ISSN 2294-4931

IAS

NwLtr 258

October 2015

www.sedimentologists.org

International Association of Sedimentologists

IAS Council

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CONTENTS

EDITORIAL

The main issues of Newsletter 258 is the Lecture Tour scheduled for the 2016-2017 (September-September). Past IAS President Poppe de Boer will offer a lecture on **Modern versus ancient controls on sedimentary systems; the present is not always the key to the past»**

All subscribing IAS members can make a request to host Prof. de Boer. Applications can be submitted through a subscribing IAS member's profile only. IAS cannot guarantee that all applications are honored, as the final Lecture Tour schedule will have to take into account several factors, such as the Lecturer's availability, regional coverage, etc.

IAS will cover the travel expenses; the host institution is expected to cover the housing/living expenses. Please, visit the IAS website www.sedimentologists.org and book the lecture.

The Depositional Record is the new and open access journal of the IAS. In the Newsletter are reported all the editorial information the cover picture of the first issueand the abstract of the first published paper.

Report of the Summer School on Fluvial Facies Logging and Architectural Documentation and Interpretation held in Kamchia Resort, Varna District, northeast Bulgaria on August 25–30, 2015 is in the central part of the Newsletter.

Chelsea L. Pederson reported on post-graduated grant she received in 2nd Grant Session 2013. The report fashion is new, and I invite the granted student to follow her example.

Matthew R. Warke1 reported on Stratigraphic and geochemical framework of the Palaeoproterozoic rise in atmospheric oxygen: Transvaal Supergroup (South Africa). The research has been conducted also thanks to IAS grant –1st session, 2015.

Since Newsletter 256, a new session named «Frames from the World» is launched. Anybody is welcome to contribute to it.

Student Grant applications guidelines close the Newsletter.

IAS has restyled the webpage (www.sedimentologists.org): please have a look at it, log in and fill the spaces under your profile, and renew your membership for 2015. Remember that being an IAS member gives you the following benefits:

- access to the online versions of Sedimentology and Basin Research, including all issues ever published;
- access to the printed versions of Sedimentology and Basin Research at very favourable rates;
- access to the IAS Member Directory;
- the Friendship Scheme which gives free membership to people in less-developed countries;
- the electronic Newsletter;
- a network of National Correspondents, which report on the activities in their countries;
- International Sedimentological Congress every four years at reduced fees;
- annual Regional Meeting and meetings sponsored by the IAS at reduced fees;
- special lecturer tours allowing sedimentology groups to invite a well-known teacher to give talks and short courses in their country;
- travel grants for PhD student members to attend IAS sponsored meetings;
- research grants for PhD student members (maximum 1.000 Euros);
- institutional grants for capacity building in 'Least Developed Countries' (LDC), (maximum 10.000 Euros)
- biannual Summer Schools focused on cutting edge topics for PhD student members.

I would like to remind all IAS members that:

- the IAS Newsletter 258 is published on-line and is available at: http://www.sedimentologists.org/publications/newsletter
- the next IAS Meeting will be held from 23-25 May 2016 in Marrakech (Morocco). For details, please click: https://www.sedimentologists.org/ims2016

The Electronic Newsletter (ENIAS), started in November 2011, continues to bring monthly information to members. For information on ENIAS contact ias-office@ugent.be

Check the new Announcements and Calendar. Meetings and events shown in CAPITAL LETTERS and/or with * are fully or partially sponsored by IAS. For all of these meetings, IAS Student Member travel grants are available. Students can apply through the IAS web site. To receive the travel grant, potential candidates must present the abstract of the sedimentological research they will present at the conference. More info @ www.sedimentologists.org

Vincenzo Pascucci
(IAS General Secretary)

13th IAS Special Lecture Tour 2016-2017

IAS is proud to announce that long-time IAS member and Past President Poppe de Boer has agreed to conduct the IAS Lecture Tour in 2016-2017 with a lecture on **«Modern versus ancient controls on sedimentary systems; the present is not always the key to the past».**

The basic idea of uniformitarianism dating back to the late 18th century - when Hutton, Whewell, Lyell and others proposed the idea of uniformitarianism in contrast to catastrophism. The idea is that physical and chemical laws have not changed, and that in the distant past sedimentary processes have acted as they do today. However, obviously all kinds of controls have changed and varied in the course of geological time. E.g. the rate of *eustatic sea-level change* has varied, with rates up to a metre per 100 years during icehouse periods and rates several orders of magnitude (s)lower during greenhouse periods. Such differences lead to a different response of sedimentary systems.

Why is the Black Sea the only present-day example fitting the so-called Black Sea Model for anoxia and *black shale* deposition? Why is extensive anoxia, as in the North Atlantic and Tethys Oceans during the middle Cretaceous, not encountered in present-day oceans? Why is there a dominance of reports of *orbital cyclicity* from the Cretaceous? Is the absence of recent analogues for *Saline Giants* as in the Mediterranean during the Miocene and in the Permian Paradox Basin accidental or due to different conditions in those days?

The present-day Earth's surface with high mountains (Himalaya, Andes) is not representative for various other parts of the geological record; for example, after the break-up of Pangea major plate collisions were largely absent, with consequences for the continental relief and the character and extent of *terrestrial and shallow marine environments*. Such differences may explain biological evolutionary trends and the occurrence of sedimentary facies

Figura 1.- Poppe de Boer standing on Cretaceous aeolian sandstone (Iberain Basin, Spain)

without recent analogues such as *lithographic limestones*.

