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The SEDIMENTARY Record

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INSIDE: FITTED-FABRIC GRAINSTONES – COMMONLY OVERLOOKED EVIDENCE FOR VADOSE DIAGENESIS AND SUBAERIAL EXPOSURE

PLUS: PRESIDENT'S COMMENTS, SGD NEWS, STUDENT COUNCILOR'S COMMENTS

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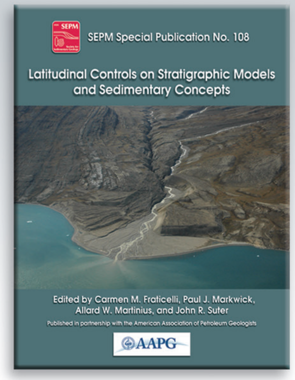

Special Publication #108

Latitudinal Controls on Stratigraphic Models and Sedimentary Concepts

Edited by: Carmen M. Fraticelli, Paul J. Markwick, Allard W. Martinius and John R. Suter

It is self-evident that a better understanding of depositional systems and analogs leads to better inputs for geological models and better assessment of risk for plays and prospects in hydrocarbon exploration, as well as enhancing interpretations of earth history. Depositional environments—clastic and carbonate, fine- and coarse-grained, continental, marginal marine and deep marine—show latitudinal variations, which are sometimes extreme. Most familiar facies models derive from temperate and, to a lesser extent, tropical examples. By comparison, depositional analogs from higher latitudes are sparser in number and more poorly understood. Numerous processes are amplified and/or diminished at higher latitudes, producing variations in stratigraphic architecture from more familiar depositional "norms." The joint AAPG/SEPM Hedberg Conference held in Banff, Alberta, Canada in October 2014 brought together broad studies looking at global databases to identify differences in stratigraphic models and sedimentary concepts that arise due to differences in latitude and to search for insights that may be applicable for subsurface interpretations. The articles in this Special Publication represent a cross-section of the work presented at the conference, along with the abstracts of the remaining presentations. This volume should be of great interest to all those working with stratigraphic models and sedimentary concepts.

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Special Publication #110

From the Mountains to the Abyss: The California Borderland as an Archive of Southern California Geologic Evolution

Edited by: Kathleen M. Marsaglia, Jon R. Schwalbach, and Richard J. Behl

This SEPM/PS-SEPM volume celebrates the life and scientific achievements of Donn S. Gorsline focusing on the California Continental Borderland, a region where Donn worked extensively. The 18 papers in this volume span offshore Borderland basin settings and exposures in onshore, inner Borderland regions affected by tectonic uplift. They touch on aspects of sedimentation in the modern source-to-sink sedimentary systems, encompassing some world-class Miocene to Pleistocene outcrops and the subsurface distribution of submarine fan and hemipelagic facies, as well as the structural evolution of the Borderland basins and their associated magmatic components. The broad topics covered will be of interest to a spectrum of geologists and geophysicists interested in transtensional to transpressional basin settings, the Cenozoic tectonic evolution of southern California, models of deep-marine to coastal depositional systems, as well as regional hydrocarbon exploration. Additionally, the geologic history and structure of the California Continental Borderland are connected with the distribution of modern seafloor life and marine ecosystems. This volume serves as a benchmark of current research in the region with the aim of spurring future exploration and study.

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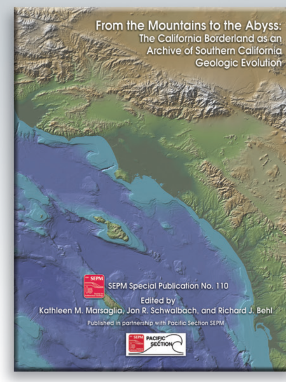

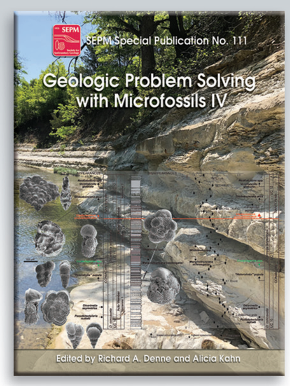

Special Publication #111

Geologic Problem Solving with Microfossils IV

Edited by: Richard A. Denne and Alicia Kahn

Every four years micropaleontologists from across the globe gather in Houston, Texas for the quadrennial conference of the North American Micropaleontology Section–SEPM (NAMS) to learn, share, and network on applied micropaleontology. Geologic Problem Solving with Microfossils IV was held on April 5–8, 2017 with 130 participants. Fourteen of the 95 presentations were selected for publication, which includes papers on geologic applications utilizing foraminifera (benthic and planktic), calcareous nannofossils, palynology, and conodonts, in studies of rocks and sediments ranging from the Pennsylvanian to the modern.

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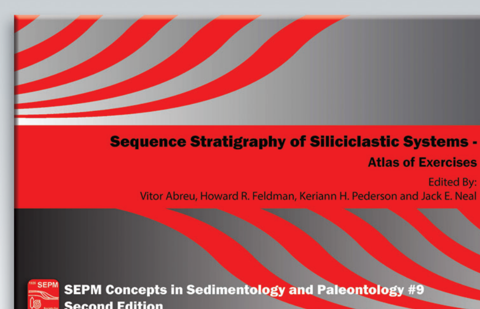
Concepts in Sedimentology and Paleontology 9 (2nd edition)

Sequence Stratigraphy of Siliciclastic Systems

Edited by: Vitor Abreu, Howard R. Feldman, Keriann H. Pederson, and Jack E. Neal



This publication is the result of more than 3 decades of sequence stratigraphy research and application. 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).The stratigraphic concept of a depositional sequence was introduced to the scientific literature by Peter Vail and his colleagues in the late 70s, building on the shoulders of giants like Chamberlain, Sloss and Wheeler. Since then, several papers compared and contrasted the original sequence-stratigraphic school published in the AAPG Memoir 26 in 1977 with other approaches to subdivide the geologic record, as well as, debating the model validity and impact on the community. At its core, the "model" is really a stratigraphic interpretation method, which was never explicitly documented in the literature. The objective of this book is to present the 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. 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). This book in an 11 x 17 format is designed to be easily used for teaching or self-learning experiences. In the second edition of the "Atlas", the book was divided in 2 separately bound volumes—Exercises and Solutions—to make it easier to use the publication as text book for sequence stratigraphy courses in universities. Also, a new exercise was added and several of the existing exercises went through major updating and editing.

