



Edies

*International Commission on Stratigraphy
Subcommission on Ediacaran Stratigraphy*

**Newsletter of the Subcommission
on Ediacaran Stratigraphy**

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Remarks from the Chair

By Shuhai Xiao

Eddies is six years old in 2018! Please join me in giving a big round of applause to Marc Laflamme for his sustained efforts to put together this newsletter for our community!

When updating the Ediacaran Subcommission mailing list a few weeks ago, I pleasantly noted that the Ediacaran community has grown significantly, with a large (and still growing) cohort of early career scientists. This is a strong sign of the healthy development of our field and our community. It also reminds me of the need to diversify our tools of communication. The young cohort is savvy about social media (e.g., Facebook, Twitter, LinkedIn, WeChat, among many others), which is a faster way of communication and is tracked by bibliometric indices such as Altimetric. Thus, I am pondering over the possibility of having a social media officer in the Subcommission. If anyone is interested in starting an Ediacaran social media group, please let me know (xiao@vt.edu). This would be a great opportunity for a young colleague who already knows the ins and outs of social media.

Kudos to Alex Liu and his colleagues for organizing the hugely successful ISECT conference in St. John's, Newfoundland, Canada (15–29 June, 2017); to Detlef Walde, Dermval do Carmo, and their colleagues for leading a field trip in Corumbá, Brazil (12–16 July, 2017); and Kristin Bergmann for putting together the spectacular field trip in Oman (14–21 January, 2018). In the reminder months of 2018, we will have at least two Subcommission events: the Nevada field workshop led by Emmy Smith (April 26–May 2, 2018) and the International Conference on Ediacaran and Cambrian Sciences organized by Xingliang Zhang (August 12–16, 2018, Xi'an, China; <http://www.icecs2018.cn/>). I hope that we can make some progress in TES and SES at these conferences/workshops. Our goal is to initiate a vote on the criteria for the definition of the TES and SES. I look forward to seeing you in Las Vegas and Xi'an!

Notes from the Secretary

By Marc Laflamme

This past year was particularly busy, with several subcommission initiatives, mostly focusing on the establishment of the SES (Second Ediacaran Stage) and TES (Terminal Ediacaran Stage). The International Symposium on the Ediacaran–Cambrian Transition (ISECT) was held on June 15–29, 2017, in Newfoundland, Canada, which brought together a global community of Ediacaran and Cambrian workers to celebrate the 50th anniversary of the discovery of the Mistaken Point fauna (Liu et al., in press, *Episodes*). The Subcommission co-sponsored this symposium and held a business meeting in Newfoundland. Eleven voting members (Grazhdankin, Kaufman, Laflamme, Alexander Liu, Pengju Liu, Malgorzata Moczydlowska-Vida, Narbonne, Shields-Zhou, Rood, Xiao, and Zhu) and several corresponding members participated in this symposium. Three field trips focusing on the Ediacaran System were organized during this symposium. Following the conference, a special volume in the Canadian Journal of Earth Sciences is also planned for the upcoming year. Should you wish to contribute an article, please contact Marc Laflamme at marc.laflamme@utoronto.ca.

In July 2017, the Subcommission sponsored a field conference in Brazil to investigate the Ediacaran Corumba Group in southwestern Brazil. Voting Member Xiao and corresponding members Detlef Walde, Dermval do Carmo, and Juliana de M. Leme participated in this field conference.

Finally, in January 2018, Kristin Bergmann (MIT) organized and led an exciting field trip to the Ediacaran sections of Iran. Stay tuned in the new year as we distribute a meeting synopsis.

In closing, I'd like to draw everyone's attention to several upcoming fieldtrips and conferences (see *Upcoming meetings and workshops* below) that are being hosted by members of the subcommission. It's always great when our community comes together, and these past few workshops have been stellar.