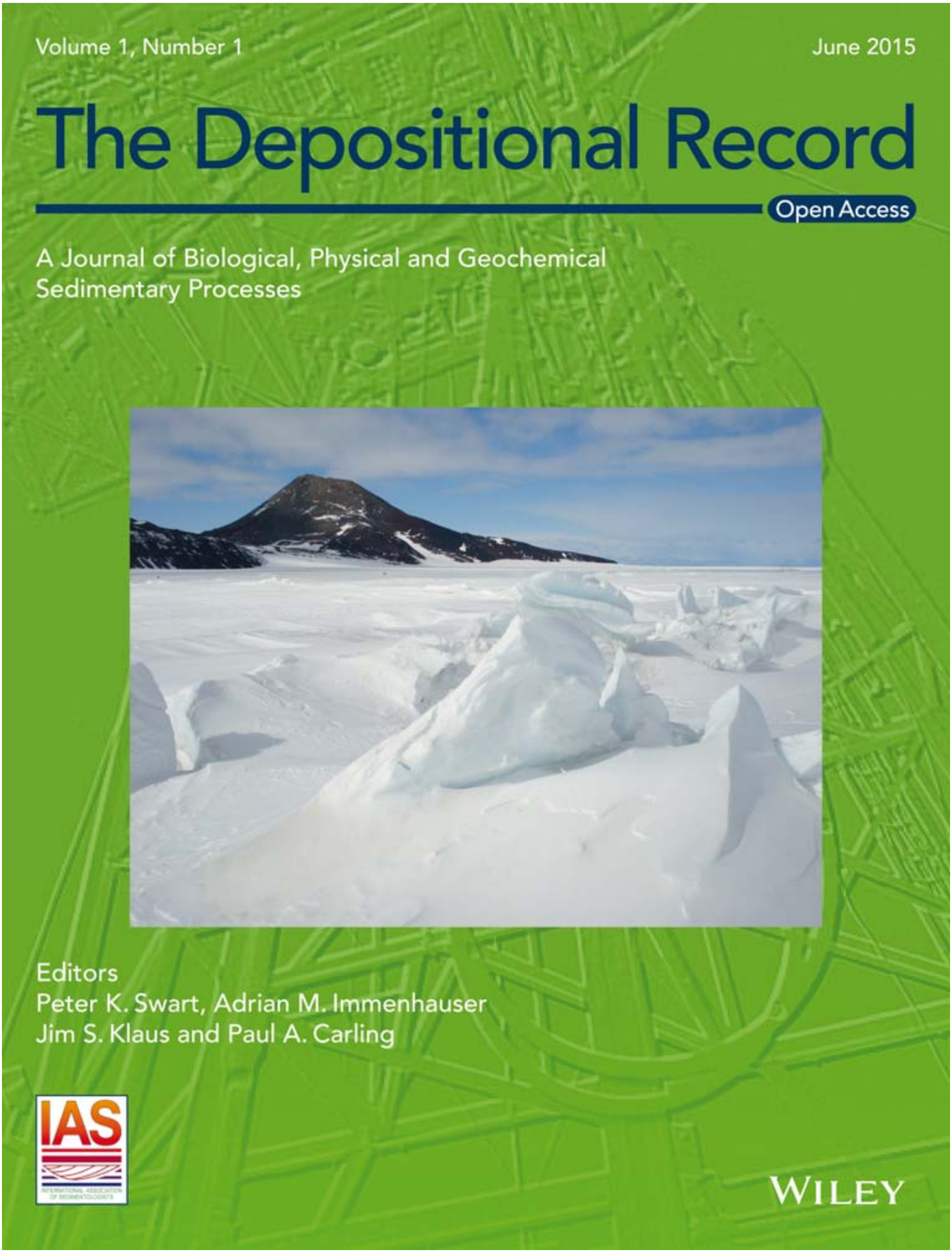
Other lectures/short courses:

Tide-influenced sedimentary systems; processes and products; sensitivity to other controls: the ocean tide has been active since the early days of our planet, and has influenced the character of a variety of marine sedimentary systems. Features like tidal resonance and amphidromic systems may amplify the tide, and local controls, such as basin subsidence, sediment composition and vegetation may greatly affect the character of the sedimentary record. An overview will be given and prominent questions will be discussed.

Orbital (Milankovitch) cycles: pathways for the transfer of orbital signals into the sedimentary record; the recognition of orbital signals in sediments often focuses on the (statistical) recognition of cycle patterns. This lecture concentrates on the transfer mechanisms of orbital signals (from decennial to multi-millennial scale) through climate and oceanography, into different sedimentary environments and facies; from alluvial fans to the deep sea.

Moreover: time will be available for discussions with students and staff, field activities, etc.

Poppe de Boer is emeritus Professor in Sedimentology at Utrecht University. He was IAS Treasurer from 1986-1994 and IAS President from 2010-2014. He published on a wide variety of topics among which tide-influenced sedimentary facies, orbital signals in sedimentary successions, organic-rich facies. He co-edited volumes on «Tide-influenced sedimentary environments and facies» (1988), «Orbital forcing and cyclic sequences» (IAS SP 19, 1994), «Analogue and numerical forward modelling of sedimentary systems; from understanding to prediction» (IAS SP 40, 2008), and on «Phanerozoic black shales and oceanic anoxic events: geochemistry, sedimentology and stratigraphy» (2012). Current research interests concern catastrophic events, today's developing greenhouse, tidal facies, and sedimentary systems in arid environments.


Volume 1, Number 1
June 2015
The Depositional Record
Open Access
A Journal of Biological, Physical and Geochemical Sedimentary Processes
Editors
Peter K. Swart, Adrian M. Immenhauser
Jim S. Klaus and Paul A. Carling
IAS
WILEY

The Depositional Record

Open Access

The journal of the International Association of Seidmentologisits

Aims and Scope

The Depositional Record The journal will emphasize the application of sedimentary processes to the study of paleoclimate, changes of the chemical environment throughout deep time (such as changes in the composition of seawater oxygen isotopic composition and Mg/Ca ratios, ocean acidification etc.), modern studies on ocean acidification, extraterrestrial sedimentology, application of genetic methods to understanding sedimentological processes, such as using genetic probes to understand processes, interaction between the biological and geological systems such as calcification in carbonate secreting organisms, the role of microbes in the formation of carbonate minerals, the use of novel geochemical methods such as clumped isotopes, the application of non-mass dependent fractionation of systems involving more than two stable isotopes, as well as normal sedimentary processes. The journal will cover all time scales from the Modern to the Ancient Earth. Hence we would include experimental studies on modern organisms and sedimentary systems as well as the application of such results to the oldest sediments on Earth and periods in between.