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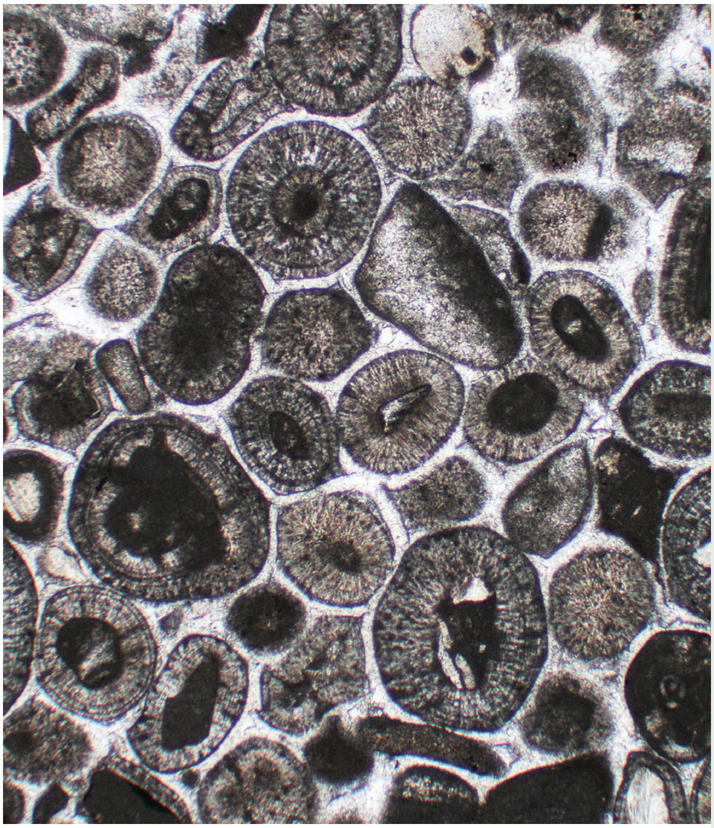

Cover image: Ooid grainstone from Lower Jurassic limestone, Central Atlas region, Morocco with fitted fabric that formed due to dissolution in the vadose zone followed by early cementation. Photo by Dana Ulmer-Scholle. Long Axis = 2.5mm

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Fitted-Fabric Grainstones – Commonly Overlooked Evidence for Vadose Diagenesis and Subaerial Exposure

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ABSTRACT

Some carbonate grainstones have distinctive fitted fabrics that form due to dissolution in the vadose zone that are only rarely recognized or correctly interpreted. These grainstones have flattened and concavo-convex grain contacts where the grains fit together like puzzle pieces and are commonly lined with early marine or meteoric cement. Examples of these fitted fabric grainstones have been identified in carbonates from the Archean to the Holocene and likely occur in shallow marine, eolian and lacustrine carbonate grainstones throughout the geologic record.

Fitting occurs due to dissolution at grain contacts by meteoric or mixed marine-meteoric fluids that over time flattens the grain contacts. Although these grainstones may at first appear to be compacted, burial compaction can be ruled out because there is commonly no sign of pressure solution, the early cement that forms at the surface clearly postdates the fitting of the grains and is unaltered by the fitting process, and because these fabrics are found in Pleistocene and Holocene grainstones that have never been buried. Because this feature forms during periods of subaerial exposure, it can help to identify cryptic exposure surfaces and sequence boundaries.

INTRODUCTION

The term fitted-fabric grainstone is used here to describe the appearance of some carbonate grainstones that have flattened and concavo-convex grain contacts that fit together like puzzle pieces yet are lined with early cement that show little or no signs of burial compaction or pressure solution. These fitted fabrics form due to dissolution at grain contacts in the vadose zone (the interval below the surface but above the water table) and are therefore evidence of subaerial exposure. Fitted fabric grainstones are common in the rock record but have only rarely been identified, primarily due to lack of awareness of the feature and its origin.

Clark (1979), in a discussion of an ooid grainstone with fitted fabrics found in Cussey and Friedman (1977), wrote that the original idea that fitted fabrics came from dissolution in the vadose zone came from R. J. Dunham (1924-1996), who called it "vadose compaction." According to Clark, Dunham found ancient examples in the Mississippian Gasper Limestone and a modern example forming in beachrock at Cayo Arenas, Mexico and summarized these findings in an unpublished report for Shell Oil Company. Clark later interpreted fitted fabric grainstones in the Permian Zechstein Formation of the Netherlands (Clark, 1980, 1986) and the Jurassic Arab A Formation of Qatar (Clark et al., 2004) to have formed due to vadose compaction. Others who worked with Dunham or may have been aware of this report have also referred to vadose origin of the fitted fabric grainstones. Wilson (1975, p.430) described a fitted fabric grainstone from the Arab C Formation of Qatar as having formed due to "early solution." Sellwood et al (1985) interpreted "overpacking" of grains under cemented hardgrounds in the Jurassic Great Oolite of the UK to be due to vadose dissolution and Hird and Tucker (1988) interpreted a fitted fabric ooid grainstone from the Carboniferous Brofiscin Oolite in Wales to form due to meteoric waters causing "dissolution at grain contacts into concavo-convex and fitted fabrics." All credit for the initial observations and interpretations should go to Dunham and these earlier authors.

Despite these earlier references, most fitted fabric grainstones go unnoticed due to lack of awareness of this feature or are misinterpreted as having formed due to burial compaction. This is likely because there has never been a publicly available paper devoted solely to their description and interpretation. Once one is aware of the feature, it becomes clear that they are very common. The purposes of this paper are therefore to establish criteria to recognize fitted fabric grainstones, to demonstrate how commonly they occur and to discuss their origin, distribution and utility as an indicator of subaerial exposure.

DESCRIPTION AND OCCURRENCE OF FITTED FABRIC GRAINSTONES

Grainstone is a grain-supported carbonate rock with little or no mud between the grains (Dunham, 1962). Grainstones that develop fitted fabrics are generally deposited in high-energy environments such as shoals, barrier bars and beaches or eolian settings, but not all such grainstones develop fitted fabrics.

Figure 1 shows, for comparison, a cemented ooid grainstone without fitting (Fig. 1A), a grainstone that has been subjected to burial compaction (Fig. 1B) and a fitted fabric grainstone (Fig. 1C). The ooid grainstone without fitting (Fig. 1A) has round grains that show no signs of fitting with point contacts between grains where they are touching. The interparticle pore space is filled with fibrous isopachous rim cement followed by blocky calcite. The grainstone that has been compacted in a burial environment (Fig. 1B) has pressure solution sutures between the grains and no isopachous rim cement that separates them. Figure 1C shows a fitted fabric grainstone for comparison. Fitted-fabric grainstones may be subjected to later burial compaction but, in most cases, they do not show pressure solution features at grain contacts. The grains fit together with flattened, polygonal or concavo-convex contacts but are also coated with early isopachous rim cement around and between most of the grains.

Figure 2 shows a well-fitted ooid grainstone from the Jurassic of Morocco (from p. 357 of Scholle and Ulmer-Scholle, 2003). The grains fit together like puzzle pieces and unaltered isopachous rim cement fills gaps between the grains. Some lamina on the ooids have been dissolved. There are pillars of undissolved grain where grain contacts are maintained and there is no cement between the grains which are important to the interpretation of how fitted fabric grainstones form.