TES Working Group Members

Voting Members:

Narbonne, Guy M. (Chair)
Moczydlowska-Vidal, Malgorzata (Secretary)
Alvaro, Jose-Javier
Buatois, Luis A.
Gehling, James G.
Grazhdankin, Dmitri V.
Jensen, Soren
Kaufman, Alan Jay
Laflamme, Marc
Liu, Alex
Schiffbauer, James
Sharma, Mukund
Warren, Lucas
Wood, Rachel
Xiao, Shuhai
Yuan, Xunlai
Zhu, Maoyan

Corresponding Members:

Christie-Blick, Nicholas
Duda, Jean-Pierre
Dornbos, Stephen
Erwin, Doug
Grey, Kathleen
Jiang, Ganqing
Li, Chao
Ivantsov, Andrey
Knoll, Andrew
Mangano, Gabriela
Meyer, Michael
Rai, Vibhuti
Reitner, Jochim
Schiffbauer, James
Shields-Zhou, Graham A.
Vickers-Rich, Patricia
Weaver, Patricia
Yin, Chongyu
Zhu, Maoyan

SES Working Group Members

Voting Members:

Chuanming Zhou (Chair)
Christie-Blick, Nicholas
Grazhdankin, Dima
Grey, Kathleen

Jiang, Ganqing
Kaufman, Alan Jay
Liu, Pengju
Moczydlowska-Vidal, Malgorzata
Sharma, Mukund
Shields, Graham
Xiao, Shuhai

Corresponding Members:

Adamson, Peter William
Alvaro, Jose-Javier
Gehling, James G.
Gaucher, Claudio
Jensen, Sören
Joshi, Harshita
Kenchington, Charlotte
Laflamme, Marc
Li, Chao
Liu, Pengju
Liu, Alex
Nagovitsin, Konstantin
Rai, Vibhuti
Schiffbauer, James
Shukla, Rajita
Sperling, Erik
Tiwari, Meera
Vickers-Rich, Patricia
Willman, Sebastian
Xunlai Yuan
Yin, Chongyu
Zhu, Maoyan

Meeting reports:

News from Down Under – By Jim Gehling

In 2016, the South Australian Government decided to investigate the potential for World Heritage listing of key geological sites in the Flinders Ranges of South Australia in order to acknowledge the key role of the geological and palaeontological record of the rock formations and fossils of the Cryogenian, Ediacaran and Cambrian successions of the Adelaide Rift Complex for understanding the rise of large and complex life on Earth.

Beginning with the discovery of archaeocyath fossils by Howchin in 1868 that established a Cambrian age for rock formations in South Australia, mapping and detailed description of the well-preserved Neoproterozoic and early Palaeozoic succession in the Adelaide Rift Complex was largely the work of the South Australian Geological Survey from 1950 through 2000. This back-bone of South Australia is still uplifting, following the breakup of Australia and Antarctica in the early Cainozoic. Extended from Kangaroo Island 100 km south of Adelaide and some 600 km north as a largely N-S trending fold belt, apart from the Mt Lofty region near Adelaide, the capital city of South Australia, the late Cambrian, Delamerian Orogeny, resulted in largely well-preserved succession with open folding, that is relatively free of regolith in the northern region where rainfall is low. Consequently, the Flinders Ranges, being the northern desert region offer unprecedented access to the stratigraphy. The relationship to the basement is well demonstrated in both the northern region centred on the Arkaroola Sanctuary.

In 2004, the ICS voted to place the Global Stratotype Section and Point for the base of the Ediacaran System in the late Neoproterozoic succession of the Ikara-Flinders Ranges National Park in Enorama Creek. The underlying Cryogenian extends from the early Sturt glacials of the GSSP marks the rapid transition from the Elatina Formation diamictites of the latest Cryogenian, and the base of the regional marker Nuccaleena Formation “cap-carbonate”. From this point, the entire overlying circa 4 km thick Ediacaran succession can be studied in outcrop all the way

to the basal Cambrian Parachilna Formation and there above for another 2 km of succession to the early mid-Cambrian Wirrealpa Formation, where the marine record largely gives way to a terrestrially dominated Lake Frome Group of late Middle Cambrian age. Arguably, few other successions on Earth provide such an almost continuous, unmetamorphosed succession through the Cryogenian Pualco Tillite and Holowilena Ironstone, up through carbonate-rich formations of the Cryogenian succession. Palaeomagnetic analyses have demonstrated these Cryogenian formations bracketed by diamictites were deposited when this terrane was in palaeolatitudes within 10° of the Cryogenian equator.