The Depositional Record is a Wiley Open Access journal, one of a new series of peer-reviewed titles publishing quality research with speed and efficiency. For further information visit the Wiley Open Access website at http://www.wileyopenaccess.com.

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Cover Illustration:

Pressure ridges form where the sea ice meets the shoreline of Ross Island, Antarctica. The ridges form annually in response to tidal forces, ocean currents, and glacial movement, which cause the sea ice to buckle upwards. Fractures between ridges may extend down to the water below, forming conduits through which seals and other wildlife can reach the surface. Access is allowed only along marked routes under the supervision of a trained guide. See Marcano et al (this issue)

The Depositional Record

The journal of the International Association of Seidmentologisits

Open Access

ISSN: 2055-4877

Volume 1, Issue 1 **June 2015**

Contents

Original Articles

ORIGINAL RESEARCH ARTICLE

Fault-block rotation controlling the distribution of fluvial sediments; a quantitative test on a Lower Pennsylvanian (Carboniferous) cyclothem succession

FRANK J. G. VAN DEN BELT*, POPPE L. DE BOER* and FRANK VAN BERGEN†,[1]

*Department of Earth Sciences, University of Utrecht, P.O. Box 80021, 3508 TA, Utrecht, The Netherlands (E-mail: f.j.g.vandenbelt@uu.nl)
†TNO/Geological Survey of the Netherlands, Princetonlaan 6, P.O. Box 80015, 3508 TA, Utrecht, The Netherlands

Keywords
Cyclothems, floodplain, fluvial, Pennsylvanian, subsidence.

[1]Present address: Nexen Petroleum UK Ltd., Prospect House, 97 Oxford Road, Uxbridge UB8 1LU, UK.

Manuscript received: 22 October 2014; Accepted: 25 February 2015

The Depositional Record 2015, 1(1):1–17

doi: 10.1002/dep2.1

ABSTRACT

Depositional models of axial fluvial systems in half-grabens predict that the fluvial-sandstone percentage increases towards the downthrown side of a fault, because channel systems tend to migrate to the area of maximum subsidence. This migration is at the expense of mudstone, but floodplain deposition occurs near faults occasionally. The models assume gradual, transverse tilting and no external base-level change, and their applicability to cases involving tectonics and/or sea-level change may therefore be restricted. Here, a quantitative analysis is presented on a subsurface data set from a Lower Pennsylvanian cyclothem succession, which formed under conditions of differential subsidence and fluctuating sea-level. The studied interval is wedge-shaped and shows a systematic thickness increase from 165 to 245 m, controlled by syndepositional fault-block tilting. It comprises three depositional units, bounded by coal groups. These units display an upward change from wedge-shaped (75 to 120 m) to tabular (42 to 55 m). Despite their variable thickness, the units contain almost equal amounts of *ca* 45 m of floodplain deposits, plus *ca* 5 m of encased channel sandstones, in all boreholes. Where units are thicker, the remaining thickness comprises fluvial-braidplain sandstone. This arrangement indicates that the units represent equal time periods, during which background subsidence allowed the deposition of thin channel sands and overbank mud on a level floodplain. Occasional tilting produced additional accommodation space, which was completely filled by sand-dominated braided systems. The temporary cessation of floodplain-mud deposition suggests that aggradation of the river system could not keep up with floodplain tilting. In addition, bypass of floodplain fines may have been promoted by a basin parallel tilting component. It is shown that (i) cases in which the standard models fully apply, and (ii) cases in which differential subsidence is too strong or too abrupt, can be distinguished by analysing cross-plots of cumulative-sandstone and cumulative-mudstone thickness.

INTRODUCTION

Pennsylvanian (Upper Carboniferous) sedimentary successions in Euramerican basins are characterized by repetitive fluvio-deltaic cycles that formed in response to glacio-eustatic sea-level fluctuations (Davies, 2008; Greb *et al.*, 2008; Rygel *et al.*, 2008). These cycles, also known as 'cyclothems' (Weller, 1930), are a few metres to tens of metres thick and commonly comprise deltaic or marine shales overlain by alternations of fluvial sandstone, floodplain mud and coal-bearing coastal-plain deposits (Fielding, 1984a; Guion *et al.*, 1995). The fluvial sandstones are mostly extensive, erosively based bodies with a thickness up to 15 to 20 m, and their width is estimated to be anywhere between a few and tens of kilometres (Fielding, 1986; Aitken & Flint, 1995; Guion & Rippon, 1995; Rippon, 1996; Jones & Glover, 2005; Rygel *et al.*, 2008).

Synsedimentary tectonics may influence or control the distribution and (stacked) thickness of the fluvial sandstones. In the Pennine Basin (UK) major fluvial-sandstone

REPORT

Summer School on Fluvial Facies Logging and Architectural Documentation and Interpretation

On August 25–30, 2015, the Summer School of Fluvial Facies Logging and Architectural Documentation and Interpretation, was held in Kamchia Resort, Varna District, northeast Bulgaria. The organization committee included Assoc. Prof. G. Ajdanlijsky and Assoc. Prof. A. Zdravkov (University of Mining and Geology «St. Ivan Rilski», Sofia, Bulgaria). The extremely helpful technical support provided by T. Georgieva (Ph.D. student at UMG) and I. Todorov (undergraduate student at UMG) is greatly appreciated. The school was kindly sponsored by IAS and gathered ten participants from the University of Mining and Geology «St. Ivan Rilski» (3 Ph.D students and 2 undergraduate students), Geological Institute of the Bulgarian Academy of Sciences (1 Ph.D student), Geological Department of the Sofia University «St. Kl. Ohridski» (1 Ph.D student), and from the Faculty of Geology and Geophisics, University of Bucharest (3 undergraduate students).