A literature review done mainly online turned up more than 40 examples of fitted fabric grainstones from the Archean to the Holocene that are presented in Online Table 1. In these examples, a few authors noticed the compaction but attributed it to burial or pressure solution, but the majority did not mention the fitted nature of the grainstones at all. In some cases, there is only minor fitting where there are only small patches of fitted grains with a few flattened contacts, in others moderate fitting with flattened contacts occurs across the thin section and in other cases the grains are highly fitted to each other like puzzle pieces such as in Figures 1C and 2 (online Table 1).

In Holocene and Pleistocene strata, fitted fabric grainstones are found in beachrock, barrier bar facies and carbonate eolianites, all of which have been subjected to vadose diagenesis. Figure 3A is an example from a Pleistocene grainstone with a caliche crust found on the west side of the island of Barbuda in the Leeward Islands of the Caribbean. Figure 3B is an example from Pleistocene of San Salvador Island, Bahamas with isopachous cement between well-fitted peloids and intraclasts in what is interpreted to be beach facies. Another good Pleistocene example is a well fitted ooid grainstone from the Miami Oolite (Figs. 3C and 3E of what is interpreted to be barrier bar facies in Halley et al., 1977). These Pleistocene examples are both around 125,000 years old and have never been buried.

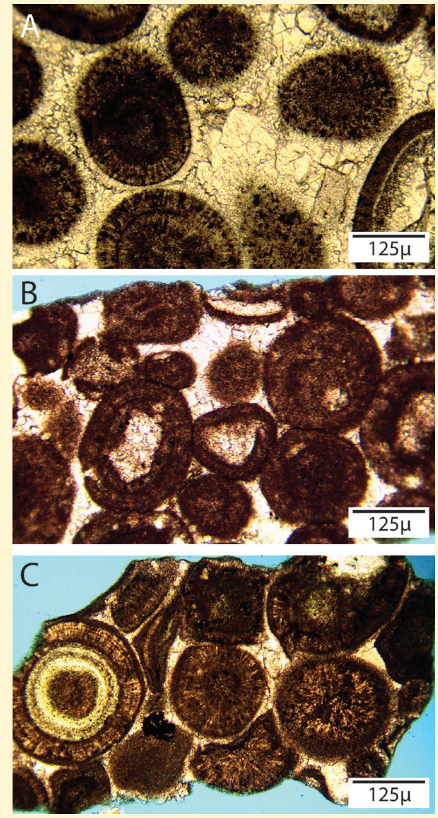

Figure 1: Grainstones from well cuttings in Cretaceous Quintuco Formation, BDC-1, Neuquén Basin, Argentina. A) Cemented ooid grainstone with no obvious burial compaction and no fitted fabric. B) Ooid grainstone subjected to burial compaction with pressure solution sutures between ooids (white arrows). C) Fitted fabric ooid grainstone with grains fitted to each other with layers of cement between the grains.

Figure 3C is an example from the Cretaceous of Argentina that shows fitted fabric in a thin section made from well cuttings in a mixed carbonate-siliciclastic grainstone with the fitting being associated with the carbonate grains. Figure 3D is from the subsurface in a well drilled in south Florida, USA which shows excellent fitting between miliolid forams and ooids. Figure 3E is an only partially cemented fitted-fabric grainstone found in

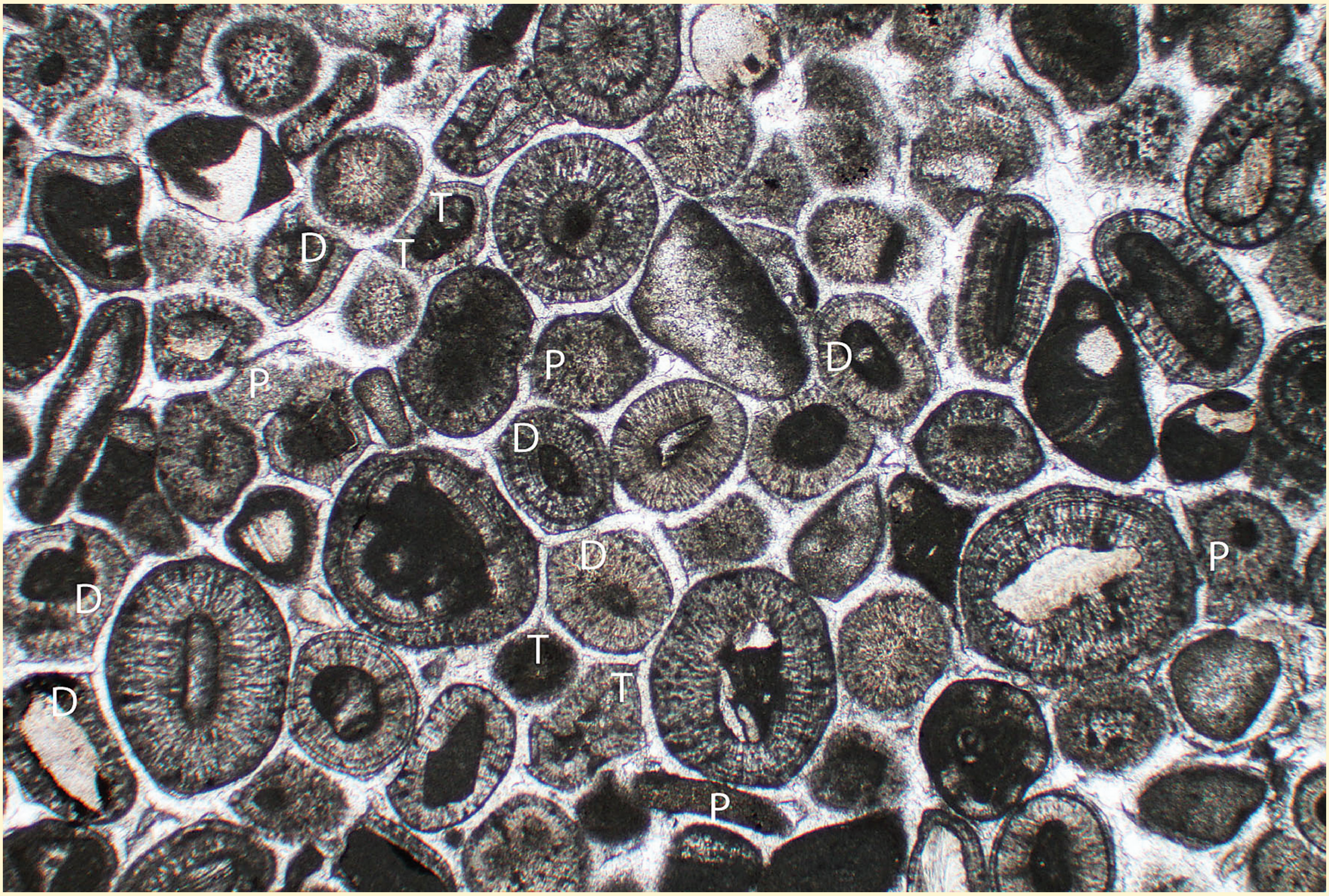

Figure 2: Fitted fabric grainstone from Jurassic of Morocco (courtesy of Peter Scholle and Dana Ulmer-Scholle). Some layers of ooids missing where dissolution (D) has occurred. Note the presence of pillars (P) of undissolved grain between some grains. Some ooids have little tails (T) on them suggesting they were once larger than they currently appear.

