spent defending science education in this country. But it really is a necessary part of our chosen profession as geologists, and students can certainly lend their weight to the fight.

**REFERENCES**


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What is SEPM and Who Runs It?

This is my last letter as president of SEPM. The year has certainly gone by fast, but I’ve had a great time and am grateful for this opportunity to serve this society.

A few weeks ago I was headed out my door for yet another meeting and ran into my neighbor Harvey. I’m going to the GCS-SEPM meeting I replied when he asked where I was going. Well, he said, I can think of what the GCS stands for, but what is SEPM? It’s the Society for Sedimentary Geology, I replied.

I guess when you get right down to it, names don’t matter much. It’s what the society is all about that matters. I have belonged to SEPM since I was a graduate student, more years than I care to mention. It was through this society that I came to know many of my best friends and colleagues. I would hardly get to see them if it were not for the annual meetings and research conferences. Those meetings also provide great opportunities to learn and generate new ideas. I usually leave physically and mentally exhausted, but also energized and ready to push on with my teaching and research. I try to take as many of my students to the meetings as I can because I see them mature professionally at every one. It is also a time for them to meet and talk with those people whose papers they have read and to learn more about career opportunities.

In addition to our regular journals, the Journal of Sedimentary Research and PALAIOS, the Society publishes special publications that encapsulate current knowledge and new ideas about specific aspects of sedimentology and paleontology. Then there are the research conferences. If you have not participated in one you really should. They are a remarkable learning experience.

I guess if Harvey asks me what SEPM does my response will be, we engage in continuing education for our membership.

During my four-year tenure as councilor for research, president-elect and president I learned a lot about how SEPM works. I also came to truly appreciate the dedicated staff in Tulsa. We can all rest assured that the society is in good hands. Officers come and go, but the society continues to operate, thanks to the staff.

Howard Harper, our executive director and Theresa Scott, who manages the Tulsa office, are the mainstays in this society.

Howard is the point man for the society. He maintains communication with other societies, an increasingly important job, and makes sure tasks are completed when they are supposed to be completed. I cannot count the times I have had to rely on Howard to provide guidance when making decisions and moral support when it was most needed.

Theresa oversees the office staff and keeps the societies financial records. I must confess that, after four years and numerous meetings dealing with the society’s financial matters, I am still baffled by the process. Her job is an awesome one and I have watched in awe as she and Howard have wrestled with the never-ending task of making predictions about sales of books and other income and tried to balance the books long before proceeds are seen. I still don’t know how they do that, but I am confident that the society is in good hands.

The rest of our small staff is just as indispensable for SEPM. Judy Tarpley is the primary point person on all of our events; Kris Farnsworth co-ordinates all of the special publications production as well as handling the website; and Michele Woods makes sure that all of the members requests for books, journals and renewals actually get done.

A good staff is essential to the success of SEPM, but the society could not, and will not, succeed without those members who volunteer their time and ideas. Among the volunteer ranks, two jobs in particular stand out as being especially demanding. That is the chairman of the Headquarters Business Committee (HBC) and the director of the SEPM Foundation. John Robinson is the current chairman of HBC. While our staff does a fantastic job, they depend on guidance from the membership, especially in making financial predictions and in providing external oversight of the business office. HBC provides that guidance. John’s job is time consuming, but he has carried it out with competence and good humor. Thank you John for your services to the society.

When you see him coming, get out your checkbook. Tim Carr does a job that many of us would not want. He oversees fund raising for the Foundation and guards those funds as though they were his own retirement nest egg. If you want money from the Foundation, you had better have a good reason, and that is the way it should be. Thank you Tim for your service to this society.

My last official function as president will be to host the annual SEPM luncheon and the president’s reception and awards ceremony in Dallas. John Van Wagoner will be the luncheon speaker. Those of you who have heard John speak know that it will be a lively and provocative talk. At the reception we will honor those members of our society who have achieved great things. It is a chance for us all to acknowledge their contributions to sedimentology. Please join us at the reception for what I promise will be an enjoyable gathering of mud and bug people.

John Anderson
President, SEPM
johna@rice.edu

Council Members & Election Results

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Special thanks to John Robinson, Fred Behnken, Janok Bhattacharya and Gary Hampson who so kindly agreed to stand for office and to all those members who actually voted.

*Newly elected to office
Global geologic changes with magnitudes and rates among the most dramatic in earth history occurred during Permo-Carboniferous times. Dramatic shifts in global tectonics resulted in the docking of Gondwana and Euramerica to create the supercontinent Pangaea and the “world ocean” Panthalassa. Fluctuations in atmospheric and oceanic chemistry, changes in global climate, and evolutionary changes associated with the Devonian – Carboniferous transition and the devastating mass extinction at the close of the Permian Period formed the backdrop for the shifting panorama of this remarkable time. These changes had marked and global impact on carbonate sequence stratigraphy, platform architecture, reef and mound characteristics, and diagenesis and reservoir properties.

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The northern Gulf of Mexico margin encompasses a variety of depositional settings characterized by different drainage basin size, physiography, fluvial morphology, climatic setting, and structural and diapiric activity. This, plus the abundance of long sediment cores and platform borings from oil industry activities, make it an unparalleled natural laboratory for sedimentological and stratigraphic studies and for testing sequence stratigraphic concepts. This volume contains twelve papers describing results from high-resolution stratigraphic studies of late Quaternary strata of the northern Gulf of Mexico, from the mouth of the Apalachicola River to the Rio Grande. These papers focus on fluvial response to climate and base-level change, variations in delta growth and evolution across the shelf, lowstand delta-fan evolution, the evolution of transgressive deposits on the shelf, the preservation of these deposits. The robust chronostratigraphic frameworks developed for the different study areas allows comparison of stratal geometries produced by contemporaneous depositional systems operating under identical eustatic conditions.

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