The purpose of the school was to provide practical field demonstration of the strength and power of the architectural analysis of fluvial sediments for reconstruction of environmental conditions and their lateral and temporal changes. For that purpose, an outcrop of the Galata Formation (Miocene), representing a meandering, sand dominated river system, composed of several channels and the associated point bars, overbank, and crevasse splay deposits, was chosen. The rocks are characterized by various structural characteristics typical for fluvial deposits, like trough and planar crossbedding, irregularly alternating with parallel and graded lamination, with or without ripple marks (including various climbing ripples), and synsedimentary features like erosional and reactivation surfaces, load casts, small-scale slides, etc.. All these features make Galata Formation a good example to demonstrate the power of architectural analysis.

The first two days of the school were dedicated to the explanation of the processes of sediment deposition in fluvial environments. At the beginning, Assoc. Prof. G. Ajdanlijsky made thorough overview of the different fluvial systems and their characteristics. Thereafter, his presentation was focused mostly on the meandering type fluvial deposits and the different facial conditions that they are associated with. Special emphasis was made on the conditions of sedimentary structures' formation and the information they carry about the sedimentary environments, followed by a thorough overview of the methods of profile logging. Assoc Prof. A. Zdravkov focused his talks on the grain-size analysis as a powerful method to estimate not only the size distribution of the siliciclastic material, but also to study its mineralogical composition and physical characteristics of the grains, like their form, degree of rounding, and various surface patterns, which are related to the distance and ways of transport. The different statistical parameters (mode, median, average, standard deviation, etc.), that can be calculated from the grain-size analysis, were also discussed, together with their geological meaning. A note on the presence and distribution of organic matter and heavy minerals within the rocks, was also done, followed by a simple field demonstration of concentration of the latter, made by G. Ajdanlijsky. At the end of day two, a sample profile was drawn in order to demonstrate the different lithofacial characteristics of the individual layers. An emphasis was made on the measurement of the orientation and dip of the cross bedded layers and the types of bounding surfaces.

The third and the forth days of the school were dedicated to profile logging and 2D description of the sedimentary rocks. For that purpose, the students were separated in two groups, situated few meters from each other, and under the supervision of G. Ajdanlijsky and A. Zdravkov were encouraged to do a thorough logging of the profile. The results were later discussed and commented around the dinner table. During the fifth day both group's profiles were put together and the correlated in order to reveal the architectural style of the fluvial system.

Two short field trips were organized during the afternoons of the third and fourth days to the nearby «Staro Oriahovo» quarry (located about 6 km to the south of Kamchia) and the «Pasha Dere» beach (located about 10 km to the north of Kamchia). There the students were shown the facial changes within the Galata Formation which were then commented in terms of sedimentary environments and conditions.

At the end, we are pleased to note that the School was able to provoke significant interest amongst the students, which we sincerely hope will continue in their future work. We also hope, that this School was only the beginning of a new tradition in organizing such meetings, since they are they provide an excellent proxy for enhancing the student education and to attract more young people to the world of the facial and palaeogeographic analysis of sedimentary sequences.

Finally, it is our great pleasure to extend our sincere gratitude to IAS for providing full financial support for the School.

George Ajdanlijsky and Alexander Zdravkov
(University of Mining and Geology «St. Ivan Rilski», Sofia, Bulgaria)

Figure 1.- Participants of the Summer School: front line from left to right: Livia and Andreea (Uni. Bucharest) and Temenuga (UMG); rear line from left to right: George Ajdanlijsky, Zlati (our most respectful transport manager), Marius (Uni. Bucharest), Ivan (UMG), Dani (BAS), Dobromira (UMG), Milena (SU), Adelina (UMG) and Lyubomir (UMG).

Figure 2.- George in a moment of inspiration explaining the processes of transport and deposition of the siliciclastic material in fluvial systems.

Figure 3.- George demonstrates the structural and textural characteristics of the rocks

Figure 4.- Alex Zdravkov unravels the power of grain-size analysis

Figure 5.- Some time for practicing ....

Figure 6.- Discussions on the origin of the spectacularly thick (over 10m) parallel cross-bedding series in Staro Oriahovo quarry.

Figure 7.- Alex in providing some notes on the origin and distribution of the organic matter within the rocks

Figure 8.- A group photo in front of an outcrop of Galata Formation on Pasha Dere beach.

Geochemical and Textural Evolution of Organic-Rich Freshwater Microbial Mud During Early Diagenesis

Chelsea L. Pederson, James S. Klaus, Donald F. McNeill,
and Peter K. Swart

Key Findings

- Carbonate muds are deposited within freshwater microbial mats in a low-lying palustrine environment within the Florida Everglades, occurring in close proximity to shallow marine carbonates.
- Syn-deposition of carbonate grains and abundant organic matter is observed in this environment, which contrasts with typical open marine settings where organics and carbonate framework deposition is typically decoupled.
- Early degradation of the abundant labile organics leads to a reduction in the concentration of TOC and more negative $\delta^{13}C$ values of the organic material.
- Alteration of carbonate grains during early burial is observed, including significant dissolution of the "stable" low-Mg calcite material, leading to alteration of the original isotopic signal in the carbonate.
- Analogous Pleistocene deposits show that textures, geochemical signatures, and organic content of microbial muds are pervasively altered during early burial.

Introduction and Significance

As microbial deposits are increasingly recognized in many depositional settings, it is important to definitively identify microbial signatures in these deposits. The ability to confirm microbial activity (precipitation, trapping, binding, cementation) in the formation of carbonates is challenging when assessing subsurface lithofacies. Depositional process can vary between environments, and microbial features can be well developed on both a micro and macro scale. Since microbial processes remain poorly understood "microbial" features can be misinterpreted.

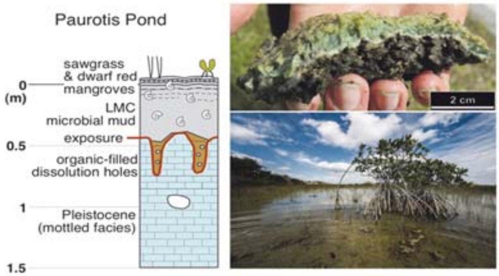

Figure 1. Left, schematic of Paurotis Pond stratigraphy. Top of the section lies at ~1 m above mean sea level. Holocene deposits typically ~0.5-1 m thick. Top right, microbial mat at surface. Bottom right, view of standing water at Paurotis Pond.