well cuttings from the Cretaceous of offshore Angola. Figures 3F is a well-fitted example from the Jurassic Arab D of Saudi Arabia which occurs in a grainstone unit that is just below a sequence boundary and a regional evaporite unit. Figure 3G is a well-fitted grainstone from the Mississippian of Wyoming, USA (from Westphal et al., 2004). Figure 3H is from the Ordovician of Pennsylvania, USA that shows moderate fitting of ooids and some echinoderm fragments.

These examples show that fitted fabrics occur in grainstones composed of ooids, peloids, intraclasts and skeletal grains. More soluble grains such as ooids and peloids are commonly fitted to less soluble grains such as quartz grains or some skeletal grains. Fitted fabrics most commonly are preserved in grainstones with grains composed of calcite, but they can also occur in grainstones with what were aragonitic grains and the presence of dissolved aragonite might supply some $CaCO_3$ for later cementation. Fitted fabrics are common in grainstones deposited in both calcite and aragonite seas (*sensu* Sandberg, 1983).

ORIGIN OF FITTED–FABRIC GRAINSTONES

The grains in these fitted-fabric grainstones (Figures 1C, 2 and 3) would not have tumbled randomly into such fitted relationships due to depositional processes. Instead, the grains are interpreted to have been dissolved and fitted to each other in the vadose zone - after deposition but prior to early cementation and burial (Clark, 1979).

Figure 4 is a diagenetic model for the formation of fitted-fabric grainstones (in part based on ideas from Dunham presented in Clark, 1979). When grainstones within the vadose zone are exposed to meteoric diagenesis, most fresh water from rainfall percolates down between the grains until it reaches the water table, but some of that water forms a meniscus around grain contacts (Figure 4A). If the fluids are undersaturated with respect to calcite, dissolution occurs which leads to flattening of the grain contacts over time (Fig. 4B) and eventually to fitting of

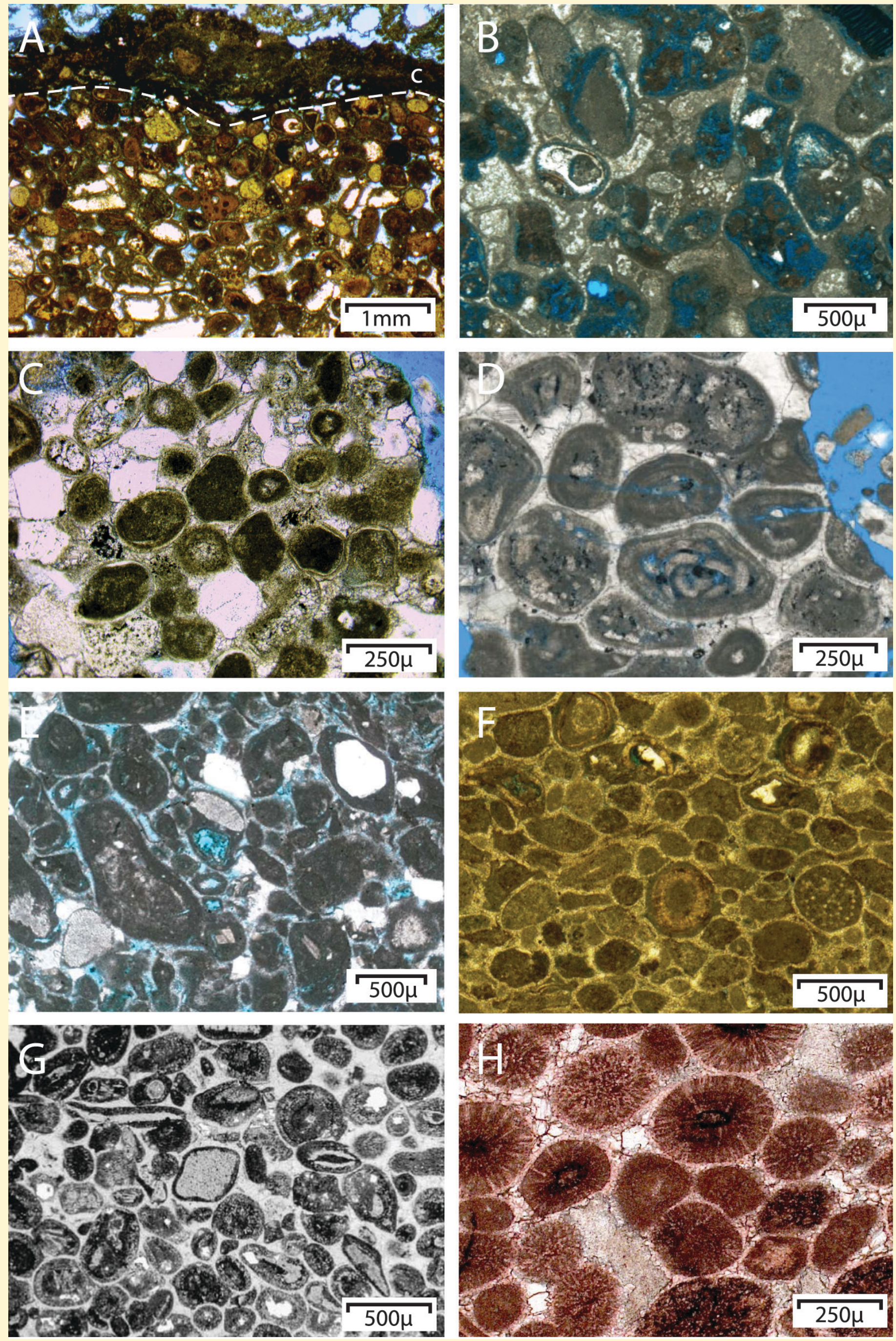

Figure 3: Examples of fitted fabric grainstones. A) Pleistocene ooid grainstone with fitted fabric from the west side of Barbuda, Leeward Islands, Caribbean, with caliche crust (c). B) Pleistocene intraclast-peloid grainstone, San Salvador Island, Bahamas (Courtesy Shawn M. Fullmer). C) Sandy ooid grainstone, Cretaceous Quintuco Formation, Neuquén Basin, Argentina. D) Miliolid-ooid grainstone with fitted fabric, Cretaceous Gordon Pass Formation, USGS core 3978, Virginia Key, FL, USA. E) Fitted fabric in intraclast-peloid grainstone, Cretaceous Pinda Formation, Bagre Field, Offshore Angola. F) Fitted fabric in intraclast peloid grainstone from Jurassic Arab D Formation, Saudi Arabia (from M. Al-Nazgah) G) Fitted fabric skeletal-ooid grainstone from Mississippian Madison Group, Wind River Basin, Wyoming, USA (from Westphal et al., 2004) H) Fitted ooid grainstone from Black River Formation, Union Furnace, Pennsylvania, USA (stained with alizarin red s) (courtesy C. Laughery and J. Kostelnik).