Moreover, these Flinders Ranges successions bear important benchmarks for understanding the Cryogenian climatic extremes and precursors to metazoan life, passing directly into a 4 km thick Ediacaran successions that hold the first evidence of what are arguably stem group metazoan phyla within a prolific assemblage of the Ediacara biota. These include sponge grade rangeomorphs, best-known from the World Heritage Mistaken Point assemblage in SE Newfoundland and the UK. The overlying 2 km thick, early Cambrian succession is rich in trace fossils and archaeocyath spongiomorphs, skeletal organisms forming the earliest framework reefs. These formations are replete with small shelly fossils of metazoan phyla that include articulates and rapidly expanding arthropod and molluscan organisms along with tabulate coralomorphs, before sedimentation ceased in the middle Cambrian with largely terrestrial deposits.

The well mapped and broadly described, spectacularly exposed and accessible Cryogenian, Ediacaran and early Cambrian successions, warrant much more intense research of their palaeontology, sedimentology and geochemistry by comparison with almost all other recognized Neoproterozoic-Cambrian successions on Earth.

Acknowledging the international importance of these successions, in April 2016, the South Australian government committed to working toward seeing World Heritage nomination of serial properties in the Adelaide Rift Complex, in recognition of its global significance. This program was funded in 2017, following the announcement the iconic Ediacara fossil, *Spriggina floundersi* had been recognized as the official State Fossil Emblem of South Australia. Named after the famous South Australian geologist, Dr. Reginal Sprigg, who first “realized” the fossils of the Ediacara biota in 1947, arguably, *Spriggina* was the first animal on Earth bearing what appears to be a “head” and “segmented” body.

The Australian Journal of Earth Sciences (AJES) is calling for papers for a Special Issue relevant to the Flinders Ranges World Heritage Nomination (FRWHN), to be published prior to the forthcoming Australian Geoscience Council Convention: Big Issues and Ideas in Geoscience (14-18 October 2018) to be held in Adelaide, South Australia. Papers should be submitted to the working group chaired by Stephen Hore (stephen.hore@sa.gov.au) of the Geological Survey of South Australia before February 2018.

Upcoming meetings and workshops:

1. Corresponding member Emmy Smith (Johns Hopkins University) will be leading a **field workshop in Nevada (April 26 – May 2, 2018)**.

2. **The 5th International Palaeontological Congress will be held in Paris, France, from July 9-13, 2018**. Several sessions will be of interest to our members, including *S6 - Biominerals through time: evolution, taphonomy and traces in the geological record*, *S9 - Coevolution of life and environments: integrating the palaeoecological, sedimentological and geochemical Records*, *S12 - Early animal life*.

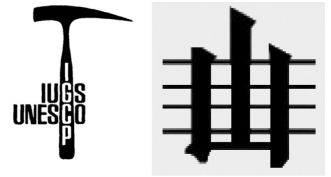
3. Dr. Xingliang Zhang at Northwest University, Xi'an, China, invites Ediacaran and Cambrian workers to participate in the **International Conference on Ediacaran and Cambrian Sciences (August 12-16, 2018, in Xi'an, China)**. Several pre- and post-conference field trips have been planned to examine Ediacaran and Cambrian successions in South China. More details can be found at www.icecs2018.cn. Inquiries should be directed to Dr. Xingliang Zhang at xzhang69@nwu.edu.cn.

4. Marc Laflamme and corresponding member Simon Darroch will be leading a field trip to the Mistaken Point Ecological Reserve and UNESCO World Heritage Site (**August 8-11 2018** - see write-up by Guy Narbonne in last year's *Eddies*) as part of the **International Sedimentological Conference (ISC) being held in Quebec City, Canada**. For additional details please see <http://isc2018.org/field-trips#PRE>.