In the Everglades there is a unique opportunity to study the modern formation of freshwater microbial mud. This project follows the formation, burial and diagenesis, and lithification of these microbial-formed carbonates. Through photosynthesis calcifying cyanobacteria alter their microenvironment and precipitate fine-grained carbonate sediment (Merz, 1992). Textural and geochemical characteristics provide a measure of early diagenesis. Furthermore, ancient freshwater microbial deposits occur in South Florida as Pliocene and Pleistocene limestones. Buried during subsequent marine transgressions, these deposits provide a direct analogue with the freshwater muds deposited today.

Calibration of Modern and Ancient Microbial Carbonates

Modern Microbial Muds at Paurotis Pond: South Florida

Holocene carbonate muds reach a thickness of ~50 cm above the underlying, karstified Pleistocene limestone (Fig. 1), and occur as light brown, mostly unstructured, homogeneous sediments, with laminations in only the top few centimeters of the microbial mat. Deposited in shallow water subject to a short hydroperiod, the calcitic mud is a result of periphyton photosynthesis, and reflects local water chemistry and hydrologic conditions (Browder, 1994). Previous work by Gleason and Spackman (1974) and Merz (1992) used both light microscope and scanning electron microscope observation to identify two dominant species of photosynthetic cyanobacteria (*Scytonema hofmannii* and *Schizothrix calcicola*) within the periphyton at Paurotis Pond. Crystal structure was documented as fine, equant shaped, dendritic or rhombohedral crystals within dense cyanobacterial mats, with a species specific crystal form (Gleason and Spackman, 1974; Merz, 1992). However, recent work has demonstrated that there is likely one type of crystal precipitated in the system. At varying stages of crystal formation, layers of crystals referred to as "dendritic", stack upon each other, eventually coalescing to create one larger "rhombohedra" (Fig. 2). In addition, SEM results have shown the modern microbial community to be much more diverse than previously reported. A complex community of microbes excretes

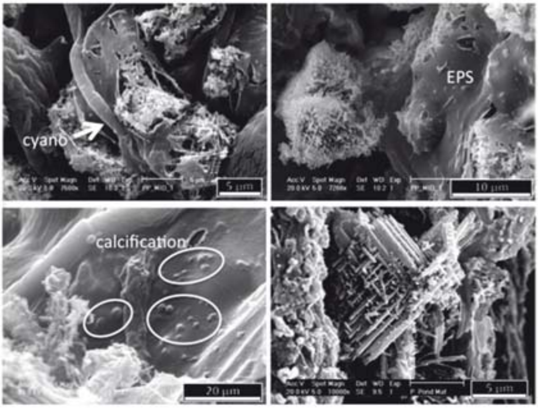

Figure 2. Scanning electron microscopy images of carbonate grains from the Paurotis Pond core, showing typical stacked, dendritic textures of individual crystals (bottom right), as well as calcification within the EPS microenvironment.

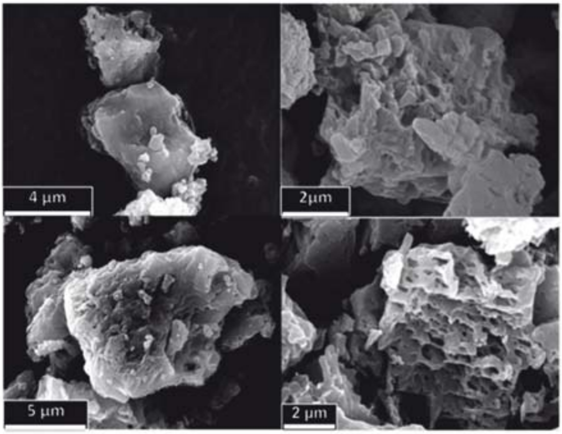

Figure 3. Scanning electron microscopy images of carbonate grains from the Paurotis Pond core, showing increasing dissolution features with depth. Top left: 0-5 cm. Top right: 5-10 cm. Bottom left: 10-15 cm. Bottom right: 20-25 cm.

exopolymeric substances (EPS), which in turn provide a suitable microenvironment for carbonate crystals to form. Scanning electron microscopy facilitated the identification of crystal growth structures within the EPS micro-environment (Fig. 2).

Early diagenesis (<5 kyr) has altered crystal textures and organic material (OM), as well as geochemical signatures. A short core from Paurotis Pond produced distinct geochemical trends as the microbial mud is buried. A slight increase in the stable isotopic values of the precipitated muds with depth ($\delta^{18}O$ -1.5 to -2.5‰ and $\delta^{13}C$ 0.5 to -0.5‰) correspond with increasing dissolution features during burial (Fig. 3). Changes in isotopic values are attributed to dissolution and fluids derived from the underlying bedrock.

The TOC decreases with depth in Paurotis Pond correlating with an unexpected depletion of the corresponding $\delta^{13}C$. This change is thought to correspond with the degradation of labile material, including EPS. This is plausible due to the role of EPS as the major food source for soil microbes, and is also supported by the lower OM observed down core. With a depth increase of only 25 cm, we see a decrease from 10.4 to 4.2% OM. If a large majority of the OM were labile, a significant decrease in TOC would be expected over a relatively short period of time, in addition to the depletion of $\delta^{13}C_{org}$ values. The $\delta^{13}C_{org}$ values start around -23‰ and decrease to about -26‰ down core. As the deposits are buried, we should expect to see TOC decrease even further, but a possible increase of $\delta^{13}C_{org}$ values as degradation switches to less labile material.