the grains. Continued downward flow eventually flushes hundreds or thousands of volumes of fluid through the pore system, removing dissolved carbonate and delivering more undersaturated water. The degree of fitting is primarily controlled by the amount of dissolution that occurs prior to cementation. Round grains subjected to this sort of dissolution might produce more polygonal fitting while those with more irregular shapes might produce a fabric that has more concavo-convex fitting. Note that pillars of undissolved material remain that maintain a gap between the grains (Fig. 4B) as were seen in Figure 2. The pillars may be only a few microns in diameter and will not always be captured in a given thin section slice but are necessary to maintain the gap between the grains (Dunham via D.N. Clark, pers. comm, 2010).

Figure 4C shows the next stage in development of fitted-fabric grainstones which is the precipitation of cement that lines the grains and fills the gaps between them. Most of the cases examined for this paper have isopachous rim cement, but some other type of early cement may be precipitated in the gaps as well. Isopachous rim cement can form in both meteoric and marine settings (Harris et al., 1985). If the cement is meteoric in origin this indicates a change in conditions from undersaturated fluid to a supersaturated fluid capable of precipitating calcite. If it is a marine cement, it would indicate a sea level rise and a shift from vadose to marine diagenesis. In either case, the cements form at or very near the surface and postdate the fitting of the grains which means that the fitting also must occur at or very near the surface. The cement is a key to the interpretation, because if the fitting was due to burial compaction or pressure solution the cements would also be affected. In one example after another the grains are fitted

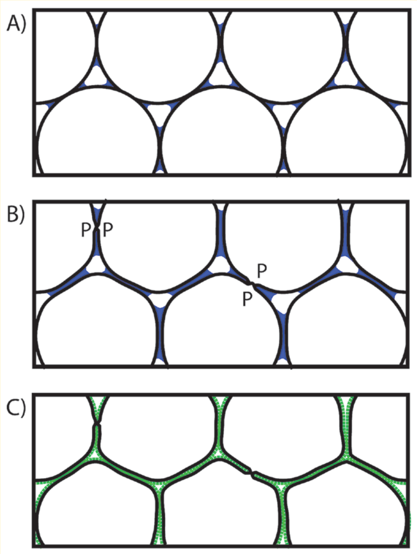

Figure 4: Schematic diagenetic model for development of fitted fabric grainstones. A) Round grains deposited and exposed to vadose diagenesis. Most fresh water percolates down to water table but some collects at grain contacts as a meniscus. B) Fresh water dissolves grains where meniscus forms leading to flattening of contacts. Gaps between grains maintained by pillars of undissolved grain (P). C) Isopachous rim cement (green color on figure) of either meteoric or marine origin fills gaps between grains.

to each other, but both the grains and the cements are unaltered by the fitting process, later burial compaction or pressure solution.

DISCUSSION

The fitting of carbonate grains due to dissolution in the vadose zone is a fundamental diagenetic process that has never been fully documented. Because there is little general awareness of this process, fitted fabric grainstones have long been overlooked or misinterpreted even though they are quite common. The author of this paper went back through projects done earlier in his career and found fitted fabrics in the Ste. Genevieve Limestone of the Illinois Basin, the Cretaceous Pinda Formation of offshore Angola (Fig. 3E), the Madison Group in Wyoming (see Westphal et al, 2004, Figure 3G), and the Black River Formation in the northern Appalachian Basin (Fig. 3H) that went unrecognized at the time. Once one is aware of the feature it becomes clear that they are very common. They occur in shallow marine, lacustrine and eolian carbonates from the Archean to Holocene and in every time period in the Phanerozoic (see online Table 1). Theoretically, any previously uncemented marine, eolian or lacustrine grainstone (or sandstone with appropriately soluble grains) might develop fitted fabrics in the in vadose zone given the right conditions.

Others have noticed the compacted appearance of the fitted fabric grainstones but misinterpreted them as having formed due to burial compaction and/or pressure solution. Bathurst (1975) interpreted a Carboniferous ooid grainstone from Ireland with fitted fabric to have formed due to pressure solution (p.465, Figure. 322). Cussey and Friedman (1977) interpreted an ooid grainstone from the Jurassic of France with fitted fabric texture to have formed due to pressure solution and "load compaction" (Figure 4 of that paper).

Grainstones that have been subjected to burial compaction and pressure solution (Fig. 1B) are easily differentiated from fitted-fabric grainstones (Figs. 1C, 2 and 3). Grainstones subjected to burial compaction and pressure solution will have visible pressure solution sutures or stylolites between the grains (Fig. 1B) that in some cases may cut across cements as well. The fitted fabric grainstones have grains with flattened, polygonal or concavo-convex contacts with unaltered early cement around and between them. Although there might be minor later burial compaction, most fitted fabric grainstones show little evidence of pressure solution.

The fitted-fabric grainstones under discussion in this paper are not formed by the same process as the vadose pisolites of the Capitan Reef discussed by Dunham (1969) and Esteban and Pray (1977). Those pisolites grew into fitted relationships due to precipitation in the vadose zone while the fitted fabrics under discussion in this paper formed at first due to dissolution of grains due to dissolution in the vadose zone.

The degree of fitting may be related to time in the vadose zone, climate, fluid chemistry, the grain types or the timing of the cementation which would bring the fitting to an end. Fitting could extend as far below the surface as the fluids doing the dissolution remain undersaturated which could be a few cm to perhaps a meter or more. Al-Nazgah (2011) found more than 20 continuous meters of fitted fabric grainstone in some locations, but this was likely due to multiple episodes of deposition, exposure and fitting rather than a single event.

While porosity can in some cases be enhanced or created by subaerial exposure (Budd et al., 1995), the development of fitted fabrics would in most cases lead to a reduction in porosity. Both the fitting of grains and the early cementation decrease overall porosity and create hardgrounds (Sellwood et al., 1985).