Field workshop on the Ediacaran Nama Group of southern Namibia

21–25 August 2016, Windhoek to Fish River Canyon, Southern Namibia

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Among all established geological periods, the Ediacaran Period is the longest, lasting from 635 Ma to 541 Ma. It is within this 94 million years of geological history that the Earth was transformed from a world dominated by microbes to one increasingly influenced by animal activities. Important evolutionary innovations occurred in the Ediacaran Period, including the rise of macroscopic animals, complex ecological interactions, and metazoan biomineralization. Resolving the causes and consequences of these biological innovations is a major focus of recent geobiological investigations. However, without a solid geological time framework, Ediacaran workers are facing significant challenges in assembling the pieces of the puzzle from different parts of the world. To develop a better understanding of Ediacaran time and life, a group of 25 geologists, geochemists, sedimentologists, and paleontologists gathered together to examine the terminal Ediacaran Nama Group at a field workshop sponsored by IGCP 587 “Identity, Facies and Time: The Ediacaran (Vendian) Puzzle” and the ICS Subcommittee on Ediacaran Stratigraphy.

The terminal Ediacaran Nama Group near Aus in southern Namibia holds a special place in the history of Ediacaran paleontology. Some of the earliest complex Ediacara-type fossils were first reported from the Nama Group (Gürich, 1929; Fedonkin et al., 2007; Xiao, 2008). This succession contains important geological information about the Shuram carbon isotope excursion (potentially the greatest C-isotope excursion in Earth history), the expansion of animal bioturbation, the rise of animal skeletonization and biomineralization, and the decline and final demise of the Ediacara biota. It is also a key succession to define the Terminal Ediacaran Stage (TES) (Xiao et al., 2016), which has been identified as one of the priorities for the Subcommittee of Ediacaran Stratigraphy following a 2014 workshop in South China (Xiao et al., 2014) and a 2015 symposium in Graz, Austria.

Participants were drawn to Namibia by the new developments and discoveries made in the Nama Group in recent years. These include new discoveries and interpretations of Ediacaran and Cambrian fossils (e.g., Narbonne et al., 1997; Jensen et al., 2000; Grazhdankin and Seilacher, 2002; Wood et al., 2002; Grazhdankin and Seilacher, 2005; Jensen and Runnegar, 2005; Elliott et al., 2011; Wilson et al., 2012; Vickers-

Rich et al., 2013; Meyer et al., 2014a; Meyer et al., 2014b; Darroch et al., 2015; Zhuravlev et al., 2015; Darroch et al., 2016; Elliott et al., 2016; Ivantsov et al., 2016), paleoecological investigation of reef-building skeletal fossils (e.g., Penny et al., 2014; Wood and Curtis, 2016), comprehensive geochemical analyses (e.g., Hall et al., 2013; Wood et al., 2015), and much needed radiometric ages from key stratigraphic horizons (Grotzinger et al., 1995). Building upon these advances, several research teams are actively working on the Nama Group in order to further improve our understanding of the late Ediacaran Period.

Before the field workshop officially kicked off, a small group of participants visited the Geological Survey of Namibia to examine its Ediacaran fossil collection, which has been significantly expanded over the past 15 years through IGCP 493/597 and includes the recently reported three-dimensional specimens of *Rangea* (Vickers-Rich et al., 2013) and *Ernieetta* (Ivantsov et al., 2016). The field workshop started with an examination of classic fossil sites on Farm Aar where ground-breaking discoveries were made in the past. Participants were able to have an up-close look at large *Pteridinium* slabs assembled by the late Dolf Seilacher, *Rangea* excavation site published by Vickers-Rich and colleagues, *Beltanelliformis* excavation site near *Ernieetta* Hill, as well as beds containing new and undescribed forms that are currently under investigation. Lively discussion and debate were heard on the outcrops about the morphology, ecology, taphonomy, and affinity of these enigmatic Ediacara-type fossils. At the lunch break in the Aar farmhouse, a brief ceremony was held to recognize Mrs. Barbara Boehm-Erni as a guardian of this paleontological heritage on her farm. Participants were also able to make a side trip to look at some amazing San petroglyphs on the farm.