Pleistocene Microbial Muds: South Florida

A Pleistocene core drilled at Joe Ree Rock Reef contains freshwater mudstone analogous to the modern mud forming at Paurotis Pond. Over the last 2.6 Myr, freshwater systems deposited microbial mud intermittently when favorable hydrologic conditions occurred, likely tied to eustatic sea-level changes. The buried freshwater deposits provide some gauge of the preservation potential of the microbial signatures at Paurotis Pond. Their stable isotopic compositions range from $\delta^{18}O$ values of -2.0 to -3.0‰ and

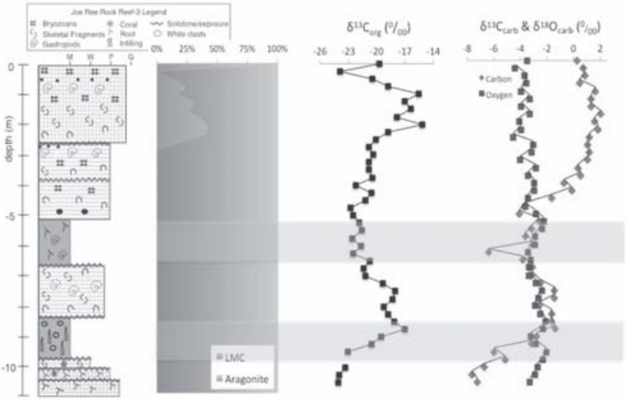

Figure 4. Data from Pleistocene carbonates from a core at Joe Ree Rock Reef (JR3). Grey areas indicate freshwater microbial muds deposits. Lithological units. Mineralogy (XRD). $\delta^{13}C$ or the organics (TOC<0.04%). Stable isotopes- $\delta^{13}C$ is shown in red, and $\delta^{18}O$ data is shown in blue.

$\delta^{13}C$ values of -1.5 to -6.5‰ (Fig. 4). These values are significantly more negative than the Paurotis Pond sediments ($\delta^{18}O$ -1.5 to -2.5‰ and $\delta^{13}C$ 0.5 to -0.5‰). The Pleistocene freshwater mudstones, at 5.2-6.6 and 8.5-9.7 m, are depleted in ^{13}C compared to the adjacent marine units (Fig. 4). The TOC of the freshwater microbial carbonate units measured less than 0.1%. These data are significant. They show that within this freshwater depositional system, significant amounts of TOC are unlikely to survive beyond early burial and just a few meteoric-marine cycles.

Implications for Preservation of Microbial Signatures

Preliminary results of this study imply that microbial signatures of freshwater carbonates are not well preserved in low-lying, coastal environments. Deviation from modern inorganic isotope signals implies that the alteration process affects even these dense LMC mudstones. Organic values also display altered signatures relative to the Modern. However, these values can still provide indirect evidence of a microbial origin. As more labile material is often associated with microbial mats (i.e. sites of precipitation), degradation of this material will result in a depleted signal when compared to that of non-microbial deposits.

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IAS Postgraduate Grant Scheme Report -1st session, 2015

STRATIGRAPHIC AND GEOCHEMICAL FRAMEWORK OF THE PALAEOPROTEROZOIC RISE IN ATMOSPHERIC OXYGEN: TRANSVAAL SUPERGROUP (SOUTH AFRICA).

Matthew R. Warke[1*]

Introduction and rationale

The Palaeoproterozoic Duitschland Formation (Transvaal Supergroup, South Africa) is a mixed succession consisting of glacial diamictite, mudstones, carbonates (including stromatolitic carbonates), sandstones, and conglomerates (Coetzee, 2001). Its deposition coincided with the Great Oxidation Event (GOE), when atmospheric oxygen levels first rose above 10^{-5} present atmospheric level. This change is evidenced by the abrupt disappearance of mass independent fractionation trends in sulphur isotopes (S-MIF), which is attributed to the establishment of an oxidised sulphur cycle operating in the oceans and atmosphere (Farquhar et al., 2000).

In the Duitschland Formation the disappearance of S-MIF signals occur across the mid-Duitschland (MD) sequence boundary (Guo et al., 2009). This means that carbonates in the lower Duitschland may preserve the geochemical signals of seawater immediately prior to the GOE. Further, the MD sequence boundary has been proposed as a regional and global stratigraphic correlation surface, based on the assumption that it represents a ‘cryptic glacial erosion surface’ (Hoffman, 2013).

However, the depositional environment of the Duitschland Formation is not fully understood and multiple settings have been proposed: (i) open marine shelf (Button, 1973), (ii) intracratonic basin (Martini, 1979), and (iii) foreland basin (Coetzee, 2001). Any interpretation of the MD sequence boundary’s stratigraphic significance, and its geochemical record, requires a better understanding of the depositional environment. Thus far this has been hampered by a relative lack of outcrop based studies.

Methods

Fieldwork was conducted on the farm Langbaken 340KS, building on a previous campaign conducted in 2013. Mapping at 1:10,000 scale was conducted, extending the existing map to 6 km^2 of coverage. Resampling of

Figure 1.- Typical example of clast-supported, chert conglomerate associated with the mid-Duitschland. It is more common at Langbaken than at previously described Duitschland localities. Compass for scale.

carbonates was conducted along three of four existing logs, increasing the sampling resolution to one sample every 5 m. These samples have been micro-drilled for carbon and oxygen stable isotope analysis. XRD and XRF analysis will also be conducted on selected samples.

Clast counts were conducted on different conglomerate facies and on the basal Duitschland diamictite. A 0.5 x 0.5 m quadrat was used and clast lithology, size, and roundness were recorded. Samples of all lithologies were gathered for petrographic and geochemical analysis.

Preliminary results and discussion

Mapping and logging revealed significant thickness variations and facies differences between Langbaken 340KS and the Duitschland Formation type locality on the farm Duitschland and drill core (Coetzee, 2001). Most notable amongst these differences is the presence of significant thicknesses of

Figure 2.- Decimeter thick, laterally discontinuous conglomerate incising into the lower carbonates; note the large clasts within the carbonate prior to conglomerate deposition. Pencil for scale.

Figure 3.- Basal Duitschland diamictite with BIF and chert clasts visible. Hammer for scale.

clast-supported, chert conglomerate, likely derived from the underlying iron formations. Approximately 20 m of this conglomerate occurs beneath the MD sequence boundary and a further minimum of c.a. 100 m occurs above the MD sequence boundary where it is interbedded with a brown weathering mudstone. Two facies of conglomerate are described, one of which shows a significant variation in matrix colour and amount and so may be classed as a further third facies. It is also noted that the thickness of the basal Duitschland diamictite is much greater here than on Duitschland Farm or in drill core.