Value as an Indicator of subaerial exposure. – Because they form in the vadose zone, fitted fabrics are an indication of subaerial exposure. Fitted fabrics may be more common than karst, caliche or any other indicator of subaerial exposure in carbonates and are easily recognized in thin sections from well cuttings, core and outcrops. They are therefore a useful tool when trying to identify exposure surfaces and picking sequence and cycle boundaries. In the Jurassic Arab D of Saudi Arabia, Al-Nazghah (2011) was able to correlate the fitted fabrics at the top of a thick grainstone package below an interpreted sequence boundary for 75 kilometers from one oil field to another and the surface likely extended even farther.

In most cases, the feature is found where one might pick a sequence boundary or subaerial exposure surface based on other criteria such as at the top of an ooid grainstone unit or where associated with marginal marine facies, karst or caliche. In other cases, they may help to identify cryptic exposure surfaces that are otherwise undetectable. If the grainstone has a fitted fabric as described here, it was altered in the vadose zone and is therefore evidence of subaerial exposure.

CONCLUSIONS

- Some grainstones have fitted fabrics which means that the grains fit together with flattened, polygonal or concavo-convex contacts that would not form due to normal depositional processes
- This fitting occurs due to dissolution in the vadose zone and fitted fabrics are therefore evidence of subaerial exposure
- They are common in carbonate grainstones and have been found in shallow marine carbonates from every time period in the Phanerozoic and as far back as the Archean

DEDICATION AND ACKNOWLEDGMENTS

This paper is dedicated to Robert J. Dunham who conceived of the main idea presented here. Thanks to Franz Meyer and David N. Clark for early discussions on the model and to Fred Read, Charlie Kerans, Antun Husinec and an anonymous reviewer for their helpful reviews. Thanks to all those who shared thin sections including Peter Scholle and Dana Ulmer-Scholle, Angola LNG, YPF, Mahmoud Al-Nazghah, and Chris Laughery and Jaime Kostelnik and Shawn M. Fullmer.

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PRESIDENT'S COMMENTS

I'm happy to report that this column includes news on concrete action items, as well as an inaugural SEPM event. Please read on…

1—Former President (Gary Nichols), current President (Lynn Soreghan) and, as needed, President-Elect (Mike Blum) have all pledged our Presidential funds toward engaging a digital media marketing firm (Mojo Media Labs) to help steer SEPM into the future. An ad hoc committee comprising SEPM Council and Staff is working with Mojo to reinvigorate SEPM's digital image, create a "Digital Marketing Road Map" and help SEPM better implement its core mission of supporting and propagating both the sciences of sedimentary geology and paleontology, and the scientists and students who work in these disciplines. Doing so clearly requires SEPM to navigate effectively far into the 21st century. We hope that this effort will usher in a new era of growth and relevance for SEPM, since we — as scientists of the habitable environment past, present and future — are kind of a big deal. The Mojo process will consume some months, and you will likely be asked to provide input via surveys meant to determine the best way to serve our membership, and society (current and future).

2— Council unanimously approved a new process to enable SEPM to commission, craft, and post position statements on scientific issues of societal importance. In today's world, scientific findings are increasingly politicized. SEPM is a scientific society, and SEPM's proficiency in sedimentary geology and paleontology confers an expertise in topics highly relevant to our increasingly anthropocentric world, as our membership includes those who study topics such as changes in climate, sea-level, energy resources, and life through Earth history, and even changing environments on other planets. Hence, SEPM bears a responsibility to commission and produce position statements on scientific topics of societal importance for which it has expertise. The process adopted by Council is modeled after those employed by affiliated societies such as GSA and AGU. In brief, the steps are: 1) A topic is proposed by Council or an SEPM member, and commissioned by means of a charter prepared by Council that specifies the topic, purpose, intended audience, scope, and deadline for the position statement. 2) An ad hoc committee of five experts drawn mostly from SEPM membership is formed, and meets to discuss and draft the position statement, documenting key discussion points. 3) The draft statement is posted online and distributed to SEPM members for a 6-week comment period. 4) The committee reviews member comments and revises the statement as needed. 5) The committee submits the proposed statement (with discussion points documented) to Council for review and approval. 6) The statement is posted online as SEPM's official position, and Council revisits statements every 5 years to update as needed.

3— Staff is entering the final stages of preparation for the SEPM 2020 meeting— *"The Past is the Key to a Sustainable Future,"* the seeds of which were planted at the 1995 "Earth Systems" congress in St. Petersburg, Florida. In 2016, then-SEPM President Vitor Abreu, Howard Harper, and several members of the IAS Bureau proposed SEPM's involvement in the IAS Sedimentological Congress, with the goal of joining forces and shoring up linkages with the IAS— as well as GSA's Sedimentary Geology Division— to form a united front in sedimentary geology and paleontology. SEPM held its inaugural cooperative congress with IAS in 2018, with the hope that this new tradition of joint congresses continues on a biannual schedule, with IAS and SEPM alternating the lead for this "International Sedimentary Geoscience Congress." The first oversight committee included co-Chairs Vitor Abreu and Andrea Fildani with Vincenzo Pascucci (IAS), Gary Gianniny (SGD), David Bottjer, Liz Hajek, Maria Mutti and Howard Harper. A program committee comprising Andrea Fildani, Jean Hsieh, Devon Orme and Angel Alonso Garcia worked with SEPM Headquarters to build the framework, while topical sessions, field trips, short courses and workshops were built by grass-roots efforts. We will also use this venue to present many of SEPM's awards. In addition to the many sessions, plenary talks, short courses, and workshops, the setting of Flagstaff enables world-class field excursions. Please plan to join us.

Lynn Soreghan, SEPM President

THE GEOLOGICAL SOCIETY OF AMERICA®

SEDIMENTARY GEOLOGY DIVISION

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FALL 2019 NEWSLETTER

Spectacular marine and deltaic capped sequences of the Eocene Coledo Formation near Coos Bay Oregon. Dr. Marjorie Chan, this year's winner of the Sloss Award, described these beautiful exposures with her mentor, and previous Sloss Award recipient, Robert H. Dott Jr.

The upcoming year has many opportunities for you to present your latest research in sedimentology, stratigraphy, and the many other areas which integrate with our field. First, the earlier than usual annual GSA meeting will bring us together in late September (22-25) in wonderfully sunny Phoenix! Many of the events for that meeting are described in this newsletter. Second, the SEPM International Sedimentary Geosciences Congress 2020- with a fast-approaching abstract deadline (Sept 30th) is also sponsored by the Sedimentary Geology Division of GSA, and IAS. It will be in Flagstaff Arizona April 26-29, 2020: https://sepm.org/SEPM2020. There are seven proposed field trips ranging from carbonate cyclicity, eolian bedforms to stratigraphy and sequence stratigraphy in the Grand Canyon.

These meetings in particular demonstrate that The Geological Society of America, and specifically the Sedimentary Geology Division in collaboration with our partner societies like SEPM, provide the best new science, in an exciting forum for professionals and students.