On the morning of August 23, participants were shown a section of the Kanies and Mara members at the base of the Nama Group, on Farm Pockenbank some 60 km south of Aus. The Mara Member is characterized by negative carbon isotope signatures and may be correlated with the Shuram negative carbon isotope excursion in Oman. Emerging data from the Mara Member suggest that anaerobic oxidation of methane may have contributed to the negative carbon isotope signatures seen in this and other Ediacaran units thought to be equivalent to the Shu-



Figure 1. Group picture of participants in the Nama Group field workshop, taken in front of the Aar Farmhouse. From left to right: Pengju Liu, Qing Tang, Andrea Du Plessis, Tom Rich, Ben Yang, Greg Retallack, Xiaodong Shang, Preston (driver), Juliana Okubo, Bernd Roemer, Patricia Vichers-Rich, Angela Ehling, Lucas Warren, Barbara Boehm-Erni, Gabriel Jubé Uhlein, Maoyan Zhu, Guy Narbonne, Doris Honold, Shuhai Xiao, Stuart Clenagham, Stuart Clenagham, Heda Agić, Natasha Bykova, Mike Meyer, Jay Kaufman, Les Kriesfeld, Drew Muscente. Photograph by Jeff Smith.



Figure 2. Group picture on outcrops of the Dabis Formation, Farm Pockenbank.

ram excursion. The Mara Member is also reported to host some of the oldest specimens of the biomineralizing animal fossil *Cloudina* in Namibia and potentially globally. As such, the Mara Member offers a rare opportunity to resolve the relationship between the Shuram excursion and the first appearance of *Cloudina*, which is critical in defining TES (Xiao et al., 2016). In the afternoon, we jumped to the top of the

Nama Group, observing some of the latest Ediacaran strata of the Spitzkopf Member on Farm Swartpunt. The abundance of trace fossils, soft-bodied Ediacara fossils, thrombolitic microbial buildups, biomineralizing animal fossils such as *Cloudina* and *Namacalathus*, and numerous volcanic ash beds in these strata offers an unparalleled opportunity to test hypotheses about the extinction of the Ediacara

biota (Darroch et al., 2015).

On the last day of the field workshop, some participants ventured to explore the geology and ecology of the Fish River Canyon as well as the geology of hot springs at Ai-Ais, whereas others took a trip to observe the spectacular trace fossils and ancient valley fills in the early Cambrian Nomtsas Formation on Farm Sonntagsbrunn. The field trip ended with a night stay at Fish River Canyon Village, where participants continued their discussion – over traditional Namibian beverages and safari gourmets – on Nama Group stratigraphy and paleontology, as well as plans for future expeditions.

The Nama Group field workshop was followed by a 1.5-day symposium entitled “The Dawn of Animals: Cryogenian to Cambrian” at the 35th IGC in Cape Town. The symposium included 33 oral presentations and 12 poster presentations. During IGC, the Subcommission on Ediacaran Stratigraphy held a business meeting on the evening of August 29, where an announcement was made to elect Andy Knoll and Malcolm Walter as the inaugural honorary members of the Subcommission. Plans for formal designation of the basal and terminal stages of the Ediacaran System are underway (Xiao et al., 2016) and detailed discussion of series-level subdivision will begin with a field excursion to Newfoundland in June 2017.

Whereas the Nama Group records the end game of the Ediacara biota, the Nama Group field workshop will surely start a new chapter in the study of Ediacaran paleobiology and stratigraphy. With lingering questions and unresolved enigmas, many participants have already expressed interest to come back to Namibia in the near future. After all, as the longest geological period, the Ediacaran holds many secrets that will keep geologists busy for decades to come.

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