This heterogeneity in thicknesses across the Duitschland Basin suggests that there may have been fixed points along the basin (e.g. at Langbaken) through which material derived from the weathering of the exposed iron formations was preferentially transported and deposited. This transportation was probably driven by debris flows given the incisive,

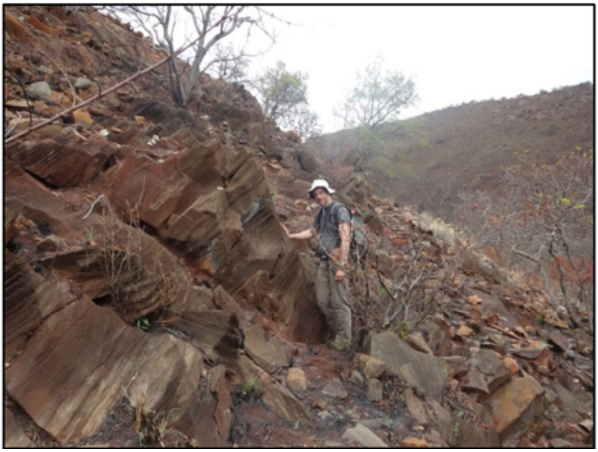

Figure 4.- Slumped carbonates in the lower Duitschland. Supervisor for scale.

channelized and massive nature of the majority of the conglomerates. It further suggests an uneven development of accommodation space along the basin, possibly as a result of erosive topography development associated with the MD unconformity, or perhaps fault-development in the basin.

There was no evidence for glaciation associated with the MD-unconformity observed which is similar to the glacial features (e.g. striated pavements, striated clasts) observed under and within the Makganyene Diamictite in Griqualand West. Thus the proposed correlation of the MD sequence boundary and the Makganyene as proposed by Hoffman (2013) cannot be corroborated by this study.

IAS Grant use

€900 was granted to this project and was used for the rental of a field vehicle and to cover fuel expenses. MRW would like to thank the IAS for their financial support. MRW is also funded by a NERC studentship.

[1]School of Earth, Atmospheric and Environmental Sciences, The University of Manchester
*matthew.warke@manchester.ac.uk

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Frames of the World

Capo Caccia, Grotta di Nettuno trail. Upper Cretaceous rudist limestone disconformably resting over the gentle karst surface (the trail – Escala del Cabirol) of the pre-bauxite Urgonian (Early Cretaceous) limestones (L. Simone & A. Cherchi,2009 - The Cretaceous carbonate system of the Nurra Region (North western Sardinia, Italy). FT Guide n. 10, IAS 2009, available on www.sedimentologists.org). Photo by V. Pascucci)

SPECIAL IAS GRANTS OR 'INSTITUTIONAL IAS GRANTS'

Special IAS Grants or Institutional IAS Grants are meant for capacity building in 3rd world countries. There exists a list of 'Least Developed Countries' (LDC) by the UN. This list categorizes countries according to income per capita and is yearly updated.

Grants are allocated to allow Geology Departments in LDC to acquire durable sedimentological equipment for teaching and research (like sieves, calcimeters, auger drilling tools, etc.) or tools that can be used by all geology students (like general geology/sedimentology textbooks, IAS Special Publications (SP), memory sticks with back issues of Sedimentology or SP, etc). Therefore the grant application should clearly demonstrate to increase the recipient's capacity to teach sedimentology at the undergraduate level (Bachelor) in a durable way. It should also indicate in what way it would enable to support sedimentological research at the graduate level (Master).

Applicants should have a permanent position at their University and should be IAS members. Applications should provide the following information (not exhaustive list):

- the mission statement of the University/Geology Department
- the approval of the University Authorities to accept the grant
- a list of permanent teaching and technical staff members of the Geology Department (with indication of their area of research)
- the structure of the geology undergraduate and graduate courses (Bachelor/Master programme with indication of courses and theoretical and practical lecture hours)
- the number of geology students
- the actual facilities for geology/sedimentology students
- a motivation of application
- a budget with justification
- the CV of the applicant, including a sedimentology research plan

The institutional grant scheme consists each year of 2 sessions of 1 grant of 10.000 Euro. Applications run in parallel with the PhD research grant scheme (same deadline for application and recipient notification). The IAS Grant Committee will seek recommendations from relevant National Correspondents and Council Members (eventually including visitation) before advising the IAS Bureau for final decision. Additional funds made available by the recipient's University are considered as a plus.

Items listed in the application will be bought through the Office of the IAS Treasurer and shipped to the successful applicant. By no means will money be transferred to the grant recipient.

IAS STUDENT GRANT APPLICATION GUIDELINES

IAS has established a grant scheme designed to help PhD students with their studies by offering financial support for fieldwork, data acquisition and analysis, visits to other institutes to use specialized facilities, or participation in field excursions directly related to the PhD research subject.

Up to 10 grants, each of about 1,000 are awarded, twice a year. These grants are available for IAS members only, and only for PhD students. Students enrolled in MSc programs are not eligible for funding and research grants are not given for travel to attend a scientific conference, nor for the acquisition of equipment.

Applicants should apply for a postgraduate grant via the IAS website. The application requires submitting a research proposal with budget and CV (template provided on the submission webpage) and a letter of support from the student's supervisor. After the deadline has passed, the IAS Bureau evaluates the submitted applications and makes a final selection. Applicants are personally informed by the Office of the Treasurer about their grant. The grants are transferred to the applicants' bank account upon submission of a short scientific and financial report.

Eligibility and selection criteria:

Applicants must be enrolled as a PhD student;

Applicants can only benefit from a postgraduate grant once during their PhD;

In the evaluation process preference will be given to those applications that i) can convincingly demonstrate that the proposed work cannot be conducted without the grant, and ii) are not supported by substantial industry funding.

Application

The application should be concise and informative, and contains the following information (limit your application to 1250 words max.):

- Research proposal (including Introduction, Proposal, Motivation and Methods, Facilities) – max. 750 words
- Bibliography – max. 125 words
- Budget – max. 125 words
- Curriculum Vitae – max. 250 words

Your research proposal must be submitted via the Postgraduate Grant Scheme application form on the IAS website before the application deadline. The form contains additional assistance details for completing the request. Please read carefully all instructions before completing and submitting your application. Prepare your application in 'Word' and use 'Word count' before pasting your application in the appropriate fields.