GSA ANNUAL MEETING

Be a part of your home for exciting discourse this year at the GSA annual meeting, where the Sedimentary Geology Division has sponsored or co-sponsored 17 Topical Sessions and the "Understanding the Neoproterozoic Earth-Life System" Pardee Symposium!

Sedimentary Geology Division shared reception with Limnology Division

Join us Tuesday evening, September 24 from 6:00 - 8:00pm at the Phoenix Convention Center, North Ballroom 120A, North Building, for a stimulating evening of networking & awards announcement. We will recognize the winners of the Sloss, Laubach, and Student Research awards as well as give away door prizes. Catch up with your SGD and Limnology colleagues and meet new connections! Drinks and snacks will be provided.

Sedimentary Geology Division/SEPM Student Research Competition: Dynamics of Stratigraphy and Sedimentation (Posters)

On Monday, September 23rd, in Halls A/B of the Phoenix Convention Center North Building, come see the brilliant science that 27 students are pursuing in sedimentary science at the SEPM/ SGD Poster Session!

Thanks to the generosity of SEPM and SGD, student authors of the top four ranked posters will be awarded $500! If you are interested in being a judge, and don't have a student in the session, please e-mail SGD Vice Chair, Dr. Amy Weislogel: Amy.Weislogel@mail.wvu.edu

See titles and abstracts at: https://gsa.confex.com/gsa/2019AM/meetingapp.cgi/Session/47878

Sedimentary Geology Division Awards

The **Laurence L. Sloss Award** for Sedimentary Geology is given annually to a sedimentary geologist whose lifetime achievements best exemplify those of Larry Sloss—i.e., achievements that contribute widely to the field of sedimentary geology and service to the Geological Society of America.

The Sedimentary Geology Division is pleased to announce **Dr. Marjorie Chan** (University of Utah) as the 2019 Laurence L. Sloss Award and the 20th recipient. Dr. Chan is a Distinguished Professor at the University of Utah, where she has been since completing her doctorate at the University of Wisconsin. Her work, carried out during nearly four decades, has had a major impact on the field of sedimentary geology.

Dr. Marjorie Chan by some of her favorite Jurassic rocks with hematite cementation and bleaching.

Margie's field-based research expertise ranges from basic sedimentology and stratigraphy to diagenesis (nodule formation, etc.). Her focus has been on Colorado Plateau geology (Precambrian to Pleistocene) and like Laurence Sloss, Margie spent her career unraveling the complexities of continental sedimentary rocks. She has been one of the trailblazers studying eolian and dry-land sedimentary records, and was one of the first groups of geologists to apply principles of sedimentary geology gleaned from planet Earth to interpret sedimentary records on planet Mars. Particularly noteworthy is her work on the formation of post-depositional concretions. These diagenetic processes related to fluid flow in sedimentary basins resulted in a spectrum of concretion chemistries (iron oxide, iron sulfide, carbonate, hematite, even azurite and malachite).

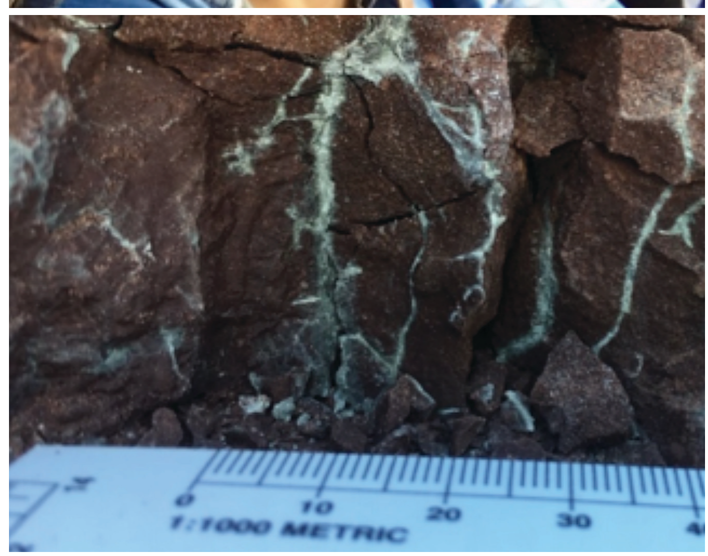
Throughout her 36-year career she has taken a leadership role in the field of siliciclastic sedimentology resulting in an impressive 140 peerreviewed publications, 150 invited lectures and a remarkable record of public outreach such as videos/films on AAPG Search and Discovery, Discovery Channel and National Geographic, leading NASA HiRise fieldtrips, etc. She has published in wide range of leading journals, such as Nature, Science, GEOLOGY, GSA Bulletin, Paleo-cubed, Geophysical Research Letters and Astrobiology and has an international reputation has one of the top spokespersons for the discipline of sedimentary geology. As GSA's 2014 Distinguished International Lecturer she gave a stunning number (53) of lectures in 6 countries. Margie has been tireless in her service to scientific societies (GSA, AAPG, and SEPM). She was elected GSA fellow (1995), Chair of Sedimentary Geology Division (2013-2015) and GSA Council (2016-2000). She has served on numerous GSA committees (Doris Curtis awards, Sloss Awards, GSA Diversity in Geosciences, etc.), chaired numerous GSA technical sessions, including two very competitive Pardee Sessions (1999 & 2000). She has been active in promoting women in geology, founder of the AAPG PROWESS (Professional Women in Earth Sciences) Committee and increasing diversity in the geosciences.

The **Stephen E. Laubach Structural Diagenesis Research Award** promotes research combining structural geology and diagenesis, and curriculum development in structural diagenesis.

The Sedimentary Geology Division and the Structural Geology and Tectonics Division of GSA are pleased to announce **Kayla Smith** as the recipient of the 2019 Stephen E. Laubach Structural Diagenesis Research Award. She is a Masters student at Utah State University. She will use the $2500 award to support her diagenesis focused research entitled "Geologic Characterization of the Great Unconformity Injection Interface Region from Field and Drillcore Analog Studies: Implications for Midcontinent Induced Seismicity" Congratulations!

Kayla Smith, 2019 Laubach Research Award Recipient (top), Gunnison Gorge fieldwork with Kayla Smith (right), Field assistant Anna Paudling (center) and Dr. Katie Potter (left).

The **Sedimentary Geology Division Student Research Award** is given to an outstanding student grant proposal in the field of sedimentary geology and stratigraphy. **Eve Lalor**, has been selected as the **2019 SGD Student Research Grant Award** for her Masters research project entitled: "Scaling of environmental responses to multiple Eocene global warming events". This $1000 award will fund her research and travel to GSA.



Eve Lalor, 2019 Student Research Award winner (top), and a photograph of a paleosol with root traces, Eocene, Willwood Fm., Bighorn Basin Wyoming (bottom). Eve is studying these post PETM paleosols to extend this composite record of climate, sedimentation rate, and floodplain drainage after this significant event in Paleogene history.