Recommendation letter (by e-mail) from the PhD supervisor supporting the applicant is mandatory, as well as recommendation letter (by e-mail also) from the Head of Department/ Laboratory of guest institution in case of laboratory visit.

Please make sure to adequately answer all questions.

Deadlines and notifications

Application deadline 1st session: 31 March.

Application deadline 2nd session: 30 September.

Recipient notification 1st session: before 30 June.

Recipient notification 2nd session: before 31 December.

NOTE: Students who got a grant in a past session need to wait 2 sessions (1 year) before submitting a Postgraduate Grant Scheme grant application again. Students whose application was rejected in one session can apply again after the notification deadline of the rejected grant application

Guidelines for recommendation letter from supervisor:

The recommendation letter from the supervisor should provide an evaluation of the capability of the applicant to carry out the proposed research, the significance and necessity of the research, and reasonableness of the budget request.

The recommendation letter must be sent directly to the Treasurer of the IAS by e-mail, and before the application deadline.

It is the responsibility of the applicant to make sure that his/her supervisor submits the recommendation letter in time. No reminders will be sent by IAS, neither to the applicant, nor to the supervisor. Applications without letter of support will be rejected.

Application Form

Research Proposal (max. 750 words)

Title: ....

Introduction (max. 250 words): .....

Introduce briefly the subject of your PhD and provide relevant background information; summarise previous work by you or others (provide max. 5 relevant references, to be detailed in the 'Bibliography' field). Provide the context for your PhD study in terms of geography, geology, and/or scientific discipline.

Proposal (max. 250 words): ...

Describe clearly your researchproposal and indicate in what way your proposal will contribute to the successful achievement of your PhD. Your application should have a clearly written hypothesis or a well-explained research problem of geologic significance. It should explain why it is important. Simply collecting data without an objective is not considered wise use of resources.

Methods (max. 125 words): ....

Outline the research strategy (methods) that you plan to use to solve the problem in the field and/or in the laboratory. Please include information on data collection, data analyses, and data interpretation. Justify why you need to undertake this research.

Facilities (max. 125 words): ....

Briefly list research and study facilities available to you, such as field and laboratory equipment, computers, library.

Bibliography (max. 125 words)

Provide a list of 5 key publications that are relevant to your proposed research, listed in your 'Introduction'. The list should show that you have done adequate background research on your project and are assured that your methodology is solid and the project has not been done already. Limit your bibliography to the essential references. Each publication should be preceded by a '*'-character (e.g. *Surlyk et al., Sedimentology 42, 323-354, 1995).

Budget (max. 125 words)

Provide a brief summary of the total cost of the research. Clearly indicate the amount (in Euro) being requested. State specifically what the IAS grant funds will be used for. Please list only expenses to be covered by the IAS grant.

The IAS will support field activities (to collect data and samples, etc.) and laboratory activities/analyses. Laboratory activities/analyses that consist of training by performing the activities/analyses yourself will be considered a plus for your application as they will contribute to your formation and to the capacity building of your home institution. In this case, the agreement of the Head of your Guest Department/Laboratory will be solicited by automated e-mail.

Curriculum Vitae (max. 250 words)

Name, postal address, e-mail address, university education (degrees & dates), work experience, awards and scholarships (max. 5, considered to be representative), independent research projects, citations of your abstracts and publications (max. 5, considered to be representative).

Advise of Supervisor and Head of Guest Department/Laboratory

When you apply for a grant, your PhD supervisor will receive an automated e-mail with a request to send the IAS a letter of recommendation by e-mail. You should, however, check with your supervisor everything is carried out the way it should be. It will be considered as a plus for your application if your PhD supervisor is also a member of IAS.

Supervisor's name: ....

Supervisor's e-mail: ....

If you apply for laboratory analyses/activities, please carefully check analysis prices and compare charges of various academic and private laboratories as prices per unit might differ considerably. Please first check whether analyses can be performed within your own University. If your University is not in a position to provide you with the adequate analysis tools, visiting another lab to conduct the analyses yourself strengthens your application considerably as it contributes to your formation and to capacity building of your home University. Please check with the Head of Department/ Laboratory of your guest lab to assure its assistance during your visit. You should fill in his/her name and e-mail address to solicit his/her advise about your visit.

Name of Head of guest Department/ Laboratory: ....

E-mail address of Head of Guest Department/Laboratory: ....

Finally, before submitting your application, you will be asked to answer a few informative questions by ticking the appropriate boxes.

- is your supervisor a member of IAS
- was this application your own initiative
- did you discuss your application with your Supervisor
- did you already had contact in the past with the Head of the Guest Department/Laboratory (if appropriate)

CALENDAR

9th International Conference on Tidal Sedimentology (Tidalites)

17th-19th November 2015
Puerto Madryn
Argentina

Jose I. Cuitiño
jcuitino@cenpat-conicet.gob.ar
http://tidalites2015.gl.fcen.uba.ar/

5th International Conference on Alluvial Fans*

29th November – 4th December 2015

James Driscoll
james.driscoll@monash.edu

32nd IAS Meeting of Sedimentology*

23rd -25th May 2016
Marrakech
Morocco

32IAS@ibnbattutacentre.org
Ibn Battuta Centre
https://www.sedimentologists.org/ims2016

XV Reunión Argentina de Sedimentología

September
2016
Santa Rosa, La Pampa
Argentina

Adriana Mehl
adrianamehl@gmail.com
xvras2016@gmail.com

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Proedex s.l. Francisco Silvela 27
28028 Madrid, Spain editorial@proedex.com

Contributions to be sent to:
Vincenzo Pascucci
IAS General Secretary
Department of Architecture,
Design and Planning,
University of Sassari,
sede di Via Piandanna 4,
07100 Sassari, Italy
Tel.: +39 079228685
pascucci@uniss.it

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