SGD Vice Chair Candidate

Brian Hampton is running unopposed for the Vice Chair Position of the Sedimentary Geology Division of GSA. Ballots closed August 30th while "The Sedimentary Record" was in press, but we anticipate welcoming Brian as the new Vice Chair of SGD at the end of the Annual GSA meeting in Phoenix!

Brian Hampton, Candidate for the Vice Chair of the Sedimentary Geology Division of GSA.

Brian is an Associate Professor at New Mexico State University, and earned his doctorate at Purdue University in 2006. His research interests center on the interplay between erosion and sedimentation with particular emphasis on field-based studies that examine the stratigraphic history and tectonic evolution of sedimentary basins. The Basin Research Lab at NMSU applies the skill sets of sedimentology, stratigraphy, structure, petrology, geochronology, geochemistry, and geologic mapping to better understand the exhumation history of mountain belts as preserved in sedimentary basins.

Statement of interest: I am both excited and honored to be considered to serve as Vice Chair of GSA's Sedimentology Geology Division (SGD)! Throughout my career as a geologist (initially as a student and now as a professional) I have benefited from excellent mentorship and support from GSA, the division, and a number of its members. I look forward to the opportunity to give back and serve the current SGD membership and am especially excited about welcoming and engaging the next generation of early-career sedimentologists to the division. Thank you for considering me for this position and if elected, I am committed to supporting the advancement of new and emerging research on any and all sedimentary-related topics.

SGD seeking new volunteers for the Joint Technical Program Committee for 2020

We thank Ryan Morgan for his long service working to organize SGD sponsored sessions for all of us who presented at the annual GSA meetings for the last 4 years! If you are interested in helping with this vital task, please contact Amy Weislogel (incoming Chair of SGD) Amy.Weislogel@mail.wvu.edu

2019 Sedimentary Geology Division Officers:

Chair – Gary Gianniny, gianniny_g@fortlewis.edu
Vice Chair – Amy Weislogel
Secretary-Treasurer – Brett McLaurin
Student Representative – Shannon Cofield
2nd Student Representative – (Ex officio) - nominations pending
Past Chair – Kate Giles

Sedimentary Geology Division Volunteers:

Representative to GSA Council – Marjorie Chan
Webmaster – Stefania Laronga
International Student Outreach Coordinator – Angela Delaloye
Ex Officio Management Board Member – Howard Harper, SEPM
2019 Joint Technical Program Committee – Piret Plink-Bjorklund (Colorado School of Mines), Ryan Morgan (Tarleton University)

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STUDENT COUNCILOR'S COMMENTS

Welcome to the start of a new academic year! This is the perfect time to give you an update on the exciting things the SEPM Student Community has been up to. My name is Kristina Butler, I am a third-year PhD candidate at the University of Texas at Austin and the SEPM Student Councilor. I've been working closely with our newly formed SEPM Student Committee to bring about big changes to how SEPM connects with and maintains its student membership.

Early in the 2019 calendar year, we polled the student community to find out WHO they are and what they VALUE. 86 of our 582 student members responded to the survey from 12 countries and 46 universities.

My priorities as Student Councilor are shaped by the survey responses. Our students want *more interaction* with SEPM through:

- **student focused events** (e.g., short courses, special talks, social events)
- opportunities to **discuss and receive advice on student issues** (e.g., mental health in graduate school, advisor/advisee power imbalance, and diversity in STEM)
- **career mentorship and training** (e.g., panel discussions with experts in industry, government, and academia)

I am encouraged that the SEPM a portion of our student members took the time to respond honestly and thoroughly to the survey. We will work hard to honor their values and interests in the coming years

Here are some highlights the SEPM Student Committees' recent accomplishments in response to the survey results:

@SEPMstudentcommunity Instagram: we are featuring SEPM students and their research on our new Instagram page. Our intention is to help our students get to know one another and gain visibility within the broader SEPM membership. Ultimately, we want to help our students promote themselves and their science. *Watch for our upcoming SEPMstudentcommunity logo design competition with big prizes!!*

Impactful student events: In August 2019, we hosted our first free student community event at the University of Buenos Aires during the 2019 AAPG ICE. Former SEPM President Vitor Abreu and owner/consultant at ACT-GEO gave a talk on sequence stratigraphy followed by a reception where we chatted with undergraduate and graduate students about the benefits of SEPM membership. Over 100 new students became members during the 2019 ICE meeting! Our next student event in Phoenix at **SEPM2020** will be announced soon.

Former SEPM President Vitor Abreu (now ACT-GEO) giving a talk at our August 2019 student event in Buenos Aires.

AND, coming this fall:

SEPMstudentcommunity newsletter: the Student Committee is implementing survey feedback to design a monthly email-based student newsletter. The idea is to keep our student members informed on topics they have TOLD us they care about. The newsletter will feature:

- upcoming grant and abstract deadlines
- announcements for webinars, short courses, field courses and other student opportunities
- recent SEPM student member manuscripts
- links to articles on pertinent student issues such as diversity in STEM, managing mental/emotional health in graduate school, career resources, and more.

This is something we are really excited about! We believe this resource will become something that students in sedimentary geology rely on and look forward to receiving. If YOU want to contribute material to the newsletter (e.g., recent STUDENT manuscripts, relevant news articles or blogs, job/internship opportunities, etc.) you can write me directly at SEPMstudentcouncilor@sepm.org.

I'm so looking forward to getting to know many of you in the next few years. I challenge you to find a way to engage with the SEPM student community. We are the next generation of leaders in industry, government, and science and we will accomplish greater things working together!

Kristina Butler
SEPM Student Councilor (2019-2021)

Call for Abstracts

Orals, Posters. PICOs

Abstract Submission closes October 7th

https://www.sepm.org/SEPM2020

Field Trip 7: A River Cuts through it; Grand Canyon Stratigraphy

Dates: **Thursday April 30 - Sunday May 10 (10 Days)**

Leader: **Gary Gianniny**

Location: **Departs and returns to Flagstaff, AZ**

A ten day motorized boat trip down the Colorado River experiencing all of the Grand Canyon's geological splendor. This trip focuses on the Neoproterozoic and Paleozoic carbonate and clastic sequences of the Southern Colorado Plateau as exposed along the Colorado River in the Grand Canyon. It also features exquisite outcrops of the Proterozoic metamorphic and igneous rocks of the inner gorge, and well exposed Neoproterozoic sediments of the Grand Canyon Super Group. These exceptional exposures provide robust analogs to many sedimentological and stratigraphic problems known only from the subsurface. Attendees will traverse the length of Grand Canyon National Park via a motorized raft which will serve as the base for short hikes to see the wide variety of geology exposed along the river.

This trip has only thirteen seats and all-inclusive cost is $4,800.
For early registration information contact Theresa Scott (tscott@sepm.org)